CALIFORNIA HIGH-SPEED RAIL EARLY TRAIN OPERATOR

Central Valley Segment
System Management & Operations
Interim Financial Plan

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Revision Log

Revision	Date of Release	Description of Changes
1	January 31, 2020	Initial Release
2	June 10, 2020	Revised Release (Updates made to Sections 17.2 and 17.3)

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Executive Summary

Purpose

It should be noted for clarity that this report is not a strict update of the ETO's last Central Valley Financial Plan Study. Although references will be made to the ETO's previous Central Valley Financial Plan Study (wherever comparable), this new report contains elements, which were not previously covered. As such, the main purpose of this report is aimed at the following:

- Continue to understand the benefits that interim HSR operations will create for the total corridor in the Central Valley;
- Understand how interim operations in the Central Valley can be executed;
- Pre-Operations (Operator Mobilization and Trial Running); and
- Analysis of the projected financial balances based on documented assumptions with the Authority and close discussions with stakeholders, including SJRRC and CalSTA; specifically, what the financial balances may look like, in line with the proposed business model, from the following perspectives: total corridor view, Authority's view and Operator's view.

Scope Summary

To further elaborate, in the Authority's Project Update Report, published on May 1, 2019, the Authority committed to having the ETO perform the following as next steps in the implementation program of the high-speed rail project, with focus on the Central Valley (Merced-Bakersfield):

- Operations Planning: The ETO coordinated the additional analysis needed to develop a more detailed operations plan, including how it would connect and integrate with other passenger rail systems, beyond the initial analysis that it completed to evaluate the interim service options;
    - Continued to develop the integrated service concept and plan working with the San Joaquins and ACE service providers to optimize the connections and maximize the services for passengers traveling between Sacramento, Oakland and San José in the Bay area;
    - Designed a highly synchronized integrated service timetable for a seamless journey;

- The existing San Joaquins fare structure was utilized for purposes of this report (consistent with the ETO's last study); however, the ETO also evaluated fare sensitivities by looking at HSR fares for this report.
- Coordinated with CalSTA, and SJRRC staff to identify the additional regional improvements and infrastructure required north of Merced and development of a joint station at Merced;
- Optimized bus connections;
- Updated ridership and revenue forecasts based on the updated service concept. A more detailed and specific ridership model will be developed to further evaluate this integrated service network to review ridership and revenue forecasts. Until this new model has been developed, the existing State model will continue to be used to estimate demand forecasts for the Central Valley (Merced – Bakersfield).

Figure ES-1 illustrates the highly planned connectivity not only between Merced – Bakersfield but also the connectivity north of Merced and south of Bakersfield. This integrated service concept provided the basis for updating the estimated operations and maintenance costs for the interim service between Merced-Fresno-Bakersfield with a start of revenue service planned in December 2028.

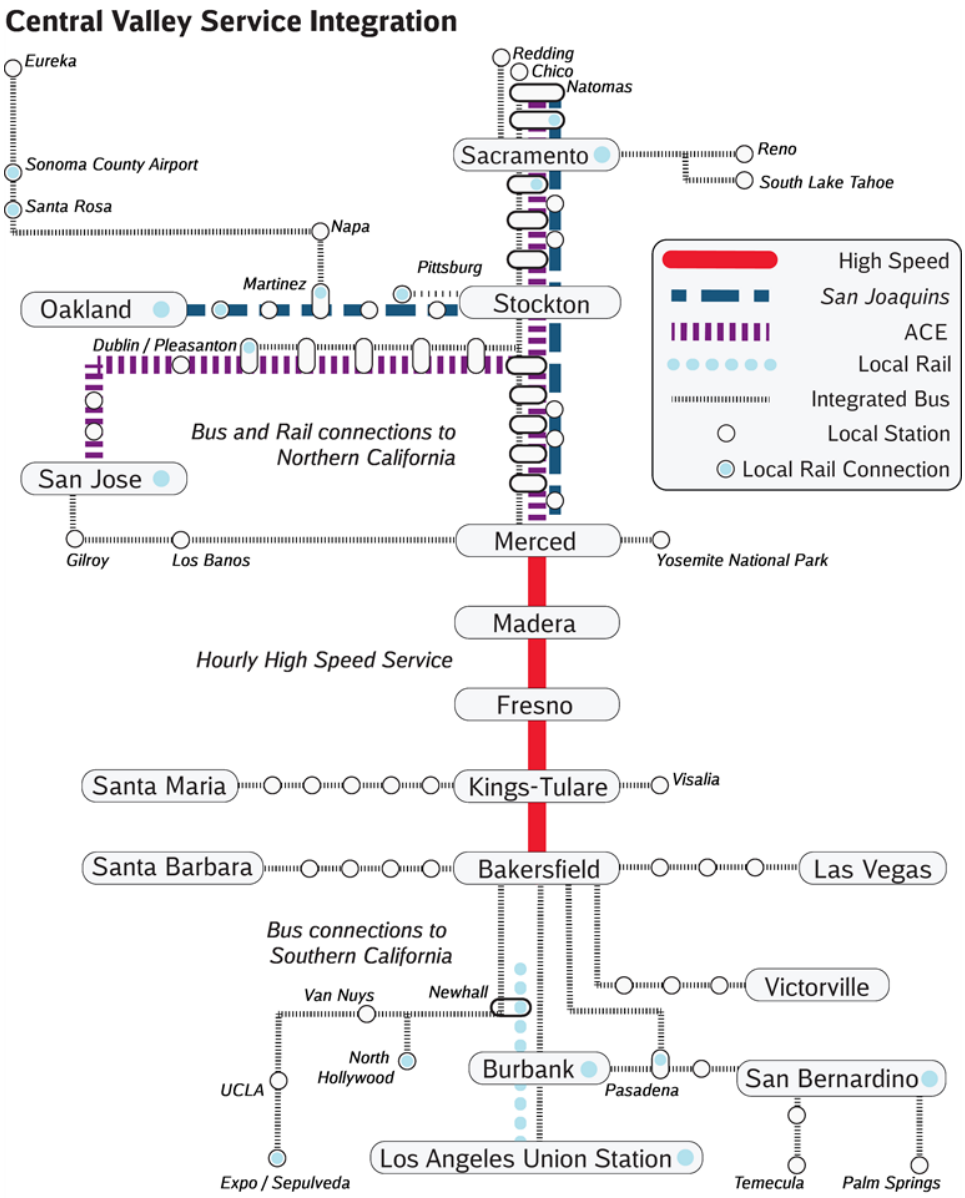


Figure ES-1: Central Valley Integrated Service Concept

The information contained in this report as they relate to O&M costs and revenues were obtained from the following sources, which includes third-party information based on documented assumptions:

- HSR O&M costs estimates were calculated by the ETO for the section Merced - Bakersfield;

- ACE and San Joaquins O&M costs were calculated and provided by San Joaquin Regional Rail Commission (SJRRC) staff;
- Ridership and revenue forecasts were generated from the State Rail Plan Model as the basis and calibrated for purposes of this report. Inputs to the ridership model were reviewed jointly by the ETO, CalSTA and SJRRC staff.

The memorandums of understanding, agreements and contracts with the SJJPA, ACE and our Central Valley partners necessary to implement operations are not covered in the scope of this update.

Findings

1. Improved Financial Balance for the Total Corridor (including ACE and San Joaquins)

After optimizing the service connections for the total corridor in the CVS and reflecting the latest envisioned business structure (described in section 4), the results comparing the O&M costs to revenues (farebox and ancillary) shows a USD41.8 million gap, which is assumed to be covered by state and local funds. This is an improvement compared to the current total state and local funding of USD70.1million for the CVS corridor: This breaks down into the approved SJJPA state funding request for the San Joaquins which was USD53.9 million[1] in the fiscal year 18/19 and the local funding request for ACE/SJRRC of USD16.2 million[2] in fiscal year 18/19.

Figure ES-2 projects the financial balance for the consolidated "Total Corridor View" of the Central Valley interim service period, which includes conventional rail services, high-speed rail services and connecting bus services. The O&M costs for the total corridor, includes, HSR, ACE, San Joaquins and bus connections and totals USD237.1 million compared to total revenues (composed of farebox and ancillary revenues) totaling USD195.3 million, which results in a gap of USD41.8 million.

[1] https://sjjpa.com/wp-content/uploads/Final-2019-SJJPA-Bus-Plan-Update-1.pdf

[2] https://acerail.com/wp-content/uploads/Work-Program-20192020.FINAL_-1.pdf

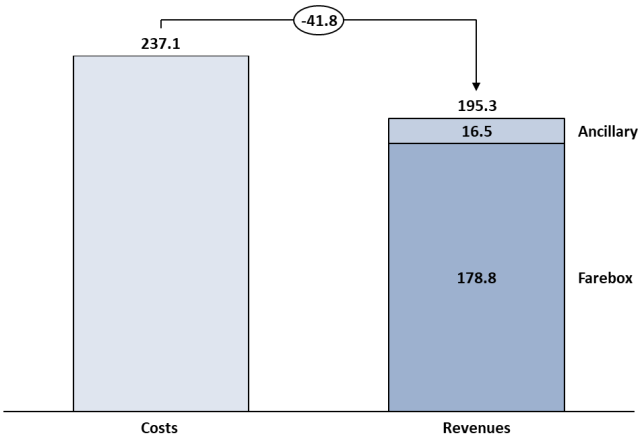


Figure ES-2: Total System 2029 O&M Costs vs. Revenues (in 2019 USD Million)

Note: Ancillary revenues include Low-Carbon Fuel Standards (LCFS) Credits. It is to be determined if these accrue to the State or to the Authority, but the ETO has included it in this systemwide projection for comparative purposes with the prior ETO study.

This is a further improvement compared to the gap of USD82.8 million for the systemwide No-Build scenario (without HSR), which was presented in the ETO's previous study. See Figure ES-3 below.

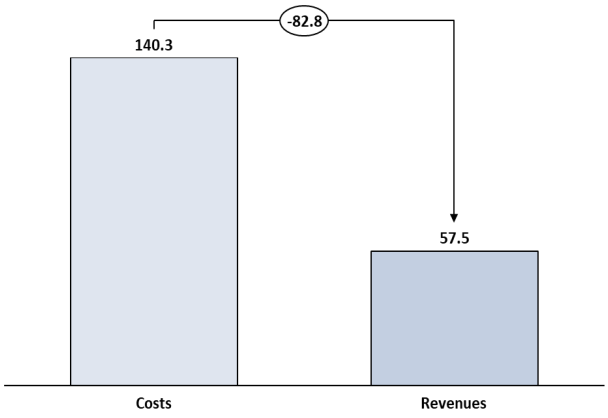


Figure ES-3:Total System 2026 Without HSR (ETO Study May 2019, in 2018 USD Million)

This further improvement in the financial balance compared to the previous ETO study is primarily driven by the following:

- Change in business structure compared to previous ETO study, which assumed the perspective of just the TOC. In this report, two financial perspectives are evaluated from the

viewpoint of the Authority and the Operator. This was driven by the Authority, who evaluated commercial strategies for how interim services in the Central Valley could look like given the policy and legal requirements regarding State subsidy;

- Updated integrated service concept reviewed with SJRRC for optimization of train and bus connections;
- The assumption of a Universal Operator, who will be responsible for HSR, conventional rail and bus services resulting in a reduction in O&M costs due to expected operational and administrative efficiencies;

2. Under the proposed Business Structure, CHSRA's costs are recovered

The Authority evaluated commercial strategies for running interim services in the Central Valley (Merced – Bakersfield). The main characteristics of the business structure during the interim Central Valley Service may look like:

- CHSRA entering into a partnership with SJRRC, who will contract with a Universal Operator to provide interim high-speed service as part of an extended corridor connecting Sacramento and the Bay Area with the Central Valley through ACE and San Joaquins regional services in Merced and connecting southern California with optimized bus services. The contractual relationship between CHSRA and SJRRC is planned to include:
    - A Train Rental Fee charged to SJRRC, such that CHSRA covers all of its maintenance and insurance costs related to Central Valley HSR rolling stock.
    - A System Access Fee charged to SJRRC for the usage of the HSR infrastructure and related assets – covering the costs incurred by CHSRA for the maintenance costs related to the infrastructure and overhead costs specific to the realization of a functioning HSR system arrangement (i.e. DBM contract management personnel, system insurance costs, rolling stock insurance costs, policing costs of the assets) for the Central Valley.
- During the interim services in the Central Valley (until Valley to Valley is completed), these responsibilities will fall with SJRRC and/or its Universal Operator for all services in the corridor, which includes:

- The existing conventional regional services (ACE, San Joaquins and buses)
- Interim high-speed service operations
- And other responsibilities see subsection 4.1.2

The Figure ES-4 below shows the financial balance on the Operator's side. The costs shown are composed of two main categories:

- One for the costs related to the system and rolling stock fees, which will be charged by CHSRA to the Operator totaling USD50.1 million for use of the HSR assets; and
- The other totaling USD186.9 million, which represents those costs direct to the Operator related to running HSR, ACE, San Joaquins and Bus services. It is assumed that the gap of USD57.7 million will primarily be covered by state and local funding or, in other words, it is assumed that there will be continued coverage of the Operator's costs via an operating subsidy. Depending on the treatment of Low Carbon Fuel Standard credits and who applies for this and is ultimately granted the right to these specific ancillary revenues, this gap of USD57.7 million may be further improved.

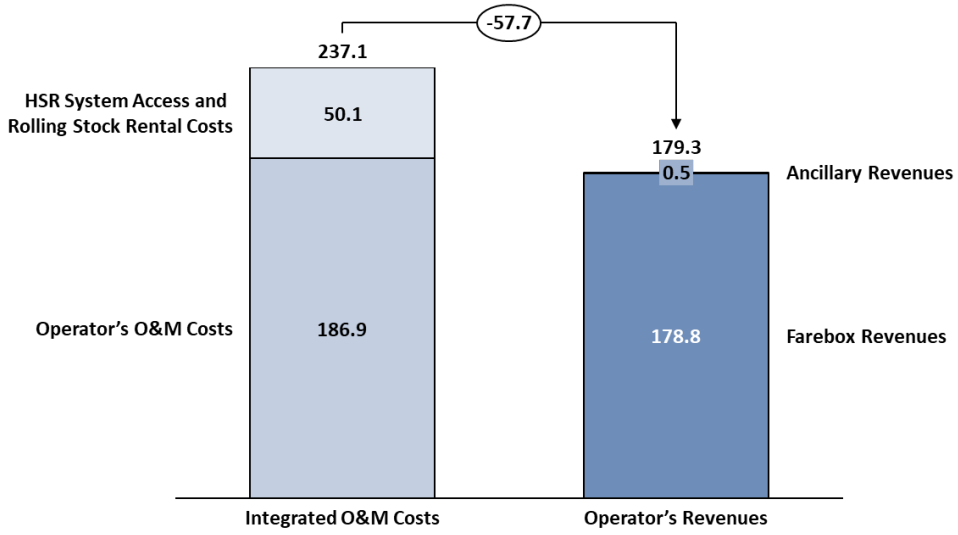


Figure ES-4: Total 2029 Operator O&M Costs vs. Revenues (in 2019 USD Million)

Note: For ease of illustration, the financial balance from the Operator's perspective also reflects the costs for system access fees and rolling stock rental fees (although these fees are assumed to be charged directly from CHSRA to SJRRC) in addition to the direct costs expected to be incurred by the Operator.

- While SJRRC undertakes the interim operations in the Central Valley, CHSRA will continue with the planning of Valley to Valley and Phase 1, as well as assume the role of Infrastructure and Rolling Stock management responsible for:
    - Managing the contracts for Track & Systems and Rolling Stock
    - Completing all phases of testing and commissioning for the system (Merced – Bakersfield)
    - Ensuring compliance of appropriate FRA requirements

During interim operations, the proposed business structure and integrated delivery of high-speed rail services, conventional rail services and connecting business services will enable:

- High-Speed service for the communities in California as soon as possible, providing mobility, economic and environmental benefits at the earliest possible time;
- SJRRC to take advantage of the improvements of the service by using high-speed trains and infrastructure; and
- Improvement to the financial balance from a total systemwide perspective.

In order for CHSRA to cover its costs on the management and maintenance of the relevant HSR rail infrastructure and assets, these costs will be covered by the revenue stream from fees charged to SJRRC. This approach results in CHSRA projecting a certain break-even situation for HSR system and assets utilized for the interim services in the Central Valley.

In Figure ES-5 below, the USD50.1 million in O&M costs on the Authority's side is fully charged to the Operator, which can be seen in the CHSRA Revenues column. In addition to the USD50.1 million, which CHSRA would receive as revenues related to the rolling stock, systems and overhead, CHSRA would also recognize ancillary revenues. It is still to be determined whether the LCFS credits accrue to the State or the Authority. The calculation of the ancillary revenues is further described in Section 7.3, CHSRA System Revenues.

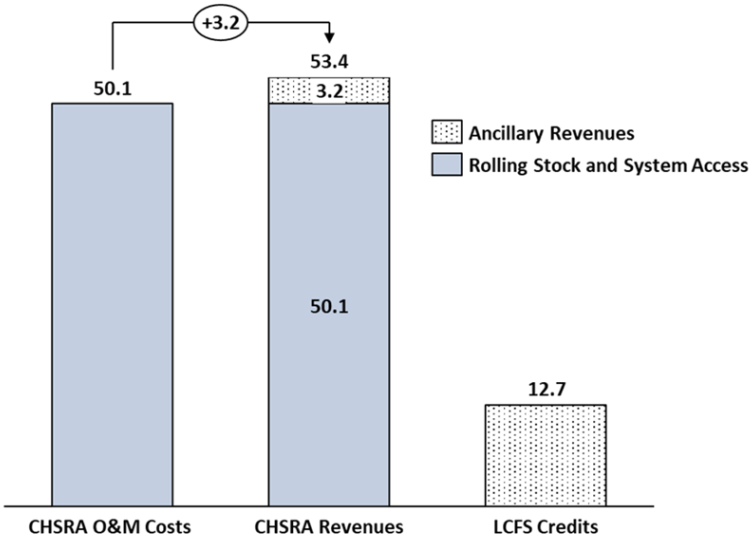


Figure ES-5: Total 2029 CHSRA O&M Costs vs. Revenues (in 2019 USD Million)

3. Optimization of Services Increases Total System Ridership

Figure ES-6 shows the annual ridership estimates for HSR, San Joaquins, ACE and bus services under different scenarios and time horizons calculated as unlinked trips.

As shown in Figure ES-7 and compared to the ETO's prior study, the total system ridership (calculated as linked trips) increases from 8,426,000 to 8,776,000, 2026 Build to 2029 Build, with HSR respectively.

This increase is a result of the following:

- Natural growth from a change in timeline horizon from start of revenue service in 2026 to 2029 (first full calendar year of interim service); and
- Optimized service connections with San Joaquins, ACE and bus connections.

Service Type	ETO Study May 2019 2017 No Build	ETO Study May 2019 2026 No Build	ETO Study May 2019 2026 Build	ETO Updated Forecast November 2019 2029 No Build	ETO Updated Forecast November 2019 2029 Build
HSR	--	--	1,671,000	--	2,049,000
San Joaquins	1,102,000	1,689,000	3,327,000	1,778,000	3,111,000
ACE	1,503,000	1,865,000	4,306,000	2,191,000	4,572,000
Thruway Bus BFD	258,000	324,000	570,000	341,000	668,000
Other Thruway Bus	470,000	561,000	912,000	587,000	1,441,000

Figure ES-6: Annual ridership estimates by service type under different scenarios are unlinked trips and not additive

Service Type	ETO Study May 2019 2017 No Build	ETO Study May 2019 2026 No Build	ETO Study May 2019 2026 Build	ETO Updated Forecast November 2019 2029 No Build	ETO Updated Forecast November 2019 2029 Build
Total System Linked Trips	2,606,000	3,555,000	8,426,000	3,969,000	8,776,000

Figure ES-7: Total systemwide annual ridership under different scenarios reflected as linked trips

When comparing the 2029 No Build to the 2029 Build, the total system ridership increase is +121%, or from 3,969,000 to 8,776,000 ridership respectively. This is supported by a significant growth in service frequency and connectivity provided by the ACE, San Joaquins and Bus services that are designed to complement the high-speed rail service between Merced and Bakersfield. Overall the addition of the connecting services north of Merced and south of Bakersfield represent a significant and transformational change over today's service frequency enabling hourly travel options between all system stops across the total system. While the HSR service almost triples the train miles between Merced and Bakersfield, the ridership increases by 98%. The connecting services north of Merced increase the train and bus miles by 122% percent and show a corresponding increase in ridership of

118%. See subsection 17.3 for further details. This increase in demand is a combination of local demand increases as well as the increased demand of HSR travelers transferring in Merced.

Consistent with the ETO's prior study, the updated ridership results were found to be reasonable after further evaluating them from the context of train and bus miles and market share analysis projected to be captured by HSR in the 2029 Build scenario compared to the 2029 No Build scenario. See Section 17, Ridership and Fare Revenue for further details regarding the 2029 Build scenario and other sensitivities conducted by the ETO.

In conclusion, interim HSR services between Merced – Bakersfield creates significant value, when connected to the total existing corridor (including ACE, San Joaquins and bus network). The development of an integrated service concept with optimized connections results in improved services and reduction in travel time for the passenger. Further the Authority evaluated a business model, which enables the use of HSR infrastructure and assets by another operator for interim service in the Central Valley. Based on the ETO's results in this report and under this business model, there is a further improvement in the projected gap between systemwide revenues and operations & maintenance costs. Next steps are to develop memorandums of understanding with providers and other Central Valley partners.

1 Introduction

1.1 Central Valley and Peninsula Corridors Operations Financial Plan Study

On May 1, 2019 the Authority published its Project Update Report as well as one of the supporting documents to this Report, the ETO's Central Valley and Peninsula Corridors Operations Financial Plan Study (Study). A summary of this Study found that operating interim services in the CVS (Merced-Bakersfield) is projected to create significant value:

- Twice the rail service offered to communities;
- Improvement to the financial balance of the total combined regional corridor for local and state funding;
- Economic development and ease of access to opportunities throughout the Central Valley; and
- Shorter travel times for passengers

However, it was found that operating an interim HSR service on the Peninsula corridor overlaying the Caltrain service does not create a substantial impact as most of the improvements are already captured by the 2028 Electrification Scenario by Caltrain (without HSR).

1.2 Purpose of this Interim Financial Plan

The main purpose of this report is aimed at the following:

- Continue to understand the benefits that interim HSR operations will create for the total corridor in the Central Valley;
- Understand how interim operations in the Central Valley can be executed;
- Pre-Operations (Operator Mobilization and Trial Running); and
- Analysis of the projected financial balances based on documented assumptions with the Authority and close discussions with stakeholders, including SJRRC and CalSTA; specifically, what the financial balances may look like, in line with the proposed business model, from the following perspectives: total corridor view, Authority's view and Operator's view.

Compared to the Financial Plan Study delivered by the ETO on May 1, 2019, this report is different in the following important ways:

- This Interim Financial Plan reflects more closely a business structure which is considered by the CHSRA as the most feasible approach for implementing interim HSR operations in the Central Valley (Merced-Bakersfield). As such, the financial balances are provided from the perspectives of CHSRA and an Operator, whereas, the previous ETO's study consolidated all costs into a single Train Operating Company. The total corridor view financial balance is also provided and in this view is comparable to the total systemwide view financial balance previously calculated in the ETO's study.
- The pre-operations phase is also described with the relevant cost estimates for this period, prior to revenue operations.

1.3 Contents

This document contains the following elements:

- Agreed-upon assumptions for service and operations characteristics
- Commercial structure assumed for financial planning of interim HSR services
- General assumptions impacting operational concepts, costs, and revenues
- Pre-operations planning concepts and cost projections
- Organizational and O&M costing for all interim HSR operations components
- Ridership, fare, and ancillary revenue projections
- Resulting financial balance for Authority, Operator and overall systemwide

1.4 Disclaimer

This document is strictly for deliberative purposes. It is neither a proposal nor an offer to perform such services. Financial projections included in this document are to be seen as high-level and indicative projections of costs and revenues. All assumptions were documented and reviewed jointly with CHSRA and SJRRC and are the basis for the O&M cost estimates and ridership and revenue projections.

2 Definitions, Abbreviations and References

Acronym	Definition
ACE	Altamont Corridor Express
ADA	Americans with Disabilities Act
AFC	Automatic Fare Collection
App	Application
APTA	American Public Transportation Association
ATO	Automatic Train Control
Authority	California High-Speed Rail Authority
BFD	Bakersfield
BN	Burlington Northern
BNSF	Burlington Northern Santa Fe (BNSF) Railway Company
C&S	Communications and Signaling
CalEPA	California Environmental Protection Agency
CalSTA	California State Transportation Agency
CAPEX	Capital Expenditures
CCTV	Close Circuit Television (Surveillance)
CEQA	California Environmental Quality Act
CHSRA	California High-Speed Rail Authority
CHP	California Highway Patrol
COO	Chief Operations Officer
CPI	Consumer Price Index
CPUC	California Public Utilities Commission
CRM	Customer Relationship Management
Ct	Cent
CVS	Central Valley Segment
D&A	Drug and Alcohol
DAS	Data Acquisition System
DB E&C	Deutsche Bahn Engineering and Consulting USA Inc.
DBA	Database Administrator

Acronym	Definition
DBM	Design, Build, Maintain
DES	Data Encryption Standard
DHS	Department of Homeland Security
EPA	Environmental Protection Agency
EPP	Emergency Preparedness Plan
ETO	Early Train Operator (DB and its subcontractors)
FRA	Federal Railroad Administration
FTE	Full-Time Equivalent
GRC	Governance, Risk, and Compliance
HMF	Heavy Maintenance Facility
HSR	High-Speed Rail
HVAC	Heating Ventilation and Air Conditioning
IGP	Interior Gateway Protocol
IIPP	Injury and Illness Prevention Plan
ISO	International Organization for Standardization
IT	Information Technology
ITCS	Installation, Testing and Commissioning Supervision
Km/h	Kilometers per hour
LA	Los Angeles
LCFS	Low Carbon Fuel Standard
M&B	Marketing and Branding
MCD	Merced
MITC	Merced Interim Track Connection
MOU	Memorandum of Understanding
MOW	Maintenance of Way
NEPA	National Environmental Policy Act
NB	No-Build scenario without HSR
NPDES	National Pollutant Discharge Elimination System
NRV	Non-Revenue Vehicles
O&M	Operation and Maintenance

Acronym	Definition
OCC	Operations Control Center
OCS	Overhead Catenary System
OMTR	Operator Mobilization and Trial Running
OSHA	Occupational Safety and Health Administration
PDPD	Per Direction Per Day
PG&E	Pacific Gas and Electric Company
PR	Public Relations
PTC	Positive Train Control
QR	Quick Response
ROW	Right of Way
RS	Rolling Stock
RWQCB	Regional Water Quality Control Boards
SJJPA	San Joaquin Joint Powers Authority
SJRRC	San Joaquin Regional Rail Commission
SOC	Security Operations Center
SPCC	Spill Prevention, Control, and Countermeasure
STIP	State Transportation Improvement Program
SWPPP	Storm Water Pollution Prevention Plan
TaaS	Ticketing as a Service
TIRCP	Transit and Intercity Rail Capital Program
TOC	Train Operating Company
TPSS	Traction Power Substation
T&S	Track and Systems
TVA	Threat and Vulnerability Assessment
TVM	Ticket Vending Machine
UP	Union Pacific
USD	United States Dollar
V2V	Valley to Valley
Wh	Watt hour

The following terms are used in this document.

Term	Definition
Account-Based	Payment system in which an account that exists on a back-end server or clearinghouse is debited to accomplish fare payment. An identifier (smart card, bar code, etc.) is presented to an electronic reader that then references the account to deduct the transit fare.
App	An application, typically a small, specialized program downloaded onto mobile devices
Base Case	2029 Scenario with HSR operations and the updated integrated service concept in this report ('2029 Build')
Closed System	A system operated solely for the purposes of a defined population, (e.g., users of transit, or other transportation services).
Credit Card	A card issued by banks, businesses, etc., enabling the holder to obtain goods and services on credit
CVS Interim Financial Plan	Central Valley Segment System Management & Operations Interim Financial Plan ("Report")
Data Encryption Standard (DES)	A widely used public-domain symmetric key cryptographic algorithm, DES is based on a published algorithm with secret keys. A method for encrypting information (See related term Triple DES).
Device Manager	Person responsible for providing and maintaining the front-end payment devices such as fare gates, validators, and ticket vending machines for, or on behalf of the Service Provider.
Encryption	The process of translating information into a code that can only be read if the reader has access to the key that was used to encrypt it. There are two main types of encryption, asymmetric (or public key), and symmetric (or secret key).
EPCRA SARA Title III	Emergency Planning and Community Right-to-Know Act, Superfund Amendments and Reauthorization Act. Title III of the SARA provisions are also known as the Emergency Planning and Community Right-to-Know Act (EPCRA).
ETO Study May 2019	ETO Central Valley and Peninsula Corridors Operations Financial Plan Study ("Study")

Term	Definition
Fare Gate	A unit that bars passage in one or both directions until it has processed a fare card or determined the user has paid a valid fare. One customer is allowed passage for each valid fare card or cash fare that is presented. Fare gates separate paid fare area from unpaid fare area in a station.
Fare Inspector	A person designated to examine and validate the authenticity of a payment for a ticket, receipt, or means of showing proper payment.
Fare Policy	An adopted statement of principle or guideline that defines a desired approach to the establishment of fares for transit services rendered. Fare policies may address issues such as environmental justice or fare equity, governance, etc., logical structure for classifying and organizing an agencies transit fare structure, fare prices, and tariff rules.
Fare Product	Specific types of pre-paid products (e.g. monthly pass, single ride and T-purse) used to gain access to services within a transportation system and defined by agency or regional fare policy.
Fare Structure	A specific schedule of fare categories and respective fare rates that customers must pay for services rendered by a transit agency/operator
Handover	The transfer of the use of the T&S and Rolling Stock assets to the Operator after the System Acceptance of T&S and Rolling Stock
HazMat	Hazardous Materials
Local Area Network	A data communication network, conforming to IEEE standards, that connects multiple computer-controlled devices in close proximity to one another, e.g., within one office or building.
Low Carbon Fuel Standard	The purpose of this regulation is to implement a low carbon fuel standard, which will reduce the full fuel-cycle, carbon intensity of the transportation fuel pool used in California, pursuant to the California Global Warming Solutions Act of 2006 (Health & Safety Code, section 38500 et seq)
Marsh	Global professional services firm with operations in insurance brokering and risk management.

Term	Definition
Network Manager	A person that sets and maintains the standards, ensures certification and regulates the entry and exit of participants to ensure the interoperability, integrity and confidentiality of devices, systems and data
No Build	Scenario which does not include HSR operations
Open-loop	A fare payment system where a third party produces the fare media used for fare payment purposes. The third-party fare media is generally accepted outside of the system (such as a credit or debit card) for payment purposes. This is in contrast to a Closed Loop System where an agency produces for media exclusively for payment within the system.
Point-of-Sale Device or Terminal	A device used to make purchase transactions at the point they occur (e.g., at a retailer location)
Pricing Engine	A software responsible for journey reconstruction and determining the price of the journey in accordance with the fare rules
Proof of Payment	A means to prove that a fare has been paid for the transport of a patron. The “proof of payment” may be observing the ticket printing, scanning wirelessly with a device, scanning with an optical laser, or scanning with an infrared optical light beam.
Reports	Database information in predetermined format
Settlement Operator	Operator who transfers funds between Payment Providers and Fare Product/ Policy Owners (or those Service Providers designated as recipient by the Fare Product/ Policy Owner
Ticketing as a Service (TaaS)	A model in which centrally hosted ticketing is licensed on a subscription basis
Ticket Vending Machine	Freestanding, unattended device used by customers to purchase or revalue fare cards. A full-service TVM can provide cash and credit card transaction service. A cashless TVM has all the capabilities of a full service TVM except accepting cash and dispensing change.
Transit and Intercity Rail Capital Program (TIRCP)	Competitive capital grants awarded by the California State Transportation Agency for projects that demonstrate reductions in future greenhouse gas emissions.
Transaction	A collection of interrelated payment steps

Term	Definition
Triple Data Encryption Standard DES	Triple DES is a type of computerized cryptography in which block cipher algorithms are applied three times to each data block. The key size is increased in Triple DES to ensure additional security through encryption. (Source: www.techopedia.com)
Universal Operator	Operator under the San Joaquin Regional Rail Commission who is responsible for HSR train operations, ACE and San Joaquins train operations and bus services
Yellow Plant	Rail-bound Maintenance Fleet

The following documents are referenced within this document.

No.	Description	Identification/Date
1	ETO Central Valley and Peninsula Corridors Operations Financial Plan Study	May 1, 2019
2	CHSRA 2019 Project Update Report	May 1, 2019
3	General Industry Safety Orders, Article 165. Employee Alarm Systems: (https://www.dir.ca.gov/title8/6184.html (accessed Jan. 31, 2020)	
4	California Senate Bill-742 Intercity Passenger Rail Services: Motor Carrier Transportation of Passengers.	Oct. 9, 2019

PART A: GENERAL ASSUMPTIONS AND COMMERCIAL STRUCTURE

3 General Assumptions

3.1 Capital Assets and Inventory

For the purpose of this report, no capital costs for significant assets, inventory (i.e. NRVs, etc.), or yellow plant have been included. It is assumed at the start of interim revenue service operations that all necessary infrastructure and assets will be available for use by the TOC.

It is assumed that most of the assets and inventory are purchased and owned by CHSRA or by another designated State of California entity. The study consequently does not account for capitalized assets or amortization/ depreciation of any assets.

Given this absence of capital costing and the limited, four-year horizon of the study, no assumptions have been made regarding the replacement costs or mid-life overhauls/ refurbishment of equipment or assets.

3.2 Labor Rates and Overhead

3.2.1 Standard Pay Grades

Figure 3-1 shows the standardized pay grades used in this report. Consistent with the ETO's previous study, pay grades were allocated to the specific positions. The pay grades are linked to the salaries shown in Figure 3-1. Assumptions related to productivity per FTE, such as shift differential, overtime premium etc., are included in these labor rates. Assumptions concerning fringe benefits, employer's costs, labor overheads etc. are not included in these rates and are detailed in the following subsections.

No.	Pay Grade	Average Salary per Annum (USD)
1	Assistant	62,062
2	Analyst	82,750
3	Manager	103,437
4	Senior Manager (fewer than ten years' experience)	124,125
5	Senior Manager (greater than ten years' experience)	155,156
6	Director	181,015
7	Senior Director	206,875

Figure 3-1: Standardized pay grades for use in this report

3.2.2 Fringe Benefits and Employer Costs

This report assumes a general healthcare contribution of USD23,699 per FTE paid for by the TOC, plus a 35% markup in addition to 'unloaded' labor rates shown above. This markup accounts for benefits contributions paid by the TOC.

3.2.3 Labor Overhead

Work uniforms, safety gear, telephone/ laptops, etc. are included in this report.

3.2.4 Unionization

This report assumes unionization as appropriate in the California railway sector context.

3.2.5 Buy America

No impact is assumed in relation to any specific Buy America Act requirements that would impact costs.

3.3 Quality, Efficiency and Productivity

3.3.1 Labor Productivity

For blue collar labor, this report assumes a productivity factor of 80% per FTE (the remaining 20% being absorbed by non-core activities, administration, shift preparations, etc.).

For white collar labor this report assumes 1,750 work hours per FTE per year.

3.4 Escalations

3.4.1 Currency

All dollar amounts in this report are provided and calculated in 2019 USD, unless stated otherwise.

3.4.2 Labor Rate Indexation

For escalation of labor rate assumptions from the ETO Study May 2019, figures were indexed from 2018 to 2019 USD at the labor cost inflation rate of 3.44% per annum.

3.4.3 Electricity Price Indexation

For escalation of electricity price assumptions from the ETO Study May 2019, electricity prices were indexed from 2018 to 2019 USD at an electricity price inflation rate of 5.04% per annum.

3.4.4 CPI/Other Indexation

For escalation of other cost assumptions from the ETO Study May 2019, the costs and applicable ancillary revenues were indexed from 2018 to 2019 USD at a CPI (Consumer Price Index) rate of 3.45% per annum.

3.5 CVS Service Vision

The CVS service vision remains focused on offering more than just a new train service at a certain hourly frequency. The following concepts were considered as key elements in support of an overall CVS service vision:

- Improvement of existing passenger service offered between Merced and Bakersfield, increasing the service frequency and reducing the travel times to and from the Central Valley;
- Integrated end-to-end travel service (Uber/Bus/LRT/San Joaquins, ACE-CHSRA):
    - Optimized schedules and infrastructure for smooth (cross-platform) transfer;

- High connectivity and consistent travel chains comprising clock-face timetables, both for the high-speed trains and for the corresponding rail and bus feeder services, are implemented for customer satisfaction;
- Setting a new high-speed rail operations standard for subsequent expansion to the V2V service; and
- CHSRA drives economic development of the Central Valley region.

3.6 CVS HSR Operations

This section describes the key characteristics of the CVS HSR operations. These assumptions were defined in consultation with CHSRA prior to the update of this report.

The key characteristics of the CVS operations are classified in the following five categories:

1. Timeline – CVS operations' start date and end date, major milestones and the critical path
2. Physical Assets – high-speed rail infrastructure and additional assets and facilities that are shared and/or available for CVS operations
3. Service Access – the connecting services, infrastructure and passenger transfer to access the CVS HSR service
4. Service Level – CVS train service characteristics
5. Revenue Policy – fare level, fare structure and revenue collection approach

3.6.1 Timeline

The analysis and projections of CVS operations costs and revenue begins in the pre-operations stage from the assumed signing of the Operating Contract Q1-2026 onwards (assessing cost of mobilization and trial running) and continues until the start of full interim HSR revenue operations service in December 2028.

This results in a forecasting period for pre-operations from Q1 2026 – 2028 and for operations from December 2028 to November 2032 (for modelling purposes only). Any cost or revenue prior or subsequent to this period is not included in this analysis. This timeframe is solely used for purposes

of this Interim Financial Plan and is subject to ongoing evaluation and updates by the Authority for implementation.

Figure 3-2 shows the scope of the report timeline.

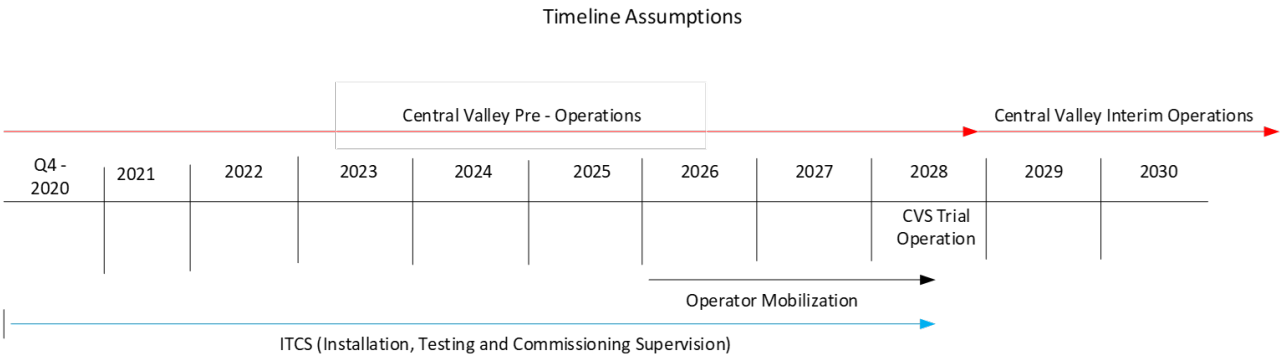


Figure 3-2: CVS Scenario Characteristics, Timeline

3.6.2 Physical Assets

3.6.2.1 Approach

The CHSRA system will consist of numerous complex asset classes with unique maintenance requirements and varying lifespans. These assets must be maintained on a schedule that is consistent with original equipment manufacturers' recommendations supplemented by regular condition and performance assessments. Proper asset maintenance directly impacts safety, service reliability, customer satisfaction, and, ultimately, cost.

The approach to developing the cost estimates for asset maintenance focuses on keeping all assets in a state of good repair throughout their useful lives until they must be renewed or replaced. Investments must be sufficient at all times to avoid the negative consequences of deferred maintenance. This perspective applies regardless of the time horizon. For the purpose of this Interim Financial Plan, the renewal or replacement cost at the end of the asset lifecycle is not included in the calculation.

3.6.2.2 Characteristics

Key physical assets in the form of stations, Heavy Maintenance Facility (HMF), TOC office facilities, HSR infrastructure and other assets are assumed to be the following:

- Stations - HSR stations (from north to south): Merced, Madera (environmentally cleared and funded by others), Fresno, Kings/Tulare and Bakersfield

Stations are assumed to be trackside stations: Trackside stations consist of open platforms and canopies, with vertical circulation elements (two elevators, two escalators and two sets of stairs per platform, pedestrian bridges), access for passengers with disabilities, platform emergency egress elements, mechanical and electrical elements, fire protection, and communication elements. Fare gates are not included. As a working assumption, no distinction between stations is applied in terms of size, passenger numbers or other attributes that would affect station-related costs.

HMF – For purposes of this Interim Financial Plan, the presence of an HMF between Fresno and Kings/Tulare is assumed (without rental/ lease costs or capital cost depreciation, but costs to maintain are included, e.g. janitorial services). The final location for the HMF is to be determined by the Authority. The HMF is assumed to comprise/accommodate the following facilities and functions:

- Rolling stock workshop;
- Stabling yard;
- Warehouse facilitating:
  - Stocking of spare parts for rolling stock;
  - Stocking of tools for rolling stock;
  - Stabling/parking of maintenance fleet and non-revenue vehicles (“yellow plant”).

As shown in Figure 3-3, the stabling yard serves as an interface between operations and heavy maintenance, while also providing a clear delineation for the signaling systems. The stabling yard is part of the core operations. It is located in the depot and designed so there are no conflicting movements between the workshop shunting and daily operations.

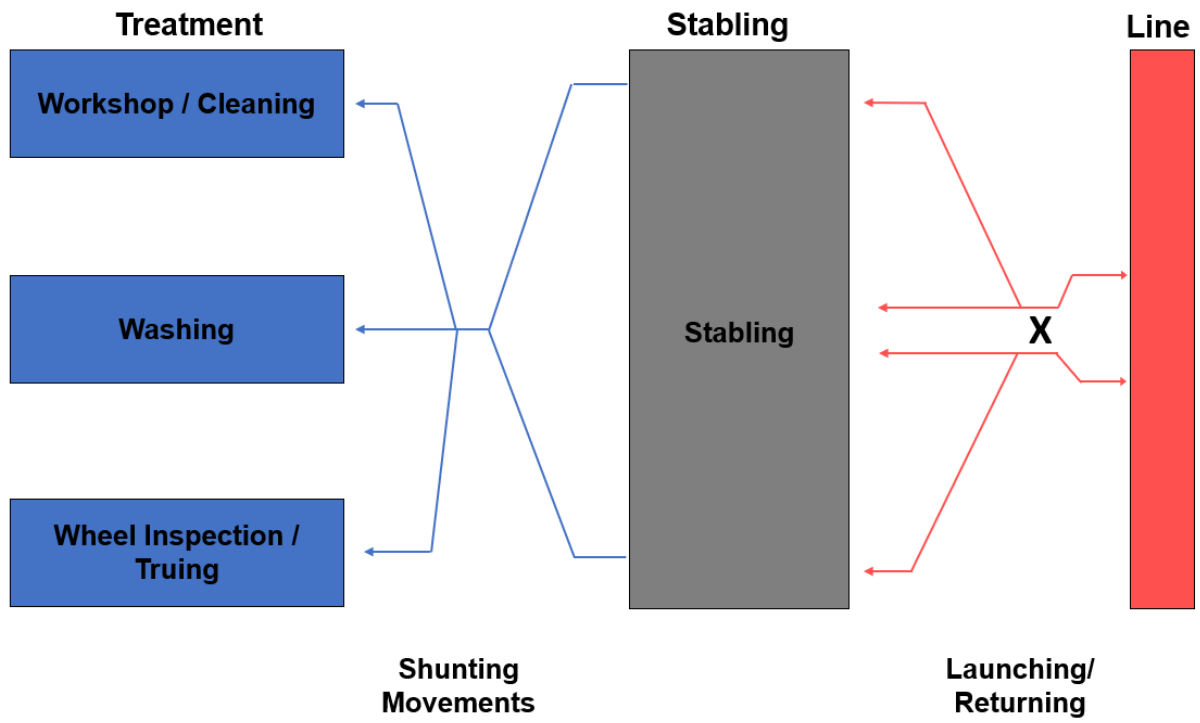


Figure 3-3: Depot concept: Stabling yard as an interface between operations and heavy maintenance

- TOC administrative building - The availability of a TOC administrative facility in Fresno is assumed with a minimum area of 15,000 square feet. Maintenance costs (e.g. janitorial services, etc.) for this space are included in this report.
- HSR track, systems and infrastructure - For the purposes of this Interim Financial Plan, it is assumed that for trial operations all track, systems, and structures are completed, and the system accepted and safety certified.

The following infrastructure operations, inspections and maintenance is included in the scope: track, systems, and track substructure between Merced and Bakersfield.

3.6.3 Service Access

It is assumed that the Universal Operator will use the HSR section between Merced in the north and Bakersfield in the south.

It is assumed that continued rail and bus connections in Merced and Bakersfield are cross-platform transfers, ensuring a seamless connection for the passengers.

It is assumed that required additional infrastructure for providing the above-mentioned connections will be available for the start of revenue service.

3.6.4 Service Level

It is assumed that there will be one train per hour operating in both directions from 5 a.m. to midnight (365 days per year, with no distinction between weekdays, weekend days, and holidays).

It is assumed that the service ramp-up effects on cost/ efficiency will be covered during the trial operations period prior to full revenue service starting in December 2028.

3.6.5 Revenue Policy

It is assumed that the fare structure on the CVS train service reflects distance-based fares, which corresponds with the existing San Joaquins fares charged for rail travel in the Central Valley between Merced and Bakersfield.

Revenue collection will be primarily done via e-ticketing services.

3.7 Warranties

It is assumed that all warranties related to subcontracts, rolling stock, equipment, and HSR infrastructure extend at least for the four-year duration of the CVS forecasting period.

3.8 Compliance

3.8.1 FRA Compliance

It is assumed that the applicability of FRA regarding track inspections will be negotiated between CHSRA and FRA. Therefore, for purposes of this report, no costs have been included. The civil structures cost estimate covers the maintenance cost for all bridges, culverts, drainage systems, retaining walls, trenches, and fencing. This includes inspections based on FRA requirements for bridges and annual structure inspections.

In addition to its oversight of operational safety matters, the FRA has several regulatory requirements related to plans, certifications, reports, inspections and other documentation. Those requirements are delineated primarily in 49 CFR 200 series. Plans required by the FRA include transporting individuals with disabilities, railroad safety, operating rules, maintenance and repair of signal and train control systems, emergency preparedness, roadway worker protection, random drug testing, and electronic communication devices. The FRA requires documentation and report topics such as alcohol misuse prevention program results, railroad injuries and illness, accidents, hours of service, passenger equipment safety, and emergency simulations. In addition, railroads must have written certification programs for the training of locomotive engineers and conductors. Certain documentation must be submitted to FRA on a scheduled basis for review and approval. In other cases, records are subject to periodic audit by the FRA to verify the records are accurate and up to date. FRA compliance is incorporated into the day-to-day work responsibilities of the TOC's health and safety, training, maintenance, operations, environmental and governance and compliance headcount for CVS.

3.8.2 Safety, Health and Environmental Compliance

Occupational Safety and Health Administration (OSHA) sets and enforces standards, requires specific types of training programs and mandates reports related to employee health and safety in the workplace. OHSA's jurisdiction covers most private sector employers and their workers. Among the specific areas regulated by OSHA are indoor air quality, noise, sanitation, hazardous chemicals, worker's hours, fall protection, fire prevention, worker injuries and illnesses.

Most of OSHA's regulations are contained in 29 Code of Federal Regulations, Parts 1904 and 1910. Some examples of specific regulations include:

- Walking-working surfaces must be inspected regularly and maintained in safe condition, free of hazards, and loads
- Employer must provide training for fall protection, overhead cranes, welding, bloodborne pathogens, and electrical safety

- Employer must keep certain records related to employee injuries, illness and death; employee fatalities must be reported to OSHA within eight hours, or within 24 hours for employee hospitalization for loss of limb or and loss of an eye

In some cases, OSHA accepts records and practices that comply with other regulatory agencies. OSHA compliance is incorporated into the day-to-day work responsibilities of TOC's health and safety and training headcount for CVS.

California has stringent laws, regulations, and state agencies that will provide environmental compliance oversight of the TOC. Each of these requires the TOC to develop plans and procedures, conduct inspections, obtain permits, track data, and provide reports, as mandated by the respective agencies. Costs for these activities are included in this report.

3.8.3 ISO Compliance

It is assumed that the future TOC for California High-Speed Rail will have both 9001 and 14001 certifications. Costs for these certifications have been included in the report.

ISO is the International Organization for Standardization, a worldwide federation of national standards bodies. In ISO 9000, the fundamental concepts and principles for quality management systems (QMS) are explained in order to help organizations, including railroads, fulfil the needs and expectations of their customers and to achieve satisfaction with their products and services. The ISO 9000 standard contains seven quality management principles related to customer focus, leadership, engagement of people, process approach, improvement, evidence abased decision making, and relationship management.

ISO 9001, based on the quality management principles described in ISO 9000, sets out the criteria and requirements for a quality management system. It is the only standard in the ISO 9000 family that can be certified to. Key to achieving an effective quality management system is the concept of risk-based thinking. Addressing both risks and opportunities establishes a basis for increasing the effectiveness of the quality management system, achieving improved results and preventing negative effect.

ISO 9001 implementation is based on the idea of continual improvement and is intended to result in:

- The ability to consistently provide products and services that meet customer needs and applicable statutory and regulatory requirements;
- Opportunities to enhance customer satisfaction;
- Addressing risks and opportunities associated with its context and objectives;
- The ability to demonstrate conformity to specified quality management system requirements.

ISO 9001 has a range of standards adapted to specific sectors and industries. For example, ISO/TS 22163 applies the ISO 9001 concepts to the railway industry and addresses principles such as RAMS (reliability, availability, maintainability and safety); key performance indicators (KPIs); failure-reporting analysis and corrective action system, and rail quality management system.

ISO 14000 is a family of standards for organizations looking to manage their environmental responsibilities. ISO 14001 sets out the criteria for an environmental management system and can be certified to. It requires organizations to consider all environmental issues related to their operations, such as air pollution, water and sewage issues, waste management, soil contamination, climate change mitigation and adaptation, and resource use and efficiency. It is intended to help organizations make efficient use of resources and reduce waste.

3.9 Tax Liabilities

This report does not assume corporate income tax, i.e. net profit/ loss projections provided are pre-tax.

3.10 Contingencies and Profit Margins

A contingency margin of 15% is assumed within the Rolling Stock and Track & Infrastructure contract. A contingency margin of 10% is assumed on top of the bus costs.

Operator's calculation: A 10% profit margin is assumed by the Operator related to the HSR O&M costs. A profit margin related to the ACE & San Joaquins O&M costs are already included in the amounts provided by SJRRC, therefore, the ETO did not calculate an additional profit margin. It is assumed that these O&M costs plus mark-up will be reimbursed 100% by SJRRC because the Operator will act as a service provider to SJRRC (no revenue risk for train operations in Central Valley).

Authority's calculation: 0% margin is calculated on top of the T&S and Rolling Stock maintenance contracts.

3.11 Status of Assumptions

An assumptions register has been documented for this report and have been discussed and agreed upon with the CHSRA as the basis for this Interim Financial Plan.

4 Commercial Structure

Based on CHSRA's current view of the commercial structure for interim HSR services implementation, this Interim Financial Plan provides pre-operations and operations financial projections. Specifically, from the perspective of CHSRA, it will charge System Access Fees and Rolling Stock rental fees to the SJRRC (at cost), who will procure a Universal Operator as the TOC for interim services in the Central Valley, until such time as V2V operations is ready for service to be operated by CHSRA. In the meantime, the TOC will be responsible for HSR train operations, ACE and San Joaquins train operations and bus connections; the TOC will be responsible in total for the associated O&M costs, bus costs and the System Access Fees and Rolling Stock rental fees, which will be charged by CHSRA.

For ease of illustration, when the financial balance is shown from the Operator's perspective, the costs also reflect the system access fees and rolling stock rental fees (although they are assumed to be charged directly from CHSRA to SJRRC) in addition to the direct costs expected to be incurred by the Operator.

The resulting high-level commercial structure for the Central Valley is illustrated below in Figure 4-1.

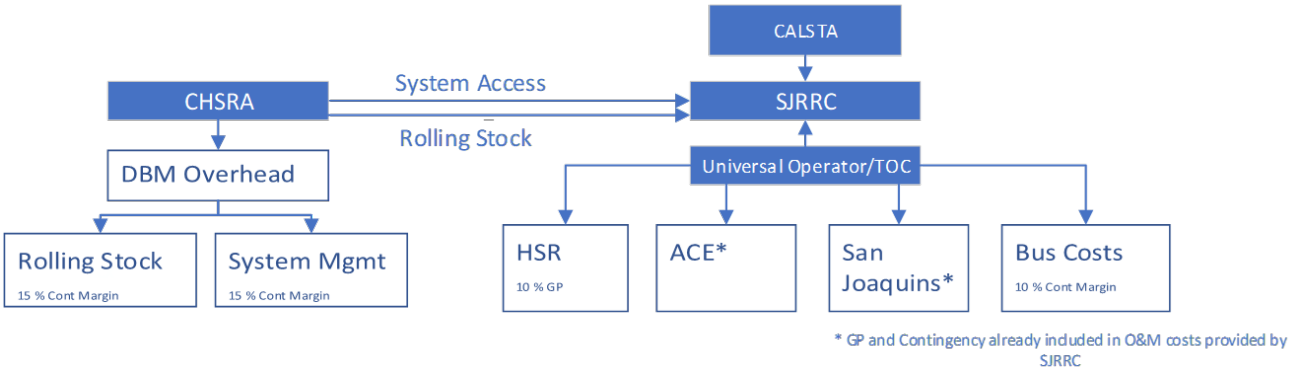


Figure 4-1: Commercial structure for CVS

4.1 Commercial Structure Elements

4.1.1 HSR System Management by CHSRA

- Management of DBM contractors Track & Systems and Rolling Stock

- Insurance, contract management, policing, regulatory/compliance

Following completion of construction and installation/delivery, and following pre-operations as described in Section 5 of this Interim Financial Plan, the expected scope of DBM contracts to be procured by CHSRA is:

- Maintenance of rolling stock:
  - Planned and corrective maintenance;
  - Rolling stock cleaning.
- Maintenance of civil structures (i.e. infrastructure and buildings);
- Maintenance of track and systems.

4.1.2 TOC for Central Valley

The expected scope of the TOC for Central Valley Train Operations is assumed to include:

- Service scheduling
- Fare structure policy
- Revenue collections
- Customer service
- Marketing and branding
- Administration
- Training, quality assurance, and compliance
- Development of ancillary revenue potential
- Security
- Policing
- Insurance

4.2 HSR Fees Payable

4.2.1 System Access Fee

The system access fee is assumed to be paid by the SJRRC for use of HSR infrastructure.

The assumed fee structure is:

- Monthly lump sum payable to cover exactly
  - costs incurred under track and systems maintenance contract
  - costs for HSR systems insurance
  - costs for CHSRA policing
  - costs for CHSRA DBM contract management personnel

4.2.2 Rolling Stock Rental Fee

The rolling stock rental fee is paid by the SJRRC for use of HSR rolling stock:

The fee structure is:

- Monthly lump sum payable to cover exactly
  - costs incurred under rolling stock maintenance contract
  - costs for HSR Rolling Stock insurance

PART B: PRE-OPERATIONS PLANNING AND COSTS

5 Pre-Operations Planning and Costs

5.1 Key Assumptions and Scope

The following Figure 5-1 illustrates the key milestones and timelines of the assumed pre-operational activities for Civil Works (CW), Track & Systems (T&S) and Rolling Stock (RS) as well as for the Operator in order to start revenue service in December 2028. For a more-detailed timeline see Appendix A, Figure A-1.

The associated costs described in this Section 5 for pre-operations activities are based on the ETO's assumptions discussed with CHSRA. As next steps, these assumptions should be re-evaluated taking into further consideration the more detailed working plans, which support all relevant FRA requirements. Therefore, the cost estimates described in this section are to be seen as high level and treated as an indication for the costs expected to be incurred by the Authority and the Operator during mobilization and trial operations.

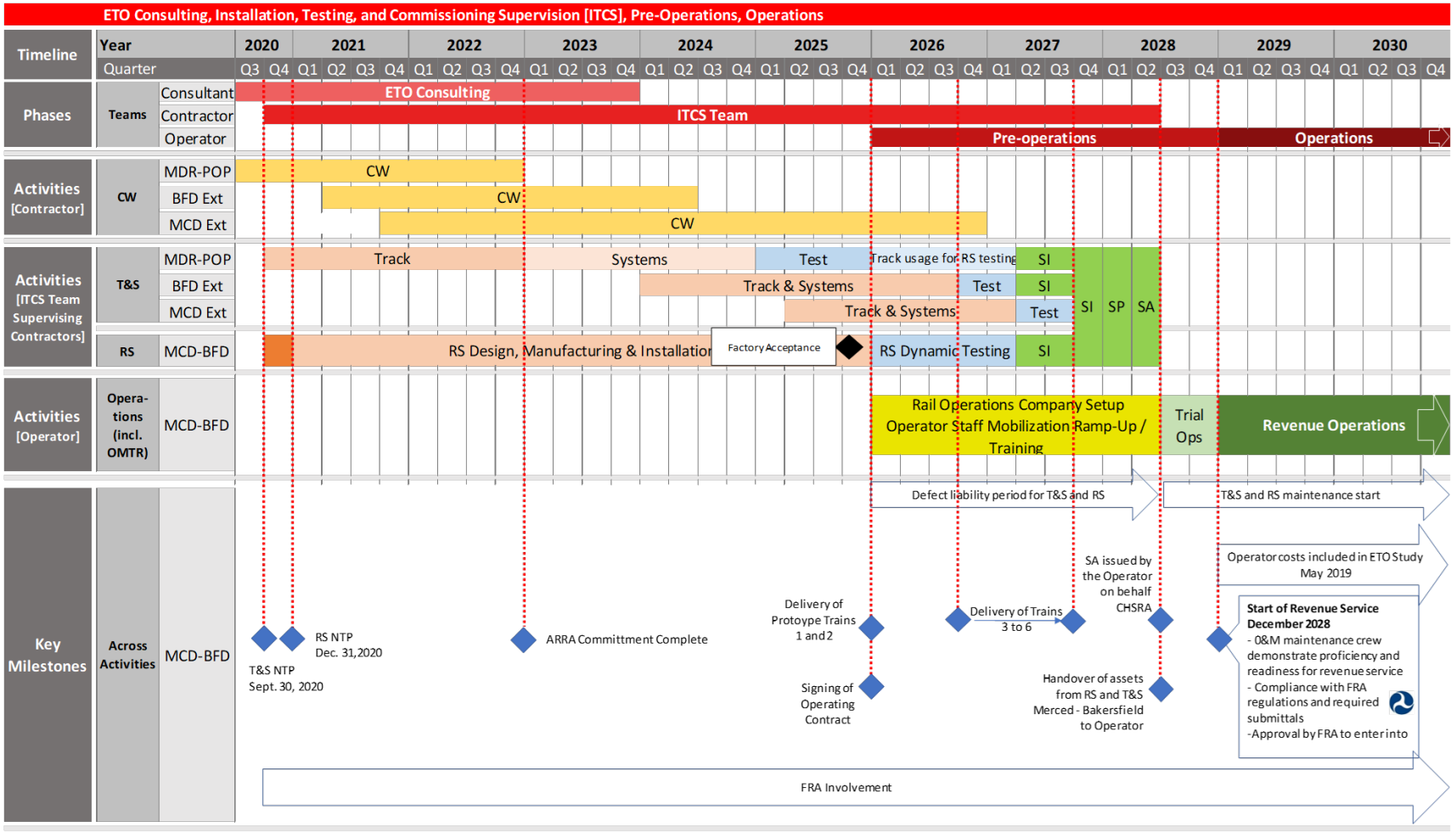


Figure 5-1: Timeline for Pre-Operations Merced-Bakersfield

ITCS (Installation, Testing, Commissioning Supervision) and Operator Mobilization will take place in parallel for a certain period of time.

ITCS and Operator Mobilization and Trial Running (OMTR) timing will be explained below including the reasons for the duration, staffing and related costs.

ITCS and OMTR Assumptions: General Planning

Two main streams of work are considered in the pre-operations period:

System Readiness (technical focus): During this stage of pre-operations, the track & systems and rolling stock suppliers will demonstrate that the rail system is fit for purpose and capable to perform according to the concept and system definition and specifications. This stage is planned to be supported by the ITCS (Installation, Testing and Commissioning Supervision) team, who will be in charge of issuing the system acceptance to the suppliers on behalf of the Authority.

Operational Readiness (process focus): In this stage, the Operator will demonstrate that all the processes, staff and resources are in place, trained and ready to start the operations. During the operational readiness stage, the Operator will test all modes of operations including the emergency management process and will achieve the FRA's approval for the necessary submittals to enter into passenger service.

The following list is based on assumptions by the ETO and agreed upon with the Authority and is the underlying basis for the overall timeline of ITCS and Pre-Operations. This remains consistent with the Authority's Project Update Report published May 1, 2019, from an overall timeline.

Timeline

- ITCS phase begins October 1, 2020 with T&S Design supervision of Madera-Poplar and ends with the system readiness of RS and T&S on June 30, 2028 when the use of the assets is transferred to the Operator for the full line Merced-Bakersfield.
- Operator Mobilization plus Trial Running also known as "Pre-operation" begins on January 1, 2026 with the assumed Signing of an Operating Contract (between CHSRA and the San Joaquins) and ends after a five months period of Trial Operations by the end of November

2028. Compliance with FRA regulations and all required submittals prior to revenue service is assumed to be in place by December 2028.

- Start of revenue service in December 2028 for Merced-Bakersfield

Civil Works

- As an integrator, it is assumed that the T&S contractor will be supporting the Authority in the acceptance of the civil works and the coordination with the contractors.
- Completion dates for civil works for Madera-Poplar, Bakersfield extension and Merced extension are based on the Project Update Report, May 1, 2019.

Track and Systems

- T&S NTP is assumed on September 30, 2020 for Madera-Poplar.
- T&S design is assumed to be an iterative process, where lessons learned from Madera-Poplar are applied to Merced and Bakersfield extensions. As a result of this, the T&S design phases for the extensions will (partly) take place before the actual installation of T&S on the extensions
    - Madera-Poplar
        - Basic track installation complete by December 31, 2022 (ARRA requirement)
        - Systems installation complete by December 31, 2024
        - Testing and Commissioning complete by December 31, 2025
        - Madera – Poplar will be used as the test track for the RS dynamic testing in 2026
    - Bakersfield Extension
        - T&S installation complete by September 30, 2026
        - Testing and Commissioning complete by March 31, 2027
    - Merced Extension
        - T&S installation complete by March 31, 2027
        - Testing and Commissioning complete by September 30, 2027

Rolling Stock

- RS NTP on December 30, 2020 (+3 months based on T&S NTP)

- Static testing will be done by the RS supplier and will finish by September 30, 2025
- Delivery of prototype trains 1 and 2 by January 1, 2026
- Dynamic testing of rolling stock on Madera-Polar between January 1, 2026 and December 31, 2026
- Delivery of trains 3-6 between October 1, 2026 and September 30, 2027

System Integration, Performance and Systems Integration

- System integration including RS starts on Madera-Bakersfield and will be extended to Merced
- 3 months of Systems Integration on the full line Merced-Bakersfield including RS, October 1, 2027 – December 31, 2027
- 3 months of Systems Performance on the full line Merced-Bakersfield incl. RS, January 1, 2028 – March 31, 2028
- 3 months of Systems Acceptance on the full line Merced-Bakersfield incl. RS, April 1, 2028 – June 30, 2028

T&S Supplier

- Defect Liability Period is assumed for T&S where the supplier covers for early challenges and regular maintenance cost until the use of the assets is handed over to the Operator by June 30, 2028
- All utility costs for T&S will be attributed to the T&S supplier until the handover of the full line to the Operator for trial operations

RS Supplier

- Defect Liability Period is assumed for RS where the supplier covers for the early challenges and regular maintenance cost the use of the assets is handed over to the Operator by June 30, 2028
- All utility costs for RS will be attributed to the RS supplier until the handover of the full line to the Operator for trial operations

Operator

- Rail Operations Company Setup between January 1, 2026 and June 30, 2028

- Trial Operations: Operator is responsible for trial operations which take place approximately between July 1, 2028 and November 30, 2028. This is the Operator's time to show proficiency and readiness for revenue operations.
- Revenue service starts in December 2028 for Merced-Bakersfield.

FRA Submittals

- It is assumed that suppliers of Track & Systems and Rolling Stock will actively fulfill all actions in compliance with all FRA requirements, including required submittals
- Authority's responsibilities to meet FRA requirements are accounted for in the ITCS staffing
- The Operator's responsibilities to meet FRA requirements during Pre-Operations and Trial Operations are accounted for in the Operator's staffing from January 1, 2026 to November 30, 2028

Automated Fare Collection

No pre-operations costs are assumed for Automated Fare Collection (AFC).

5.2 Operator Mobilization and Trial Running (OMTR)

The OMTR includes all works necessary from an operator perspective to show proficiency and readiness to run operations from day 1 of revenue service. Excluded from this are activities related to the Operations Control Center (OCC), which are part of the Tracks & Systems contract. The duration for Operator Mobilization is estimated to be 2.5 years from the assumed signing of the Operating Contract on January 1, 2026. The certified line Merced-Bakersfield is handed over to the Operator for use on June 30, 2028. The duration of Trial Running on the previously tested and commissioned line is assumed from July 1, 2028 until November 30, 2028.

The basis for the OMTR calculation are the costs derived for the actual operations during revenue service.

5.2.1 Activities

The OMTR activities include setting up an organization which will be able to execute the actual operations. For this, it needs from the first day a small team which will start hiring and training all

personnel that is needed for the operations of the line. Major tasks are training all train and station staff, plus all other staff with client duties. It is also necessary to comply with FRA requirements related to operations, with most of the FRA requirements and documentation to be fulfilled during the pre-operations phase.

Earlier operations than the proposed date in December 2028 on parts of the high-speed line or the complete high-speed line are not possible for various reasons:

1. Handover of assets will only take place by the end of Q2-2028. Until that time the RS manufacturer and T&S contractor will be performing the necessary testing.
2. In Q2 and Q3 of 2027 System integration, tests have to take place and until the end of Q3, only 2 trainsets are available. These 2 trainsets are presumed to be needed for testing. Not necessarily both of them are even equipped with an interior – that is up to the RS supplier to decide when he will do that. Train 3-6 are only available from Q3-2027 on.
3. System Acceptance is only by the end of Q2-2028. Until then neither operational staff, nor emergency services are well enough trained for anything happening with actual passengers on a high-speed train. That training will only take place during trial running.

5.2.2 Organization and Personnel

The HSR Operations organization will have its maximum size at the start of the trial operations. See Figure 5-2 for organizational structure of the operating company at day 1 of Pre-Operations.

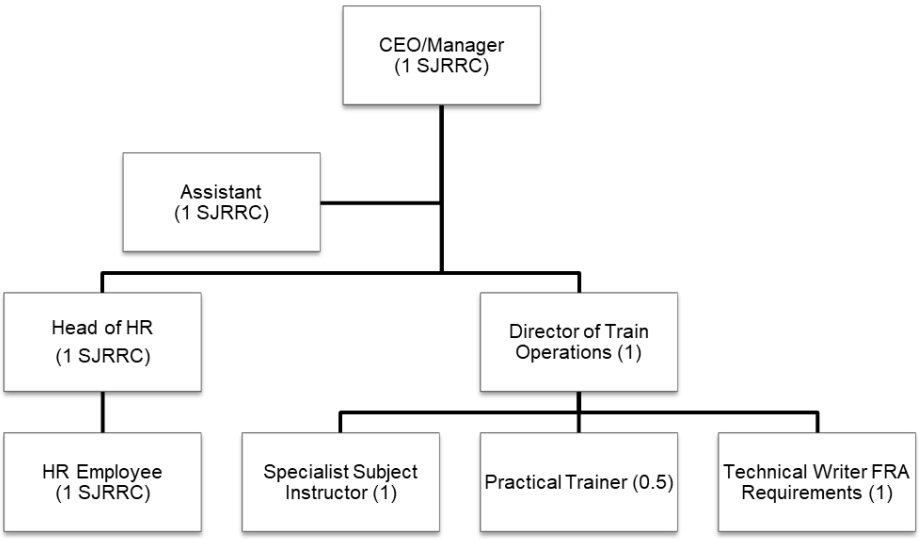


Figure 5-2: Organization of the Operating Company at Day 1 of Pre-Operations (FTE)

5.2.3 Cost Drivers

The main costs are labor. Based on the ETO's experience, the following FTEs are assumed as shown in Figure 5-3.

5.2.4 Unit Costs

The ramp-up of the total staff is presumed to be completed at the start of the trial operations. At the start of operator mobilization, a department with the following positions will be established:

No.	Function	Pay Grade Allocated	Salary (USD)	Function Start	Function End
1	**Director Train Operations**	Senior Manager (>10 years' experience)	155,156	Pre-operations contract start	Throughout operations
2	**Subject-Specialist Instructor**	Manager	103,437	Pre-operations contract start	Handover

No.	Function	Pay Grade Allocated	Salary (USD)	Function Start	Function End
3	**Practical Trainer (0.5 FTE)**	Manager	103,437	Pre-operations contract start	Handover
4	**Technical Writer FRA Requirements**	Analyst	82,750	Pre-operations contract start	Handover

Figure 5-3: Staffing and Salary Costs for Pre-Operations at Start of the Operator Mobilization and Trial-Running Phase

These four staff functions will be available from the start of the Operator Mobilization and the organization will grow until there is a complete organization as is necessary for the operations (see HSR operations organization, see section 9.1.6) at handover and the start of trial running. The cost buildup will be linear over this time.

5.2.5 Other

The operator staff during mobilization and trial running will be working at the offices and the OCC as these premises are presumed to be already available for the operator.

5.2.6 Trial running

The trial running will take place in the second half of 2028 with start of revenue service in December 2028. During trial running the complete HSR operations organization will be fully available. Test passengers might be using the trains for staff training purposes. Also, several tests with authorities will take place to test interaction with emergency services, high-speed rail on-board staff and the OCC. Various systems will be tested in live situations, such as the ticketing system and various scenarios with reduced service due to faulty or unavailable systems or infrastructure.

The staff at trial operations will be at the same level as during revenue operations. During the planned five-months trial running it is estimated that, for the first three months, electricity consumption will be at 50% of the normal usage and for months 4 and 5 of the trial it will be at 100% usage.

5.2.7 Cost Projection

Operator Mobilization and Trial-Operations Cost Items	2026	2027	November 2028
Trial operations: HSR rolling stock maintenance costs incl. contingency	-	-	6,704
Trial operations: HSR system maintenance costs incl. contingency	-	-	11,244
Trial operations: HSR DBM contract management overhead and insurance costs	-	-	1,940
Trial operations: energy consumption & non-trackside stations costs	-	-	3,132
Total costs incurred by the CHSRA during OMTR	**-**	**-**	**23,021**
Mobilization: Labor cost (salary, benefits, healthcare cost)	2,880	7,064	5,101
Mobilization: Profit margin	288	706	510
Trial-operations: HSR operations costs	-	-	4,508
Trial-operations: HSR corporate services	-	-	4,802
Trial-operations: Operator policing and security costs	-	-	1,482
Trial-operations: Profit margin	-	-	1,077
Total costs incurred by the operator during OMTR	**3,168**	**7,770**	**17,493**
Cumulative mobilization and trial-operations costs	**3,168**	**7,770**	**40,514**

Figure 5-4: Cost Projection for Operator Mobilization and Trial Operations (in USD1,000)

PART C: HSR SYSTEM MANAGEMENT BY CHSRA

6 CHSRA O&M Costs

Costs in this section are assumed to start on the first day of revenue operations. All other costs incurred before this are captured in the Pre-Operations section.

CHSRA will be the owner of the infrastructure and the vehicles for the HSR train operations and is assumed to have overhead costs with respect to CVS operations. The maintenance of the assets will be part of the DBM contracts with the T&S and the Rolling Stock supplier. The CHSRA overhead costs, the rolling stock maintenance costs and the system maintenance costs are described in this section.

6.1 CHSRA Overhead Costs

6.1.1 Key Assumptions and Scope

The overhead costs assumed for the Authority are related to the management of two DBM contracts- one with the T&S supplier and one with the RS supplier. This report assumes a commercial agreement with monthly financial transactions between CHSRA and the Operator. Other costs, which are captured as overhead for the Authority are insurance and policing costs for infrastructure assets belonging to CHSRA.

6.1.2 DBM Contract Management

For the management of the T&S DBM contract and the Rolling Stock DBM contract as well as for handling the financial transactions between the Authority and the Operator, the ETO has calculated the relevant personnel shown in Figure 6-1.

No.	Position	CVS FTE	Short Task Description	CVS Annual Salary (USD)	Pay Grade Allocation
1	Legal Head	1	Oversees DBM Contract Management Department	181,015	Director
2	DBM Program Manager	1	Oversees legal interactions with contractors	155,156	Senior Manager (greater 10 years exp.)
3	DBM Financial Manager	1	Oversees financial flows, data & performance	155,156	Senior Manager (greater 10 years exp)
4	Contract Manager	1	Advises Program Manager in FRA and railway operational related legal question	124,125	Senior Manager (fewer 10 years exp)

Figure 6-1: Staffing and Salary Costs for DBM Contract Management Department

6.1.3 Insurance

The Authority's overall strategy for insurance is still to be determined. However, for purposes of this report, the ETO has assumed that these insurance categories below will be borne by the Authority. In the ETO's last study, only those insurance categories related to the Operator were presented.

The following annual insurance costs were derived based on the values for the infrastructure assets, which the Authority will own. These categories are based on the Authority's prior Business Plan 2018. Insurance for earthquake and flood for CVS will be evaluated at a later stage.

Insurance Categories	Annual Insurance Costs	Coverage Limit	Coverage
Real and Personal Property	601	USD1 billion	Provides coverage for stations and site elements (e.g. pedestrian/bike/road access)
Rolling Stock Property	1,302	USD1 billion	Provides coverage for HSR vehicles

Track and Infrastructure Assets	1,828	USD1 billion	Provides coverage for track structure (e.g. viaducts, bridges), signaling equipment, overhead catenary
Earthquake and Flood	TBD	TBD	TBD
SUM	**3,731**	-	**-**

Figure 6-2: Insurance categories with annual premiums and coverage limits (Cost in USD1,000)

6.1.4 Policing Costs

In order to protect the Authority's system assets, the ETO has assumed CHP police officers will be in place for continuous availability covering 24 hours x 7 days a week. The ETO assumed 5.25 FTE for police officers and 1.75 FTE for supervisors. Fully loaded costs for a supervisor are currently estimated at USD184 per hour. The costs for a fully loaded officer are estimated at USD157 per hour. It should be noted that the Authority is currently in negotiations with the CHP to review and agree upon a policing plan that will be in place for the CVS.

6.1.5 Cost projection

Below Figure 6-3 is a view of CHSRA's total overhead costs.

CHSRA Overhead Cost Items	December 2028	2029	2030	2031	November 2032
Labor cost (salary, benefits, healthcare cost)	77	926	926	926	849
HSR rolling stock insurance costs	109	1,302	1,302	1,302	1,194
HSR system insurance costs	202	2,429	2,429	2,429	2,227
CHSRA policing costs	203	2,391	2,391	2,391	2,194
Total CHSRA overhead costs	591	7,048	7,048	7,048	6,463

Figure 6-3: Cost Projection for CHSRA overhead (in USD1,000)

Note: *The costs in 2028 only reflect one month of revenue operations for December based on the revenue service start date and the costs in 2032 reflect 11 months from January to November. This is applicable for all cost projections in this report.*

6.2 CHSRA Rolling Stock O&M Costs

6.2.1 Key Assumptions

For the trainsets operating on the CVS, all inspections, maintenance and heavy maintenance work will be executed in the HMF. The final location for the HMF is still to be determined by the Authority and for purposes of this report only is assumed at Fresno. Operational maintenance Level 2 which has to be performed once a year per trainset is expected to be performed in the HMF. The Level 2 comprises work such as full brake inspections and maintenance, full bogie inspections and maintenance as well as full train control inspections and maintenance. Moreover, major repairs of damages from accidents will be performed in the HMF as well.

The cost calculation for rolling stock maintenance comprises all tasks necessary to keep the trains in a safe condition for customer oriented, commercial revenue-service and all resources needed to perform the maintenance work.

Rolling stock maintenance costs comprise variable and fixed components:

- Variable recurrent costs for maintaining the trainsets according to maintenance intervals defined by the trainset supplier, and which generally vary with mileage;
- Fixed costs related to the HMF needed to maintain the trainsets.

Note: Assumptions have been made about synergies between various maintenance contractors active within the HMF. This calculation will be replaced by input from the future rolling stock supplier responsible for maintaining all trainsets as soon as it is available from the bids and later from the contract.

6.2.1.1 Rolling Stock Maintenance Variable Costs

As part of the variable costs, the following types of recurrent rolling stock maintenance are assumed to be performed:

- Planned maintenance to ensure safe, reliable, and highly available operations;
- Corrective maintenance to repair any damages and install spares to replace components that failed during operation;

- Trainset cleaning (daily inside cleaning and regular car wash).

Planned maintenance is based on maintenance cycles derived from ETO's experience with high-speed trains. It is therefore assumed, that the maintenance intervals will be defined in a similar way as in Europe and Asia. This is based on mileage, instead of time intervals. Mileage intervals are more suitable for high-speed trains because they perform at much higher annual mileage than slower freight or urban trains.

Cost projections are based on man-hours and materials cost per maintenance interval according to ETO's experience.

Several further key assumptions are highlighted:

- It is assumed that CHSRA will procure 95% of the material needed in planned maintenance—all but consumables—together with the trainsets. The industry will deliver the material tailored to maintenance work;
- Since CHSRA plans on a five-year contract-warranty for the rolling stock, it is assumed that the warranty covers 75% of the costs for corrective maintenance, staff and materials;
- It should be noted that corrective maintenance costs do not include costs for repairs caused by accidents and vandalism;
- It is assumed that procurement and handling of spares for maintenance will be managed by the same team fielded by the rolling stock supplier that manages the supply chains for manufacturing the trainsets which will be deployed for CVS. The work capacity needed to procure and handle spares is calculated as an extension of the team already available for managing the supply chains to manufacture the trainsets.

6.2.1.2 HMF Fixed Costs

For CVS operations, all maintenance work for the rolling stock will be executed in one central HMF. The HMF will be fully equipped for the envisaged level of maintenance and repair work and the staff available in Fresno will have enough capacity to perform the maintenance on CVS trainsets.

HMF will comprise the following:

- Workshop facility
- Overhaul workshop for components
- Warehouse
- Nearby carwash facility
- Nearby stabling yard
- Office space

The individual maintenance regime per railway segment defines the frequency for visiting a workshop and the amount of work to be executed on each trainset, as well as the materials needed for repairs. Similarly, each trainset will visit a carwash facility as part of the workflow, according to the different maintenance intervals.

The size of the HMF is derived from the trainsets' number of workshop visits and the time the trainsets dwell in the workshop. The dwelling time is roughly derived from the maintenance regime, which is also input for the calculation of the maintenance costs. The proposed regime defines the frequency of trainset visits, the amount of work to be executed on each trainset, as well as materials needed for the repairs.

It is assumed the HMF will be designed and built in three stages:

- The initial size of the HMF, including a warehouse, carwash and offices, will be about 118,000 square feet. The initial design stage of the HMF will accommodate two tracks for two trainsets and additional space for refurbishment of components and for the warehouse. Any possible extensions of the HMF for further developments of the high-speed trainsets should be foreseen by reserving the respective land. It is to be noted that the next stage will become operational in time for the first full heavy overhaul.
- For equipping the HMF, the ETO used the state-of-the-art technology of a DB depot and workshop as reference to derive the annual maintenance and cleaning costs for the workshop and all its equipment. The major pieces of equipment to be located in the HMF will include cranes, specialized lifts for heavy components, turning machines, measuring devices, NRVs like forklifts, etc.

- In the HMF, the single-track carwash will be built right at the beginning of the facility.

6.2.2 Cost Drivers

The major inputs for calculating the rolling stock maintenance costs are:

- The mileage of the trainsets to fulfill the timetable service;
- The number of operational trainsets needed to fulfill this service at the high level of reliability, availability and safety set for California high-speed in general;
- The size of the HMF, including the equipment necessary to execute all maintenance tasks.

From these cost drivers, the required numbers of staffing has been derived.

6.2.2.1 Mileage based costs

The following recurring maintenance cost types are driven by mileage:

Two levels of inspection, from daily inspection to inspections combined with minor maintenance work:

- In the case of CVS every five days every two weeks;

Three levels of regular maintenance work:

- In the case of CVS every two months to approximately every sixteen months;

Two levels of heavy overhaul — in CVS' case a minor one approximately every 2.5 years (every million miles); a major one approximately every five years.

The corrective maintenance cost projection is based on a cost-per-mile assumption taken from the ETO's experience for both segments of the railway.

Maintenance frequencies for different maintenance levels are shown below in Figure 6-4.

No.	Maintenance Level	Frequency in Miles	Frequency for CVS
1	Inspection 1	5,000	5 Days
2	Inspection 2	15,000	2 Weeks
3	Maintenance 1	62,500	2 Months

No.	Maintenance Level	Frequency in Miles	Frequency for CVS
4	Maintenance 2	250,000	8 Months
5	Maintenance 3	500,000	16 Months
6	Heavy Overhaul 1	1 Million	2.5 Years
7	Heavy Overhaul 2	2 Million	5 Years

Figure 6-4: Trainset mileage assumption

6.2.2.2 Number of Trainsets Based Costs

The maintenance costs are based on trainsets as follows:

- Number of operational trainsets:
  - For CVS operations four of six total trainsets will be used for the operations, one trainset is assumed for standby requirements and one for maintenance;
  - There will be a carwash facility at the depot; it is assumed that each trainset will be cleaned every five days for CVS;
  - It is assumed that five out of eight cars are powered by traction motors;
  - Cleaning comprises both car interior cleaning and exterior car wash. The trainset cars' interior cleaning is assumed to be performed daily at the HMF, including regular "rough" cleaning of the trainset cars at terminal stations or onboard (mobile cleaning).

6.2.2.3 HMF Cost Drivers

Two cost drivers influence costs for management, operation, and maintenance of the HMF:

- The size of the facility, with the number of tracks needed to maintain and clean the trainsets;
- The state-of-the-art technology, machinery and equipment needed to execute the inspection and maintenance work.

6.2.3 Organization and Personnel

As shown in Figure 6-5 below, the Train Delivery Director will be responsible for managing the HMF and the maintenance of the entire trainset fleet used on CVS, so they will be available on time and on the service level for commercial revenue-service. The vehicle engineers who maintain the trainsets in the workshop and overhaul components are part of his team. Since the fleet is small, it is assumed that the staff will spend considerable time waiting for the next trainset to be maintained. The assumed productivity rate is 60% for the personnel in the HMF facility.

In addition to the operational maintenance staff, managers are needed to:

- Plan and manage the trainset inspections, maintenance, cleaning, and the staff needed;
- Operate, maintain, and clean the HMF and their respective equipment.

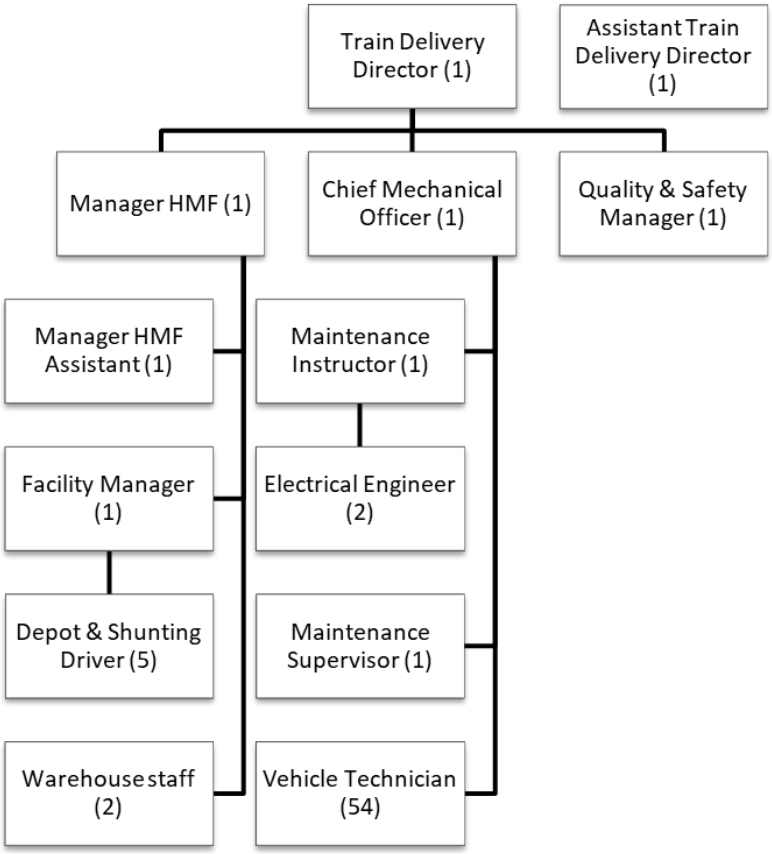


Figure 6-5: Organizational Structure of Rolling Stock Department (FTE)

Figure 6-6 below describes NRVs for rolling stock operations (*HMF vehicle).

Type of NRV	Number of NRVs	Annual Fuel Consumption per NRV (Gallons)	Annual Maintenance and Insurance Cost per NRV (USD)
Car mover	1	*	16,035
Forklift (4-ton)	1	*	7,707
Forklift (narrow aisle)	1	*	9,052
Pick-up truck	2	2,250	7,242
Stake-body truck	1	1,500	13,707
SUV	2	2,250	7,242

Figure 6-6: NRVs for rolling stock operations (*HMF vehicle)

6.2.4 Unit Costs

Labor and material costs per trainset-mile and per maintenance interval are derived from:

- ETO's experience with high-speed train maintenance;
- ETO's U.S. benchmark information and experience with regard to salary costs.

The following unit costs are assumed:

- Depending on the maintenance level to be fulfilled in each year of commercial revenue operation labor costs for planned maintenance vary. The respective material costs are low because it is assumed that CHSRA will procure 95% of the material needed in planned maintenance—all but consumables—together with the trainsets. The industry will deliver the material tailored to maintenance work.
- Corrective maintenance associated to repairs and replacements not safety critical and not directly mobility critical. Material costs for corrective maintenance are low due to assumed supplier's warranty. CHSRA plans on a five-year contract warranty for rolling stock. Therefore,

it is assumed the warranty covers 75% of the costs for corrective maintenance, staff and materials.

- CVS dedicated trainset cleaning (inside and out) is calculated at approximately USD436,242 per year and trainset, assuming daily inside cleaning and one trainset carwash every five days.
- HMF maintenance and janitorial services are based on cost per square foot (USD2.40 per year).

Figure 6-7 below shows unit costs for rolling stock and HMF maintenance.

Unit Costs	CVS (USD)
Average cost per train-mile for materials used for planned maintenance	0.03
Average cost per train mile for materials used for corrective maintenance	0.003
Annual trainset cleaning (inside and out)	2,617,457
Annual maintenance and janitorial services for the HMF	398,283
Annual maintenance cost of all workshop equipment at HMF	445,870
Annual utility cost at HMF (electricity, gas and water)	1,595,665

Figure 6-7: Rolling stock, HMF maintenance unit costs

Figure 6-8 below shows unit costs per FTE.

No.	Position	CVS FTE	Short Task Description	CVS Annual Salary (USD)	Pay Grade Allocation
1	Train Delivery Director	1	Responsible to deliver the trainsets ready for revenue operation	206,875	Senior Director
2	Assistant Train Delivery Director	1	Managing Assistant responsible for train delivery and cooperation with operation	62,062	Assistant

3	Quality and Safety Manager	1	Responsible for quality of maintenance and workshop safety and security	124,125	Senior Manager (fewer than 10 years' exp)
4	Chief Mechanical Officer	1	Manage the maintenance regime in the workshop	155,156	Senior Manager (greater than 10 years' exp)
5	Maintenance Instructor	1	Responsible for correct execution of all maintenance work	103,437	Equivalent to Manager
6	Maintenance Supervisor	1	Technical team leader	82,750	Equivalent to Analyst
7	Electrical Engineer	2	Technician who maintains electrical parts	82,750	Equivalent to Analyst
8	Vehicle Technicians/Engineers	54	Technician/Engineer who maintains mechanical parts	62,062	Equivalent to Assistant
9	Depot & Shunting Driver (full engineer's qualification)	5	Train driver: stabling yard/HMF, pull-in/pull-out services	82,750	Equivalent to Analyst

Figure 6-8: Staffing and Salary Costs for Rolling Stock Organization

Figure 6-9 below shows the resulting cost projection for the staffing and salary costs for the HMF organization.

No.	Position	HMF FTE	Short Task Description	HMF Annual Salary (USD)	HMF Pay Grade Allocation
1	HMF Manager	1	Manage the heavy maintenance facility on site	155,156	Senior Manager (more than 10 years exp)
2	Assistant Manager	1	Manage the workshop as an entrepreneurial unit	124,125	Senior Manager (less than 10 years exp)
3	Facility Manager	1	Keep the facility in good shape and operation	82,750	Equivalent to Analyst

No.	Position	HMF FTE	Short Task Description	HMF Annual Salary (USD)	HMF Pay Grade Allocation
4	Warehouse Staff	2	Manage and assign spares	62,062	Equivalent to Assistant

Figure 6-9: Staffing and Salary Costs for HMF Organization

6.2.5 Uncertainties and Contingencies

The following risks and opportunities are identified related to rolling stock maintenance:

- The maintenance costs per trainset depend on the design of the trainset, which might differ from manufacturer to manufacturer. For example, the number of bogies and wheelsets, as the most expensive components to maintain in a trainset, can differ depending on the design of the trainsets.
- It is conceivable that the supplier of the trainsets integrates the final assembly and maintenance in the same workshop, especially since the workshop will be operated far from the capacity utility. Should the contract with the trainset supplier include agreements for warranty and procurement of spares that differ from those described in these assumptions, the calculation must be adapted.

6.2.6 Cost Projection

Figure 6-10 below shows the resulting cost projection for rolling stock maintenance, including HMF.

CHSRA Rolling Stock Maintenance Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
Labor cost (salary, benefits, healthcare cost)	726	8,716	8,716	8,716	7,990
Non-revenue vehicles (rolling stock) total cost	10	120	120	120	110
Materials cost - planned and corrective maintenance	7	77	77	77	70
Rolling stock cleaning	218	2,617	2,617	2,617	2,399
Heavy Maintenance Facility total cost	205	2,461	2,461	2,461	2,256

CHSRA Rolling Stock Maintenance Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
Contingency margin - HSR rolling stock maintenance	175	2,099	2,099	2,099	1,924
Total CHSRA rolling stock maintenance costs	1,341	16,090	16,090	16,090	14,749

Figure 6-10: Cost Projection for rolling stock maintenance and HMF (in USD1,000)

Note: *This cost projection will be replaced by input from the future rolling stock supplier responsible for maintaining all trainsets as soon as it is available from the bids and later from the contract.*

6.3 CHSRA System O&M Costs

6.3.1 Introduction

The CHSRA's DBM contract with the T&S supplier includes the maintenance costs for civil works, track & systems and facilities (including trackside station costs and the MOW facility). Additionally, based on discussions with the Authority, the T&S supplier scope of work also reflects the responsibility for the OCC specific to CVS HSR operations. All these costs are referred to as the CHSRA System O&M costs within the ETO's report and will be charged back to the TOC as system access fees.

6.3.2 Organization and Personnel

The estimate is based on a goal of ensuring that the maintenance organization is staffed and resourced sufficiently to maintain all assets in a constant state of good repair and to respond within 1 hour to 1.5 hours for service interruptions on the right of way in order to minimize the impact on high-speed rail passengers.

Figure 6-11 below shows the headcount for the civil works department, the track and systems department, and the facilities department including the chief engineer, deputy chief engineer and chief engineer assistant; there is one management structure assumed for these departments.

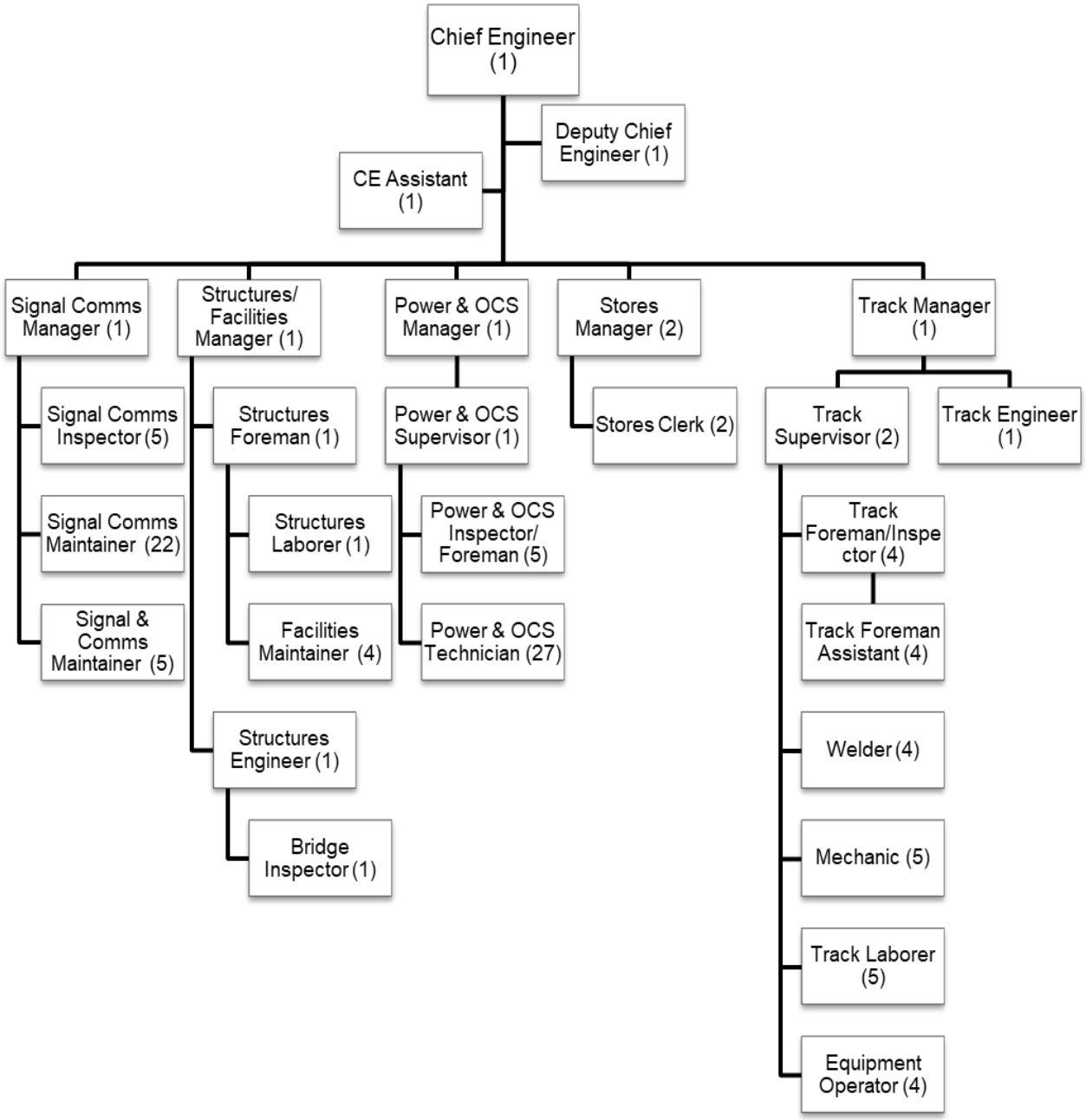


Figure 6-11: Organizational Structure of CW, T&S and Facilities Department (FTE)

6.3.3 Civil Structures Maintenance

6.3.3.1 Key Assumptions and Scope

The civil structures cost estimate covers the maintenance cost for all bridges, culverts, drainage systems, retaining walls, trenches, and fencing. This includes inspections based on FRA requirements for bridges and annual structural inspections.

The estimate includes regular visual inspections of the all structures on the alignment. All structures are assumed to be standard in design and made of concrete to ensure a long life and minimal maintenance.

Staff will perform a weekly visual inspection of the right of way.

6.3.3.2 Cost Drivers

The following items are the main cost drivers for civils structure maintenance:

- Inspections of bridges, culverts, tunnels and drainage systems;
- Fencing is assumed to be necessary on the entire CVS alignment:
    - 170.7 miles with fencing on both sides for a total of 341.4 miles; 0.5% of fencing is assumed to require repair or replacement annually, totaling 1.71 miles (i.e. 9,013 ft).

In addition, dedicated NRVs are taken into account, as shown in Figure 6-12.

Type of NRV	Number of NRVs	Annual Fuel Consumption per NRV (Gallons)	Annual Maintenance and Insurance Cost per NRV (USD)
4x4 HR crew cab truck	1	1,667	9,052
Bridge Inspection truck (HR)	1	2,000	62,945
Pick-up truck (extended cab)	5	2,000	7,242
Vacuum truck (HR)	1	500	26,897

Figure 6-12: Type of NRV

6.3.3.3 Unit Costs

The Figure 6-13 below indicates the materials costs estimate for civil structures maintenance.

The assumptions underlying the estimates are as follows:

- The costs for materials that in-house staff would purchase to repair or replace items as necessary. These costs were developed based on a comparison to other systems maintained in the U.S.;
- For all structural elements it is assumed that the 4-year warranty period will cover all major repairs/replacement work during the operations;
- It is assumed that all material and spares required for the interim 4 years of CVS will be included and procured with the initial investment budget;
- The number of culverts and drainage systems are not determinable based on the information provided but the culverts will require some ballast and/or rip rap to be replaced as a result of water displacing the stones from the inlet and outfall (a lump sum has been estimated);
- The trenches are assumed to have drainage systems and pump houses, lighting and fire alarm systems that will require regular maintenance. A lump sum is estimated for each trench as the details of the trench are not known;
- The following has been taken into account to estimate the cost of bridge maintenance:
    - The CVS system has 76 bridges that are anticipated to require no maintenance during the interim four years of operation (the cost only includes inspection);
    - The cost of bridge inspection has been captured in the maintenance cost of culverts.

Infrastructure Type	Units	Quantity	Unit Cost (USD)	Notes
Trench/retaining walls	Trench	2	51,725	Material for pumps, lights etc., in the trench.
Bridges	Bridges	76	-	No bridge maintenance will be required.
Drainage	Culverts	1	15,518	Ballast, rip/rap to repair washed-away materials.

Infrastructure Type	Units	Quantity	Unit Cost (USD)	Notes
Right of way fencing/gates	Feet	9,013	10	Assumes 0.5% of the entire ROW will require repairs/replacement

Figure 6-13: Materials Cost Estimate

Figure 6-14 below shows unit costs per FTE.

No.	Position	CVS FTE	Short Task Description	CVS Annual Salary (USD)	Pay Grade Allocation
1	Structures/ Facilities Manager	1	Oversight of Structures and Facilities Department	124,125	Senior Manager (less than 10 years exp)
2	Structures Engineer	1	Manage/perform structural inspections	155,156	Senior Manager (more than 10 years exp)
3	Bridge Inspector	1	Perform bridge inspections	103,437	Manager
4	Structures Foreman	1	Maintain and inspect structures	103,437	Manager
5	Structures Laborer	1	Support Structures Foreman	82,750	Analyst

Figure 6-14: Staffing and Salary Costs for Civil Structures Maintenance

6.3.3.4 Uncertainties and Contingencies

The design of the system is not complete and may change from the information that is currently available. The main assumption impacting this is that approximately 15% for CVS of the alignment is built on structures (bridges, tunnels or trenches). The final quantities for culverts, drainage systems, retaining walls and fencing are to be determined. In the CVS segment, tunnels are assumed to be less than 500 feet in length and will not require ventilation or fire suppression systems.

There is no available information in terms of trespassers or egress along the alignment. This may impact the amount of fencing requiring repair during operations. There is no data in terms of vandalism/graffiti which may require additional repairs or painting.

6.3.3.5 Cost Projection

The Figure 6-15 below shows the resulting cost projection for maintenance of civil structures.

Civil Structures Maintenance Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
Labor cost (salary, benefits, healthcare cost)	69	831	831	831	761
Maintenance of bridges cost	-	-	-	-	-
Maintenance of drainage cost	1	16	16	16	14
Maintenance of trenches & retaining walls cost	9	103	103	103	95
Maintenance of right of way fencing / gate cost	8	93	93	93	85
Non-revenue vehicles (civil structures) cost	16	195	195	195	179
Total maintenance of civil structures costs	103	1,238	1,238	1,238	1,135

Figure 6-15: Cost Projection for Maintenance of Civil Structures (USD1,000)

6.3.4 Track and Systems Maintenance

6.3.4.1 Key Assumptions and Scope

- The alignment does not include any tight curves which would require increased rail replacement;
- Traction power substations, and communications and signal houses are placed at regular intervals along the alignment;
- The signal system will include PTC (Positive Train Control) and ATO (Automatic Train Control);
- Wi-Fi communications will be made available to passengers on the trains. There will be a Wi-Fi network along the alignment;

- Based on expected negotiations with the FRA, ETO has excluded from this report the estimate for labor and equipment maintenance cost of performing visual track inspections, per the CHSRA's direction;
- Signaling and communication staff are assumed to be combined;
- Signaling and communication houses are assumed to be combined;
- Staffing level assume that inspections and maintenance will be performed during non-revenue hours;
- Inspections and maintenance will be performed during non-revenue hours;
- Track geometry testing will be performed by equipment installed on rolling stock and will be maintained by the rolling stock manufacturer. Data from testing will be provided to TOC.
- The alignment is 170.7 miles of double track with 25kV catenary systems along the entire length;
- The track is assumed to be 100% slab track;
- There are three maintenance bases on the corridor to allow for response times of 1 hour to 1.5 hours during revenue service;
- It is assumed that the inspector will perform an initial inspection to prepare the work for the night crew;
- The power and OCS personnel will be tasked with performing the non-invasive inspections of the traction power substations in addition to responding to incidents with the power and/or OCS systems;
- The personnel in the power crew must be licensed electricians to perform the required inspections. There is a total of 27 FTEs employed as power and OCS technicians;
- Maintenance crew during non-revenue hours will consist of one foreman, one equipment operator, one welder and two laborers.

Crew support during revenue and non-revenue hours

<u>Base crew during revenue hours (signal/communication tech/maintainers)</u>

- One person x 19 hours x 365 days x 3 bases = 20,805 hours

- One FTE = 1,794 hours per year
- 11 FTE signal/communication tech/maintainer plus one support = 12 FTE signal/ communication tech/maintainers

Maintenance crew during non-revenue hours (signal/communication tech/maintainers):

- Three persons x 8 hours x 365 days x two crews = 17,520 hours
- One FTE = 1,794 hours per year
- Total FTE = 10 FTE signal/ communication tech/maintainers

Base crew during revenue hours (track inspectors):

- One person x 19 hours x 365 days x one base = 6,935 hours
- One FTE = 1,794 hours per year
- Total FTE = four FTE track inspectors
- Five persons x 8 hours x 365 days x two crews = 29,200 hours
- One FTE = 1,794 hours per year
- Total FTE = 17 FTE track

Base crew during revenue hours (power and OCS technicians):

- One person x 19 hours x 365 days x three bases = 20,805 hours
- Total FTE = 11 FTE power and OCS technicians

Maintenance crew during non-revenue hours (power and OCS technicians)

- OCS: Three persons x eight hours x 365 days x two crews = 17,520 hours
- Power: Two persons x eight hours x 365 days x two crews = 11,680 hours

- One FTE = 1794 hours per year
- Total FTE = 17 FTE power and OCS technicians

6.3.4.2 Cost Drivers

The Figure 6-16 below provides quantities that have been used to develop the track and systems maintenance costs.

Category	CVC Units	Type	Notes
ROW miles	170.7	Miles	
Track miles	341.4	Miles	
Slab Track	341.4	Miles	
Switches	56	Each	
Yard switches	-	Each	Quantity not yet determined
Interlockings	12	Each	
Signaling and Comm Control Houses	50	Each	
Radio houses	-		
TPSS	44	Each	One every 4.25 miles, two at HMF
Catenary	341.4	Miles	
Yard/Facility Catenary	-		Quantity not yet determined

Figure 6-16: Quantities Used to Develop T&S Maintenance Costs

6.3.4.3 Unit Costs

The following table in Figure 6-17 shows unit costs for the track and systems maintenance labor per FTE.

No.	Position	FTE	Short Task Description	Annual Salary (USD)	Pay Grade Allocation
1	Chief Engineer	1	Responsible for all aspects of department	206,875	Senior Director
2	Deputy Chief Engineer	1	Supports Chief Engineer	181,015	Director
3	Chief Eng. Asst.	1	Performs administrative tasks for Chief Engineer	62,062	Assistant
4	Track Manager	1	Responsible for all aspects of track	124,125	Senior Manager (less than 10 years' exp)
5	Track Engineer	1	Monitors track infrastructure	103,437	Manager
6	Track Supervisor	2	Supervises track maintenance tasks	103,437	Manager
7	Track Inspector/ Foreman	4	Performs track inspections and manage track maintenance crews	103,437	Manager
8	Track Foreman Assistant	4	Leads track maintenance crews	82,750	Analyst
9	Track Laborer	5	Performs track maintenance activities	82,750	Analyst
10	Track Equipment Operator	4	Operates various types of equipment	103,437	Manager
11	Track Welder	4	Performs track welding	103,437	Manager
12	Non-Revenue Eq. Mechanic	4	Maintains non-revenue equipment	82,750	Analyst

No.	Position	FTE	Short Task Description	Annual Salary (USD)	Pay Grade Allocation
13	Signal and Communications Manager	1	Responsible for all aspects of train control systems	155,156	Senior Manager (more than 10 years exp)
14	Signal and Communications Inspector	5	Supervises train control maintenance tasks	103,437	Manager
15	Signal and Communications Tech/ Maintainer	22	Performs train control maintenance tasks	103,437	Manager
16	Power and OCS Manager	1	Responsible for all aspects of power systems	155,156	Senior Manager (more than 10 years exp)
17	Power and OCS Supervisor	1	Supervises OCS activities	124,125	Senior Manager (more than 10 years exp)
18	Power and OCS Inspector/ Foreman	5	Performs OCS inspections and direct maintenance activities	124,125	Senior Manager (less than 10 years' exp)
19	Power and OCS Tech.	27	Performs OCS maintenance activities	103,437	Manager
20	Signal & Comms Engineer	5	Responsible for all system functioning	124,125	Senior Manager (less than 10 years exp)

Figure 6-17: Staffing and Salary Costs for Track and Systems Maintenance Labor

Material Costs

Figure 6-18 below indicates the annual materials costs for track and systems maintenance. The costs are for materials that in-house staff would purchase to repair or replace items as necessary. These costs were developed based on a comparison to other systems maintained in the US. Comparable

assets were evaluated against the assets that will be used for HSR operations and resulting costs were also scaled where necessary.

The cost of tools and maintenance (e.g. calibration) and tool replacement is included in the figures. It is assumed that specialized tools will be provided as part of the initial capital purchase. It is assumed that all material and spares required for the first five years will be included and procured within the initial capital purchase.

Item	Unit	Quantity	Unit Cost (USD)	Notes
Train control and comm	Comm and signal houses	50	517	This cost includes the apparatus of PTC and ATO switches, transponders, PIS and PAS, CCTV, WiFi, SCADA and RADIO
Traction power (TPSS)	Power facilities	44	1,035	TPSS materials are not included in subcontracted services.
Overhead catenary system (OCS)	Track-miles	341.4	155	OCS material such as wire and hangers.
Track	Track-miles	341.4	155	Track material such as rail, frogs, welds, ties, ballast and clips.

Figure 6-18: Materials Costs for Track and Systems Maintenance

The costs described below in Figure 6-19 reflect those services assumed to be performed by third-party vendors.

Item	Division	Cost Type	Unit	Qty	Unit Cost (USD)	Notes
Electricity consumption	C&S	Utilities	Signal houses	50	13,508	
Electricity consumption	Power	Utilities	Power facilities	44	13,508	

Item	Division	Cost Type	Unit	Qty	Unit Cost (USD)	Notes
Wi-Fi connectivity	C&S	Service	Signal and comm houses	50	4,138	Connectivity service for passengers
Ultrasonic Rail Testing	Track	Service	Three times a year	3	124,140	Performed by subcontractor
Geometry Testing	Track	Service	Every other month	6	-	Performed by subcontractor
Rail Grinding	Track	Service	Track mile	342.4	7,242	Performed by sub-contractor; Once during 4 year period for CVS (2032)
Vegetation Control	Track	Service	Track-miles	342.4	517	Vegetation control along the right of way and in the yard

Figure 6-19: Cost of Services to Be Performed by Third-Party Vendors

Rail grinding is an essential element of a railroad maintenance program. Over time, the proper (designed) interface between train wheels and the rail is degraded as a result of normal operations. In order to maximize the life and value of these rail assets, precision removal of fatigued metal and restoration of the rail head profile need to be periodically performed depending largely on the geometry of the track and the tonnage of the trains.

During routine track inspections the running rail surface is inspected for wheel/rail interface wear. It is assumed that maintenance grinding to the rail in the CVS need to be performed one time during the four-years. Prior to grinding, detail measurements of the existing rail profile would be taken in order to develop a grind plan. Similarly, measurements would be taken at the end of the project to verify that the rail had been ground to the specific designated profile.

The cost estimate is based on U.S. standards for rail profile grinding and Euro norm standards for the type of grinding stones in a high-speed rail environment. It also assumes that the TOC will have a full five hours of productive work time during the overnight maintenance period, high performance rail

grinding equipment and reasonable travel times to access the work locations. Mobilization costs are not included in the cost.

NRV for Track and Systems

Personnel, vehicles and/or equipment that may be necessary as a result of a force majeure event is not included. Maintenance personnel during revenue service will work a primary shift only and will use trains to transport themselves and equipment to the extent possible.

The following Figure 6-20 indicates the cost of NRV for the Track and Systems unit. This cost includes fuel, maintenance, insurance and anticipated state fees. Third-party vendors will maintain the NRVs.

Vehicle type	Qty	Annual fuel consumption (gallons)	Annual maintenance and insurance cost (USD)
Backhoe-HR	1	175	9,417
Bucket loader	1	700	17,032
Bucket truck-OCS	2	2,000	26,121
Flat cars	3	-	6,724
Fuel and lube truck	1	2,000	32,457
Hi-rail inspection truck	2	3,000	11,897
Hydraulic, self-propelled rail lifts	2	250	7,159
Logging Truck-HR	2	750	36,208
Lowboy trailer	1	-	9,344
Pick-up truck-extended cab	7	2,000	19,656
Rail puller	2	-	6,621
Speedswing	1	4,000	19,656
Spot tamper	1	20	31,035

Vehicle type	Qty	Annual fuel consumption (gallons)	Annual maintenance and insurance cost (USD)
SUV	1	1,333	7,242
Swivel dump-HR	2	750	30,141
Tractor trailer	1	350	18,880
Utility trucks-mechanic	2	2,000	12,931
Utility trucks-Signal	6	1,667	27,363
Utility trucks-signal crew	3	1,667	17,121
Van-comm.	4	1,333	18,207
Water tank	2	-	7,242
Welders truck	1	2,000	18,621

Figure 6-20: Cost of Non-Revenue Vehicles for the Track and Systems Unit

6.3.4.4 Uncertainties and Contingencies

The design of the system is not complete and may change from the information that is currently available. The signal and communication houses and traction power substations for the CVS section were based on a partial track chart confirmed with CHSRA.

The optimization of the track layout and systems infrastructure was not part of the scope of this report. It is assumed that the infrastructure will be sufficient to allow maintenance and inspection activities without major impact in train traffic (i.e. track diversions, sidings, and yellow plant maintenance access and stabling).

It is assumed that the quantities in Figure 6-16 will not impact the costing significantly, but until these are quantified and the design is known this is a risk to the accuracy of the cost numbers.

The track inspection labor staff has been reduced based on the direction of the CHSRA to assume the FRA will provide a waiver relaxing visual track inspection requirement from three times per week to one per week or once every two weeks.

6.3.4.5 Cost Projection

The following Figure 6-21 shows the resulting cost projection for maintenance of track and systems.

Track and Systems Maintenance Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
Labor cost (e.g. salary, benefits and healthcare)	1,128	13,538	13,538	13,538	12,410
Signal houses, Comms, Wi-Fi total cost of maintenance & electricity	76	908	908	908	832
Power facilities total cost of maintenance & electricity	58	693	693	693	635
Track maintenance cost	50	602	602	602	3,024
Non-revenue vehicles (track & systems) total cost	96	1,152	1,152	1,152	1,056
Total maintenance of track and systems costs	1,408	16,893	16,893	16,893	17,958

Figure 6-21: Cost Projections for Track and Systems Maintenance (USD1,000)

6.3.5 Facilities

6.3.5.1 Key Assumptions and Scope

The facilities maintenance cost items for CVS include:

- CVS Stations
- MOW (Maintenance-of-way) facilities
- OCC

Specifically, five CVS stations, two CVS MOW facilities and the OCC are included in the maintenance cost estimates.

The CVS stations will consist of side platforms, an overhead bridge, four elevators per station, canopies, lighting, limited parking, benches, signage, and other station appurtenances.

The MOW facilities will consist of office space for MOW staff, locker rooms for employees to change, and storage space including HVAC (Heating Ventilation and Air Conditioning) systems, lighting and other necessary systems.

The maintenance plan for the facilities is to utilize a small internal staff and rely on third-party contractors to perform specific, specialized tasks. The following facility-specific maintenance and repair tasks are assumed to be subcontracted:

- Janitorial services
- HVAC
- Fire extinguisher servicing
- Fire alarm monitoring/servicing
- Elevators
- Pest control

6.3.5.2 Cost Drivers

The cost drivers are the number of CVS stations, station appurtenances, physical layouts, and the number of parking spaces. The MOW facilities cost drivers are the size and layout of the building.

The parking lot striping and paving should not be required under normal maintenance conditions in the first years of operations.

6.3.5.3 Unit Costs

Figure 6-22 below shows unit costs per FTE.

No.	Position	FTE	Short task description	Annual Salary (in USD)	Pay Grade Allocation
1	Stores Manager	2	Manage procurement and inventory	103,437	Manager
2	Stores Clerk	2	Process inventory, warehouse activities	82,750	Analyst
3	Structures/ Facilities Manager	Included in civil structures	Oversight of Structures and Facilities Department (repeat of position listed in civil structures)	155,156	Senior Manager (greater than ten years' experience)

No.	Position	FTE	Short task description	Annual Salary (in USD)	Pay Grade Allocation
4	Facilities Maintainer	4	Perform minor maintenance activities and oversee subcontractors	103,437	Manager

Figure 6-22: Staffing and Salary Costs for Facilities Management/Maintenance

The Figure 6-23 below indicates the unit costs for facilities management and maintenance. The costs listed below are for materials that in-house staff would purchase to repair or replace items as necessary.

Type	Division	Cost Type	Units	Qty	Unit Cost (USD)	Cost Components
Building maintenance materials	CVS Stations	Materials	Stations	5	10,966	Cost of benches, signs, bike racks, canopy parts, tactile, platform edging, railings, etc.
Building maintenance materials	MOW	Materials	MOW facility	2	5,173	Cost of doors, wall repairs, windows, etc.

Figure 6-23: Material Costs Facilities

The Figure 6-24 below indicates the cost of services to be performed by third-party vendors.

Type	Division	Cost Type	Units	Qty	Unit Cost (USD)	Cost Components
Elevator services/ maintenance	CVS Stations	Service	Elevators	20	8,793	Four elevators per station at five stations
Building services	MOW	Service	MOW Facility	2	28,707	Lighting repairs, janitorial services, landscaping, etc.

Figure 6-24: Third-Party Vendor Service Costs

NRVs are assumed to be shared with the track and systems department. The following Figure 6-25 indicates the cost of utilities to be performed by third-party vendors.

Item	Type of Facility	Quantity	Unit cost (USD)
Electricity consumption	OCC	1	38,863
Electricity consumption	MOW Facility	2	24,431
Water consumption	MOW Facility	2	2,586
Gas consumption	MOW Facility	2	2,586

Figure 6-25: Utilities Costs for Third-Party Vendors

Figure 6-26 below indicates the cost of NRVs for facility management/maintenance.

Vehicle type	Qty	Annual fuel consumption (gallons)	Annual maintenance and insurance cost (USD)
Pick-up truck-extended cab	1	2,000	7,242
SUV	2	1,333	7,242

Figure 6-26: NRVs for Facility Management/Maintenance

NRVs to be used for the maintenance of civil structures will be shared with the Track and Systems Department.

6.3.5.4 Uncertainties and Contingencies

The design of the system is not complete and may change from the information that is currently available.

6.3.5.5 Cost Projection

Figure 6-27 below shows the resulting cost projection for maintenance of facilities.

Facilities Cost Items	December 2028	2029	2030	2031	November 2032
Labor cost (salary, benefits, healthcare cost)	86	1,027	1,027	1,027	942
Stations - trackside cost	19	231	231	231	211
Maintenance of Way Facilities cost	11	127	127	127	116

Facilities Cost Items	December 2028	2029	2030	2031	November 2032
Non-revenue vehicles (facilities) cost	4	42	42	42	39
OCC electricity costs total	3	39	39	39	36
Total maintenance of facilities costs	122	1,466	1,466	1,466	1,344

Figure 6-27: Cost Projection for Maintenance of Facilities (USD1,000)

6.3.6 Operations Control and Dispatching

6.3.6.1 Key Assumptions and Scope

The Operations Control and Dispatching is assumed to be within the responsibility of the T&S supplier during CVS operations, as communicated by CHSRA. The Operations Control Center (OCC) consists of the hardware, software, personnel and policies for the operation of high-speed rail passenger trains as shown in Figure 6-28 below. These systems and people will monitor and control train operations, right-of-way activities and the status of the traction power system 24 hours per day, 365 days per year.

The core mission of the OCC is to ensure safe, efficient and reliable service that meets customer expectations daily. The OCC design will be based on a concept of total systems integration. An advanced technology control and monitoring system will integrate all functions performed by the OCC on an efficient software platform. Automatic Train Operation (ATO) shall be possible. The system will capture and process data from trains, field equipment and subsystems on HSR corridors and present the information to OCC staff, a division of highly trained skilled railroad operations professionals.

Even in a widely automated world, the most important element of the OCC is a human being, the Dispatcher, who knows the OCC's functions in detail and is well trained in managing the flow of trains on the network. Thus, the Dispatcher has all responsibility for safety, punctuality and efficiency of the railroad operations.

Figure 6-28: The Operations Control Center (OCC)

6.3.6.2 Cost Drivers

The main cost drivers for the OCC are the staffing costs to cover dispatching for 24 hours during service hours and during maintenance hours at night.

Additional staff for OCC system support is required 24/7 including systems not related to dispatching but with safety-critical and reliability functions performed by these systems. Both the hardware and software need to be running continuously and regularly maintained and updated. These systems will be made largely redundant with the anticipation that certain failures will need to be addressed immediately. There will be onsite (at the OCC) and offsite presence (for continuity reasons if the OCC has to be evacuated) of both maintenance staff and necessary spare parts.

6.3.6.3 Organization and Personnel

The Operations Control Director oversees the OCC department which is shown in the following Figure 6-29.

The chief line, line and depot dispatchers will work in a three-shift system. To cover a position in a three-shift system over 24 hours, 365 days per year and assuming a full-time operational employee's (FTE's) net working time of 1794h per year, a total of five FTE are required:

$$365d * \frac{24h}{1{,}794\frac{h}{yr}} = 4.88FTE \approx 5FTE$$

Respectively, the positions of chief line dispatcher, line dispatcher and depot dispatcher require five FTE each for 24/7 presence. Information controllers will work in a two-shift system, i.e. during the revenue operation of the high-speed trains.

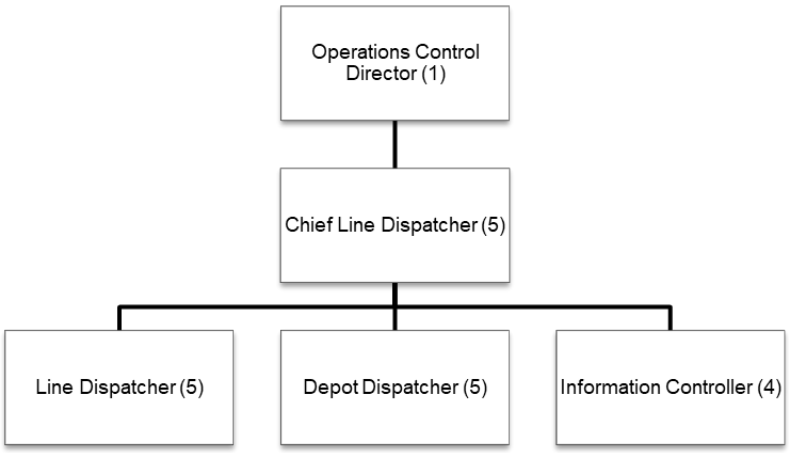


Figure 6-29: Organizational Structure of OCC Department (FTE)

6.3.6.4 Unit Costs

Figure 6-30 below shows the unit costs per FTE.

No.	Position	FTE	Shifts	Short Task Description	Yearly Salary (USD)	Pay Grade
1	Operations Control Director (including Incident Manager's role)	1	1	Director's level, responsible for OCC, dispatching, operational controlling, info provision, chief incident mgmt.	155,156	Senior Manager > 10 years

No.	Position	FTE	Shifts	Short Task Description	Yearly Salary (USD)	Pay Grade
2	Chief Line Dispatcher (incl. Dispatcher's role)	5	3	Operational head of OCC, regulator, operational dispatching, OHC SCADA supervision	103,437	Manager
3	Line Dispatcher	5	3	Operational line dispatching	82,750	equivalent to Analyst
4	Depot Dispatcher	5	3	Operational depot & shunting movement dispatching	82,750	equivalent to Analyst
5	Information Controller	4	2	Information provider to passengers and stakeholders	62,062	Assistant

Figure 6-30: Staffing and Salary Costs for OCC Department

The OCC systems support contract costs for both the onsite (at the OCC) and offsite presence of both maintenance staff and necessary spare parts are annually assumed to be USD1,035,000.

6.3.6.5 Cost Projection

Figure 6-31 below shows the cost projection for the OCC.

Operations Control and Dispatching Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
Labor cost (salary, benefits, healthcare cost) with ramp up	236	2,834	2,834	2,834	2,598
OCC systems support contracts cost	86	1,035	1,035	1,035	948
Total Operations Control and Dispatching costs	322	3,868	3,868	3,868	3,546

Figure 6-31: Cost Projection for Operations Control and Dispatching (in USD1,000)

6.3.7 Cost Projection

The Figure 6-32 below shows the cost projection for CHSRA System O&M, which contains O&M for Civil Structures, T&S, Facilities, and Operations Control and Dispatching.

System Maintenance Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
Labor cost (salary, benefits, healthcare cost)	1,519	18,230	18,230	18,230	16,711
Non-revenue vehicle cost (gas, insurance, maint.)	116	1,389	1,389	1,389	1,273
Materials, services, utilities cost	321	3,846	3,846	3,846	5,998
Contingency margin - HSR system maintenance	293	3,520	3,520	3,520	3,597
Total CHSRA maintenance system costs	2,249	26,985	26,985	26,985	27,580

Figure 6-32: Cost Projection for CHSRA System Maintenance (USD1,000)

6.4 CHSRA O&M Cost Projection

Figure 6-33 below is a view of the overall CHSRA's O&M costs.

CHSRA O&M Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
HSR system maintenance costs incl. contingency	2,249	26,985	26,985	26,985	27,580
HSR rolling stock maintenance costs incl. contingency	1,341	16,090	16,090	16,090	14,749
HSR Overhead Costs	591	7,048	7,048	7,048	6,463
Total CHSRA O&M costs	4,181	50,123	50,123	50,123	48,792

Figure 6-33: Cost Projection for Overall CHSRA Maintenance Cost (USD1,000)

7 CHSRA System Revenues

This section describes the structure and projection of revenues planned to be recognized by CHSRA in relation to making the HSR system assets available to an operator of HSR services.

These revenues comprise two categories of revenue streams:

- Revenue streams related to operation of rail services for use of HSR infrastructure and assets:
  - System Access Fees, which are payable by the Operator to CHSRA for use of the HSR infrastructure, assets, station assets and related assets for the purpose of rail service provision;
  - Train Rental Fees, which are payable by the Operator to CHSRA for availability of HSR rolling stock for use by the operator for the purpose of rail service provision.
- Revenue streams related to ancillary business opportunities.

In line with the business structure proposed for HSR assets and operations for the Central Valley, the sum of system access fee and train rental fee revenues should cover all the costs incurred by CHSRA in relation to ensuring the availability of the Central Valley HSR system and assets to the Operator. The balance of these revenue streams and these costs should be zero i.e. CHSRA should achieve break-even.

Revenues planned to be recognized by CHSRA from ancillary business opportunities are not part of the above break-even requirements – and will therefore appear as a surplus revenue stream on top of the System Access Fee and Rolling Stock Rental Fee.

7.1 System Access Fees

System Access Fees will be charged by CHSRA to the Operator for access for use of HSR infrastructure.

The annual System Access Fees will cover the following costs:

- All costs payable by CHSRA to the contractor holding the DBM contract for maintenance of HSR track and systems (which in addition includes responsibility for maintenance of HSR civil

works and structures, operation of train control and dispatch, and maintenance of track-side station facilities);

- Contract management overhead costs incurred by CHSRA for the purpose of managing the DBM contracts as well as the contractual and financial arrangements with the operator; and
- Insurance costs incurred by CHSRA related to the assets that will be owned by CHSRA.

For the purpose of this report, the System Access Fee is calculated as annual lump sum amounts – based on the above-mentioned costs which need to be covered.

This does not preclude eventually structuring the System Access Fee into (partially) variable fees per train-mile, per revenue-mile, per train-path or on a different variable basis.

The resulting annual System Access Fees due to be paid by the Operator to CHSRA are shown in Figure 7-1 below.

System Access Fee Items	Dec. 2028	2029	2030	2031	Nov. 2032
HSR system maintenance cost	1,955	23,465	23,465	23,465	23,982
Contingency margin - HSR system maintenance	293	3,520	3,520	3,520	3,597
DBM contract management department labor cost (salary, benefits, healthcare cost)	77	926	926	926	849
HSR system insurance costs	202	2,429	2,429	2,429	2,227
CHSRA policing costs	203	2,391	2,391	2,391	2,194
Total system access fees	2,731	32,731	32,731	32,731	32,849

Figure 7-1: System Access Fees (USD1,000)

7.2 Rolling Stock Rental Fees

Rolling Stock Rental fees will be charged by CHSRA to the Operator for use of the HSR rolling stock.

The annual Train Rental Fees will cover the following costs:

- All costs payable by CHSRA to the contractor holding the DBM contract for maintenance of rolling stock (which in addition includes responsibility for maintenance of the Heavy Maintenance Facility);
- Insurance costs incurred by CHSRA for HSR Rolling Stock

For the purpose of this report, the Train Rental Fee is calculated as annual lump sum amounts – based on the above-mentioned costs which need to be covered.

As with the System Access Fee, this does not preclude eventually structuring the Train Rental Fee into (partially) variable fees per train-set per annum or per hour, per train-mile, or on a different variable basis.

The resulting annual Rolling Stock Rental Fees due to be paid by the operator to CHSRA are shown in Figure 7-2 below.

Rolling Stock Rental Fee Items	Dec. 2028	2029	2030	2031	Nov. 2032
HSR rolling stock maintenance costs	1,166	13,992	13,992	13,992	12,826
Contingency margin - HSR rolling stock maintenance	175	2,099	2,099	2,099	1,924
HSR rolling stock insurance costs	109	1,302	1,302	1,302	1,194
Total rolling stock rental fees	1,450	17,393	17,393	17,393	15,943

Figure 7-2: Rolling Stock Rental Fees (USD1,000)

7.3 System Ancillary Revenues

7.3.1 Introduction

Potential sources of ancillary revenue, which are planned to be recognized by CHSRA related to HSR infrastructure and services on the Central Valley Segment, have been analyzed. This analysis is highly preliminary due to a number of factors, including:

1. The available data to conduct the analysis of ancillary revenue opportunities is primarily based on reports prepared by CHSRA and its consultants for the 2018 Business Plan[3].

2. Although these reports were prepared relatively recently and involved an in-depth examination of ancillary revenue opportunities, they were focused on a larger initial project configuration, specifically the V2V (San Jose to Bakersfield) and Phase 1 scenario.

3. The focused nature and timeframe of the CVS analysis did not allow for performance of material independent research and due diligence. As such, certain professional assumptions have been made that, while considered reasonable, should be verified with further data.

4. The preliminary CVS station designs are categorized as “platforms and canopies”, which therefore limits the opportunity for stations as a destination revenue source.

Accordingly, while interim operations on the CVS are expected to generate some ancillary revenue, the level is still uncertain.

7.3.2 Ancillary Revenue Categories and Responsible Party Allocations

The ancillary revenue opportunities examined for the CVS projections primarily comprise the 13 ancillary revenue categories down-selected by the CHSRA for inclusion in the Final 2018 Business Plan. Another opportunity is revenue from the generation and sale of Low Carbon Fuel Standard (LCFS) credits which is discussed in section 7.3.6.[4]

The list of ancillary revenue opportunities is set out in Figure 7-3 below and represents the Authority’s view. It is divided into two groups based on the party responsible for pursuing the opportunity – namely: the CHSRA (system ancillary revenues) or the Operator (operations ancillary revenues). The system ancillary revenue opportunities are discussed in the remainder of subsection 7.3, and operations ancillary revenue opportunities shown in Figure 7-3 will be discussed in Section 18.

[3] Referenced reports include: (i) Final 2018 Business Plan Ancillary Revenue Technical Documentation, June 1, 2018; (ii) Ancillary Revenue Report, December 22, 2017; and California High-Speed Rail, Preliminary Estimates for Ancillary Revenue Contributions, 2018 Business Plan, January 25, 2018.

[4] The purpose of this regulation is to implement a low carbon fuel standard, which will reduce the full fuel-cycle, carbon intensity of the transportation fuel pool used in California, pursuant to the California Global Warming Solutions Act of 2006 (Health & Safety Code [H&S], section 38500 et seq

System Ancillary Revenues	Operations Ancillary Revenues
Excess land (during pre-operations only)	Advertising: billboard
Sponsorship: branding exclusivity	Advertising: rolling stock & station-level
Sponsorship: station naming	Retail: station-level
Sponsorship: system naming	Web-based advertising
Telecommunications: longitudinal fiber	
Telecommunications: towers	

Figure 7-3: System Ancillary Revenues of the Authority and Operations Ancillary Revenues

7.3.3 Base Metric Drivers – System Ancillary Revenues

As in the 2018 Business Plan, the ancillary revenue estimates were prepared using a relevant base metric driver for each ancillary revenue category. These drivers generally relate to a major system feature, as shown in Figure 7-4 below.

Base Metric Driver	Applicable System Ancillary Revenue Type(s)
Number of stations	Sponsorship (station naming)
Number of stations	Telecommunications (towers)
Right-of-way (ROW) miles	Telecommunications (longitudinal fiber)
Other (generally fixed per annum dollar amounts profiled over a defined timeframe)	Sponsorship (branding exclusivity)
Other (generally fixed per annum dollar amounts profiled over a defined timeframe)	Sponsorship (system naming)

Figure 7-4: Basic metric drivers for system ancillary revenues

The levels assumed for these base metric drivers in the CVS analysis are:

- **Number of stations:** Five stations are included: Merced, Madera, Fresno, Kings/Tulare, and Bakersfield. These stations consist of platforms and canopies with two escalators, two elevators, and two sets of stairs on each side and pedestrian bridges; and
- **Right-of-way (ROW) miles:** A total of 170.7 ROW miles are assumed to be acquired.

7.3.4 Timing Parameters – System Ancillary Revenues

Key timing assumptions for system ancillary revenues in the CVS analysis include:

- First year of Pre-Operations phase with start of T&S NTP– Q4 2020
- ROW acquired – 2022
- Real property acquired – 2023
- Operations commencement – December 2028.

As in the 2018 Business Plan, each system ancillary revenue type is profiled to commence and, in some instances, to occur entirely during one of three phases as shown in Figure 7-5 below.

Timing phase	Applicable system ancillary revenue type(s)	Date range
Pre-operations	Excess land (fee simple interest)	2020 to 2024
Pre-operations	Telecommunications (towers)	2023 onward
Pre-operations	Telecommunications (longitudinal fiber)	2022 onward
Operations	Sponsorship (branding exclusivity)	December 2028 onward
Operations	Sponsorship (station naming)	December 2028 onward
Operations	Sponsorship (system naming)	December 2028 onward
Operations	LCFS revenues	December 2028 onward

Figure 7-5: Timing Phase, Applicable System Ancillary Revenue Type(s) and Date Range

The ancillary revenue cash flow projections for the CVS analysis reflect the first four years of operations (December 2028- November 2032). Ancillary revenue arising beyond this timeframe has not been considered. As such, ancillary revenue from ground leases is not reflected in the projections.

7.3.5 Net Revenue Unit Multipliers – System Ancillary Revenues

7.3.5.1 Background

In the detailed analysis supporting the 2018 Business Plan, CHSRA and its consultants prepared low, medium, and high benchmark multipliers for each of the ancillary revenue opportunities.[5] These benchmark multipliers were then applied to the relevant base metric driver for each ancillary revenue type, producing low, medium, and high ancillary revenue cases. The medium ancillary revenue case then formed the basis for forecasting ancillary revenues within the 2018 Business Plan. All such ancillary revenue calculations were made on a net revenue basis (i.e. taking into account the operating costs of their pursuit).

7.3.5.2 Unit Multipliers for System Ancillary Revenues in the CVS Analysis

CHSRA's prior ancillary revenue reports were reviewed and discussed with the CHSRA team of consultants. Based on this information, the following unit multipliers were applied to generate a "medium" system ancillary revenue case for the CVS projections (see Figure 7-6 below). As was previously the case, these multipliers are for the calculation of system ancillary revenues on a net revenue basis.

In general, these assumptions reflect the view that ancillary revenues will be lower than those projected for V2V and Phase 1 in the 2018 Business Plan because of:

- Limited service in terms of capacity and frequency;
- The service serves smaller markets in the Central Valley; and
- The median household income in Central Valley counties is materially lower than those in the Bay Area and Los Angeles.

[5] A summary of these ancillary revenue multiplier estimates (low, medium, and high) and key benchmarking assumptions supporting them are set out on page 11 of the report entitled "California High-Speed Rail, Preliminary Estimates for Ancillary Revenue Contributions, 2018 Business Plan", dated 25 January 2018

System Ancillary Revenue Category	Multiplier Estimate for CVS (USD2019)	Multiplier Estimate for CVS (USD2017)	Discussion/Rationale	Prior Low/ Medium/High Levels in 2018 Business Plan (USD2017)
Excess land	8,581,440 per annum	8 million per annum	Equals prior medium estimate (USD40 million in aggregate).	6 million/8 million/ 12 million per annum for five years (commencing immediately)
Sponsorship: branding exclusivity	53,634 per annum	50,000 per annum	Equals 50% of prior medium estimate. CVS is primarily rural. Lower CVS median household income.	0/100,000/200,000
Sponsorship: station naming	26,817 per station	25,000 per station	Equals 50% of prior medium estimate. CVS is primarily rural. Lower CVS median household income.	0/50,000/100,000
Sponsorship: system naming	1,072,673 per annum	1 million per annum	Equals 50% of prior medium estimate. CVS is primarily rural.	0/2 million/4 million
Telecommunications: longitudinal fiber	10,630 per ROW mile	10,000 per ROW mile	Equals prior low estimate. (N.B. may require legal action, as discussed in the 2018 Business Plan)	10,000/25,000/40,000
Telecommunications: towers	21,453 per station	20,000 per station	Equals prior low estimate	20,000/25,000/30,000

Figure 7-6: Unit Multipliers for CVS Medium Case System Ancillary Revenues

7.3.6 Low Carbon Fuel Standard Credits

The Authority may be eligible to generate LCFS credits worth between USD12.68 million and USD21.30 million until 2030 during CVS operations. In October 2018, the ARB (California Air Resources Board) approved a rule change for the LCFS program extending to 2030. This provides

a solid indication that the market for these credits is strong and for purposes of this report revenues has been included for the years 2028-2030 according to current program's term.

"Credits" and "Deficits" mean the units of measures used for determining a regulated party's entity's compliance with the average carbon intensity requirements in section 95484. Credits and deficits are denominated in units of metric tons of carbon dioxide equivalent (CO2e) and are calculated pursuant to sections 95486(b)95486.1(a), (c), 95486.2(a)(5) and (b)(5), 95489 and 95490.[6] For this report, USD12.68 million worth of LCFS credits has been assumed based on HSR's annual energy consumption for electric rail propulsion which is assumed to be 75,050 MWh.[7,8]

Figure 7-7 below shows the Revenue Projection for LCFS credits (in USD 1,000).

Low Carbon Fuel Standard (LCFS) Revenue Items	December 2028	2029	2030	2031	November 2032
Ancillary revenue - Low Carbon Fuel Standard (LCFS) Credits	1,057	12,679	12,679	-	-
Total LCFS ancillary revenues	1,057	12,679	12,679	-	-

Figure 7-7 Revenue Projection for LCFS credits (USD1,000)

7.3.7 CVS Projection – System Ancillary Revenues

Under the assumptions set out above in this section, the projected "medium" case net system ancillary revenues for the CVS are as follows:

All phases of the System's net ancillary revenues (medium case) are shown in Figure 7-8 below.

[6] https://www.arb.ca.gov/regact/2018/lcfs18/fro.pdf.

[7] Formula used for generating LCFS credits from MWh used for heavy rail propulsion: Credits = [Diesel CI – (Electricity CI / EER)] * EER * Energy Density / 1000 * MWh

[8] Formula Sources (https://www.arb.ca.gov/regact/2018/lcfs18/fro.pdf): CI of Diesel in 2029 (81.62 gCO2e/MJ; Table 2). Energy Density of Electricity (3.6 MJ/kWh; Table 4). HSR would generate credits under Fixed-Guideway regulations, using electricity as the fuel pathway (either grid average carbon-intensity, "CI", or clean zero-CI sources). CI of Grid Average Electricity in all years (93.75 gCO2e/MJ; Table 7-1). CI of Zero-Carbon Electricity (0.0 gCO2e/MJ; Table 7-1). Energy Economy Ratio of Electricity relative to Diesel (4.6 [dimensionless]; Table 5

LCFS Price Sources:
• https://www.neste.com/corporate-info/investors/market-data/lcfs-credit-price
• https://www.arb.ca.gov/fuels/lcfs/credit/lrtmonthlycreditreports.htm

System Ancillary Revenue Items (USD1,000)	2028	2029	2030	2031	Nov. 2032
Excess land	-	-	-	-	-
Telecommunication - towers	107	107	107	107	98
Telecommunication - longitudinal fiber	1,877	1,877	1,877	1,877	1,721
Ground leases	-	-	-	-	-
Sponsorship - branding exclusivity	4	54	54	54	49
Sponsorship - station naming	11	134	134	134	123
Sponsorship - system naming	89	1,073	1,073	1,073	983
Total system ancillary revenues excl. LCFS	**2,089**	**3,245**	**3,245**	**3,245**	**2,974**

Figure 7-8: Revenue Projection for System Ancillary Revenues (USD1,000)

Figure 7-9 below displays the revenue projection for CHSRA revenues (in USD1,000).

7.4 Revenue Projection

Consolidated Revenue Items	2028	2029	2030	2031	Nov. 2032
HSR system access fee revenues	2,731	32,731	32,731	32,731	32,849
HSR rolling stock rental fee revenues	1,450	17,393	17,393	17,393	15,943
System ancillary revenues excl. LCFS	2,089	3,245	3,245	3,245	2,974
Total CHSRA consolidated revenues	6,270	53,368	53,368	53,368	51,767

Figure 7-9: Revenue Projection for CHSRA Revenues (USD1,000)

8 CHSR System Management Financial Balance

Based on the costs incurred by and revenues planned to be recognized by CHSRA, it is possible to project a financial balance for CHSRA.

This financial balance is projected as a result of the CHSRA O&M costs and the CHSRA system revenues.

8.1 Financial Balance CHSRA

The financial balance of CHSRA is composed of the following:

- Costs:
  - All costs payable by CHSRA to the contractor holding the DBM contract for maintenance of HSR track and systems (which in addition includes responsibility for maintenance of HSR civil works and structures, operation of train control and dispatch, and maintenance of track-side station facilities);
  - All costs payable by CHSRA to the contractor holding the DBM contract for maintenance of rolling stock (which in addition includes responsibility for maintenance of the Heavy Maintenance Facility);
  - Contract management overhead costs incurred by CHSRA for the purpose of managing the DBM contracts as well as the contractual and financial arrangements with the Operator; and
  - Insurance costs incurred by CHSRA for the assets that will be owned by the Authority including Rolling Stock.
- Revenues:
  - The System Access Fees (calculated to cover CHSRA's Track & Systems DBM costs, contract management overhead costs, and insurance costs).
  - The Rolling Stock Rental Fees (calculated to cover CHSRA's Rolling Stock DBM cost and rolling stock property insurance costs).
  - Ancillary Revenues

The resulting projection of CHSRA's financial balance in 2029 of interim operations on the Central Valley Segment is shown below in Figure 8-1.

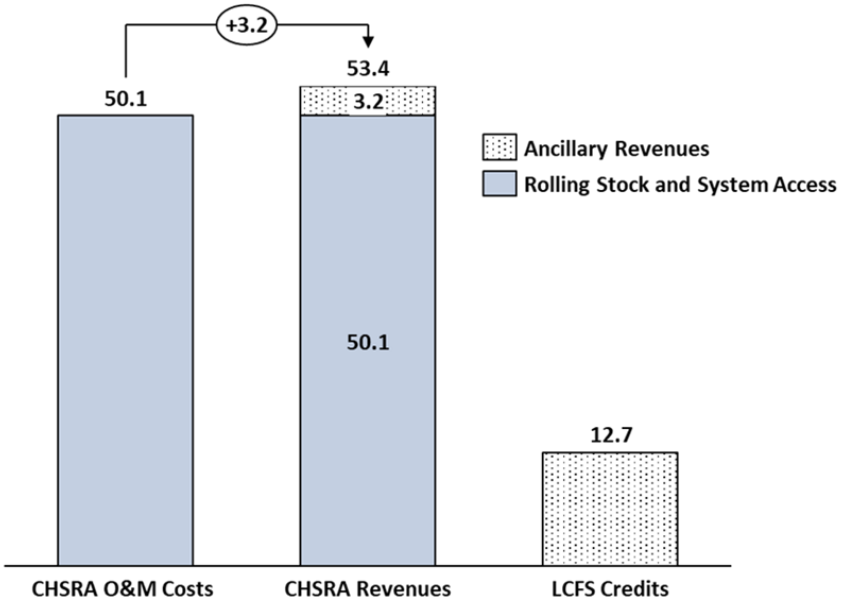


Figure 8-1: Total 2029 CHSRA financial balance (in 2019 USD Million)

Note: Ancillary revenues include Low-Carbon Fuel Standard (LCFS) credits. It is to be determined if these accrue to the State or to the Authority, but the ETO has included it in this systemwide projection consistent to the prior ETO study.

The overall balance results in a surplus to CHSRA of USD3.2 million as a result of (i) break-even achieved on the balance of costs and revenues specific to use of HSR infrastructure and assets for rail services, and (ii) additional revenues planned to be recognized by CHSRA from ancillary business opportunities. LCFS revenues are shown separately as the treatment of the LCFS credits are to be determined whether they accrue to the Authority or to the State.

PART C: INTEGRATED TRAIN OPERATIONS

9 HSR Train Operations

9.1 Key Assumptions and Scope

9.1.1 Service concept

The service concept for the High-Speed Rail services through the Central Valley Segment (CVS) plans for one high-speed train per hour per direction.

For best connectivity:

- All high-speed trains are scheduled according to a clock face timetable, in which departures and arrivals occur at the same minute of each hour;
- At the northern terminus of the high-speed rail, at Merced (MCD), the schedule provides for conveniently timed transfers between high-speed trains and corresponding San Joaquins and Altamont Corridor Express (ACE) trains, as well as for buses;
- At the southern terminus of the high-speed rail, at Bakersfield (BFD), the schedule provides for conveniently timed transfers between high-speed trains and buses.

Figure 9-1 below shows the CVS mileage and stations.

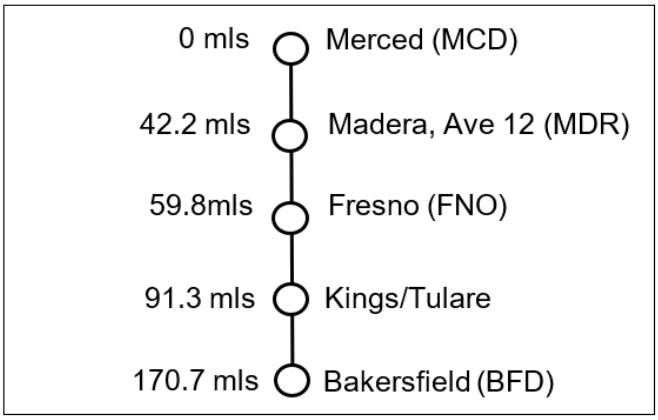


Figure 9-1: CVS Mileage and Stations

The revenue service extends over approximately 19 hours per day for seven days per week. Additional peak or reduced off-peak hour services or holiday period services are not modelled. For maintenance purposes of infrastructure and rolling stock, nightly operations-free time slots of approximately five hours are scheduled. The Heavy Maintenance Facility (HMF) for the rolling stock maintenance is assumed to be located in the area south of Fresno.

9.1.2 Stations

The 170.7-mile travel corridor between the northern terminus, Merced, and the southern terminus, Bakersfield, will have regular intermediate stops at Madera, Fresno and Kings/Tulare. It is assumed that the Merced HSR station (also known as Merced Intermodal Station) will bring conventional trains (San Joaquins, Altamont Corridor Express ACE) and high-speed trains together at one station for convenient passenger transfers.

To make this possible, San Joaquins and ACE trains approaching Merced from the north will switch from the BNSF tracks (Stockton Subdivision) to Union Pacific tracks (Fresno Subdivision) through cross-over tracks or “The Loop”, also referred to as the Merced Intermodal Train Connection (MITC) (see Figure 9-2 below), in an industrial area on existing tracks and will not end at today’s San Joaquins station. Instead they will terminate at the future Merced High-Speed Rail Station.

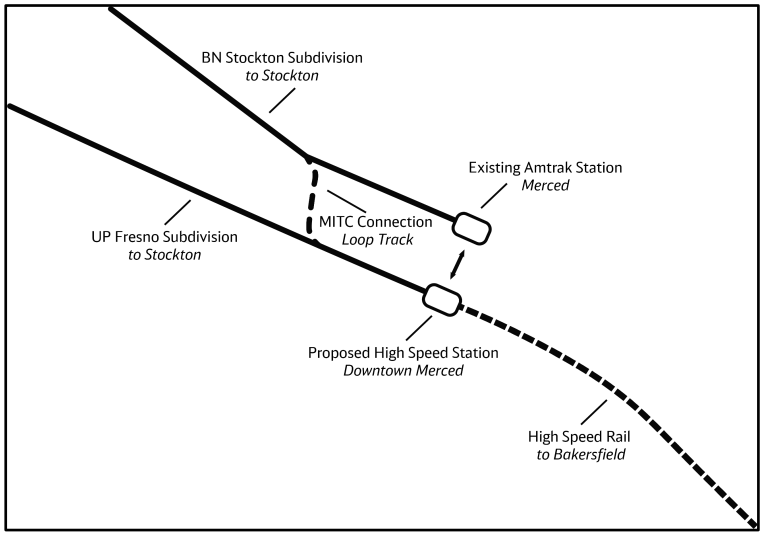


Figure 9-2: Schematic Sketch of MITC Connection Between BN Stockton Subdivision and UP Fresno Subdivision (“The Loop”)

Currently, a new at-grade HSR station is environmentally cleared for the site between G Street and Martin Luther King, Jr. Street. This is the basis for the projected operations and maintenance cost calculations. However, latest discussions between CHSRA and City of Merced propose an elevated HSR station between R Street and O Street, where HSR and San Joaquins trains meet cross-platform. ACE trains are assumed to arrive and depart at-grade.

9.1.3 Connectivity

The CVS HSR station infrastructure is assumed to support convenient transfer between train to train (short cross-platform transfer) or train to bus to keep transfer times short and the overall travel experience attractive as seen in Figure 9-3 below which shows an example of seamless inter-modal transfer supporting an attractive travel chain in Germany.

Figure 9-3: Cross-Platform Transfer Between DB Regional Express Train and DB Bus in Germany

Customer satisfaction and successful operation of the high-speed rail system are central success factors. To achieve these, a high degree of connectivity and the creation of consistent and integrated travel chains throughout California comprising clock face timetables, both for the high-speed trains

and the corresponding rail and bus feeder services, are a must. All high-speed trains will be connected as follows:

- At Merced, the northern terminus, train connectivity is provided from/to:
  - San Jose (1x ACE)
  - Oakland (5x San Joaquins)
  - Sacramento – Natomas (6x San Joaquins; 3x ACE Northbound and 5x ACE Southbound)

The assumed future ACE and San Joaquins with the intermediate stations are shown in Figure 9-4 below and are further discussed in Section 11.

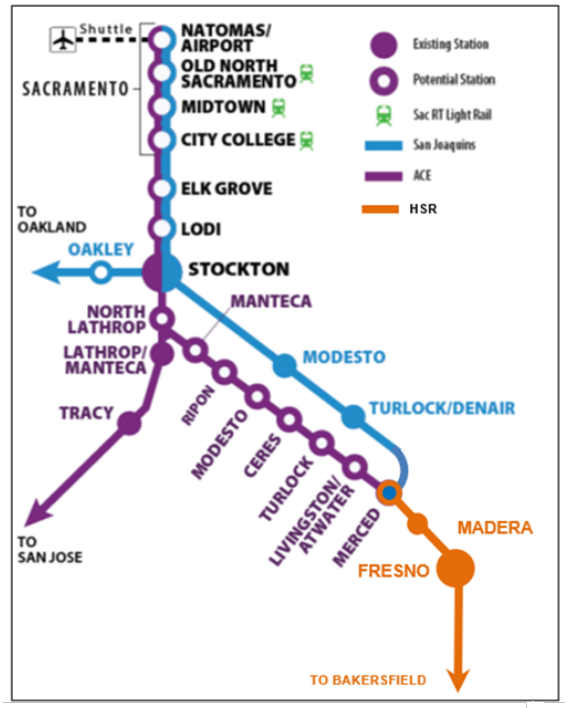


Figure 9-4: Possible Future Connectivity of CVS HSR Services with San Joaquins and Altamont Corridor Express ACE at Merced

See Section 12 for details regarding additional bus connections assumed at Merced and the southern terminal at Bakersfield.

Timetables/Stringline Diagram

The following timetables Northbound (Figure 9-5, Figure 9-6) and Southbound (Figure 9-7, Figure 9-8) provide comprehensive information on all high-speed trains. The timetable is uniform across all 365 days per year. All high-speed trains start from and terminate at the Stabling Yard.

Station	ST-2	ST-4	102	104	106	108	110	112	114	116
Bakersfield	/	/	6:19	7:19	8:19	9:19	10:19	11:19	12:19	13:19
Kings Tulare	/	/	6:53	7:53	8:53	9:53	10:53	11:53	12:53	13:53
Fresno	5:09	6:09	7:09	8:09	9:09	10:09	11:09	12:09	13:09	14:09
Madera	5:21	6:21	7:21	8:21	9:21	10:21	11:21	12:21	13:21	14:21
Merced	5:42	6:42	7:42	8:42	9:42	10:42	11:42	12:42	13:42	14:42

Figure 9-5: HSR Schedule Northbound-1

Station	118	120	122	124	126	128	130	132	ST-6	ST-8
Bakersfield	14:19	15:19	16:19	17:19	18:19	19:19	20:19	21:19	22:19	23:19
Kings Tulare	14:53	15:53	16:53	17:53	18:53	19:53	20:53	21:53	22:53	23:51
Fresno	15:09	16:09	17:09	18:09	19:09	20:09	21:09	22:09	23:07	/
Madera	15:21	16:21	17:21	18:21	19:21	20:21	21:21	22:21	/	/
Merced	15:42	16:42	17:42	18:42	19:42	20:42	21:42	22:42	/	/

Figure 9-6: HSR Schedule Northbound-2

Station	ST-1	ST-3	101	103	105	107	109	111	113	115
Merced	/	/	6:08	7:08	8:08	9:08	10:08	11:08	12:08	13:08
Madera	/	/	6:30	7:30	8:30	9:30	10:30	11:30	12:30	13:30
Fresno	/	5:41	6:41	7:41	8:41	9:41	10:41	11:41	12:41	13:41
Kings Tulare	4:58	5:58	6:58	7:58	8:58	9:58	10:58	11:58	12:58	13:58
Bakersfield	5:30	6:30	7:30	8:30	9:30	10:30	11:30	12:30	13:30	14:30

Figure 9-7: HSR Schedule Southbound-1

Station	117	119	121	123	125	127	129	131	ST-5	ST-7
Merced	14:08	15:08	16:08	17:08	18:08	19:08	20:08	21:08	22:08	23:08
Madera	14:30	15:30	16:30	17:30	18:30	19:30	20:30	21:30	22:30	23:30

Station	117	119	121	123	125	127	129	131	ST-5	ST-7
Fresno	14:41	15:41	16:41	17:41	18:41	19:41	20:41	21:41	22:41	23:41
Kings Tulare	14:58	15:58	16:58	17:58	18:58	19:58	20:58	21:58		
Bakersfield	15:30	16:30	17:30	18:30	19:30	20:30	21:30	22:30		

Figure 9-8: HSR Schedule Southbound-2

The following Figure 9-9 shows the high-speed rail services between Merced and Bakersfield.

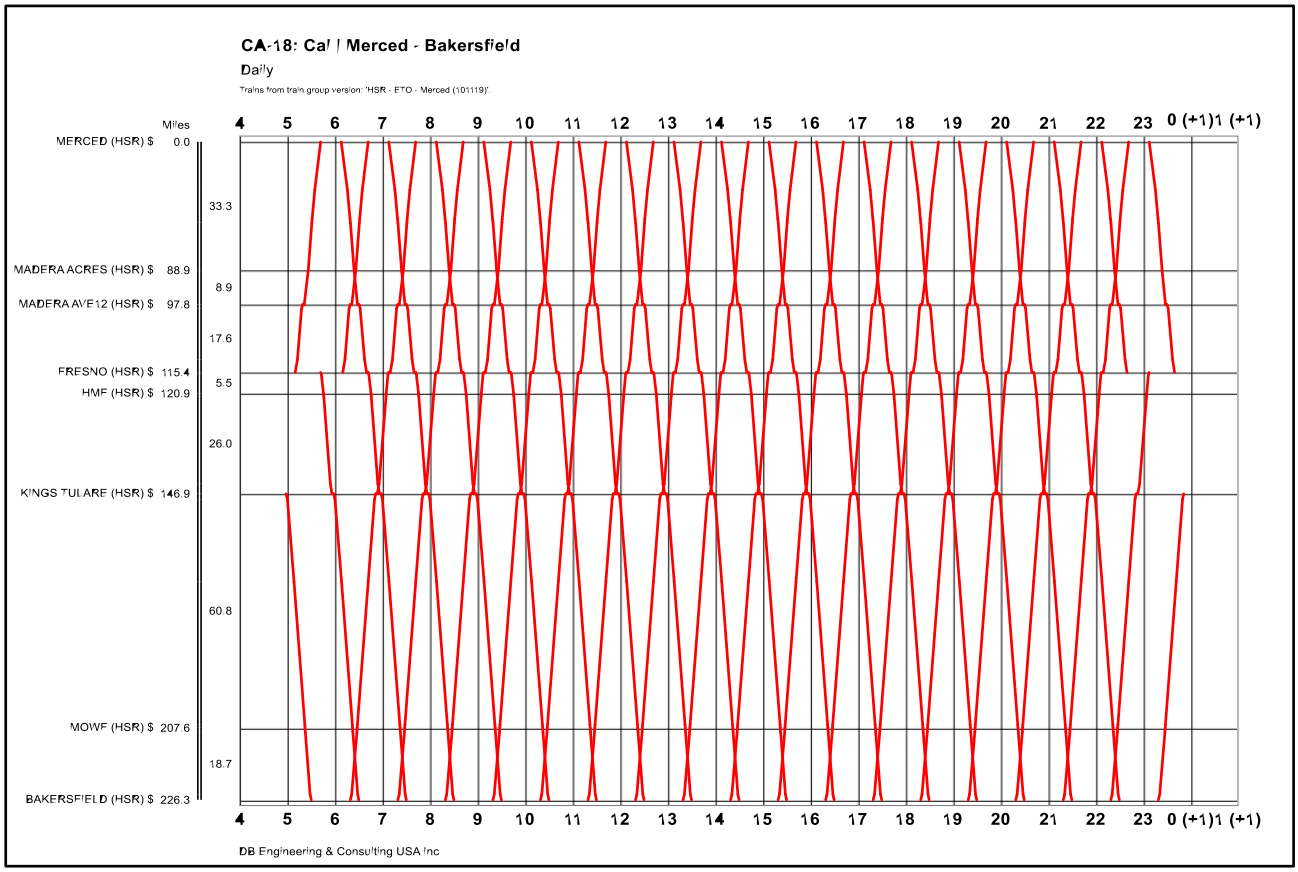


Figure 9-9: Stringline Diagram of HSR Services Between Merced and Bakersfield

9.1.4 Rolling Stock

Operating one train per hour per direction on the CVS will require six trainsets:

- Four operational trains

- One train for operational reserve
- One train for maintenance

9.1.5 Organization and Personnel

Figure 9-10 below shows the organizational structure for CVS operations and reflects the specific requirements of multi-shift operations.

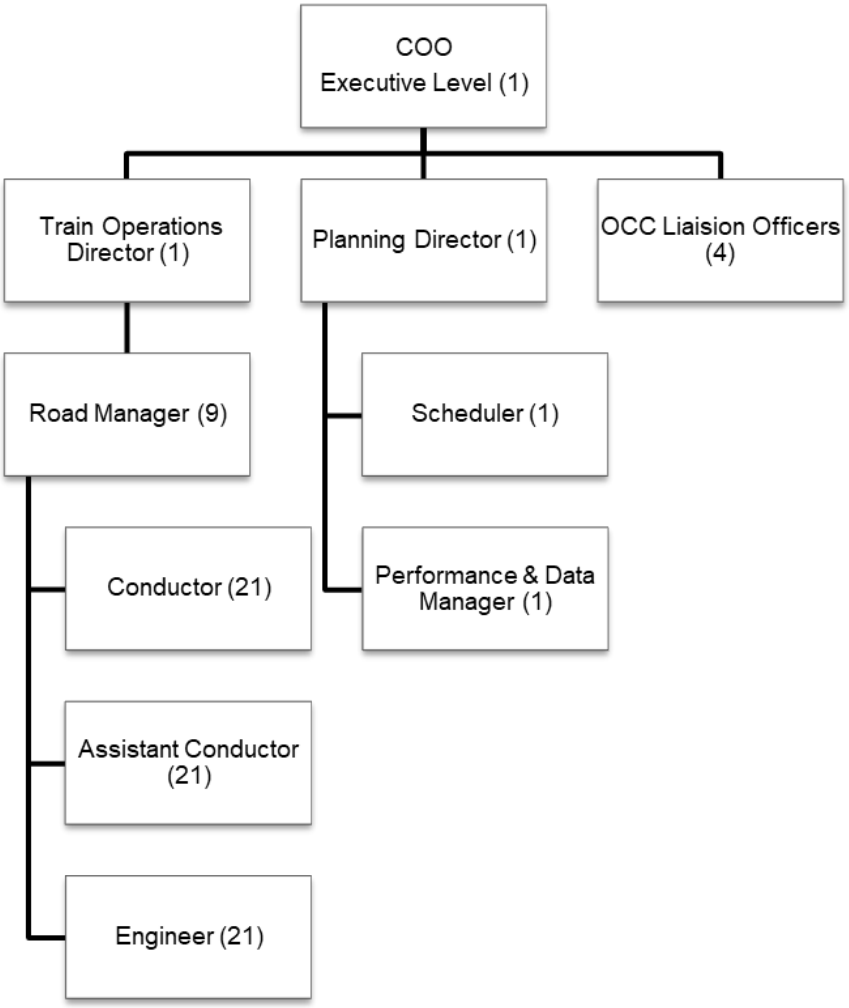


Figure 9-10: Organizational Structure of Operations Department (FTE)

9.1.6 Cost drivers

The main cost drivers for operations are:

- Staffing cost;
- Traction power cost;
- Auxiliary energy cost; and
- Costs related to Non-Revenue Vehicles (NRVs)

Operations Staff

Labor cost in operations is mainly characterized by the need for alignment between overall operations hours and the shifts to be filled by the employees with their respective working times. A mark-up factor is included to reflect inevitable inefficiencies in such crew shift planning. The result is the number of staff expressed in Full Time Employees (FTEs).

A total of 80 FTEs will be needed to fill all operational positions for a total of 27,206 train hours per year.

- Train Operations Personnel (road managers, train crews) will work in a two-shift system.
  - *For trains in revenue service*: The daily operation of four high-speed trains in revenue service for around 19 hours[9] results in a total of 27,206 annual train hours, including turn times.
  - Adding a 12.5% mark-up factor for inevitable inefficiencies in crew shift planning etc., results in a total of 30,607 hours. Based on 1,794 working hours assumed per operational FTE (full time employee), this results in approximately 17 FTEs per each train crew position.

$$\frac{30{,}607h}{1{,}794\ \frac{h}{FTE}} = 17.06FTE \approx 17FTE$$

  - The four trains in revenue service, therefore, require 17 engineers, 17 conductors and 17 assistant conductors (i.e. one per trainset).

[9] For precise operational data see above timetables

- A fifth train serves as an operational reserve (protect train) during the 19 hours of revenue service of the other four trains, and is in stand-by mode, equipped with engineer, conductor and one assistant conductor to be quickly activated, when needed.

$$365d * \frac{19h}{1{,}794\frac{h}{yr}} = 3.87FTE \approx 4FTE$$

- In addition, 4 engineers, 4 conductors and 4 assistant conductors (i.e. one per train) will be needed for a functional protect train. During stand-by, the engineer of the protect train will assist the depot & shunting driver in shunting trains in the stabling yard and heavy maintenance facility.

- Planning Personnel (e.g. scheduler, performance and data manager) will work in a one-shift system.
- OCC Liaison Officers (4 FTE) are not subject to a shift regime. During their annual working time they will work in the OCC as part of the TOC. Even if they are not authorized to issue directives, their advice as interface managers and support on dispatching decisions will help achieve punctuality and customer satisfaction. The Liaison Officers are fully Rules Qualified as Line Dispatchers.

Traction Power Cost

Referencing a Deutsche Bahn's BR407 (ICE 3) 8-car-trainset at an empty train weight of 439 tons, the electricity consumption at a speed of 180 mph (i.e. 290 km/h), is approximately 65.97 Wh/ton-mile. A speed of 180 mph is modeled due to the number for stations and distances between each station, however, the maximum design speed of the alignment is 220 mph. Considering a trainset with an average 156 passengers – based on HSR ridership results - of approximately 450 tons and a distance of 170.7 miles for the single trip Merced–Bakersfield on the high-speed line, the energy consumption results in 5.07 MWh traction power per single trip.

Auxiliary Energy Cost

The time-related auxiliary energy consumption for HVAC (heating, ventilation, and air conditioning) is 0.35 MWh of 250 kWh per trainset per single trip. An additional 0.15 MWh must be added per single trip to account for turning times at Merced and Bakersfield.

Non-Revenue Vehicle (NRV) cost

The following Figure 9-11 displays non-revenue vehicles that are assumed for the Operations Department.

Type of NRV	Number of NRVs	Annual fuel consumption per NRV (gallons)	Annual maintenance and insurance cost per NRV (in USD)
SUV	2	1,000	8,069
Mini bus	1	1,340	8,069
Pick-up	5	1,684	8,069
Sedan	1	783	6,983

Figure 9-11: NRV Cost Drivers

9.1.7 Unit costs

The corresponding unit costs for operations staff, traction power consumption, auxiliary energy consumption and non-revenue vehicle costs are shown here below.

Operations Staff

The FTEs and required qualifications for the Operations Department as shown in detail in Figure 9-12 below were derived from the specific experience of high-speed rail operations in Germany and rail operations in the USA.

No.	Position	FTE	Shifts	Task	Yearly Salary (USD)	Pay Grade
1	Chief Operating Officer	1	1	Senior executive, responsible the HSR operations department	206,875	Senior Director Executive level TOC
2	Train Operations Director	1	1	Director level, responsible for all train-related operations and on-board services for CVS segment	155,156	Senior Manager > 10 years

No.	Position	FTE	Shifts	Task	Yearly Salary (USD)	Pay Grade
3	Road Manager	9	3	Supervision and quality assurance of train operations, disposition of train crews, operational emergency management	103,437	Manager
4	Conductor	21	2	Train manager	82,750	equivalent to Analyst
5	Assistant Conductor	21	2	Assistant train manager	62,062	Assistant
6	Engineer	21	2	Train driver: open track	82,750	equivalent to Analyst
7	Planning Director	1	1	Director level, responsible for scheduling, performance management	155,156	Senior Manager > 10 years
8	Scheduler	1	1	Long-term, ad-hoc and construction-related scheduling	82,750	Analyst
9	Performance & Data Manager	1	1	Evaluation of operations-related data; introduction of lean management	82,750	Analyst

No.	Position	FTE	Shifts	Task	Yearly Salary (USD)	Pay Grade
10	OCC Liaison Officer by TOC (full dispatcher's qualification)	4	3	Employees of the TOC located in the OCC to advise as interface managers and support on dispatching decisions	82,750	equivalent to Analyst

Figure 9-12: Staffing and Salary Costs of Operations Department

Traction Power Unit Costs

The sole electricity supplier in the Central Valley is Pacific Gas & Electricity (PG&E) with its "E20" industrial tariff at 13.14 ct/kWh[10]. Recuperation of brake energy into the system is assumed to be technically absorbed by PG&E, but not reimbursed. Accordingly, a high-speed train trip (one direction) will result in energy cost of USD666.

Auxiliary power unit costs

The auxiliary power unit cost is USD45 per single train trip.

Non-Revenue Street Vehicles unit costs

The fuel price is assumed at USD4.25/gallon.

9.1.8 Uncertainties and contingencies

The main uncertainties related to projection of operations costs are related to:

- The possibility of an increase in labor unit costs due to a potential shortage of suitable high-speed rail operations personnel driving up wages;
- The possibility of future increases in energy tariff.

[10] www.pge.com/tariffs/electric.shtml "Industrial" (NOV 01, 2019 – present); referenced on Dec 18, 2019

9.2 Cost projection

The Figure 9-13 below shows the resulting cost projection for operations.

HSR Train Operations Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
HSR operations labor cost (salary, benefits, healthcare cost with ramp-up)	891	10,693	10,693	10,693	9,802
Trainset energy consumption cost	838	9,871	9,871	9,871	9,059
Non-revenue vehicles (operations) cost	10	125	125	125	114
Total HSR operations costs	1,740	20,689	20,689	20,689	18,976

Figure 9-13: Cost Projection for HSR Train Operations (USD1,000)

10 Operator's Facilities

10.1 Key Assumptions and Scope

The Operator's combined facilities maintenance cost items for CVS include:

- CVS Non-trackside Stations
- TOC administration building

The TOC administration building will include the area for the administrative and executive staff including typical systems found in an office environment.

10.2 Cost Drivers

The cost drivers are the number of CVS stations, station appurtenances, and physical layouts.

10.3 Unit Costs

The following Figure 10-1 shows the unit costs for facilities management and maintenance. The costs listed below are for materials that in-house staff would purchase to repair or replace items as necessary.

Type	Division	Cost Type	Units	Qty	Unit Cost (USD)	Cost Components
Building maintenance materials	TOC Admin Building	Materials	TOC Admin Building	1	2,690	Cost of doors, wall repairs, picture hangers, ceiling tiles, windows, etc.

Figure 10-1: Material Costs Facilities

The Figure 10-2 below shows the cost of services assumed to be performed by third-party vendors.

Item	Division	Cost Type	Units	Qty	Unit Cost (USD)	Cost Components
Building services	CVS Stations	Service	Stations	5	87,933	Lighting repairs, janitorial services, landscaping, etc.

Item	Division	Cost Type	Units	Qty	Unit Cost (USD)	Cost Components
Building. Services	TOC Admin building	Service	TOC Admin building	1	105,519	Lighting repairs, janitorial services, landscaping, etc.

Figure 10-2: Third-Party Vendor Service Costs

The following Figure 10-3 indicates the cost of utilities to be performed by third-party vendors.

Item	Type of Facility	Quantity	Unit Cost (USD)
Electricity consumption	CVS Stations	5	26,259
Water consumption	CVS Stations	5	414
Electricity consumption	TOC Admin building	1	109,941
Water consumption	TOC Admin building	1	25,863
Gas consumption	TOC Admin building	1	10,345

Figure 10-3: Utilities Costs for Third-Party Vendors

10.4 Uncertainties and Contingencies

The design of the system is not complete and may change from the information that is currently available.

10.5 Cost Projection

The Figure 10-4 below shows the resulting cost projection for maintenance of the Operator's facilities.

Operator's Facilities Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
Stations - non-trackside cost	48	573	573	573	525
TOC Admin Building costs	21	254	254	254	233
Total Operator's facilities costs	69	827	827	827	758

Figure 10-4: Cost Projection for Management/Maintenance of Facilities (USD1,000)

11 Conventional Rail Train Operations

11.1 Key Assumptions and Scope

The ETO obtained updated O&M cost estimates from SJRRC for ACE and San Joaquins. This was based on an updated integrated service concept that was evaluated jointly with SJRRC with the goal of maximizing ridership while balancing the associated O&M costs to still arrive at an overall benefit from a total systemwide perspective. The importance in providing a view of the ACE and San Joaquins O&M costs in addition to the HSR O&M costs is to analyze the impact from a total integrated corridor view because the proposed interim operations in the Central Valley is about operating as a total system. It should be noted that all bus connections are covered in Section 12, and are therefore not included in this section.

11.2 ACE and San Joaquins O&M Costs

The updated ACE and San Joaquins O&M costs were provided to the ETO based on an updated integrated service concept. See Section 9.1.4 for details regarding the connectivity. Additionally, SJRRC assumed a reduction in O&M costs (compared to what was provided in the ETO's last CVS study) for ACE and San Joaquins, which reflected operational efficiencies they believe can be achieved by implementing a universal operator to oversee operations of HSR, ACE, San Joaquins and bus connections. The ETO did not audit the estimates provided but, in general, found the estimates to be reasonable based on the assumptions made.

11.3 CAPEX

The ETO discussed the CAPEX with SJRRC and CalSTA, which will be needed to support the integrated service concept described in this report. Based on the high-level discussions and review conducted, the ETO concludes that most of the investments are currently funded to support revenues operations, which are expected to begin in December 2028 for Merced – Bakersfield. These investments represent joint funding by CHSRA for the HSR infrastructure and funding secured by SJRRC for the ACE and San Joaquins connections.

Once all funding is secured by SJRRC for those investments, which are seen as necessary to achieve the integrated services at Merced intermodal, the following may be achieved:

- Five San Joaquins round trips between Merced-Oakland.
- Two San Joaquins round trips between Merced-Sac Valley Station via UP Fresno Sub.
- Four San Joaquins round trips between Merced-Natomas via UP Sacramento Sub.
- Three ACE Northbound trains between Merced-Natomas via UP Sacramento Sub.
- Five ACE Southbound trains between Natomas-Merced via UP Sacramento Sub.
- One ACE round trip between Merced-San Jose.

This totals 15 ACE/San Joaquins northbound trains connecting to HSR and 17 total ACE/San Joaquins southbound trains connecting to HSR (1 San Joaquins and 1 ACE Southbound trains both meet the same HSR connecting train at Merced). These services are reflected in the 2029 Build scenario with HSR in Figure 11-1 below which also illustrates the changes in services between the No Build Scenarios and Build Scenarios and reflects 365 service days a year unless otherwise stated.

City Pairs	2017 NB (Current Service)	2026 NB (Prior ETO Study); 2029 NB	2026 Build with HSR (Prior ETO Study)	2029 Build with HSR
Merced-Sacramento via San Joaquins	0	0	6	6
Sacramento – Bakersfield via San Joaquins	2	4	0	0
Oakland – Merced via San Joaquins	5 (to Bakersfield)	5 (to Bakersfield)	5 (thereof 1 train Stockton to Oakland)	5
Sacramento Natomas – Merced via ACE	-	1Rail + 3Rail/Bus (Bus Merced-Ceres)*	Northbound: 1Rail + 3Rail/Bus: Southbound: 1Rail + 5 Rail/Bus (Bus Merced-Ceres)*	3 Northbound/ 5 Southbound (Note: 2 additional Northbound trains outside HSR operational hours)
San Jose – Merced via ACE	-	1*	1*	1
(*) 253 service days per year				

Figure 11-1 Connecting Train Services at Merced Intermodal for Build Scenarios and Train Services for No-Build (NB) Scenarios

It should be noted that the main investment costs for the following are needed to support the integrated service level concept described in this report and are under discussions for determining potential funding sources:

- Net additional funds associated with changing the existing Merced station location from MLK Jr. Way and G Street to R Street (supplemental environmental documentation, Right-of-Way, Civil Construction, Track & Systems, and any other costs associated with extending the existing terminus of HSR infrastructure). Elevated station at Merced R Street is planned to be environmentally cleared by SJRRC.
- Merced Interim Track Connection (MITC) for enhanced San Joaquins service
- Net additional funds associated for Madera Station relocation to Avenue 12 which is in the environmental clearance process by SJJPA/SJRRC.[11]

11.4 Cost Projection

Figure 11-2 below shows the cost projection for conventional train operations.

Conventional Train Operations Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
Conventional rail costs - ACE	4,012	48,149	48,149	48,149	44,137
Conventional rail costs - San Joaquins	3,916	46,994	46,994	46,994	43,078
Total ACE and San Joaquins O&M costs	7,929	95,143	95,143	95,143	87,214

Figure 11-2: Cost Projection for Conventional Train Operations (USD1,000)

[11] https://sjjpa.com/wp-content/uploads/Agenda-Item-7.1-Madera-Station-Relocation-Document.pdf

12 Bus Services

12.1 Key Assumptions and Scope

12.1.1 Introduction

As part of the continued effort to develop an integrated service concept for CVS as shown in Figure 12-1, the ETO has worked closely with SJRRC to create a working model for the bus connection network to optimize connectivity between HSR rail services and major markets in the state of California. The buses north of Merced will supplement conventional rail operations, while the buses south of Bakersfield will provide connectivity from HSR to the Southern California markets during the interim service.

With additional bus connections to the train connections north of Merced, it is assumed there will be a service of 18 daily round trips between Merced and San Jose, 18 daily round trips between Merced and Oakland via Dublin-Pleasanton BART as well as 18 daily round trips between Merced and Sacramento. For Southern California, the developed bus connection network represents a focus on the Los Angeles market with the goal of offering a seamless journey to West Los Angeles, LA Union Station via Burbank and Pasadena/San Bernardino.

Considering California's regulation to transition to all-electric public buses by 2040[12] and recent developments in the public transit sector with agencies successfully implementing electric bus fleets, the ETO assumes a nearly full electric operated bus network. Further it is assumed that technological progress will enable higher battery storage to support end-to-end distances of most the proposed routes in Figure 12-1 below.

The use of other zero-emissions technology for intercity buses needs to be considered as well for some of the routes with greater distances (e.g. Martinez-Eureka) which battery electric buses may not support by the end of 2028. Infrastructure requirements will need to be further evaluated and are not discussed in this report.

[12] https://ww2.arb.ca.gov/news/california-transitioning-all-electric-public-bus-fleet-2040

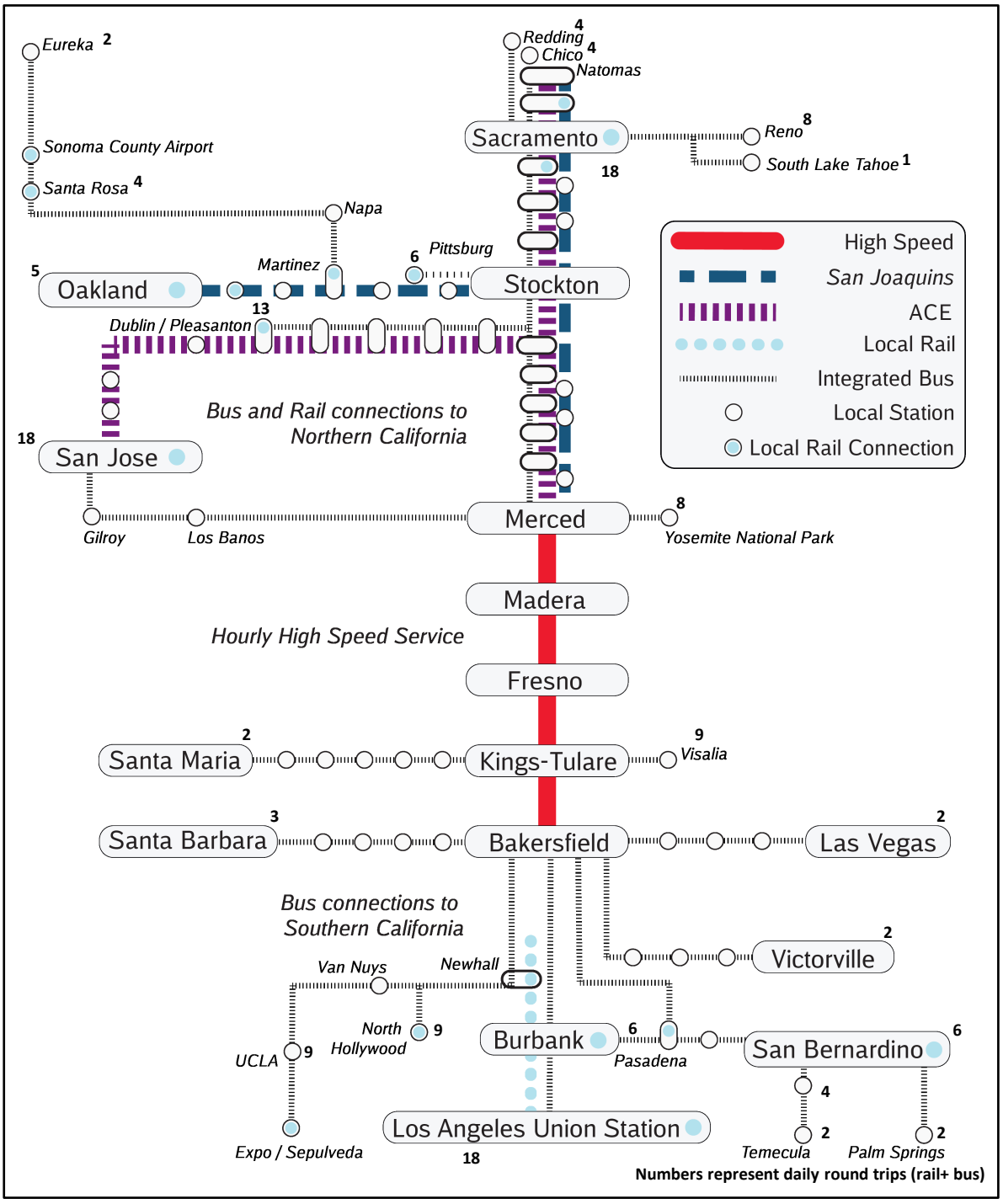


Figure 12-1: Central Valley Service Integration with Rail and Bus Connections to HSR (in Red)

12.1.2 General planning principles and assumptions

The following planning principles were considered to optimize access to different markets:

- Bus services are assumed to be identical in daily round trips and routes over 365 days per year;
- The service level is assumed as daily round trips which are indicated as per direction per day (PDPD);
- No parallel train or bus service along the same route will be assumed north of Merced. Buses will fill in slots when there is no connecting train.

12.2 Bus Services - Northern California

Bus connections to HSR services at Merced:

- San Jose via Gilroy, Los Banos (17 PDPD)
- Dublin/Pleasanton BART (13 PDPD) for transfer to Oakland/San Francisco area
- Sacramento-Natomas (9 PDPD[13, 14])
- Yosemite National Park (8 PDPD) - An increment in bus services is assumed compared to today's services

Bus services from and to Sacramento

- Chico (4 PDPD)
- Redding (4 PDPD)
- Reno (8 PDPD) - An increment in bus services is assumed compared to today's services
- South Lake Tahoe (one PDPD)

Additional bus services

- Bus shuttle service is assumed between Stockton and Pittsburg/Bay Pt. to connect to BART

[13] 5 of 9 connections have a transfer at Stockton from Oakland-bound San Joaquins trains
[14] 1 of 9 connections has a transfer at Manteca from San Jose-bound ACE train

- Bus services from Martinez (San Joaquins) to Santa Rosa (4 PDPD) and to Eureka (2 PDPD)

12.3 Bus Services - Southern California

Bus connections from and to HSR services at Bakersfield

- Los Angeles Union Station via Burbank Airport (18 PDPD)
- Newhall (18 PDPD) to connect to Metrolink and future additional train connections. From Newhall the buses will to continue to:
    - Expo Sepulveda via Van Nuys and Westwood-UCLA to connect to Expo Line (9 PDPD)
    - North Hollywood to connect to Metro Red Line (9 PDPD)
- Pasadena to connect to LA Metro Gold Line during peak period (6PDPD). These buses will continue to:
    - San Bernardino (6 PDPD) and to Riverside (4 PDPD)/Temecula (2 PDPD) and Palm Springs (2 PDPD)
- Santa Barbara via Fillmore, Santa Paula, Oxnard, Ventura, Carpinteria as currently provided (3 PDPD)
- Victorville via Tehachapi, Mojave, Lancaster, Palmdale, Littlerock as currently provided (2 PDPD)
- Las Vegas via Barstow (2 PDPD)

Bus connections to HSR at Kings/Tulare:

- Santa Maria via Lemoore, Kettleman City, Paso Robles, Atascadero, San Luis Obispo, Groover Beach as currently provided (2 PDPD)
- Visalia (9 PDPD). An increment in bus services is assumed compared to today's services between Hanford and Visalia.

Additional bus services

- Bus shuttle service is assumed from Burbank as additional service for the Pasadena area during off-peak period (6 PDPD)

12.4 Cost drivers

The bus costs in this report are based upon an average price per bus-mile, which are assumed to be incurred by a Universal Operator and the annual distances traveled along the bus routes. An average price of USD3.50 per bus-mile was provided by SJRRC and is used as the basis for the cost calculation related to the bus connections described in the subsections 12.2 and 12.3. This reflects a current statewide average price for existing contracts with diesel-operated fleets. As there is currently no other data available to the ETO, for purposes of this report the USD3.50 per bus-mile is used as the basis for electric bus operations.

As reviewed with SJRRC and CALSTA, the bus costs for the services from Sacramento to Redding and from Sacramento to Chico as well as the bus costs from Merced to Yosemite and from Kings/Tulare to Visalia are assumed to be shared between the Operator and local entities which is modelled in this report. Also, the bus costs for the services from Sacramento to Reno and to South Lake Tahoe are assumed to be paid by the Capitol Corridor Joint Powers Authority, as is the case today.

12.5 Uncertainties and Contingencies

The main uncertainties related to bus operation projections are:

- Possible fuel price increases
- Future increased congestion of highways which negatively impact bus operations due to longer travel times and potentially higher bus costs

12.6 Cost Projection

The Figure 12-2 below shows the projected costs for the bus services for Northern California and Southern California.

Bus Services Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
Bus connection costs - North	1,264	15,173	15,173	15,173	13,908

Bus Services Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
Bus connection costs - South	1,554	18,642	18,642	18,642	17,089
Contingency margin - Bus service	282	3,382	3,382	3,382	3,100
Total bus connection costs	3,100	37,197	37,197	37,197	34,097

Figure 12-2: Cost Projection for Bus Services (USD1,000)

13 Integrated Corporate Services and Functions

13.1 Key Assumptions and Scope

It is assumed that there will be a Universal Operator that will be responsible for HSR train operations, ACE and San Joaquins train operations and bus connections north of Merced and south of Bakersfield.

As such there will be one common overhead to support these operations. This overhead will include corporate functions, such as, Executive Management, Finance and Accounting, HR (Human Resources), IT (Information Technology), and GRC (Governance, Risk and Compliance). In discussions with SJRRC, it was determined that some of these positions, which were previously calculated as full time FTEs in the ETO's previous study can be covered by existing positions today within SJRRC, either in whole or in part and are reflected in Figure 13-1 accordingly.

13.2 Finance and Accounting

The finance and accounting team as shown in Figure 13-1 below will be responsible for the functions of accounting, procurement and contracting and warranty. The team's main responsibilities will be to ensure proper financial reporting so the TOC remains in compliance with the law and to improve financial results.

This team will also create budgets and forecasts, analyze performance and develop strategies to improve profitability. Based on the latest discussions with SJRRC it is assumed that SJRRC currently covers the majority of the staffing requirements for finance and accounting).

13.2.1 Organization and Personnel

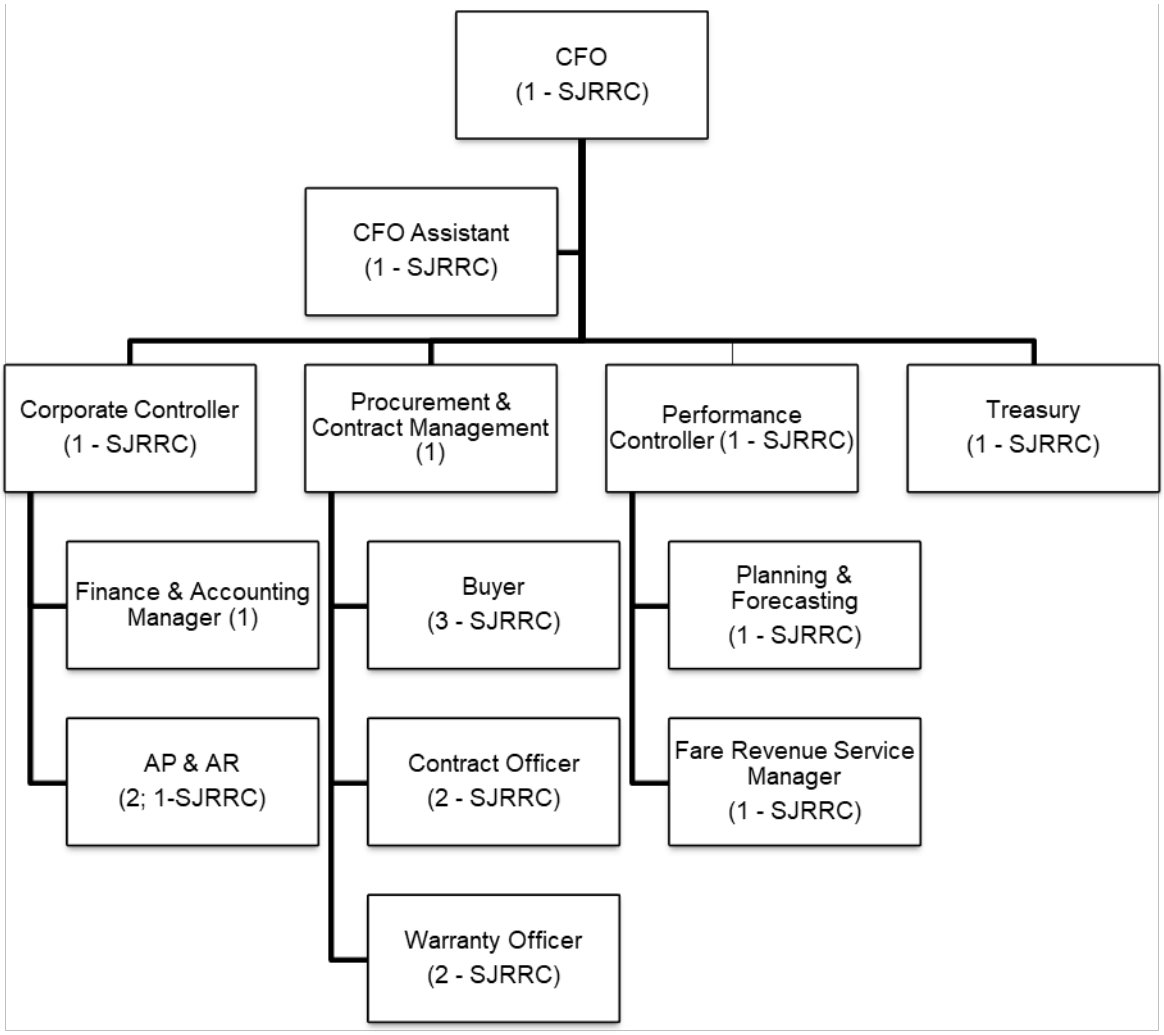


Figure 13-1: Organization and Personnel of the Finance and Accounting Team (FTE)

13.2.2 Unit Costs

The following Figure 13-2 shows the staffing and salary costs for the finance and accounting team.

No.	Position	CVS FTE	Short task description	Annual Salary (USD)	Pay grade allocated
1	Procurement and Contract Manager	1	Responsible for developing and executing procurement strategies and actively managing risks and opportunities on contracts	155,156	Senior Manager (greater than ten years' experience)
2	Finance & Accounting Manager	1	Responsible for ensuring GAAP accounting	103,437	Manager
3	AP & AR	0.5 each	Responsible for accounts payable and accounts receivable	82,750	Analyst

Figure 13-2: Staffing and Salary Costs for Finance and Accounting

13.3 Human Resources

The HR department's primary functions will be to assist with attracting and retaining employees. Employees of the TOC will be oriented towards:

- Organizational policies of the TOC system
- Customer service
- Safety and security
- Employee conduct and human resource policies
- Drug and alcohol testing program

Another major part of HR responsibility will be to provide training.

To staff and retain qualified personnel adequately at all levels of the organization, proper training will be provided. The training program will be comprised of a number of discreet modules covering specific subjects pertinent to management, operations and facilities maintenance.

The training program for train crews, and for operations supervisors, will include:

- Railroad safety
- Accidents/incidents response

- Railroad operating practices
- Train driving hours
- Safety at work
- New techniques / vehicles / component trainings

It will specifically address, as required, operations crew certification training which is described below. Federal regulations are constantly subject to review and revision. For example, the FRA is exploring possible changes to 49 CFR 240 in order to bring the training program for locomotive engineers more closely into line with the more recent Part 242 program for conductors. Additionally, changes to the FRA's System Safety Program are anticipated in 2020. It will be important for training programs to be updated as federal regulations evolve.

- 49 CFR Part 240
  - The purpose of this part is to ensure that only qualified persons operate a locomotive or train.
  - This part prescribes minimum Federal safety standards for the eligibility, training, testing, certification and monitoring of all locomotive engineers to whom it applies. This part does not restrict a railroad from adopting and enforcing additional or more stringent requirements not inconsistent with this part.
  - The qualifications for locomotive engineers prescribed in this part are pertinent to any person who operates a locomotive, unless that person is specifically excluded by a provision of this part, regardless of the fact that a person may have a job classification title other than that of locomotive engineer.
- 49 CFR Part 242
  - The purpose of this part is to ensure that only those persons who meet minimum Federal safety standards serve as conductors, to reduce the rate and number of accidents and incidents and to improve railroad safety.
  - This part prescribes minimum Federal safety standards for the eligibility, training, testing, certification and monitoring of all conductors to whom it applies. This part does

not restrict a railroad from adopting and enforcing additional or more stringent requirements consistent with this part.

  - The conductor certification requirements prescribed in this part apply to any person who meets the definition of conductor contained in §242.7, regardless of the fact that the person may have a job classification title other than that of conductor.

- Operating Rules for operations employees (49 CFR Part 217.11)
  - To ensure that each railroad employee whose activities are governed by the railroad's operating rules understands those rules, each railroad to which this part applies shall periodically instruct each such employee on the meaning and application of the railroad's operating rules in accordance with a written program retained at its system headquarters and at the division headquarters for each division where the employee is instructed.
- Drugs & Alcohol training for supervisors (49 CFR Part 219.11 (g)
  - Any regulated employee who is subject to performing regulated service for a railroad is deemed to have consented to testing as required in subparts B, C, D, E, F, G, and K of this part.
- Emergency preparedness training (49 CFR Part 239.101)
  - Employee training and qualification—(i) On-board personnel. The railroad's emergency preparedness plan shall address individual employee responsibilities and provide for initial training, as well as periodic training at least once every two calendar years thereafter, on the applicable plan provisions. As a minimum, the initial and periodic training shall include:
    - Rail equipment familiarization;
    - Situational awareness;
    - Passenger evacuation;
    - Coordination of functions; and
    - “Hands-on” instruction concerning the location, function, and operation of on-board emergency equipment.
- Radio communications (49 CFR Part 220)

  - This part prescribes minimum requirements governing the use of wireless communications in connection with railroad operations. In addition, this part sets forth prohibitions, restrictions, and requirements that apply to the use of personal and railroad-supplied cellular telephones and other electronic devices. So long as these minimum requirements are met, railroads may adopt additional or more stringent requirements.

- Railroad accidents and incidents (49 CFR Part 225)
  - The purpose of this part is to provide the Federal Railroad Administration with accurate information concerning the hazards and risks that exist on the Nation's railroads. FRA needs this information to effectively carry out its regulatory responsibilities under 49 U.S.C. Sections 201-213. FRA also uses this information for determining comparative trends of railroad safety and to develop hazard elimination and risk reduction programs that focus on preventing railroad injuries and accidents. Any State may require railroads to submit to it copies of accident/incident and injury/illness reports filed with FRA under this part, for accidents/incidents and injuries/illnesses which occur in that State.
- General Code of Operating Rules Transportation
  - These rules have been adopted by many passenger and freight railroads in the western half of the United States, including Caltrain and ACE here in California and would be relevant for the TOC to adopt as well.

TOC will establish a recertification program in accordance with 49 CFR Part 240 and Part 242. Training for facilities maintainers will include roadway worker protection, blue flag protection, radio communications, and accident/incident response.

As it relates to training of the operations workforce, TOC will provide trainings for all newly recruited staff and provide periodic refresher/ recertification training thereafter in order to ensure that all employees have the necessary skills and competencies to execute safe, reliable and customer-oriented operation and maintenance procedures and services.

Training costs are included for job specific positions as described above and additionally for all employees with focus on railway fundamentals training, including rules and regulations, operating

HSR network, safety, accident/incident response, radio communications, leadership, human resources, and finance and accounting.

13.3.1 Unit Costs

Unit costs per FTE for Human Resources are shown below in Figure 13-3.

No.	Position	CVS FTE	Short task description	Annual Salary (USD)	Pay grade allocated
1	HR Manager	0.5	Responsible for administration of company polices, employee benefits, training, hiring and retention	124,125	Senior Manager (fewer than ten years' experience)
2	Recruiter	1.5	Responsible for hiring new employees that meet company's needs	82,750	Analyst
3	Coordinator	1.5	Responsible for execution of day to day HR activities	82,750	Analyst
4	HR Assistant	1	Provides administrative support to HR dept	62,062	Assistant
5	Learning & Development Officer	0.5	Responsible for training and career development programs for employees	103,437	Manager

Figure 13-3: Staffing and Salary Costs for HR

13.4 IT

The following minimum network characteristics are to be considered:

- It is assumed that all the costs for network implementation, required hardware and software, and systems will be in place before the start of revenue service;
- All costs associated with the initial IT asset purchases are not included in this report. The values represented here are only for maintenance and operations of the IT infrastructure;
- Security will be implemented using:

- Encryption
- Risk assessments
- Vulnerability assessment
- Incident and change management
- Employee training
- Performing audits
- Keeping applications up to date
- Preventing unauthorized access
- Establishing role-based access
- Implementing firewall and viruses scanning techniques

The following minimum characteristics will be considered for the design and implementation of data centers with core, distribution and access layers:

- It is assumed that all data center services are contracted through cloud service;
- An on-premises data center is considered but only for those minimum services that cannot be subcontracted;
- All critical systems will be implemented considering high availability with failover options to reduce the need of additional staff to attend the critical failures;
- It is assumed that a backup control center will be available and ready for operations before the start of the revenue service in 2028 to mitigate against disaster; and
- It is assumed that the system will run on cloud services using Microsoft Web Services.

It is assumed that all end user equipment such as desktops, printers, laptops, etc. is already supplied before the start of revenue service. No budget has been included for any initial capital investments. The values in the budget represent only the operations and maintenance costs.

13.4.1 Cost Drivers

The cost drivers for IT will be composed of staffing labor, contract services and hardware as shown in Figure 13-4 below.

No.	Service Contract	CVS Annual Cost (in USD)
1	Computer service contracts	53,277
2	Servers & network hardware	214,800
3	Telephone & Internet	256,039
4	Internet Connectivity (TOC, HMF)	20,690
5	Desktop User Software	82,945
6	Automatic Passenger Counting	7,411
7	Reporting Database & Reports	20,690
8	HASTUS Scheduling Software	82,760
9	Safety Management	56,691
10	ADP (Payroll, HR)	129,106
11	Azure Solution	113,795
12	Accounting (GP in cloud)	24,580
13	Customer Response System (Year 1)	40,346 (Year 1: 50,691)
14	Asset Maintenance Management Software	431,387

Figure 13-4: IT contract services

13.4.2 Unit Costs

Figure 13-5 below shows the IT unit costs per FTE.

No.	Position	CVS FTE	Short Task Description	Annual Salary (USD)	Pay grade allocated
1	IT Manager	0.5	Accomplishes information technology staff results by communicating job expectations; planning, monitoring, and appraising job results; coaching employees; initiating, coordinating, and enforcing systems, policies, and procedures	181,015	Director
2	Database Developer Lead	0.5	Serves as technical team lead for database software development projects	155,156	Senior Manager (greater than 10 years' experience)
3	Database Administrator (DBA)	0.5	Uses specialized software to store and organize data. The role may include capacity planning, installation, configuration, database design, migration, performance monitoring, security, troubleshooting, backup, and data recovery	124,125	Senior Manager (fewer than 10 years' experience)
4	IT Infrastructure Architect/Lead	0.5	Helps design and implement information systems to support the CVS enterprise infrastructure	155,156	Senior Manager (greater than 10 years' experience)
5	Senior System Engineer	0.5	Ensures the stability, integrity, and efficient operation of the in-house information systems that support core organizational functions. This is achieved by monitoring, maintaining, supporting, and optimizing all networked software and associated operating systems	124,125	Senior Manager (fewer than 10 years' experience)

No.	Position	CVS FTE	Short Task Description	Annual Salary (USD)	Pay grade allocated
6	Junior System Engineer	0.5	Helps in monitoring, maintaining, supporting, and optimizing all network software and associated operating systems	103,437	Manager
7	Senior Network Engineer	0.5	Helps design and plan the deployment, maintenance, development, upgrade, and support of the network system	124,125	Senior Manager (fewer than 10 years' experience)
8	Junior Network Engineer	0.5	Helps in monitoring, maintaining, supporting, and optimizing all network systems	103,437	Manager
9	IT Support	3	Provides support services both on-site and remotely	62,062	Assistant
10	Senior Application Architect	0.5	Works with third-party application developer to create user information solutions by developing, implementing, and maintaining Internet/intranet applications	155,156	Senior Manager (greater than 10 years' experience)
11	Application Analyst	0.5	Consults with management and helps develop software to fit clients' needs. Provides accurate, quality analysis of new program applications, conducts testing, locates potential problems, and solves them efficiently	103,437	Manager
12	IT Security Manager	0.5	Responsible for protecting the CVS's computers, networks and data against threats, such as security breaches, computer viruses or attacks by cyber-criminals	155,156	Senior Manager (greater than 10 years' experience)
13	IT Security Analyst	0.5	Helps plan and carry out security measures to protect an organization's computer networks and systems	103,437	Manager

No.	Position	CVS FTE	Short Task Description	Annual Salary (USD)	Pay grade allocated
14	IT Security Engineer	0.5	Implements solutions to protect CVS's network against threat such as viruses and attacks, IT Security Engineer will also help to keep the network infrastructure up to date and perform auditing on routine	124,125	Senior Manager (fewer than 10 years' experience)

Figure 13-5: Staffing and Salary Costs for IT

13.5 Management, Governance, Risk and Compliance

The TOC is assumed to have an integrated approach towards GRC to support operational efficiency. This reduces duplication of activities and efforts, thereby helping to control costs. Most importantly, focusing on GRC will help the TOC cope with compliance requirements, as well as with external laws and regulations.

Governance activities will assist in facilitating accurate, timely information deemed critical to management so they can make decisions. Together with active risk management and compliance with internal and external requirements, management can prioritize actions, implement consistent strategies, and assess potential costs with associated mitigation plans.

In addition to GRC, this section captures the management team, which includes the CEO and some of the CEO's direct reports, such as the Corporate Services Director and Legal Director.

13.5.1 Unit Costs

The following Figure 13-6 shows the unit costs per FTE.

No.	Positions	CVS FTE	Short task description	Annual Salary (USD)	Pay grade allocated
1	Corporate Service Director	1	Responsible for the functions of HR, IT, GRC, and Insurance	181,015	Director

No.	Positions	CVS FTE	Short task description	Annual Salary (USD)	Pay grade allocated
2	Governance, Risk and Compliance Manager	0.5	Responsible for oversight of company risks and ensures internal and external compliance	124,125	Senior Manager (fewer than 10 years' experience)
3	Internal Compliance	0.5	Responsible for ensuring internal compliance to company polices and regulations	103,437	Manager
4	External Compliance	0.5	Responsible for ensuring external compliance to governing state bodies	103,437	Manager
5	Insurance Manager	0.5	Responsible for administering and maintaining company's insurance programs	155,156	Senior Manager (greater than 10 years' experience
6	Insurance Manager Assistant	0.5	Supports insurance manager	62,062	Assistant

Figure 13-6: Staffing and Salary Costs for Management, Governance, Risk and Compliance

Figure 13-7 below displays the organizational structure of the management and corporate services department.

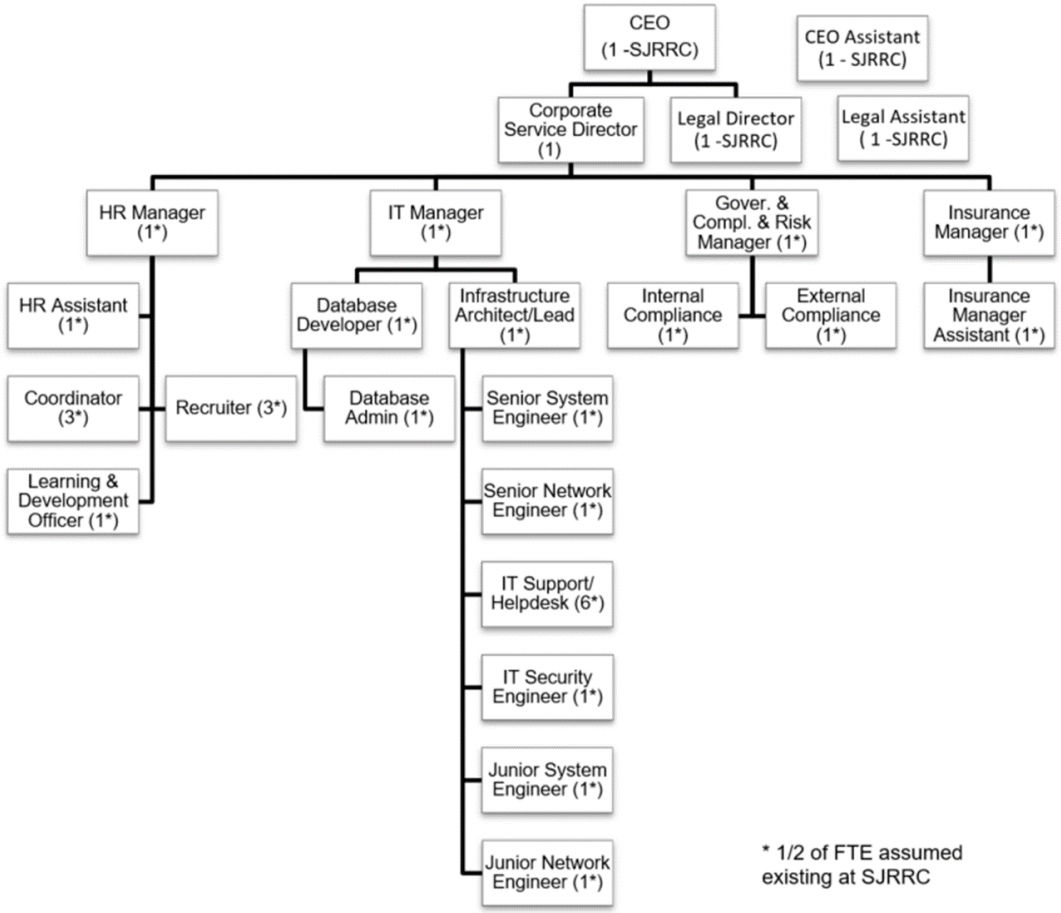


Figure 13-7: Organizational Structure of Management and Corporate Services Department (FTE)

13.6 Environmental, Health and Safety (EHS)

13.6.1 Key Assumptions and Scope

Environmental

California has rigorous laws, regulations and state agencies that will provide environmental compliance oversight for the CHSRA. The CPUC (California Public Utilities Commission), the California EPA (Environmental Protection Agency), the California Occupational, Health and Safety Administration, the California Air Resources Board, State Water Resources Control Board, and the California Energy Commission will each play important roles in areas such as safety, health, noise, electromagnetic interference, emergency response, vegetation control, air and water quality, spill prevention and control, and sustainability.

Each of these regulations requires the TOC to develop plans and procedures, conduct inspections, obtain permits, track data, and provide reports, as mandated by the respective agencies. For example:

- The CPUC requires immediate and monthly reports regarding accidents;
- The Regional Water Quality Control Board and the State Water Resources Control Board permit conditions require periodic storm water sampling and inspections;
- The Certified Unified Program Agency requires plans and other documentation, updated annually, for spill prevention, containment, and counter measures;
- Cal EPA requires reports, inspections, plans, and other documentation related to hazardous waste.

It is assumed that the headcount necessary to staff the environmental department consists of four personnel, including an Environmental Officer, an Environmental Technician, an Administrative Assistant, and a Certified Pesticide Applicator. In addition to the headcount, ETO anticipates the need for permit costs.

Assuming that all required plans are developed prior to the start of operations, the Environmental Department will be responsible for performing and/or implementing the following items:

- Aboveground petroleum storage tanks

Obtain permits, implement plans, develop training modules, document inspections, and certify the SPCC (Spill Prevention, Control, and Countermeasure) plan. At the HMF, it is assumed there will be one aboveground petroleum storage tank of less than 10,000 gallons to provide fuel for vehicles supporting train operations and maintenance.

- Regional Water Quality Control Board

Ensure compliance with regulations governing equipment service documentation, training, wastewater, facility water, SWPPP (Storm Water Pollution Prevention Plan), IGP (Interior Gateway Protocol), and the NPDES (National Pollutant Discharge Elimination System) permit. It is assumed that a private QSD will develop the SWPPP prior to operations. The Environmental Technician will provide regular inspections, as required by the IGP and SWPPP.

- San Joaquins Valley Air Pollution Control District

Obtain permits, schedule inspections, and certify portable equipment for CVS. It is assumed that all heavy equipment, such as cranes, will be Tier 3 or above. The Environmental Officer will work closely with the Vehicle Technician to ensure that all vehicles are maintained in accordance with conditions of the permits.

- CEQA (California Environmental Quality Act) and NEPA (National Environmental Policy Act)

Develop and perform employee training, implement the weed control plan. The Environmental Officer will act as Weed Management Officer during the operations period. The goal is to identify and eradicate noxious weeds in the alignment.

- Hazardous Materials

Obtain permits, write performance reports, train personnel, inspect, and prepare shipping manifests. In addition, the community right-to-know in EPCRA SARA (Emergency Planning and Community Right-to-Know Act, Superfund Amendments and Reauthorization Act) Title III requires an emergency response report and a hazardous materials business plan, both developed by the Environmental Officer.

- Sustainability

Implement plans as required by the FRA and the State of California; provide monthly and annual reports on sustainability.

The major points for calculating costs associated with environmental tasks are requirements for obtaining environmental permits, and labor for implementing plans and ensuring compliance with various environmental permits.

The State of California and FRA require numerous environmental permits to operate and maintain high-speed trainsets. It is assumed that the Environmental Officer will be responsible for researching the necessary permits and directing staff to fill out permit applications as necessary.

Environmental labor is needed to develop environmental plans and ensure that the plans are implemented as required, develop training procedures for employees working in various departments, report on sustainability items, and direct environmental personnel.

It is assumed that air pressure vessels inspection requirements are considered within the environmental scope of work.

Health and Safety

The following are considered in the field of health and safety:

- IIPP (Injury and Illness Prevention Plan)

  The H&S (Health and Safety) Officer will be responsible for developing and implementing an effective IIPP. Required IIPP elements include:

  - Responsibility
  - Compliance
  - Communication
  - Hazard assessment
  - Accident/exposure investigation
  - Hazard correction
  - Training and instruction

- Record keeping

An effective IIPP must fully involve all employees, supervisors and management, identify specific workplace hazards, correct said hazards in an appropriate and timely manner, and provide effective training. The plan must be reviewed annually.

- Heat illness prevention

The H&S Officer will be responsible for developing and implementing a heat illness prevention plan that applies to all outdoor places of employment. The plan includes emergency response procedures and must be reviewed annually.

- EPP (Emergency Preparedness Plan)

The Health and Safety Officer will be responsible for developing and implementing an EPP and making a training program available online for all emergency responders. The plan includes:

  - Initial and on-board notification to the control center;
  - Informing passengers and indicating corrective countermeasures. The control center notifies emergency responders, adjacent rail modes of transportation, and appropriate railroad officials;
  - The EPP must be distributed at least once every three years or when plans change.

- Fire Safety

The Health and Safety Officer develops and implements written procedures for the inspection, testing, and maintenance of all fire safety systems and equipment. The plan must be reviewed annually.

Emergency Action Plan

The Health and Safety Officer will be responsible for developing and implementing the plan. Required emergency action plan elements include procedures for:

- Emergency evacuation
- Employees who remain to operate critical plant operations before they evacuate
- Accounting for all employees

- Employees performing rescue or medical duties
- The preferred means of reporting fires and other emergencies
- Names, or regular job titles and contact information for persons/departments who must be contacted for further information about duties under the plan

An alarm system that complies with Article 165 must be established. The plan must be reviewed annually or when plans change.

Valley Fever

- The H&S Officer will be responsible for implementing Valley Fever control measures in coordination with the county public health officer. Plan requirements include:
  - Training for recognizing symptoms of illness and minimizing exposure;
  - Providing washing facilities;
  - Providing vehicles with enclosed, air-conditioned cabs;
  - Making respiratory protection masks with particulate filters available to workers.

Radiofrequency Radiation Exposure Limits and Electric System

The H&S Officer will be responsible for reporting maximum permissible levels for whole and partial body exposure to electromagnetic energy, documentation of safety standards, and training personnel for proper operation, maintenance, repair, and inspections of electrical systems.

The major points for calculating costs associated with health and safety tasks are labor costs for the development and implementation of plans and ensuring compliance with health and safety codes.

Healthy and Safety Labor

The H&S Officer will be responsible for developing:

- Health and safety plans and for ensuring that the plans are implemented as required;
- Training procedures for employees working in various departments;
- Directing health and safety personnel.

13.6.2 Cost Drivers

The cost drivers are labor, permit costs and third-party environmental costs.

13.6.3 Organization and Personnel

Figure 13-8 below shows the organizational structure of the EHS department.

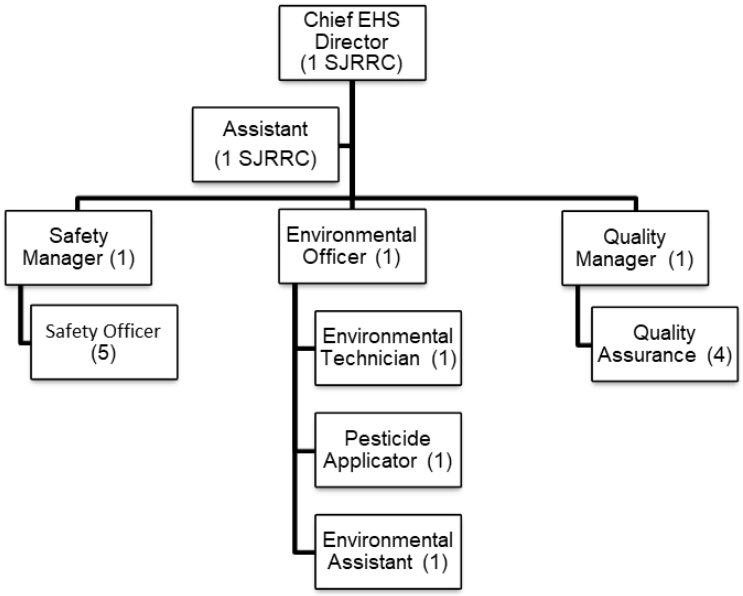


Figure 13-8: Organizational Structure of EHS Department (FTE)

13.6.4 Unit Costs

The Figure 13-9 below shows the third-party costs for EHS.

Cost items for EHS	Total in USD
Health and safety consumables: Respiratory protection masks (Valley Fever)	11.16 per box of 20
Environmental subcontract costs	3,000
Environmental permit costs	86,640

Cost items for EHS	Total in USD
Health and safety permit costs	12,569
Health and safety subcontractor costs	21,725
Water usage costs	29,437

Figure 13-9: Unit Costs for EHS Cost Items

Staffing and salary costs for the EHS organization are shown in Figure 13-10 below.

No.	Position	CVS FTE	Short task description	Annual salary (USD)	Pay grade allocation
1	Safety Manager	1	Responsible for executing safety programs/policies	155,156	Senior Manager (greater than ten years' experience)
2	Safety Officer	5	Responsible for developing safety programs for employees	80,000	Analyst
3	Quality Manager	1	Develops quality standards	155,156	Senior Manager (greater than ten years' experience)
4	Quality Assurance	4	Executes quality standards	103,437	Manager
5	Environmental Officer	1	Responsible for developing environments programs and ensuring external compliance	124,125	Senior Manager (fewer than ten years' experience)

No.	Position	CVS FTE	Short task description	Annual salary (USD)	Pay grade allocation
6	Environmental Technician	1	Supports Environmental Officer	62,062	Assistant
7	Pesticide Applicator	1	Performs pesticide application	62,062	Assistant
8	Environmental Assistant	1	Provide admin support to Environmental Officer	62,062	Assistant

Figure 13-10: Staffing and Salary Costs for EHS

13.6.5 Uncertainties and Contingencies

It is expected that there will be numerous environmental permits required by the State of California and the FRA to operate and maintain high-speed trainsets. It has yet to be seen the full requirements needed for environmental permits and therefore, not all the permit costs reflected in this report may be 100% reflective of all the future environmental permit costs.

In the event that additional plans are required for the TOC to comply with health and safety regulations, an increase in costs may result. Numerous plans will be prepared in advance of train operations. These plans must address required site and project specific measures accurately for the plans to comply with all conditions and measures and prevent cost overruns associated with preparing compliant versions.

13.7 Insurance

The Authority's overall strategy for insurance is to be determined. For purposes of this report, the ETO has assumed the insurance categories below will be borne directly by the Operator:

- General and Rail Liability
- Business Interruption

13.7.1 Business interruption

Business interruption insurance is loosely defined as the railroad's loss of net profits plus any continuing expenses arising out of / triggered by a loss to insured property by an insured cause of loss (fire, flood, earthquake, etc.). The key is the required trigger. Without an affirmative trigger, business interruption coverage will not be available under the property policy.

Underwriters calculate the cost of business interruption coverages differently. Some price it as a function of property damage rates for other insured property, while others may develop an average rate for the property damage and apply this to the declared business interruption exposure. For these estimations, a 50% surcharge was applied on real and personal property rate to develop the business interruption rate.

13.7.2 General and Rail Liability

General and Rail Liability provides third-party bodily injury and third-party property damage coverage. The railroad liability policy provides third-party bodily injury and third-party property damage coverage, including passenger liability while in the train and on the platform. Defense coverage erodes the self-insured retention and is included in the limit of insurance. The policy limit is an annual aggregate and can be reinstated at 125% of the annual premium. The policy does not provide any employee injury coverage (workers' compensation).

For purposes of this report, it has been assumed to provide coverage up to the federal cap of USD300 million for passenger liability and USD50 million to cover other third-party liability, for a total of USD350 million. The casualty program would most likely include a primary program (first layer) an umbrella policy (second layer) and the excess liability policies to the required limit. The estimated premium and rates are based off of eight (8) peer passenger rail programs whose information is collected at each renewal and housed within Marsh's Benchmarking platform.

13.7.3 Insurance Cost Drivers

The cost drivers for insurance are annual insurance costs for Business Interruption and General and Rail Liability and are shown in Figure 13-11 below.

Insurance Categories	Annual Costs (USD2019)	Coverage Limit	Coverage
Business Interruption	59,674	USD100 million	Provides coverage for the loss of operating revenue during suspended railway operations
General and Rail Liability	1,960,870	USD350 million	Provides third-party bodily injury and third-party property damage coverage
SUM	**2,020,544**		

Figure 13-11: Annual Insurance Costs

13.7.4 Uncertainties and Contingencies

For purposes of this report, only very high-level estimates were provided for insurance coverages and a more detailed review of the requirements would need to be undertaken to understand all the potential activities and risks, which could affect the coverage needed and associated premiums.

13.8 Cost Projection

The resulting cost projection for management, corporate services, trainings, insurance and other costs (uniforms, safety gear and office supplies) is shown in Figure 13-12 below.

Integrated Corporate Services and Functions Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
TOC management labor cost (salary, benefits, healthcare cost)	48	571	571	571	523
Corporate service labor cost (salary, benefits, healthcare cost)	229	2,752	2,752	2,752	2,523
Financial department labor cost (salary, benefits, healthcare cost)	44	532	532	532	488
Safety department labor cost (salary, benefits, healthcare cost)	168	2,012	2,012	2,012	1,844
Customer engagement department labor cost (salary, benefits, healthcare cost)	306	3,671	3,671	3,671	3,365

Integrated Corporate Services and Functions Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
Environmental contracts & permits costs	10	119	119	119	109
Office supplies cost	7	80	80	80	73
Health & Safety contracts & permits	24	293	293	293	269
IT costs	129	1,544	1,535	1,535	1,407
Uniforms & safety gear total cost	17	208	208	208	191
Training costs	107	1,288	1,288	1,288	1,180
HSR operations insurance costs	168	2,021	2,021	2,021	1,852
Total integrated corporate services costs	1,258	15,090	15,081	15,081	13,824

Figure 13-12: Cost Projection Integrated Corporate Services and Functions (USD1,000)

14 Fare Collection

14.1 Key Assumptions and Scope

Ticketing systems and payment options have evolved significantly from the days when passengers bought paper tickets and train systems hired armored cars to pick up cash at stations and haul it to money rooms where it was sorted into piles and counted.

While there is no way to predict what technological advancements will be in place when high-speed rail service begins in the Central Valley, it is possible to describe the approach to a modern revenue collection system.

In addition to customer convenience and travel experience, the proposed key goals are:

- Payment Integration so that travelers can easily plan and make a trip using multiple mobility services with a single transaction;
- Data security and Identity protection to be compliant with the current and upcoming consumer privacy laws and regulations. For example, on January 1, 2020, the California Consumer Privacy Act went into effect which grants consumers the right to know what information companies have about them and to have that information deleted;
- Multiple payment options addressing the needs of low-income riders and riders who still rely heavily on cash. Studies found that 7.4 percent of Californians are considered “unbanked” and pay their bills with cash;[15] and
- Minimizing the high cost of collecting revenues is an important consideration. The cost reductions can include specification development, software development or acquisition, hardware, information technology infrastructure, licenses, security, system monitoring and analytics, card production, maintenance and labor.

[15] https://economicinclusion.gov/surveys/2017household/documents/tabular-results/2017_banking_status_California.pdf

14.1.1 Overall Fare Collection Approach

The ETO conducted studies as part of a separate work package regarding fare collection systems, with a focus on technology trends, market forces, and business strategy.

It is anticipated that current planning efforts lead by the State of California to enable integrated public transit trip planning and payment will allow travelers throughout the State to access bus and train schedules, to identify price options and to book trips across various connecting services, including high-speed rail. The Authority and SJRRC support the State's Integrated Travel Project and its goals to improve the customer experience, increase ridership and lower costs for public transportation service providers. The proposed revenue collection system is based on these assumptions:

- No metal barriers;
- Minimal to no reliance on conductors to routinely validate customer payment;
- Stations will not have staffed ticket windows. Instead, station platforms will be barrier-free;
- Kiosks will enable walk-in customers to obtain a valid access code paid with a cashless form of payment;
- Operating costs are primarily based on "ticketing as a service" (TaaS), see Section 2 Definitions, and payment transaction fees rather than maintenance of equipment and cash management;
- The payment architecture includes the following:
    - Open, permitting multiple types of transactions (including on-board purchases) in addition to paying for train service;
    - Other mobility account providers (e.g. other train operating companies or mobility platforms to distribute a ride on the high-speed rail system);
    - Transactions will be tied directly to personal accounts, unlike older style smart cards and magnetic stripe cards where the value resides on the card itself; and
    - Tickets will be the latest form of electronic identification, whether it is a code on a mobile device, a chip in a credit card, a biometric scan (if that technology is perfected and accepted) or another technology yet to be invented.

The high-speed rail revenue collection “system” by December 2028 will be sufficiently versatile to integrate proven technologies, to accept all fare products and to validate payment electronically in a manner that minimizes fare evasion.

Options will be provided to enable cash customers to pay for a ride and receive a travel instrument. Three possible concepts might be:

- Contract with widely available retail partners (e.g. convenience stores, drug stores, gas stations) so that customers will have the ability to conveniently purchase train travel using cash.
- Offer a travel instrument for customers, who do not purchase a ticket in advance but who will have 24 hours to go to a financial services company that accepts cash in order to verify payment for the ride.
- Conventional TVMs which accept cash payments in order to support 20% of the population today who rely on this method (the current cash-to-electronic ticket sales ratio in the Central Valley on the San Joaquins is approx. 20% cash to 80% electronic/credit).

14.1.2 Roles

The SJRRC is assumed to be the owner of the fare policy and the fare products. However, it is now possible to outsource the roles of device manager, settlement operator, pricing engine operator and payment provider. The role of the mobility account provider can be covered by the train operating company and/or other providers. In the case of multiple service providers, there is need for a network manager who ensures that funds are allocated based on pre-set rules and commercial agreements.

14.1.3 Timing

It is anticipated that fare media technology decisions will be made closer to the testing, commissioning and trial running period prior to the start of revenue service. Therefore, it is anticipated that system definition, procurement of TaaS products and integration testing and acceptance will take place between 2026 and 2028 in time for trial operations during the second half of 2028 and revenue service beginning in December 2028.

14.2 Cost Drivers

The cost of retail transactions is a good indicator of cost levels of payment for transit uses global standards and off-the-shelf solutions. With the move toward TaaS in transit, the ETO expects to see lower costs of up to 5 percent of revenues compared with more traditional approaches to fare collection that relied on significant capital investment, proprietary equipment and a sizable operations labor force. This estimate of 5% includes cost categories such as:

- Transaction fees
- Simple validation equipment (EMV or QR code)
- API availability
- Connectivity
- Reporting

The fare collection cost, which represents 5% of collected HSR fares are in line with information provided by SJRRC for current e-ticketing costs and what ETO found on an analysis of bid proposals for mobile apps system for ACE Rail.

14.3 Uncertainties and Contingencies

As there is still uncertainty regarding which technology will be deployed by the start of HSR operations at the end of 2028, uncertainty for the exact fare collection costs remain as well.

14.4 Cost Projection

The following Figure 14-1 shows the resulting cost projection for fare collections.

HSR Fare Collection Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
HSR fare collection costs	158	1,891	1,891	1,891	1,733
Total HSR fare collection costs	158	1,891	1,891	1,891	1,733

Figure 14-1: Cost Projection for HSR Fare Collection (USD1,000)

15 Marketing and Branding

15.1 Key Assumptions and Scope

15.1.1 M&B Development

M&B (Marketing and Branding) is an essential early element for the overall marketing and branding success. It will set the stage by building excitement, anticipation, interest, and intent to try. Positive branding will help define and convey the experience of travelling by HSR, imbuing the future experience with positive emotion.

M&B will be designed based on research to communicate the practical passenger benefits of HSR travel across California simply and clearly, capturing the imaginations of our target audiences, stakeholders, and potential sponsors, and establishing California as the leader in innovative transportation across the US.

15.1.2 Importance of M&B Planning

The TOC will need to create an advertising and public relations campaign providing detailed strategies for creating a positive, memorable brand identity and recommended marketing strategies and tactics to launch the CVS interim service. The plan will define the elements as well as the resources, schedules and costs, both internal and external, to implement the plan. Marketing will strategically concentrate on the factors most likely to build interest and anticipation and to encourage the public to change longstanding travel and mobility habits.

The TOC's early approach is assumed to be: subcontract with an accomplished California-based marketing firm and conduct market research to help identify the most effective messaging and visuals to create a compelling brand identity for HSR. The product name will be enhanced by an eye-catching brand logo and an innovative design to communicate the brand identity and will be applied to all forms of communication. The TOC and the M&B firm will test a variety of options among target audiences to ensure creation of a truly inspiring brand.

The TOC will subsequently need to develop an aggressive marketing and public information campaign to build interest and educate people about HSR. They will include fully integrated media strategies that reach individual audience segments through paid, earned and social media with targeted

messages that resonate with their lifestyle, interests and needs. Aspirational messaging will build intent to ride while educating about “nuts and bolts” issues such as parking at stations, connecting services, fares, how to purchase tickets and train schedules. Marketing will also promote key benefits of the new service, including travel time, personal productivity, competitive fares and state-of-the-art booking solutions. The program will ensure that the timing of marketing campaigns will be fully aligned with the operational launch schedule and progress.

It is assumed that the staffing structure, contracts and costs for M&B including marketing and customer service are based on the assumption of a customer-centric operation.

The recommendations provided within this section include both the foundational structure for the marketing and customer service functions established for the TOC in the Central Valley.

Key to the success of the M&B plan is the assumption that the TOC will include a distribution platform that will feed into a customer account / CRM platform for the TOC to collect passenger data and create customer accounts for the purpose of providing optimized customer service, account-based ticketing, and one-to-one customer marketing and passenger communications, as well as integrating a loyalty program.

The following types of functions are assumed to be performed by the TOC:

Marketing and communications;

- Customer service, in-person at a station and via phone through a Customer Call Center as described in the organization chart and list of assumptions;
- Management of customer accounts and profiles by an enterprise CRM system;
- Fare pricing, promotions, sales, analytics and related e-commerce integration with website, mobile app, etc.

15.2 Cost Drivers

In accordance with the above described marketing and branding concept, M&B costs comprise recurring cost components related to:

- Advertising agency service contract;

- Customer call center;
- Loyalty program;
- PR/ crisis communications firm service contract;
- Web and mobile integration and analytics support, as well as CRM licensing agreements. This interfaces with the revenue collection function.

There is assumed to be upfront fixed costs related to realization of customer account management/ CRM platform, website, and customer facing app are excluded. These are assumed to have been put in place and paid for on commencement of revenue service.

The major cost drivers for calculation of the commercial marketing and customer service functions and contracts include:

- Market size—media market size influences the spend and budget
    - For the full-service advertising agency contract for the CVS corridor, it is assumed that the initial campaign launch has already occurred during the pre-operations time period, but there is a first-year investment to support a larger awareness campaign. It is also assumed that the media markets would include those within Merced and Bakersfield, in addition to markets served by feeder bus (LA) and the existing San Joaquins connection (Oakland/ Sacramento). Both the LA and Oakland media markets are larger than the Central Valley markets, and therefore cost more to place advertisements. The first-year investment spend of USD1.81 million plus USD258,625 in production is based on comparable state route annual marketing budgets for San Joaquins (USD1.5 million), Capitol Corridor (USD1.7 million), and Surfliner (USD2 million). It is assumed that the budget for the following years would be reduced from USD2.069 million to USD1.55 million.
- Call center based on estimated ridership
    - Outsourced Call Center contracts are generally negotiated based on labor and call times. They are set up similar to an agency structure in which staff have more than one client but are also staffed to be available for emergencies. The Call Center will include live operators available during all hours of operation to assist passengers with ticketing,

trip planning, refunds, and schedule questions. The contract would also include reactive social media support. For the CVS corridor it is assumed a ridership of 2,049,000 annual riders would require a monthly service contract of USD775,875. By comparison, Capitol Corridor annual ridership is 1.7M and their Call Center contract is USD1,074,000 annually.

- Hours of operation—Determines need for station coverage
  - The hours of operation will influence the total need for station coverage. It is currently assumed that a Station Assistant will be present at all times at each station during operation. The Station Assistants help passengers in the field with boarding, ticketing, ADA, groups, etc. In order to calculate the Station Assistant FTEs the following has been assumed:
    - 20 hours of daily coverage for a 19 - hour operations service operating seven days a week;
    - A 40-hour work week;
    - 20 hours times 7 days /week equals 140 hours per station, per week, for a total of 560 hours per station per month;
    - It is assumed there will be 3.5 FTEs per station, however, to cover breaks ETO assumes 4 FTEs per station.

15.3 Organization and Personnel

The organization and personnel of the M&B department is presented in the following Figure 15-1. For the five stations on the CVS corridor a total of 20 station assistants are assumed. For the second year it is assumed that people will be more familiar with the service and therefore station assistants would be provided during peak hours only. A total of 12 station assistants are assumed in year 2 and beyond.

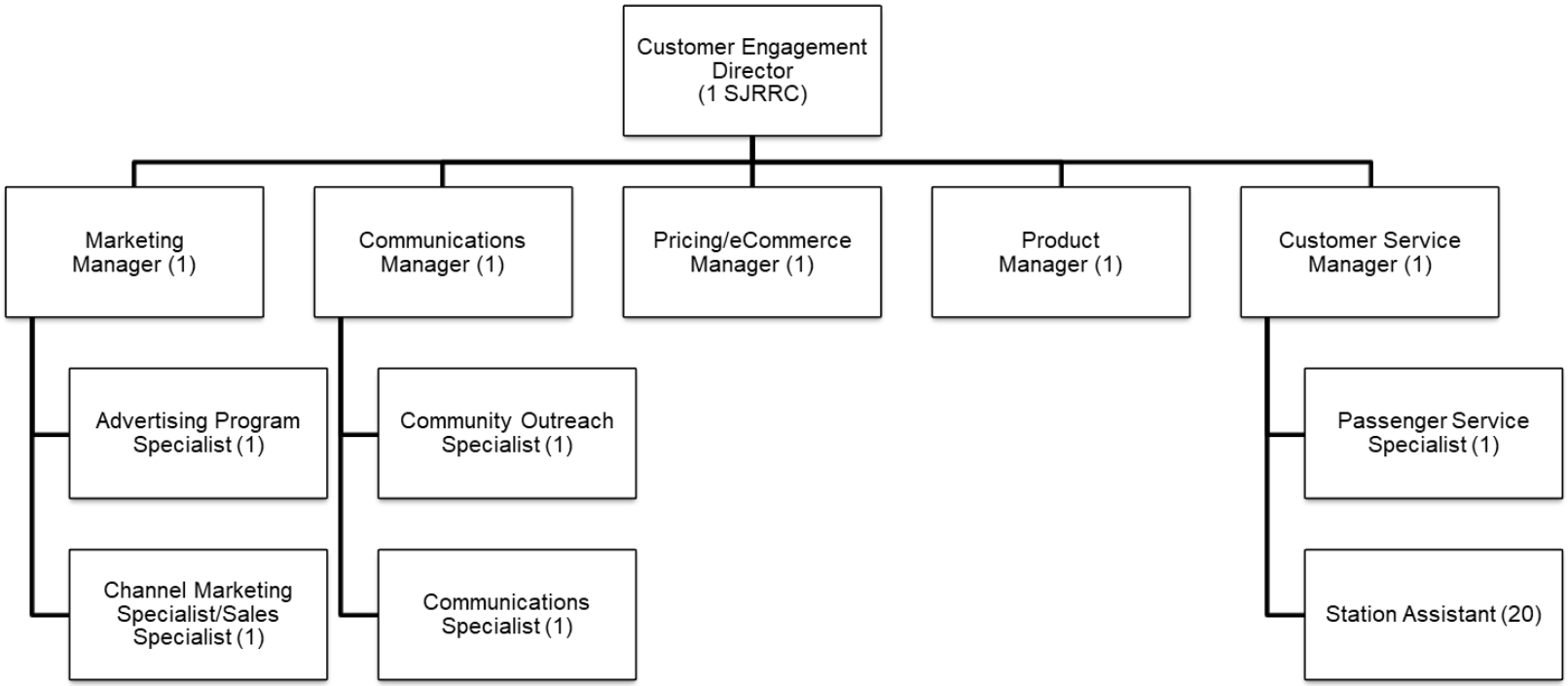


Figure 15-1: M&B Department (FTE)

15.4 Unit Costs

The unit costs for the M&B staffing and the M&B service contracts are presented below in Figure 15-2 and Figure 15-3.

No.	Position	CVS FTE	Short task description	Annual salary (USD)	Pay grade allocated
1	Manager: Marketing	1	Sets policy with all other departments	124,125	Senior Manager (fewer than ten years' experience)
2	Manager: Communications	1	Serves as the PIO (public information officer) for the service. Manages all of the media relations, social media messaging and passenger messages. Oversees the contracts for the PR/Crisis Comm and the shared graphic designer contract with Marketing	103,437	Manager
3	Manager: Pricing/ eCommerce	1	Supports director and entire department	103,437	Manager
4	Manager: Product	1	Oversees the advertising agency, market research and loyalty program support, and on-call graphic design contracts	103,437	Manager
5	Manager: Customer Service	1	Oversees the advertising program, channel marketing and sales, promotions, and research for the service	103,437	Manager

No.	Position	CVS FTE	Short task description	Annual salary (USD)	Pay grade allocated
6	Specialist: Advertising/Marketing Program	1	Administers the advertising plan and budget and serves as the day-to-day contact with the advertising agency. Reports to the Marketing Manager.	82,750	Analyst
7	Specialist: Channel Marketing/Sales	1	Serves as the public information officer for the service	82,750	Analyst
8	Specialist: Communications	1	Manages all of the media relations, social media messaging, and passenger messages	82,750	Analyst
9	Specialist: Community Outreach	1	Oversees the contracts for public relations/crisis communications agency (on-call 24 hours) and the shared graphic design contract with Marketing	82,750	Analyst
10	Specialist: Passenger Service	1	Oversees a pool of Station Assistants in the field. Reports to the Customer Service Manager.	82,750	Analyst
11	Station Assistant	20	Tasks are to assist the passengers in the field at stations with boarding, ticketing, ADA, groups, etc. Station assistants do *not* sell tickets or handle cash in any way.	62,062	Assistant

Figure 15-2: Staffing and Salary Costs for M&B Department

Contract Type	Qty	CVS Total Annual Cost (USD)	Remarks
Full service advertising agency	1	2,069,000	CVS Assumption(s): First-year investment of USD1.81 million + USD258,625 in production. Media markets include those within Merced and Bakersfield in addition to markets served by feeder bus (LA) and existing San Joaquins connection (Oakland/Sacramento). All collateral printing needs fall under this contract. Budget estimate based on comparable state route marketing budgets for San Joaquins (USD1.5 million), Capitol Corridor (USD1.7 million), and Surfliner (USD2 million). In follow up years, the annual budget is USD1.55 million.
Market research consulting firm	1	124,140	Service is assumed to be provided as needed. Assumption is with a totally separate service, different service area, route and pricing structure, the Peninsula would require a similar cost as the CVS with some economies of scale realized using the same contractor.
Loyalty program support agency	1	186,210	Assumes a production and retainer cost of USD15,518 per month. Not determined by number of participants, but by initial build out and number of communications issues per month to passengers
On call graphic designer (shared with Communications)	1	25,863	Assumes passenger communications and ad hoc requests from marketing and communications (not requiring skills of a full-service ad agency) are included
Public relations/crisis communications agency (on-call 24 hours)	1	77,588	CVS Assumption(s): USD5,017 monthly retainer for ongoing clip service, support during larger PR programs, and on-call crisis communications support. Proactive PR and media monitoring contract (USD10,345 annually). Any serious crisis would need additional funds.
Call center (includes social media support contract/reactive)	1	775,875	CVS Assumption(s): Negotiated contract based on labor and call times.

Contract Type	Qty	CVS Total Annual Cost (USD)	Remarks
Customer relationship management system/DB (CRM)	1	103,450	CVS Assumption(s): Licensing fee based on number of users and would include both call center and in-house license usage;
Website/App	1	103,450	CVS Assumption(s): As-needed programming, support and analytics. Both website and app are fully developed; therefore, the cost does not include design/development budget.

Figure 15-3: M&B Service Contracts Costs

15.5 Uncertainties and Contingencies

It is assumed that the number of stations would only impact the total number of Station Assistants needed, and not the rest of the marketing and customer service staff.

15.6 Cost Projection

Figure 15-4 below shows the resulting cost projection for marketing and branding.

Marketing and Branding Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
Marketing & branding costs	289	3,422	2,948	2,948	2,703
Total marketing and branding costs	289	3,422	2,948	2,948	2,703

Figure 15-4: Cost Projection for Marketing and Branding (USD1,000)

16 Security and Policing

16.1 Key Assumptions and Scope

It should be highlighted that SJRRC is currently evaluating a policing plan with the CHP. The basis for the cost estimates reflects estimates provided by the Authority in terms of estimated hourly rates for police officers and supervisors. In combination with discussions held with SJRRC (based on what they currently have in place), the ETO assumed a conservative calculation for policing coverage. These costs are assumed to be direct to the Operator. Security costs are also covered in this section and are assumed to be direct to the Operator.

The CVS consists of five stations with Merced as the northernmost station and Bakersfield as the southernmost station needing security services. Security information presented in this report is aligned with current rail transit security standards referenced by the APTA (American Public Transportation Association), DHS (Department of Homeland Security), and Federal Transit Administration security standards:

- The Security Operations Center (SOC) will house all CCTV monitors and intrusion detection alarms to monitor security at stations and other key assets, including the maintenance facility; and
- Stations and parking facilities within the system will be managed by a combination of electronic security and security patrols.

The security guards' duties include:

- Routine station inspections;
- Communicating with the SOC for all emergencies;
- Monitoring CCTV cameras in the SOC;
- Assisting customers as needed in stations; and
- Security patrols as needed.

For policing, the following is assumed:

- One on-board police officer will be available per train during revenue hours to ensure passenger safety; and
- For all onboard and right of way incidents along the rail corridor one FTE will be on-call duty.

16.2 Cost Drivers

The cost drivers are security and CHP staffing. Staffing costs for the CVS include security guards at the stations, HMF, MOW and TOC/ OCC as well as CHP on board the HSR trains. In addition to security staffing costs, there will be maintenance costs for security hardware. For the on-board police officers, a fully loaded hourly cost of USD157 is assumed.

16.2.1 Organization and Personnel

Figure 16-1 below shows the organizational structure of the security department. The CVS staffing would consist of a Security Manager, in charge of daily security operations and coordination, and the SOC. Three Security Operation Field Supervisors will be required to cover the north and south ends of the CVS operating segment, based on the planned scheduled hours of service, and report activity to SOC. In addition, private contracted security personnel (26 total) are required to provide security at stations and the maintenance facility, and to staff the SOC to monitor electronic security.

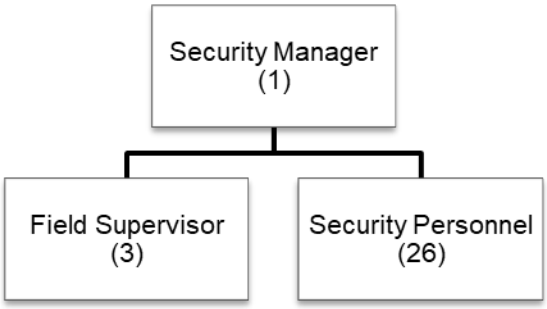


Figure 16-1: Organizational Structure of Security Division (FTE)

The CHP staff consists of one on-board police officer per train and one for on-call duty to address right of way incidents.

16.2.2 Maintenance Costs

16.2.2.1 Security Systems

It is anticipated that the annual maintenance costs for both the vehicles for security personnel and the electronic security systems are included in the security contract. Based on that, the following assumptions were made:

On the CVS corridor, each station will have a total of eight CCTV cameras (four covering the platform edges, two covering the TVMs and two covering the fare array area (turnstiles).

Each station will have four intrusion detection contacts. Each station area assumes a parking lot with four CCTV cameras covering parking lot areas. The heavy maintenance facility will have ten CCTV cameras and ten intrusion detection contacts. Signal houses and miscellaneous facilities will have a total of ten intrusion detection contacts.

The costs associated with maintenance of these systems are estimated to be approximately USD931 per device per year.

16.2.2.2 Vehicles

Vehicle maintenance is added to the cost of providing security.

16.3 Unit Costs

Figure 16-2 below shows the unit cost per FTE for Security.

No.	Position	FTE CVS	Short task description	Annual Salary (in USD)	Pay grade allocated
1	Security Manager	1	In charge of daily security operations and coordination	155,156	Senior Manager (greater than 10 years' experience)

No.	Position	FTE CVS	Short task description	Annual Salary (in USD)	Pay grade allocated
2	Field Supervisor	3	To cover the north and south ends of the operating segments, based on the planned scheduled hours of service, and report activity to SOC.	82,750	Analyst
3	Security	26	Stationed at HMF (CVS corridor) stations and TOC building to monitor cameras and ensure security at the premises	62,062	Assistant

Figure 16-2: Staffing and Salary Costs for Security Department

Figure 16-3 below shows the cost for security vehicles.

No.	Type of security vehicle	Number of vehicles CVS	Annual maintenance cost (USD per vehicle)
1	SUV	2	10,345

Figure 16-3: Security Vehicles

Figure 16-4 below shows the cost for security equipment.

No.	Type of security equipment	Quantity of security equipment CVS	Annual maintenance cost (USD per device)
1	Electronic security device	110	931

Figure 16-4: Security Equipment Overview

Figure 16-5 below shows the calculated FTEs based on the revenue operations schedule and the assumed fully loaded hourly rates for a CHP officer.

No.	Position	FTE CVS	Short task description	Hourly rate fully loaded (in USD)
1	On-Board Police Officer	12	In charge of incidents on the trains	157.00
2	On-Call Police Officer	1	On-call duty for right of way incidents.	157.00

Figure 16-5: Staffing and Hourly Rates for CHP Policing

16.4 Uncertainties and Contingencies

To provide adequate security for the system, a TVA (Threat and Vulnerability Assessment) must be performed to determine the security needs at each station and along the right of way. This will involve local police, who can provide crime statistics for their jurisdiction as well as estimated ridership numbers. Contingent on the TVA information, additional security design (e.g. cameras, lighting, fencing, intrusion detection) and/or procedural mitigation measures (e.g. increased patrols) may be required to address potential threats.

The interconnected, varied, and expansive scope of the HSR system creates unique security challenges that are best addressed through stakeholder communication, coordination, and collaboration. To best assist surface transportation owners and operators with their security needs, the TOC will focus its efforts on system assessments, voluntary interconnecting operator compliance with industry standards, collaborative law enforcement and security operations, accurate and timely exchange of intelligence information, regulatory oversight, and technological expertise. Threats and vulnerabilities identified by the TVA at stations and outlying points must be mitigated to provide a safe, secure environment for the riding public, employees and emergency response personnel.

16.5 Cost Projection

The Figure 16-6 shows the resulting cost projection for security and policing.

Security and Policing Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
HSR policing costs	387	4,567	4,567	4,567	4,191

Security and Policing Cost Items	Dec. 2028	2029	2030	2031	Nov. 2032
Security department labor cost (salary, benefits, healthcare cost)	286	3,434	3,434	3,434	3,148
Operator security costs (hardware)	10	123	123	123	113
Total security and policing costs	684	8,124	8,124	8,124	7,452

Figure 16-6: Cost Projection for Security and Policing

17 Ridership and Fare Revenue

17.1 Ridership Model Background

For purposes of updating the ridership and revenue forecasts associated with the revised integrated service concept, the ETO used the California State Transportation Agency Ridership forecast model. The ETO used this same model in its previous Study.

The model results from the ETO's previous Study for the following below remain largely unchanged:

2017 No Build Raw

2017 No Build Adjusted

2026 No Build

2026 Merced – Bakersfield HSR

It should be noted however, that the no build ACE ridership estimates that were previously reported used an incorrect annualization factor, which has since been corrected.

The above source provides high-level forecasts of ridership and revenue which are indicative. This result should not be relied upon solely for decision-making. The ETO does not own any of these models and does not have any control on the reliability of the data and the outputs from the models.

17.2 Calibration of Existing State Rail Plan Ridership Forecast Model

In consultation with SJRRC and CalSTA, the following process (including assumptions) was conducted using the existing model from the State Rail Plan project:

- This process included a transformation of the data to a 2029 time horizon to reflect the proposed first full calendar year of the interim service;
- The estimates were scaled to reflect differences between the raw model output and observed ridership counts for a 2017 base year situation for both the San Joaquins as well as the ACE services;

- Assumed the HSR Central Valley section as part of the total corridor including ACE and San Joaquins;
- Included in the model the future available connections and improvements in the northern and southern Central Valley by 2029;
- Modified rail travel impedance matrices for interim operating scenario in Central Valley including connecting bus and rail services;
- Transfers are assumed to be optimized with HSR service i.e. timed, cross-platform transfers with no physical barriers;
- Assumed connecting services: Direct connections to re-routed San Joaquins and ACE services as well as Thruway buses out of Fresno, Kings Tulare, and Bakersfield. Thruway bus connection to Metrolink at Newhall. Direct Thruway bus connection from Merced to San Jose via State Route 152;
- Used the existing policy fare structure for the San Joaquins corridor; and
- Executed the model with the new considerations.

Values were estimated for the Ridership Forecast in the specific section between Merced and Bakersfield (future HSR Section) and the rest of the total CVS corridor (incl. ACE, San Joaquins, and Thruway bus connections). The results of the calibrated model framework from the State Rail Plan project are shown below. Total ridership is forecasted at 2,049,000 with associated fare revenues of USD37.8 million for HSR. The Figure 17-1 below displays the traffic demand for 2029 in the Central Valley.

From/To	Merced	Madera	Fresno	Tulare	Bakersfield	Total
Merced	0	35,900	162,900	65,500	308,200	572,500
Madera	35,900	0	2,500	4,300	13,600	56,300
Fresno	162,900	2,500	0	134,900	197,800	498,100
Kings Tulare	65,500	4,300	134,900	0	98,900	303,600
Bakersfield	308,200	13,600	197,800	98,900	0	618,500
Total	**572,500**	**56,300**	**498,100**	**303,600**	**618,500**	**2,049,000**

Figure 17-1: Traffic Demand (HSR, Trips/Year) in the Central Valley (Year 2029 "Steady State")

Figure 17-2 below shows the fare revenue in the Central Valley.

From/To	Merced	Madera	Fresno	Tulare	Bakersfield	Total
Merced	0	395,000	2,281,000	1,114,000	8,013,000	11,803,000
Madera	395,000	0	21,000	52,000	326,000	794,000
Fresno	2,281,000	21,000	0	675,000	4,352,000	7,329,000
Tulare	1,114,000	52,000	675,000	0	1,681,000	3,522,000
Bakersfield	8,013,000	326,000	4,352,000	1,681,000	0	14,372,000
Total	**11,803,000**	**794,000**	**7,329,000**	**3,522,000**	**14,372,000**	**37,820,000**

Figure 17-2: Fare Revenue in the Central Valley 2019 USD (Year 2029 "Steady State")

17.3 Summary of Ridership and Revenue Values

As shown in Figure 17-3 below and compared to the ETO's prior study, the total system ridership (calculated as linked trips) increases from 8,426,000 to 8,776,000, 2026 Build to 2029 Build, respectively. The schedule for the revised 2029 build assumptions compared to the 2026 build runs had changes which created the most notable impact on these results:

- Systemwide background growth from 2026-2029 of 3.5% a year, varies across regions
- HSR increase due to improved bus and ACE connections
    - ACE connection to Merced improved
    - Improved bus frequencies
    - New buses: Merced <-> San Jose, Merced <-> Dublin Pleasanton, Stockton <-> Pittsburg, Newhall <-> N Hollywood, Pasadena <-> Burbank
- San Joaquins Oakland -> Stockton (ACE) segment removed
- San Joaquins NB AM peak trains replaced by buses
- Some switching from rail to buses when bus offers improved transit option

Figure 17-3 also summarizes the ridership forecasts, including the 2029 Merced – Bakersfield and how this compares to the previous forecast 2026 Merced – Bakersfield Build and No Build.

Service Type	ETO Study May 2019 2017 No Build	ETO Study May 2019 2026 No Build	ETO Study May 2019 2026 Build	ETO Updated Forecast November 2019 2029 No Build	ETO Updated Forecast November 2019 2029 Build
HSR – Unlinked	--	--	1,671,000	--	2,049,000
San Joaquins – Unlinked	1,102,000	1,689,000	3,327,000	1,778,000	3,111,000
ACE – Unlinked	1,503,000	1,865,000	4,306,000	2,191,000	4,572,000
Thruway Bus BFD* – Unlinked	258,000	324,000	570,000	341,000	668,000
Other Thruway Bus* – Unlinked	470,000	561,000	912,000	587,000	1,441,000
Unlinked Trips are not additive					
Total System - Linked trips**	**2,606,000**	**3,555,000**	**8,426,000**	**3,969,000**	**8,776,000**

Figure 17-3 Annual Ridership Estimates by Service Type Under Different Scenarios - Unlinked Trips Are Not Additive

Notes: *Reflects approved Senate Bill 742 in future scenarios which allows transportation of passengers who are not connecting to a passenger rail service; **The system total for ridership is calculated as linked trips, i.e. trips transferring from ACE, San Joaquins or Thruway bus connections are only counted once for total ridership.

Comparison of Train/Bus Miles and Ridership

The ETO compared the updated ridership forecasts to the train/bus miles in order to illustrate the relationship between the two. Given the increase in train/bus miles based on the updated service concept, this has resulted in increased ridership outside of the growth contribution attributed to the update in time horizon from 2026 to 2029.

When comparing the 2029 No Build to the 2029 Build, the total system ridership increase is +121%, or from 3,969,000 to 8,776,000 ridership respectively. This increase is supported by a significant growth in service frequency and connectivity provided by the ACE, San Joaquins and bus services that are designed to complement the High-Speed Rail service between Merced and Bakersfield.

Overall, the addition of the connecting services north of Merced and south of Bakersfield represent a significant and transformational change over today's service frequency enabling hourly travel options

between all system stops across the total system. While the HSR service almost triples the train miles between Merced and Bakersfield, the ridership increases by 98%. The connecting services north of Merced increase the train and bus miles by 122% percent and show a corresponding increase in ridership of 118%. This increase in demand is a combination of local demand increases as well as the increased demand of HSR travelers transferring in Merced. Figure 17-4 below shows a comparison of the ridership increase versus the increase in train miles by segment of the total system.

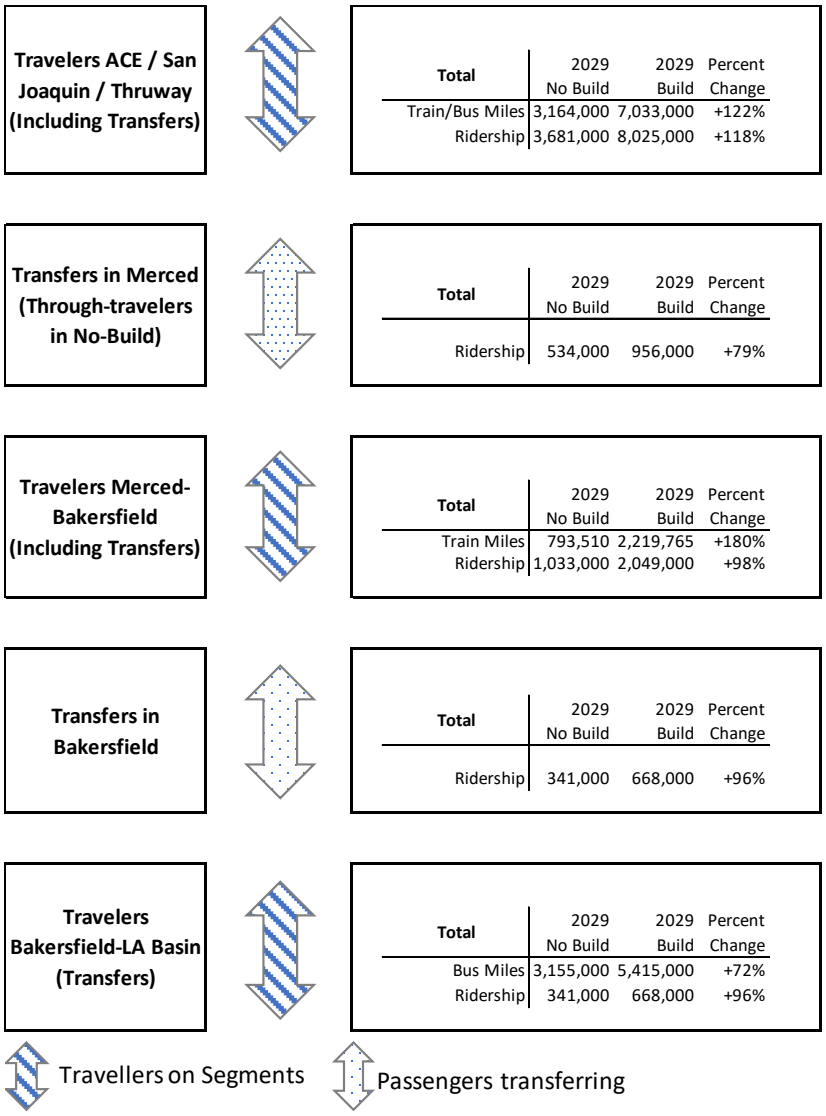


Figure 17-4 Ridership and Train/Bus Miles Increase by Segment of Total System

Market Share Analysis

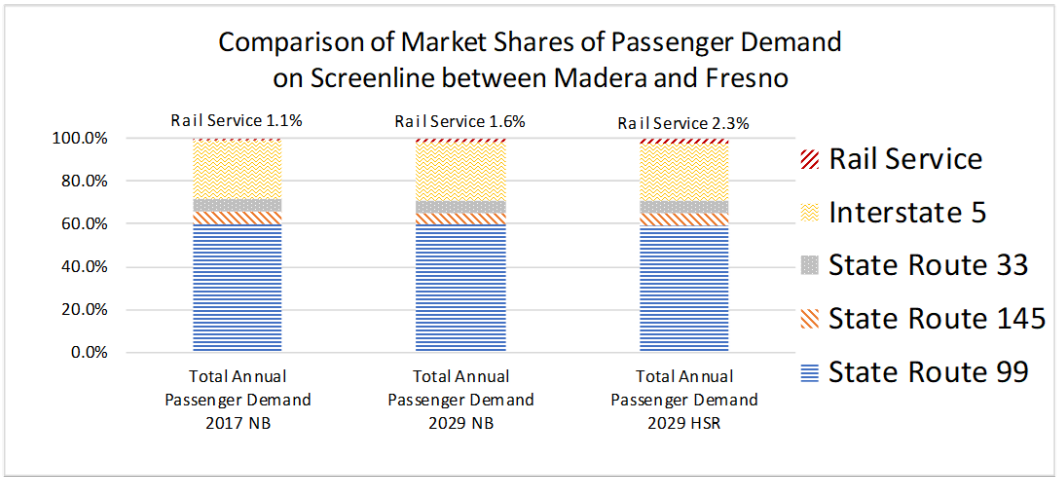
The ETO provided market share data in the context of HSR performance and existing overall corridor travel counts. The HSR ridership market share was compared with average annual daily traffic along the SR 99, SR 145, SR33, and I-5 corridors. Figure 17-5 below shows the following:

- Rail service market represents a small percentage of the total market share in all of the scenarios, 2017 No Build, 2029 No Build and 2029 HSR between 1.1% and 2.3%.
- From the 2017 NB scenario to the 2029 HSR scenario, the HSR market share is only expected to grow by 1.2% (from 1.1% to 2.3%).

The changes between the 2017 No Build and the 2029 No Build and Build scenarios are due to increases in population, greater congestions on roadways, travel time savings, and improved rail service options in both the No Build and Build scenarios. The Figure 17-5 illustrates the market share study results looking specifically at rail service between Madera and Fresno.

Comparison of Screenline Market Share in Section between Madera and Fresno (Screenline spans Interstate 5 to State Route 99)

Route	Total Annual Passenger Demand 2017 NB	Total Annual Passenger Demand 2029 NB	Total Annual Passenger Demand 2029 HSR
State Route 99	60.1%	59.8%	59.4%
State Route 145	5.7%	5.7%	5.6%
State Route 33	5.8%	5.7%	5.7%
Interstate 5	27.3%	27.2%	27.0%
Rail Service	1.1%	1.6%	2.3%
Total	100.0%	100.0%	100.0%



Note: Does not include growth of highway demand. Future market shares are actually lower when growth is considered.

Figure 17-5 Market Share Study Results

Sensitivity Analysis (Non-Optimized Connections)

In addition, to the 2029 Merced – Bakersfield HSR ridership and revenues forecast, the ETO also conducted a sensitivity test intended to show the impact of non-optimized connections, assuming the following:

- Transfers perceived as more severe: increase transfer perception factor from 0.95 to 1;

- HSR frequency/transfer connections are halved to reflect a reduced connection frequency from 18 to 9 trains, i.e. a passenger has only a connection every two hours between HSR and other services; and
- Increase transfer time from 10 minutes to 20 minutes to reflect a non-coordinated transfer schedule.

The results of this sensitivity analysis, can be seen below in the scenario called, “2029 B DS” (non-optimized connections). The following should be noted regarding these results:

- 75% of the systemwide revenue is in the entirely north of Merced segment, meaning 75% of the revenue is largely unchanged by the non-optimized connections scenario revision;
- The intra-CV (defined as HSR trips between Merced-Bakersfield) HSR trips are not impacted; and
- Key metrics:
  - HSR ridership declines 19% relative to the 2029 build baseline scenario.
  - ACE & San Joaquins trips through Merced decline 4% each and Thruway bus ridership declines 11%.
  - The overall system impact is a decline of 6%.

Figure 17-6 below shows percentage of change in ridership.

FROM	2017 NB	2026 NB	2026 NB	2029 NB	2026 B	2029 B
TO	**2026 NB**	**2026 B**	**2029 NB**	**2029 B**	**2029 B**	**2029 B DS**
HSR					23%	-19%
San Joaquins	53%	97%	5%	75%	-6%	-4%
ACE	24%	131%	17%	109%	6%	-4%
Thruway Bus BFD	26%	76%	5%	96%	17%	-11%
Other Thruway Bus		63%	5%	145%	58%	-3%
Total System	**36%**	**137%**	**12%**	**4%**	**109%**	**-6%**

Figure 17-6 Estimated % Change in Ridership Between Scenarios

Fare Revenue

SJRRC is planned to recognize the farebox revenues resulting from the ridership. Below in Figure 17-7 are the fare revenue estimates based on the ridership forecasts provided above. Revenue allocation is based on existing fare structure but should be noted that this can change with further detailed planning with the integrated services. The ETO believes that using the existing fare structure reflects a conservative and reasonable approach in estimating farebox revenues. These estimates do not represent a commitment by regional rail operators or other entities to finance or fund these services. Further planning has to be undertaken and commercial agreements have to be developed to allow for such commitments

Figure 17-7 below shows the farebox revenues in 2018 USD from the ETO's previous Study for the 2017 No Build, 2026 No Build and 2026 Build. Amounts are shown in 2019 USD for the 2029 No Build, 2029 Build and 2029 Build Downside (non-optimized connections) scenarios.

Service Type	ETO Study May 2019 2017 No Build	ETO Study May 2019 2026 No Build	ETO Study May 2019 2026 Build	ETO Updated Forecast November 2019 2029 No Build	ETO Updated Forecast November 2019 2029 Build	ETO Updated Forecast November 2019 2029 B Downside
HSR	-	-	30,505,000	-	37,820,000	29,788,000
San Joaquins	24,280,000	31,708,000	65,281,000	33,104,000	62,458,000	59,503,000
ACE	9,975,000	12,528,000	40,124,000	14,607,000	45,265,000	42,536,000
Thruway Bus BFD	3,398,000	4,271,000	7,507,000	4,498,000	8,799,000	7,816,000
Other Thruway Bus	7,515,000	8,970,000	15,501,000	9,383,000	24,492,000	23,715,000
Total System	**45,168,000**	**57,477,000**	**158,918,000**	**61,592,000**	**178,834,000**	**163,358,000**

Figure 17-7 Annual Revenue Estimates by Service Type Under Different Scenarios (in USD)

Fare Sensitivity Testing

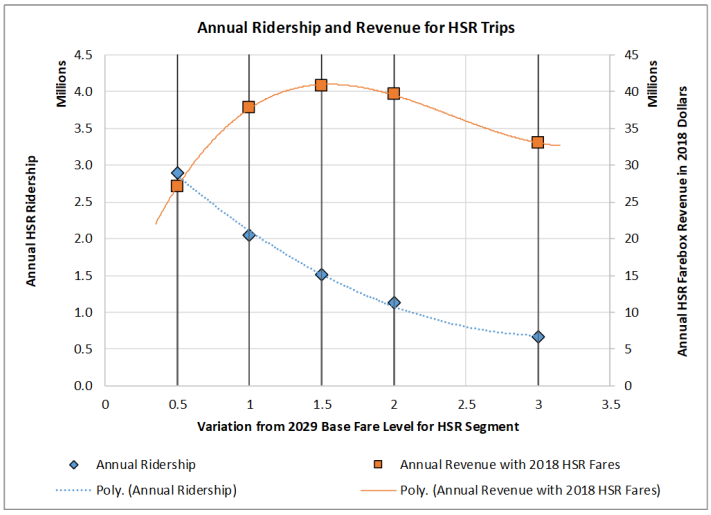
The fares used in the demand modeling effort and the base case forecasts represent average fare levels. In the Base Case these fares are near the average yield per passenger of the existing San Joaquins service. The actual fare products and fares over the course of the year are different from average assumptions including available discounts. The ETO conducted a fare-sensitivity analysis

performed to analyze whether using the existing average fare for the HSR service represents a conservative assumption and if there is a potential upside or downside to HSR revenue expectations.

Figure 17-8 below illustrates ridership and revenue outcomes at each fare level. Currently, HSR fares are set at 100%, resulting in USD35 million to USD40 million in HSR farebox revenue. Revenues may be maximized at 150% of base fares. There is the potential for high revenue generation even if tickets are set at 200% of base fares. Based on the analysis there is an upside where higher average HSR fares could generate higher HSR revenue. It is important to note that even in a case of an increased average fare the service would still provide a range of fare products and lower-cost options that are comparable to existing fares. It is necessary to study and analyze such fare policy decisions in more detail prior to the start of the HSR interim service.

Annual Ridership and Revenue Estimates – Summary HSR in Central Valley

Scenario	Annual Ridership	Perc. Diff. vs. 100% 2018 Fares	Annual Revenue with 2018 HSR Fares	Perc. Diff. vs. 100% 2018 Fares	HSR Fare Change	HSR Ridership Elasticity vs. 100%
50% of 2018 HSR Fares	2,895,000	+41.3%	$27,013,000	-28.6%	-50.0%	-0.825
100% of 2018 HSR Fares	2,049,000	---	$37,820,000	---	---	---
150% of 2018 HSR Fares	1,505,000	-26.6%	$40,797,000	+7.9%	+50.0%	-0.531
200% of 2018 HSR Fares	1,131,000	-44.8%	$39,627,000	+4.8%	+100.0%	-0.448
300% of 2018 HSR Fares	668,000	-67.4%	$33,042,000	-12.6%	+200.0%	-0.337



Note:
The fare sensitivity tool is based on 2026 model horizon and shows differences due to calculation process as compared to the 2026 model output.
The relative relationship of fares and the resultant ridership and revenue output is used and scaled to the 2029 model output in the next steps.
Fares on connecting services remain constant as in Base Case model run.

Figure 17-8 HSR Fare-Sensitivity Test Results for Ridership and Revenues

18 TOC Ancillary Revenues

18.1 Introduction

The system ancillary revenue opportunities are discussed in section 7.3 with the allocation of the revenues to the Authority and the Operator, see Figure 7-6. The operations ancillary revenue opportunities are discussed in the remainder of this section.

18.1.1 Base Metric Drivers – Operations Ancillary Revenues

As in the 2018 Business Plan, the ancillary revenue estimates were prepared using a relevant base metric driver for each ancillary revenue category. These drivers generally relate to a major system feature, as shown in Figure 18-1 below.

Base metric driver	Applicable operations ancillary revenue type(s)
Ridership	Advertising (rolling stock & station-level)
Ridership	Baggage and associated fees
Number of stations	Advertising (billboard)
Number of stations	Web-based advertising
Parking spaces	Parking fees
Retail space square footage	Retail (station level)

Figure 18-1: Basic Metric Drivers for Operations Ancillary Revenues

The levels assumed for these base metric drivers in the CVS analysis are:

- **Ridership:** The annual ridership figure for the initial year of operations is forecast at [2,049,000] passengers;
- **Number of stations:** Five stations are included: Merced, Madera, Fresno, Kings / Tulare, and Bakersfield. These stations simply consist of platforms and canopies, with pedestrian bridges, two escalators, two elevators, and two sets of stairs on each side. They do not include actual buildings at this stage of the project;

- **Parking spaces:** Parking available
- **Retail space square footage:** A total of 5,000 square feet of retail space is assumed, split evenly among the five stations. Based on 1,000 square feet per station, this translates into one or two retail facilities per station, such as a coffee shop or a drycleaner. For actual build out, larger stations, such as Fresno, may have larger or more retail activity – and the smaller stations, such as Madera, may have less;

18.1.2 Timing Parameters – Operations Ancillary Revenues

Key timing assumptions for operations ancillary revenues in the CVS analysis include:

- Operations commencement – December 2028.

As in the 2018 Business Plan, each of the operations ancillary revenue types is profiled to commence (and, in some instances, to occur entirely) during one of three phases in time, as shown in Figure 18-2 below.

Timing Phase	Applicable Operations Ancillary Revenue Type(s)	Date Range
Pre-operations	Not applicable	2020 to 2028
Operations	Advertising (billboard)	December 2028 onward
Operations	Advertising (rolling stock & station-level)	December 2028 onward
Operations	Baggage and associated fees	December 2028 onward
Operations	Parking fees	December 2028 onward
Operations	Retail (station level)	December 2028 onward
Operations	Web-based advertising	December 2028 onward

Figure 18-2: Timing Phase, Applicable Operations Ancillary Revenue Type(s) and Date Range

It should be noted that the ancillary revenue cash flow projections for the CVS analysis have been designed to reflect the first four years of operations (December 2028 – November 2032). Ancillary revenue arising beyond this timeframe has not been considered.

18.1.3 Net Revenue Unit Multipliers – Operations Ancillary Revenues

18.1.3.1 Background

In the detailed analysis supporting the 2018 Business Plan, the CHSRA and its consultants prepared low, medium, and high benchmark multipliers for each of the ancillary revenue opportunities.[16] These benchmark multipliers were then applied to the relevant base metric driver for each ancillary revenue type, producing low, medium, and high ancillary revenue cases. The medium ancillary revenue case then formed the basis for forecasting ancillary revenues within the 2018 Business Plan. All such ancillary revenue calculations were made on a net revenue basis (i.e. taking into account the operating costs of their pursuit).

18.1.3.2 Unit Multipliers for Operations Ancillary Revenues in the CVS Analysis

The CHSRA's prior ancillary revenue reports were reviewed and discussed with the CHSRA team of consultants. Based on this information, the following unit multipliers were applied to generate a "medium" operations ancillary revenue case for the CVS projections (see Figure 18-3). As was previously the case, these multipliers are for the calculation of operations ancillary revenues on a net revenue basis.

In general, these assumptions reflect the view that ancillary revenues will be lower than those projected for V2V and Phase 1 in the 2018 Business Plan because of:

- Limited service in terms of capacity and frequency;
- The service only serves smaller markets in the Central Valley; and
- The median household income in Central Valley counties is materially lower than those in the Bay Area and Los Angeles.

Figure 18-3 shows unit multipliers for CVS medium case operations ancillary revenues.

[16] A summary of these ancillary revenue multiplier estimates (low, medium, and high) and key benchmarking assumptions supporting them are set out on page 11 of the report entitled "California High-Speed Rail, Preliminary Estimates for Ancillary Revenue Contributions, 2018 Business Plan", dated 25 January 2018

Operations ancillary revenue category	Multiplier estimate for CVS (in 2019 USD	Multiplier estimate for CVS (in 2017 USD)	Discussion/Rationale	Prior Low / Medium / High levels in 2018 Business Plan (in 2017 USD)
Advertising: billboard	53,634 per station	50,000 per station	Equals prior low estimate. CVS is primarily rural. No network effects.	50,000 / 75,000 / 100,000
Advertising: rolling stock & station-level	0.054 per passenger	0.05 per passenger	Equals prior low estimate. CVS is primarily rural. More basic station design. Less dwell time.	0.05 / 0.075 / 0.10
Baggage and associated fees	NIL per passenger	NIL per passenger	Assumption for purposes of this report: policy of no baggage fees.	0 / 1.25 / 2.50
Parking fees	NIL per annum, per parking space	NIL per annum, per parking space	Assumption for purposes of this report: policy of no parking fees.	750 / 1,125 / 1,500
Retail: station level	8.58 per square foot	8.00 per square foot	Equals prior low estimate. Significantly reduced station sizes; more basic space types.	8.00 / 10.40 / 12.40
Web-based advertising	21,453 per station	20,000 per station	Equals prior low estimate. CVS is primarily rural. Lower CVS median household income.	20,000 / 40,000 / 60,000

Figure 18-3: Unit Multipliers for CVS Medium Case Operations Ancillary Revenues

18.1.4 CVS Projection – Operations Ancillary Revenues

As shown in Figure 18-4 below, under the assumptions set out above in this Section the projected "medium" case net operations ancillary revenues for the CVS are as follows:

- Net Operations Ancillary Revenues – Medium Case – Operations Period

TOC Ancillary Revenue Items	Dec. 2028	2029	2030	2031	Nov. 2032
Billboard Advertising	22	268	268	268	246
Advertising (Rolling Stock and Station Level)	9	110	110	110	101
Baggage and Other Associated Fees	-	-	-	-	-

TOC Ancillary Revenue Items	Dec. 2028	2029	2030	2031	Nov. 2032
Parking Fees	-	-	-	-	-
Retail - Station Level	4	43	43	43	39
Web-based Advertising	9	107	107	107	98
Total TOC ancillary revenues	44	528	528	528	484

Figure 18-4: Revenue Projection for TOC Ancillary Revenues (USD1,000)

19 Operator Financial Balance: Central Valley

This section projects out the financial balance of conventional and high-speed rail service operations (including connecting bus services) in the Central Valley. The balance of costs and revenues specific to conventional rail, high-speed rail and connecting bus service operations, and including additional revenue from ancillary business opportunities which an operator could develop. The balance projects the following costs and revenues related to Central Valley rail and bus service operations:

- Costs:
  - The System Access and Train Rental Fees payable by the Operator to CHSRA for use and availability of and/or access to the high-speed rail infrastructure and assets;
  - The operations, maintenance and overhead costs of providing conventional and high-speed rail services; and
  - Costs of bus services connecting to and from the rail services
- Revenues
  - Fare revenue collected for conventional and high-speed rail travel
  - Ancillary revenues

The resulting financial balance is shown in Figure 19-1 below. The overall balance results in a gap of USD57.7 million as a result of the direct O&M costs as well as for the system access and the rolling stock rental costs against the farebox and ancillary revenues.

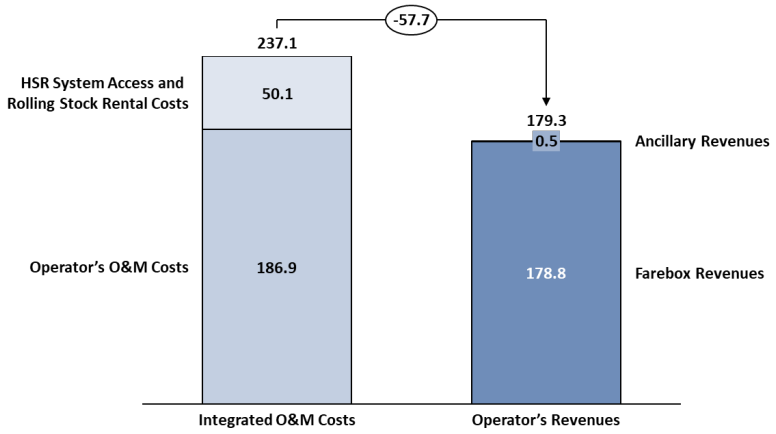


Figure 19-1: Total 2029 with HSR (in 2019 USD Million)

PART D: TOTAL SYSTEM VIEW

20 Consolidated O&M Costs

Figure 20-1 below displays the consolidated costs of operating high-speed rail, conventional rail and connecting bus services – again without separating these out into distinct components of the proposed business structure.

Costs are nonetheless presented in the grouping and sequence of the 'blueprint' of the proposed business structure: maintenance costs of HSR rolling stock, the operation and maintenance costs of HSR civil works as well as track and systems, operation and maintenance costs of HSR stations and other facilities, overheads (environmental expenses, insurance, contract management, policing) related to HSR operations and HSR operations costs (power, labor, etc.), conventional rail service operating costs and connecting bus service (net) operating costs.

Operations Consolidated O&M Cost Items	December 2028	2029	2030	2031	Nov. 2032
HSR rolling stock maintenance costs	1,166	13,992	13,992	13,992	12,826
Civil structure O&M costs	103	1,238	1,238	1,238	1,135
Track & System O&M costs (incl. OCC)	1,733	20,800	20,800	20,800	21,539
Facilities O&M costs	119	1,427	1,427	1,427	1,308
DBM contract management overhead and insurance	388	4,657	4,657	4,657	4,269
CHSRA policing costs	203	2,391	2,391	2,391	2,194
HSR operations costs	1,788	21,262	21,262	21,262	19,501
HSR operations insurance costs	168	2,021	2,021	2,021	1,852

Operations Consolidated O&M Cost Items	December 2028	2029	2030	2031	Nov. 2032
HSR corporate services	1,089	13,070	13,060	13,060	11,972
Marketing & communication costs	289	3,422	2,948	2,948	2,703
HSR fare collection costs	158	1,891	1,891	1,891	1,733
TOC admin building costs	21	254	254	254	233
Operator policing and security costs	684	8,124	8,124	8,124	7,452
ACE and San Joaquins O&M costs	7,929	95,143	95,143	95,143	87,214
Bus connection costs	2,818	33,815	33,815	33,815	30,997
Contingency margin - HSR rolling stock maintenance	175	2,099	2,099	2,099	1,924
Contingency margin - HSR system maintenance	293	3,520	3,520	3,520	3,597
Contingency margin - Bus service	282	3,382	3,382	3,382	3,100
Profit margin - HSR operator	381	4,548	4,499	4,499	4,126
Operations consolidated O&M costs	19,787	237,055	236,523	236,523	219,676

Figure 20-1: Cost Projection for Total System O&M (USD1,000)

21 Consolidated Revenues

21.1 Consolidated Ancillary Revenues

Figure 21-1 below shows the projected consolidated ancillary revenues, which include those ancillary revenues expected to be realized by the Authority and by the Operator.

Operations Consolidated Ancillary Revenue Items	Dec. 2028	2029	2030	2031	Nov. 2032
Telecommunication - towers	9	107	107	107	98
Telecommunication - longitudinal fiber	156	1,877	1,877	1,877	1,721
Ground leases	-	-	-	-	-
Sponsorship - branding exclusivity	4	54	54	54	49
Sponsorship - station naming	11	134	134	134	123
Sponsorship - system naming	89	1,073	1,073	1,073	983
Low Carbon Fuel Standard (LCFS) Credits	1,057	12,679	12,679	-	-
Billboard Advertising	22	268	268	268	246
Advertising (Rolling Stock and Station Level)	9	110	110	110	101
Baggage and Other Associated Fees	-	-	-	-	-
Parking Fees	-	-	-	-	-
Retail - Station Level	4	43	43	43	39
Web-based Advertising	9	107	107	107	98
Total operations consolidated ancillary revenues	1,371	16,452	16,452	3,773	3,459

Figure 21-1: Revenue Projection for Operations Consolidated Ancillary Revenues (USD1,000)

21.2 Operations Consolidated Farebox Revenues

Finally, Figure 21-2 below shows the consolidated farebox revenues from HSR, conventional rail and connecting bus services for the projection period.

Operations Consolidated Farebox Revenue Items	Dec. 2028	2029	2030	2031	Nov. 2032
HSR fare revenue	3,152	37,820	37,820	37,820	34,668
San Joaquins	5,205	62,458	62,458	62,458	57,253
ACE	3,772	45,265	45,265	45,265	41,493
Thruway Bus BFD	733	8,799	8,799	8,799	8,066
Other Thruway Bus	2,041	24,492	24,492	24,492	22,451
Total operations consolidated farebox revenues	14,903	178,834	178,834	178,834	163,931

Figure 21-2: Revenue Projection for Operations Consolidated Farebox Revenues (USD1,000)

22 Consolidated Financial Balance

Figure 22-1 below projects the financial balance for the consolidated 'package' of conventional rail services, high-speed rail services, and connecting bus services – for the Central Valley interim operations period.

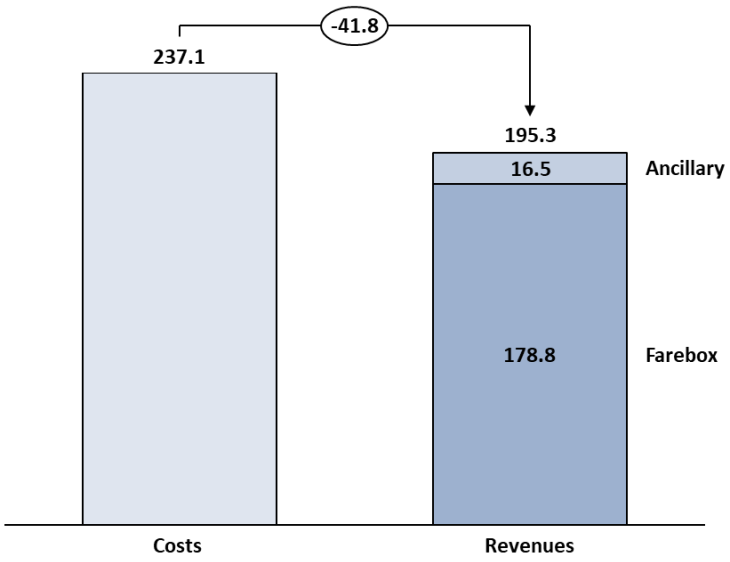


Figure 22-1: Total System 2029 O&M Costs vs. Revenues (in USD2019 Million)

Note: Ancillary revenues include Low-Carbon Fuel standards (LCFS) credits. It is to be determined if these accrue to the State or to the Authority, but the ETO has included it in this systemwide projection consistent to the prior ETO study.

The O&M costs for the total corridor, including, HSR, ACE, San Joaquins and bus connections is USD237.1 million compared to the total revenues (composed of farebox and ancillary revenues), resulting in a gap of USD 41.8 million in year 2029.

23 Conclusions

Scope Summary

In the Authority's Project Update Report, published on May 1, 2019, the Authority committed to having the ETO perform the following as next steps in the implementation program of the high-speed rail project, with focus on the Central Valley (Merced-Bakersfield):

- Operations Planning: The ETO coordinated the additional analysis needed to develop a more detailed operations plan, including how it would connect and integrate with other passenger rail systems, beyond the initial analysis that it completed to evaluate the interim service options;
    - Continued to develop the integrated service concept and plan working with the San Joaquins and ACE service providers to optimize the connections and maximize the services for passengers traveling between Sacramento, Oakland and San José in the Bay area;
    - Designed a highly synchronized integrated service timetable for a seamless journey;
- The existing San Joaquins fare structure was utilized for purposes of this report (consistent with the ETO's last study); however, the ETO also evaluated fare sensitivities by looking at HSR fares for this report;
- Coordinated with CalSTA, and SJRRC staff to identify the additional regional improvements and infrastructure required north of Merced and development of a joint station at Merced;
- Optimized bus connections;
- Updated ridership and revenue forecasts based on the updated service concept. A more detailed and specific ridership model will be developed to further evaluate this integrated service network to review ridership and revenue forecasts. Until this new model has been developed, the existing State model will continue to be used to estimate demand forecasts for the Central Valley (Merced – Bakersfield).

Findings

Based on the scope for this Interim Financial Plan, the ETO notes these findings:

1. Improved Financial Balance for the Total Corridor (including ACE and San Joaquins)

After optimizing the service connections for the total corridor in the CVS and reflecting the latest envisioned business structure (described in section 4), the results comparing the O&M costs to revenues (farebox and ancillary) shows a USD41.8 million gap, which is assumed to be covered by state and local funds. This is an improvement compared to the current total state and local funding of USD70.1million for the CVS corridor: This breaks down into the approved SJJPA state funding request for the San Joaquins which was USD53.9 million[17] in the fiscal year 18/19 and the local funding request for ACE/SJRRC of USD16.2 million[18] in fiscal year 18/19.

Figure 23-1 below projects the financial balance for the consolidated "Total Corridor View" of the Central Valley interim service period, which includes conventional rail services, high-speed rail services and connecting bus services. This O&M costs for the total corridor, including, HSR, ACE, San Joaquins and bus connections totals USD237.1 million compared to total revenues (composed of farebox and ancillary revenues), which totals USD195.3 million and results in a gap of USD41.8 million.

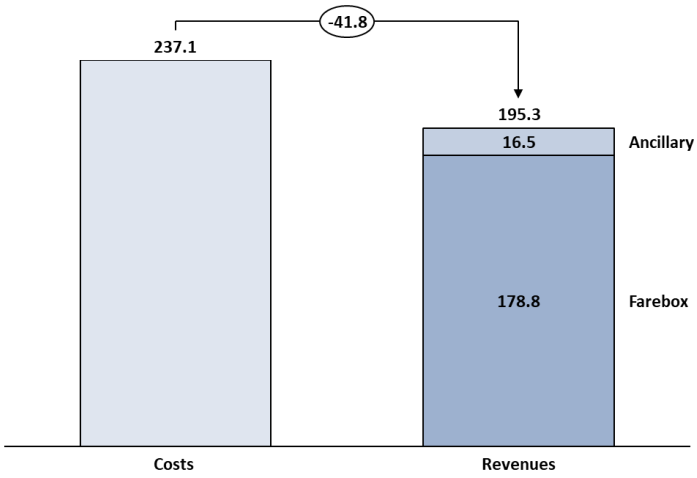


Figure 23-1: Total System 2029 O&M Costs vs. Revenues (in 2019 USD Million)

[17] https://sjjpa.com/wp-content/uploads/Final-2019-SJJPA-Bus-Plan-Update-1.pdf
[18] https://acerail.com/wp-content/uploads/Work-Program-20192020.FINAL_-1.pdf

Note: Ancillary revenues include Low-Carbon Fuel Standards (LCFS) credits. It is to be determined if these accrue to the State or to the Authority, but the ETO has included it in this systemwide projection for comparative purposes with the prior ETO study.

This is a further improvement compared to the gap of USD82.8 million for the systemwide No-Build scenario, which was presented in the ETO's previous study. See Figure 23-2 below.

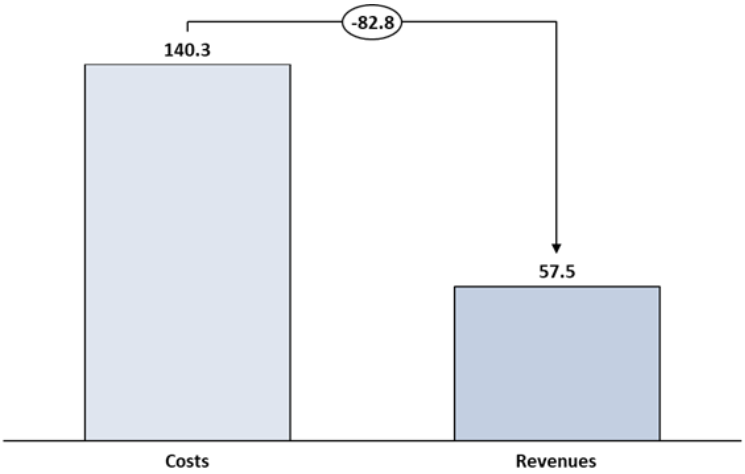


Figure 23-2:Total System 2026 Without HSR (ETO Study May 2019, in 2018 USD Million)

This further improvement in the financial balance compared to the previous ETO study is primarily driven by the following:

- Change in business structure compared to previous ETO study, which assumed the perspective of just the TOC. In this report, two financial perspectives are evaluated from the viewpoint of the Authority and the Operator. This was driven by the Authority, who evaluated commercial strategies for how interim services in the Central Valley could look like given the policy and legal requirements regarding State subsidy;
- Updated integrated service concept reviewed with SJRRC for optimization of train and bus connections;
- The assumption of a Universal Operator, who will be responsible for HSR, conventional rail and bus services resulting in a reduction in O&M costs due to expected operational and administrative efficiencies;

2. Under the Proposed Business Structure, CHSRA's costs are recovered

The Authority evaluated commercial strategies for running interim services in the Central Valley (Merced – Bakersfield). The main characteristics of this business structure during the interim Central Valley Service may look like:

- CHSRA entering into a partnership with SJRRC, who will contract with a Universal Operator to provide interim high-speed service as part of an extended corridor connecting Sacramento and the Bay Area with the Central Valley through ACE and San Joaquins regional services in Merced and connecting southern California with optimized bus services. The contractual relationship between CHSRA and SJRRC is planned to include:
    - A Train Rental Fee charged to SJRRC, such that CHSRA covers all of its maintenance and insurance costs related to Central Valley HSR rolling stock.
    - A System Access Fee charged to SJRRC for the usage of the HSR infrastructure and related assets – covering the costs incurred by CHSRA for the maintenance costs related to the infrastructure and overhead costs specific to the realization of a functioning HSR system arrangement (i.e. DBM contract management personnel, system insurance costs, rolling stock insurance costs, policing costs of the assets) for the Central Valley.
- During the interim services in the Central Valley (until Valley to Valley is completed), these responsibilities will fall with SJRRC and/or its Universal Operator for all services in the corridor, which includes:
    - The existing conventional regional services (ACE, San Joaquins and buses)
    - Interim high-speed service operations
    - And other responsibilities see subsection 4.1.2

The Figure 23-3 shows the financial balance on the Operator's side. The costs shown are composed of two main categories:

- One for the costs related to the system and rolling stock fees, which will be charged by CHSRA to the Operator totaling USD50.1 million for use of the HSR assets; and

- The other totaling USD186.9 million, which represents those costs direct to the Operator related to running HSR, ACE, San Joaquins and Bus services. It is assumed that the gap of USD57.7 million will primarily be covered by state and local funding or, in other words, it is assumed that there will be continued coverage of the Operator's costs via an operating subsidy. Depending on the treatment of Low Carbon Fuel Standard credits and who applies for this and is ultimately granted the right to these specific ancillary revenues, this gap of USD57.7 million may be further improved.

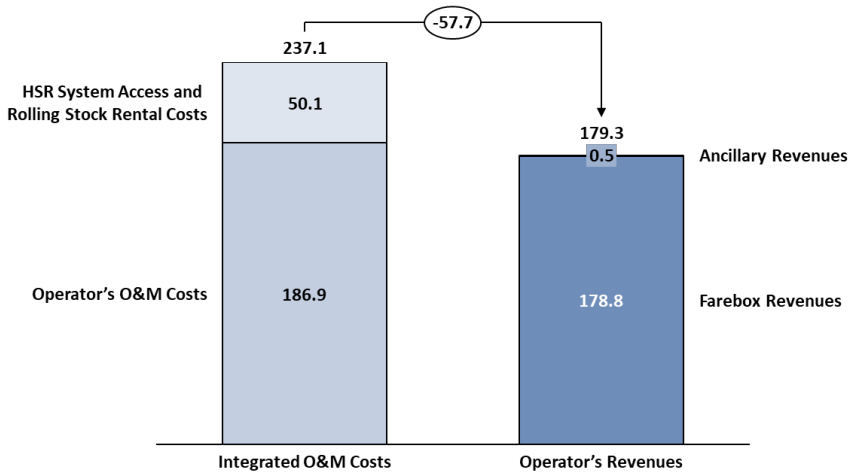


Figure 23-3: Total 2029 Operator O&M Costs vs. Revenues (in 2019 USD Million)

Note: For ease of illustration, the financial balance from the Operator's perspective also reflects the costs for system access fees and rolling stock rental fees (although these fees are assumed to be charged directly from CHSRA to SJRRC) in addition to the direct costs expected to be incurred by the Operator.

- While SJRRC undertakes the interim operations in the Central Valley, CHSRA will continue with the planning of Valley to Valley and Phase 1, as well as assume the role of Infrastructure and Rolling Stock management responsible for:
  - Managing the contracts for Track & Systems and Rolling Stock
  - Completing all phases of testing and commissioning for the system (Merced – Bakersfield)
  - Ensuring compliance of appropriate FRA requirements

During interim operations, the proposed business structure and integrated delivery of high-speed rail services, conventional rail services and connecting business services will enable:

- High-Speed service for the communities in California as soon as possible, providing mobility, economic and environmental benefits at the earliest possible time;
- SJRRC to take advantage of the improvements of the service by using high-speed trains and infrastructure; and
- Improvement to the financial balance from a total systemwide perspective.

In order for CHSRA to cover its costs on the management and maintenance of the relevant HSR rail infrastructure and assets, these costs will be covered by the revenue stream from fees charged to SJRRC. This approach results in CHSRA projecting a certain break-even situation for HSR system and assets utilized for the interim services in the Central Valley.

In Figure 23-4 below, the USD50.1 million in costs on the Authority's side is fully charged to the Operator, which can be seen in the CHSRA Revenues column. In addition to the USD50.1 million, which CHSRA would receive as revenues related to the rolling stock, systems and overhead, CHSRA would also recognize ancillary revenues. It is still to be determined whether the LCFS credits accrue to the State or the Authority. The calculation of the ancillary revenues is further described in Section 7.3, CHSRA System Revenues.

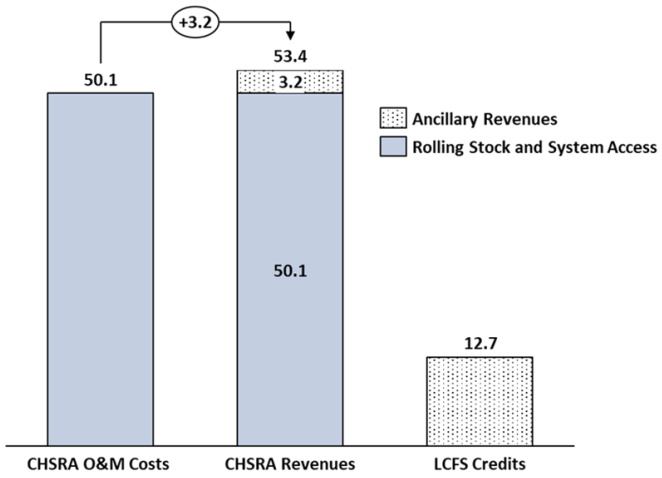


Figure 23-4: Total 2029 CHSRA O&M Costs vs. Revenues (in 2019 USD Million)

3. Optimization of Services Increases Total System Ridership

Figure 23-5 shows the annual ridership estimates for HSR, San Joaquins, ACE and bus services under different scenarios and time horizons calculated as unlinked trips.

As shown in Figure 23-6 and compared to the ETO's prior study, the total system ridership (calculated as linked trips) increases from 8,426,000 to 8,776,000, 2026 Build to 2029 Build, with HSR respectively.

This increase is a result of the following:

- Natural growth from a change in timeline horizon from start of revenue service in 2026 to 2029 (first full calendar year of interim service); and
- Optimized service connections with San Joaquins, ACE and bus connections.

Service Type	ETO Study May 2019 2017 No Build	ETO Study May 2019 2026 No Build	ETO Study May 2019 2026 Build	ETO Updated Forecast November 2019 2029 No Build	ETO Updated Forecast November 2019 2029 Build
HSR	--	--	1,671,000	--	2,049,000
San Joaquins	1,102,000	1,689,000	3,327,000	1,778,000	3,111,000
ACE	1,503,000	1,865,000	4,306,000	2,191,000	4,572,000
Thruway Bus BFD	258,000	324,000	570,000	341,000	668,000
Other Thruway Bus	470,000	561,000	912,000	587,000	1,441,000

Figure 23-5: Annual Ridership Estimates by Service Type Under Different Scenarios Are Unlinked Trips and Not Additive

Service Type	ETO Study May 2019 2017 No Build	ETO Study May 2019 2026 No Build	ETO Study May 2019 2026 Build	ETO Updated Forecast November 2019 2029 No Build	ETO Updated Forecast November 2019 2029 Build
Total System Linked Trips	2,606,000	3,555,000	8,426,000	3,969,000	8,776,000

Figure 23-6: Total Systemwide Annual Ridership Under Different Scenarios Reflected as Linked Trips

When comparing the 2029 No Build to the 2029 Build, the total system ridership increase is +121%, or from 3,969,000 to 8,776,000 ridership respectively. This is supported by a significant growth in service frequency and connectivity provided by the ACE, San Joaquins and Bus services that are designed to complement the high-speed rail service between Merced and Bakersfield.

Overall the addition of the connecting services north of Merced and south of Bakersfield represent a significant and transformational change over today's service frequency enabling hourly travel options between all system stops across the total system.

While the HSR service almost triples the train miles between Merced and Bakersfield, the ridership increases by 98%. The connecting services north of Merced increase the train and bus miles by 122% percent and show a corresponding increase in ridership of 118%. See subsection 17.3 for further details. This increase in demand is a combination of local demand increases as well as the increased demand of HSR travelers transferring in Merced.

Consistent with the ETO's prior study, the updated ridership results were found to be reasonable after further evaluating them from the context of train and bus miles and market share analysis projected to be captured by HSR in the 2029 Build scenario compared to the 2029 No Build scenario. See Section 17, Ridership and Fare Revenue for further details regarding the 2029 Build scenario and other sensitivities conducted by the ETO.

In conclusion, interim HSR services between Merced – Bakersfield creates significant value, when connected to the total existing corridor (including ACE, San Joaquins and bus network). The development of an integrated service concept with optimized connections results in improved services

and reduction in travel time for the passenger. Further the Authority evaluated a business model, which enables the use of HSR infrastructure and assets by another operator for interim service in the Central Valley. Based on the ETO's results in this report and under this business model, there is a further improvement in the projected gap between systemwide revenues and operations & maintenance costs. Next steps are to develop memorandums of understanding with providers and other Central Valley partners.

APPENDIX A:

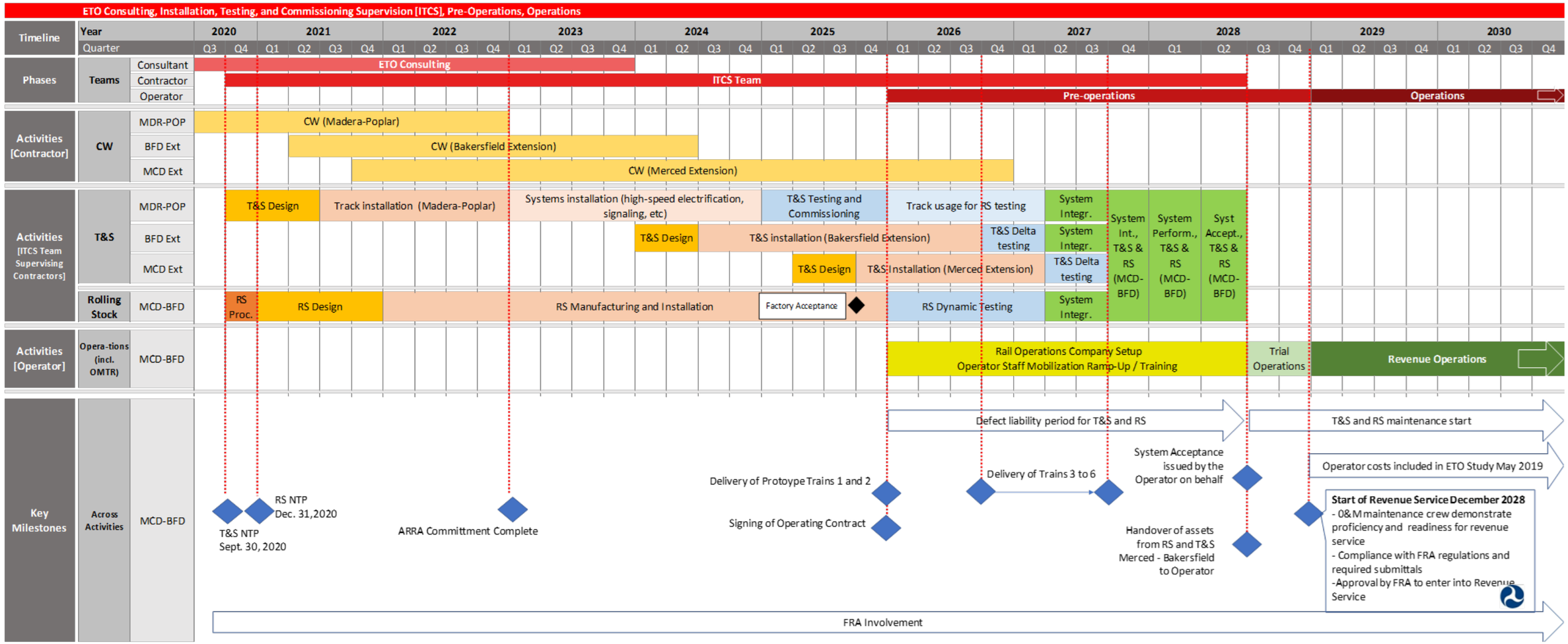


Figure A-1: Timeline for Pre-Operations Merced-Bakersfield