

ZERO EMISSION

PASSENGER RAIL AND TRAIL



Project Concept Report

FINAL

October 24, 2025

SCCRTC Zero Emission
Passenger Rail and Trail Project





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List of Acronyms and Abbreviations

AAR	Association of American Railroads
ADA	Americans with Disabilities Act
AMBAG	Association of Monterey Bay Area Governments
AREMA	American Railway Engineering and Maintenance-of-Way Association
ASM	Alternative Safety Measure
BART	Bay Area Rapid Transit
BCA	Benefit-Cost Analysis
BSMP	Railroad Bridge Safety Management Program
CalBCA	California Benefit Cost-Analysis
CalEPA	California Environmental Protection Agency
CalSTA	California State Transportation Agency
Caltrans	California Department of Transportation
CA MUTCD	California Manual of Uniform Traffic Control Devices
CCC	California Coastal Commission
CCTV	Closed-Circuit Television
CDP	Census-Designated Place
CEQA	California Environmental Quality Act
CFR	Code of Federal Regulations
CGS	California Geological Survey
CHRIS	California Historical Resources Information System
CHTS	California Household Travel Survey (2012)
CIDH	Cast-In-Drilled-Hole
CIP	Cast-In-Place
CNDDDB	California Natural Diversity Database
Corridor ID	Corridor Identification & Development
CPTED	Crime Prevention Through Environmental Design
CPUC	California Public Utilities Commission
CRHR	California Register of Historic Resources
CRT	Commuter Rail Transit
CTC	California Transportation Commission
CTCS	Centralized Traffic Control System (frequently also referenced as CTC)
CWA	Common Work Area
CWR	Continuously Welded Rail
DMU	Diesel Multiple Unit
DOR	Caltrans Division of Rail
DPG	Deck-Plate Girder
DRM	Direct Ridership Model
DRMT	Caltrans Division of Rail and Mass Transportation
DTSC	Department of Toxic Substances Control
E-ATC	Enhanced Automatic Train Control

FEMA	Federal Emergency Management Agency
FHWA	Federal Highway Administration
FLIRT	Fast Light Innovative Regional Train
FMMP	Farmland Mapping and Monitoring Program (California Department of Conservation)
FORT	Friends of the Rail & Trail
FRA	Federal Railroad Administration
FSP	Federal-State Partnership
FTA	Federal Transit Administration
GHG	Greenhouse gas
GIS	Geographic Information System
GO	General Order
H&H	Hydrology & Hydraulics
HVAC	Heating, Ventilation and Air Conditioning
ICC	Interstate Commerce Commission)
I-ETMS	Interoperable Electronic Train Management System
IJA	Infrastructure Investment & Jobs Act
IP	Iowa Pacific Railroad
IPH	Iowa Pacific Holdings
KML	Keyhole Markup Language XML file format to display geographic data
KMZ	KML file “zipped” (compressed)
LBS	Location-based services
LH	Locomotive Hauled
LMF	Layover and Maintenance Facility
LPA	Locally Preferred Alternative
LRDP	UC Santa Cruz Long-Range Development Plan
LRT	Light Rail Transit
LRV	Light Rail Vehicle
LTE/5G	Long-Term Evolution/5G (wireless broadband)
LWA	Lower-Work Area
MBSST	Monterey Bay Sanctuary Scenic Trail Network
METRO	Santa Cruz Metropolitan Transit District
MOW	Maintenance-of-Way
MP	Milepost
MPDG	Multimodal Project Discretionary Grant (INFRA, MEGA, Rural)
MRE	Manual of Railway Engineering
MRZ	Mineral Resource Zone
MST	Monterey-Salinas Transit
MTIS	Major Transportation Investment Study
MU	Multiple-Unit
NAHC	Native American Heritage Commission
NCTD	North County Transit District
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service

NOE	Notice of Establishment
NRHP	National Register of Historic Places
NRV VM	Non-Revenue Vehicle Maintenance Office
NSRT	Nationwide Significant Risk Threshold
NTCD	North County Transit District (San Diego)
NTD	National Transit Database
NWIC	CHRIS Northwest Information Center
OCIP	Owner Controlled Insurance Program
OD	Origin-Destination
OTM	Other Track Materials
PAD	Public Authority Designation
PC/PS	Precast Prestressed
PeMS	Performance Measurement System (Caltrans)
PES	Portable Equipment Storage
PFA	Polyfluoroalkyl substances
psi	pounds per square inch
PTC	Positive Train Control
QC	Quality Control
QZ	Quiet Zone
QZRI	Quiet Zone Risk Index
RIWH	Risk Index with Horns
RNIS	Rail Network Integration Study
ROCC	Rail Operations Control Center
ROM	Rough Order of Magnitude
RSD	Rail Safety Division
RTC	Rail Traffic Controller™
RTFS	Rail Transit Feasibility Study
Rules	Rules of Practices and Procedure
S&I	Service and Inspection
SB 1	Senate Bill 1
SB 375	California Sustainable Communities & Climate Protection Act of 2008
SBCTA	San Bernardino County Transportation Authority
SC&MB	Santa Cruz & Monterey Bay Railway
SCBG	Santa Cruz, Big Trees and Pacific Railway
SCBRL	Santa Cruz Branch Rail Line
SCC	Standard Cost Categories
SCC Model	Santa Cruz County Travel Demand Model
SCCRTC	Santa Cruz County Regional Transportation Commission
SCRRA	Southern California Regional Rail Association
SEPTA	Southeastern Pennsylvania Transportation Authority
SFHA	special flood hazard area
SLF	Sacred Lands Files (maintained by NAHC)
SMART	Sonoma-Marín Area Rail Transit District



SMGB	California State Mining and Geology Board
SP	Southern Pacific Railroad
SPP	St. Paul and Pacific Railroad
SRP	California State Rail Plan
SSM	Supplementary Safety Measure
STB	Surface Transportation Board
SWRCB	State Water Resources Control Board
TAMC	Transportation Agency for Monterey County
TAZ	Travel Analysis Zone
TCAA	Transit Corridor Alternatives Analysis
TDM	Santa Cruz County North Coast Transportation Demand Management Plan
TOD	Transit-Oriented development
TPC	Train Performance Calculator
TPG	Through-Plate Girders
TPH	Total Petroleum Hydrocarbons
TRM	Train Revenue Miles
TVM	Ticket Vending Machine
UP	Union Pacific Railroad
UCS	Unified Corridor Investment Study
UCSC	University of California, Santa Cruz
ULWP	Upper-Level Work Platforms
USDOT	U.S. Department of Transportation
USFWS	U.S. Fish and Wildlife Service
UST	Underground storage tank
UV	Ultraviolet (light)
VMT	Vehicles Miles Traveled
VMS	Variable Message Screens
ZEMU	Zero-Emissions Multiple-Unit
ZEPR	Zero Emission Passenger Rail and Trail Project

Acknowledgements

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- Santa Cruz METRO
- Transportation Agency for Monterey County
- University of California, Santa Cruz

Community Members and Groups

Members of the public and stakeholder groups provided extensive input throughout development of the ZEPRT Project concept. The community's thoughtful participation in discussions about the Project's purpose and need, and input on the development of elements of the proposed Project, has played a crucial role in shaping the Draft Project Concept and demonstrates the immense value of public participation in the local transportation planning process.

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Preface

The Santa Cruz County Regional Transportation Commission (SCCRTC) is pleased to present the Zero Emission Passenger Rail and Trail (ZEPRT) *Final Project Concept Report*. The purpose of this report is to respond directly to the questions most frequently raised by our community, our partner agencies, and the Commission about the feasibility and potential of implementing passenger rail service along Santa Cruz County's coastal Santa Cruz Branch Line (SCBRL) rail corridor.

For years, community members have asked the following about passenger rail:

- *What would it actually look like for our region?*
- *How long would it take to travel to and from Watsonville and Santa Cruz?*
- *How much would it cost to build, operate, and maintain?*
- *How many people would use it?*

This report was developed to answer these questions in a clear, data-driven, and locally relevant way. It builds on years of planning, including the 2015 *Rail Transit Feasibility Study*, 2019 *Unified Corridor Investment Study*, and the 2021 *Transit Corridor Alternatives Analysis*. With this ZEPRT *Project Concept Report*, SCCRTC advances that work by refining conceptual engineering, evaluating costs and ridership based on current and future conditions, and identifying next steps should the Commission and community wish to move forward.

Purpose and Intent

The ZEPRT *Project Concept Report* is not a decision document. It does not commit the SCCRTC or local jurisdictions to building a rail project, nor does it select a preferred alternative. Instead, it provides the foundational technical information needed to inform future decisions about whether, and how, passenger rail might best serve the people of Santa Cruz County.

This report answers key questions that have persisted since the Commission's acquisition of the Santa Cruz Branch Rail Line in 2012. While the SCBRL corridor's potential as a multimodal transportation and recreation asset has been recognized for more than a decade, the specific details of implementing passenger rail service have remained uncertain. The ZEPRT Project effort — named for its emphasis on **zero-emission technologies** and **integrated trail design** — seeks to illuminate what a future system could realistically look like.

In doing so, the report evaluates several conceptual service options, technologies, and infrastructure configurations. It examines the estimated travel times between key destinations; outlines capital cost estimates for rail infrastructure, vehicles, maintenance facilities, and stations; projects operating and maintenance costs; and estimates potential ridership based on local travel patterns and population density.

Community Questions, Data-Driven Answers

Every question that shaped this study reflects a value expressed by our community — equity, sustainability, connectivity, and fiscal responsibility. The community wants to understand how rail service



would compare with other options in terms of time, cost, and benefit. They want to know if rail can truly serve working families commuting from South County, students and employees traveling to UCSC or Downtown Santa Cruz, and visitors moving along the coast, all without adding to traffic or emissions.

This report provides technical answers that can ground those conversations in fact rather than speculation. The information contained herein can also support regional, state, and federal grant funding applications, should future phases of study or implementation be pursued.

A Foundation for Future Decisions

The ZEPRT *Project Concept Report* establishes a common baseline of understanding. By defining what passenger rail could cost, how it might perform, and who it could serve, the SCCRTC and the public will be better equipped to weigh the potential benefits against other community priorities and investments.

Importantly, this report also identifies next steps, including environmental review, community engagement, and funding strategies, should the Commission elect to continue advancing the ZEPRT Project.

Acknowledgments

This work reflects collaboration among SCCRTC, our consultant partners, member agencies, and community stakeholders who have contributed their time, expertise, and local insight. The Commission extends its appreciation to the residents and organizations who have engaged in this process with curiosity, creativity, and a shared desire to improve mobility, equity, access, and sustainability across Santa Cruz County.

Looking Ahead

As we plan for a more connected, sustainable future, this report serves as a tool for informed dialogue and transparent decision-making. Whether or not passenger rail ultimately moves forward, the findings presented in this *Project Concept Report* will guide our region in making the best use of our publicly owned SCBRL rail corridor — and as one that balances transportation, recreation, and environmental goals for generations to come.

Sarah Christensen, P.E., Executive Director

*Santa Cruz County Regional Transportation Commission
October 2025*

Executive Summary

ES-1.0 Introduction

This Santa Cruz County Regional Transportation Commission (SCCRTC) Zero Emission Passenger Rail and Trail (ZEPRT) Project Executive Summary presents a summary of outcomes developed to-date for the proposed implementation of a new daily passenger rail service operating on the SCCRTC-owned Santa Cruz Branch Rail Line (SCBRL) corridor.

The current status of the ZEPRT Project concept development and related background, analysis and related assumptions, findings, and potential next steps — as developed in 2024-2025 through robust coordination and outreach between SCCRTC and other agency and railroad stakeholders, local communities, and the public — are presented in this *Final Project Concept Report* document.

The development of the ZEPRT Project concept reflects the collaborative effort of many individuals and organizations whose contributions were instrumental in advancing the Project. The SCCRTC extends its appreciation to Project consultant HDR Engineering, Inc., with special thanks to Mark McLaren (Project Manager), Chris O’Gara (Deputy Project Manager), Tiffany Mendoza (Project Strategic Communications Lead), and other Project contributors for their technical leadership, analysis, and guidance throughout the Project Concept development process. A special thank you to SCCRTC staff members Riley Gerbrandt (Project Manager), Grace Blakeslee (Project Planning Lead), and Shannon Munz (Communications Specialist) for their tireless efforts.

SCCRTC also acknowledges the valuable input and coordination provided by agency partners and stakeholders on the Project Development Team, including the California Department of Transportation (Caltrans); the Santa Cruz Metropolitan Transit District (METRO); the Transportation Agency for Monterey County (TAMC); University of California-Santa Cruz (UC Santa Cruz); the Cities of Watsonville, Capitola, and Santa Cruz; and Santa Cruz County staff.

Most importantly, the SCCRTC thanks the Santa Cruz County community for its continued engagement and thoughtful feedback throughout the development of the ZEPRT Project concept phase. Residents, community groups, and local businesses of Santa Cruz County who participated in and provided feedback through the ZEPRT Project’s many workshops, open houses, public meetings, and stakeholder briefings helped shape a Project concept that reflects local community values, transportation needs, and a regional vision which supports a more connected and sustainable future.

ES-2.0 ZEPRT Project Background and Overview

The ZEPRT Project concept, launched in 2023, identifies concepts and solutions to better connect populated areas of Santa Cruz County, support diverse transportation needs, provide bicycle and pedestrian linkages, and enhance safe access. The Project concept builds on studies previously completed by SCCRTC — including the *Rail Transit Feasibility Study* in 2015, *Transit Corridor Alternatives Analysis* in 2021, and *Rail Network Integration Study* in 2021 — which identified a locally preferred alternative for Electric



Passenger Rail. The Project name and scope have been changed to allow exploration of other existing and emerging technologies, in addition to electrification, that will also achieve the goal of zero emissions transportation.

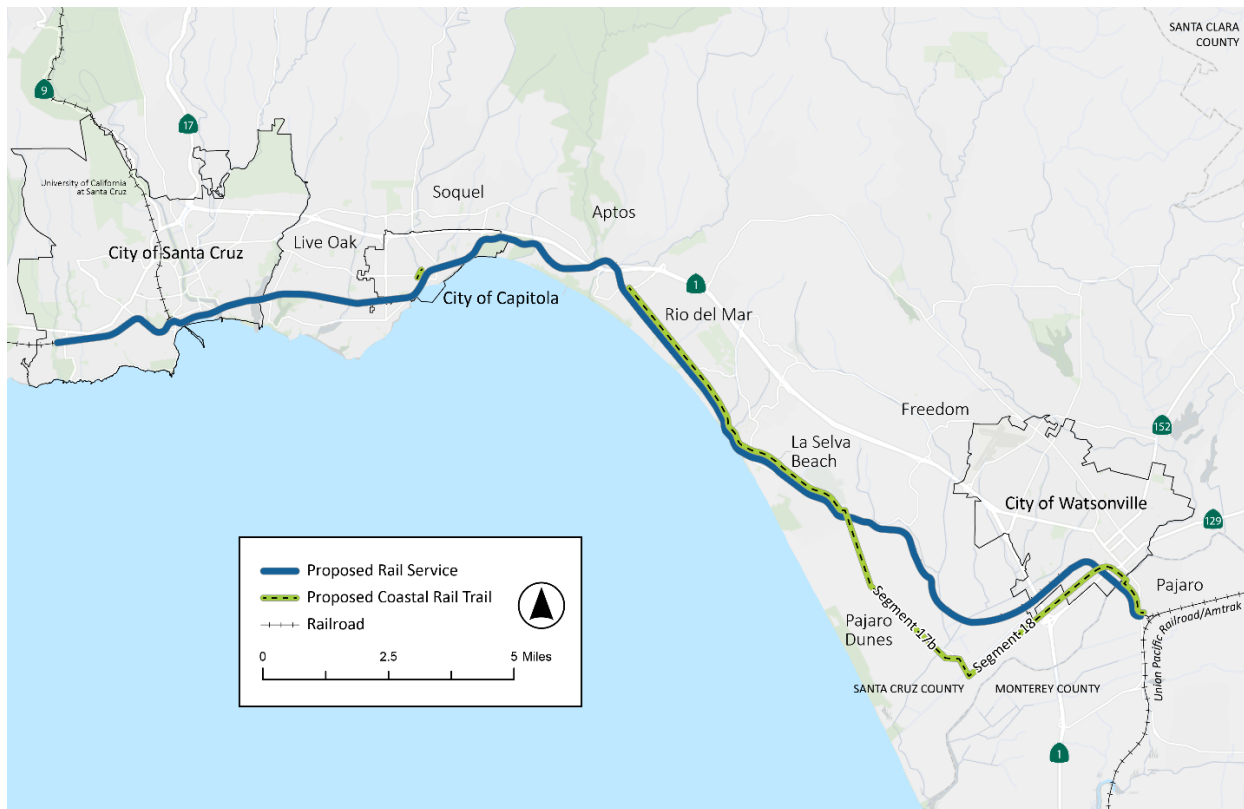
Proposed ZEPRT Project

The ZEPRT Project proposes implementation of new passenger rail service and stations on approximately 22 miles of the SCBRL from Pajaro in the east with the city of Santa Cruz in the west. The Project also proposes to develop 12 miles of the Coastal Rail Trail — Segments 13-20 from Rio Del Mar Boulevard through the community of La Selva Beach and the city of Watsonville — and the Capitola Trestle reach (Segment 11, Phase 2). A map showing the proposed ZEPRT rail and Coastal Rail Trail alignments on the SCBRL and a history of the SCBRL are shown below as Figure 1.

Benefits of the ZEPRT Project include:

- Launching of a high-capacity and environmentally friendly zero-emissions passenger rail service and stations that will reduce local travel times and improve transit system reliability.
- Connecting the most populated areas of Santa Cruz County to the California State Rail Network at Pajaro, as envisioned in the 2024 *California State Rail Plan* and other state and local planning initiatives, to allow for rail connections to the San Francisco Bay Area, Sacramento, Gilroy, and other major population centers within the State of California.
- Improving transit as well as pedestrian and bicycle connections to community activity centers, thus supporting the local economy and providing better access between housing, jobs, and other destinations.
- Providing 12 miles of new multi-use bicycle and pedestrian trail to enhance local bicycle and pedestrian safety and connectivity.
- Catalyzing core connectivity, as the SCBRL passes within one mile of approximately half of Santa Cruz County's population, over 90 parks, 40 schools, and other destinations.
- Reducing vehicle miles traveled, congestion, and greenhouse gas emissions in Santa Cruz County.

Figure ES-2.1 Proposed ZEPRT Rail and Coastal Trail Alignment



Source: HDR

ES-3.0 Public Engagement Approach and Findings

Robust stakeholder engagement and public outreach are critical to understanding the needs, issues, challenges, and opportunities for a transformative transportation project and using them as inputs to support project development. This approach was employed through development of the ZEPRT Project concept, with outreach tactics tailored to each of the Project's four major milestones.

Outreach events and activities conducted from early 2024 to summer 2025 included nine in-person community meetings, four virtual open houses, seven information sessions, virtual and in-person office hours on five days, more than 60 stakeholder meetings, and widespread outreach and notification efforts along the SCBRL corridor and adjacent communities between Santa Cruz and Pajaro. These engagement efforts resulted in more than 500 in-person connections, dozens of touchpoints with key stakeholders, and over 5,000 people reached through virtual events to-date.

The ZEPRT Project has collected over 1,500 comments from community members and hundreds of input points through interactive engagement activities. Key themes from this community feedback include:

- Preference for efficient, reliable, quiet, and fast passenger rail service

- Desire for completion of the trail, and strong interest in ensuring high-quality, continuous, and safe trail facilities
- Desire for improved connectivity to downtowns, employment centers, key community centers and recreation, and the state rail system, as well as the west side of Santa Cruz
- Support for the most efficient, least expensive rail and trail alignments
- Preference for efficient, reliable, and quiet multiple unit passenger rail vehicles
- Requests for transparency on Project costs and benefits
- Concerns related to Project cost estimate, fares, feasibility, funding, environmental impacts, and noise
- Expressed desire for investing in underserved communities, particularly pertaining to affordable, reliable, and safe transportation access, and economic benefits
- Interest in preservation of the SCBRL railroad corridor
- Interest in ridership projections and comparisons to other passenger rail systems

ES-4.0 Conceptual ZEPRT Ridership and Revenue Projections

Modeling was developed for the ZEPRT Project to conceptually identify the number of passengers that would take the passenger train, including estimation of the number of passengers boarding at each proposed station, for a passenger rail service operating on 30-minute headways daily from 6 a.m. to 10 p.m. over the SCBRL between Pajaro and Natural Bridges Drive in Santa Cruz. The analysis balanced the number of riders who would use each station, with the need to optimize operations to reduce end-to-end system total travel time.

Ridership Modeling and Analysis

Analysis was prepared using a combination of the Santa Cruz County Travel Demand Model (SCC Model) and a Direct Ridership Model (DRM), which leveraged both tools to have a regional understanding of travel patterns paired with detailed land use and circulation factors around potential ZEPRT station areas. The SCC Model is a regional travel demand model forecasting travel in Santa Cruz County and to and from adjacent counties, and it considered projected land uses as well as travel characteristics within the county. Use of the DRM complemented the SCC Model by incorporating more detailed location information, such as type and intensity of land uses around stations, parking supply, and levels of bus transit access.

Evaluating ridership relies upon collaboration with local partner agencies to tailor assumptions, accounting for community context and areas of planned growth, and data from multiple sources. Data used as inputs for the ZEPRT ridership modeling was collected from Santa Cruz County, UC Santa Cruz, cities of Watsonville and Santa Cruz, Santa Cruz METRO, and Visit Santa Cruz. The data considerations for the ZEPRT Project ridership projections included:

- **Regional Context:** Capturing inter-county travel
- **Complementary and Competing Modes:** Connecting various mode choices en route
- **Transit Network and Service Plan:** Including active network and plan
- **Weekend and Seasonal Travel:** Understanding travel characteristics on atypical days

- **Non-Commuter Trip Applicability:** Accounting for various trip purposes
- **Station Area Context:** Providing detailed station area network and characteristics
- **Parking Supply and Pricing:** Utilizing parking as a variable influencing travel behavior
- **Transit Focus:** Gearing towards transit and alternative mode trips

Preliminary Ridership and Revenue Projections

While ZEPRT ridership projections will be finalized as the Project advances, preliminary outcomes from the modeling and analysis include the following:

- Typical ridership is approximately 4,200–5,400 riders per weekday for the year 2045.
- Weekend ridership is likely to be slightly lower than weekday ridership but could increase during holiday and vacation periods.
- Ridership assumptions related to future land use changes, such as planned developments in Downtown Watsonville consistent with the adopted *Downtown Watsonville Specific Plan*. Growth associated with other future developments could contribute additional riders. Growth specifically attributable to development consistent with the City of Santa Cruz's *Downtown Plan Expansion* and the City of Watsonville's *Watsonville 2050 General Plan Update*, both of which are not yet adopted, was not included in the baseline ridership projections, but could be incorporated into future ridership forecast revisions.
- Improved overall transportation network improvements, such as walking and biking access to stations, wayfinding, direct bus transit connections, park and ride facilities, that show increases in the upper end of the ridership projection range.

While ZEPRT service revenue projections will be confirmed as the Project advances, preliminary analysis was developed based on general regional context, tourism activity, commute travel patterns, and comparable U.S. transit systems and it identified a potential ZEPRT fare structure for a flat fare and zone-based fare. Annual farebox revenue for ZEPRT for the year 2045 was conceptually estimated at \$5.1 million to \$6.4 million. Additional strategies for generating ZEPRT system revenue were also identified, including advertising at stations and on trains, transit-oriented development, electronic fare collection, and more.

ES-5.0 Potential ZEPRT Stations

The ZEPRT Project has identified nine proposed stations on the SCBRL corridor between Pajaro and Santa Cruz, based on ridership demand and the ability to provide transportation access and multimodal connectivity. The proposed station locations and design features are identified and described below.

Station Locations

Throughout the ZEPRT Project planning process, several station locations were considered, including those advanced from the previous *SCCRTC Transit Corridor Alternatives Analysis*, identified by general community inputs and request for seasonal and beach access. Station locations were then evaluated to determine which would best serve the community and maximize ridership, using projections for each of the identified stations as well as considerations for railroad safety and operations, site access, transit

connectivity, community connectivity and equity, engineering and environmental feasibility, and existing and known future adjacent land use.

Nine potential station locations have been identified for ZEPRT — from east to west — as follows:

- Pajaro
- Downtown Watsonville
- Aptos
- Cabrillo
- Capitola
- 17th Avenue
- Seabright
- Beach Street / Downtown
- Natural Bridges Drive

Figure ES-5.1 Proposed Project Alignments with Station Locations for Initial Service



Source: HDR

Potential Design Concept and Features

The design, layout, and amenities at each ZEPRT station would vary based on the location and the way riders access the station. The following elements were also considered during preliminary station concept development for the ZEPRT Project:

- User-centered design concept to represent the community and its people through the following design pillars:
 - Physical environment, community culture, and demographics
 - Cohesive systemwide identity with community pride, safety, and usability
 - User needs that support the journey from origin to destination
- Security and safety
- Passenger experience
- Connectivity and multimodal travel (i.e., bicycle, bus, etc.)
- Navigation and wayfinding
- Future climate sustainability conditions
- Maintainability

It is anticipated that design elements, basic features, and level-boarding platforms will be consistent across stations; however, the following layout and additional features may vary:

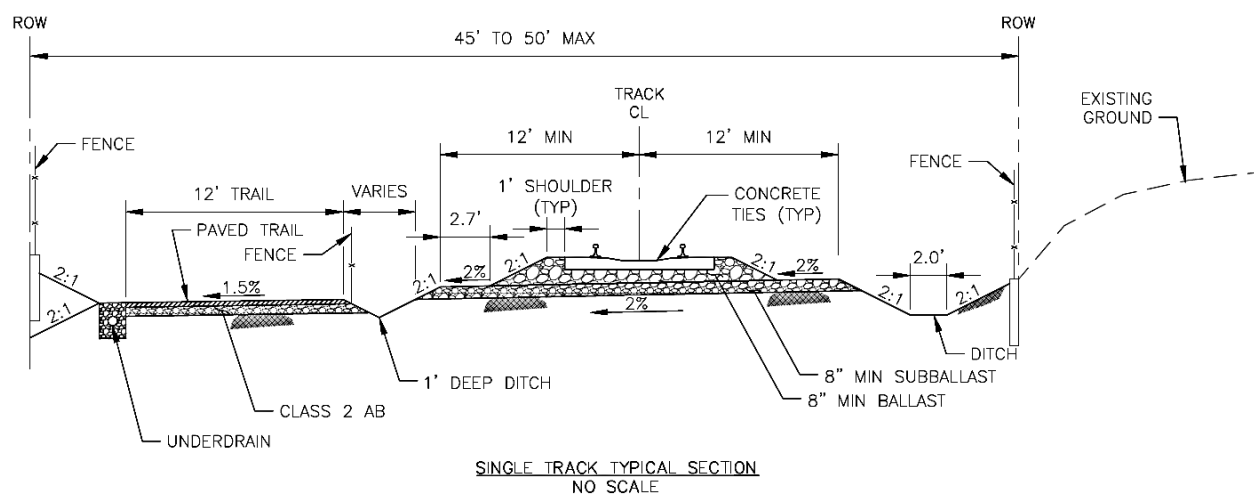
- Parking
- Kiss-and-Ride
- Bicycle Parking
- Multimodal Connectivity (including with other transit modes and Coastal Rail Trail)
- Platform Shelter
- Seating
- Ticket Vending
- Wayfinding and Public Information

Station locations and conceptual layouts will be confirmed as the ZEPRT Project advances.

ES-6.0 Proposed Conceptual Rail and Trail Alignment

A key activity for the ZEPRT Project is to conceptually identify proposed rail and Coastal Rail Trail alignments that can be accommodated within the SCBRL corridor right-of-way between Pajaro and Santa Cruz. The proposed alignments, including for the SCBRL corridor typical section below, take into consideration a robust iterative process consisting of conceptual level engineering design, technical analysis, assessment of potential constraints and impacts, and extensive community and stakeholder engagement.

Figure ES-6.1 Preferred Width Typical Section for Rail and Trail



Source: HDR

The initial conceptual rail and trail alignments presented for the ZEPRT Project in 2024 were designed to fit in the existing SCBRL corridor, where feasible, while accommodating both the rail and trail infrastructure, and also optimizing ZEPRT operations to enhance safety and multimodal connectivity and allow for passenger train speeds that would reduce end-to-end travel time and provide for a competitive transit service across Santa Cruz County.

Subsequent refinements to the proposed ZEPRT rail and trail alignments during Project development have accounted for the following:

- Areas where the SCBRL rail line alignment is currently situated within a roadway (i.e., Walker Street in Watsonville and Beach Street in Santa Cruz).
- Areas of constrained right-of-way on the SCBRL where the rail and trail alignments may not both fit owing to the need to meet regulatory guidance, standards, and requirements of the Federal Railroad Administration (FRA) and California Public Utilities Commission (CPUC) related to clearances for rail operations and for separation between rail and trail facilities.
- Consideration for trail segments within the SCBRL that have already been constructed or are currently in design.

The rail and trail alignments will be further refined as the ZEPRT Project advances.

ES-7.0 Conceptual ZEPRT Network and Operating Plan

Operations planning is an iterative process supported by an understanding of safety, ridership demand, engineering feasibility, and community benefits and impacts, as well as industry experience and best practices. All of this is necessary to support safe, efficient, and reliable passenger rail service with the rail network and operating schedule that matches service demand and is competitive with other modes of transport. This approach has been employed during the development of the ZEPRT Project.

Operations Modeling and Analysis Assumptions

A model of the SCBRL between Pajaro and Natural Bridges Drive in Santa Cruz was developed in Rail Traffic Controller™ software to simulate operations of the ZEPRT on 30-minute headways over the proposed rail alignment (daily between 6 a.m. and 10 p.m.) and at the nine potential stations developed during the conceptual level engineering design completed for the Project to date. Outputs from the model were used to determine approximate end-to-end travel times, support the conceptual ridership forecast for a time-competitive service, confirm passenger rail vehicle and fleet requirements, and to validate the location of potential sidings for meet-pass events between passenger trains.

Operations analysis developed to date assumes that existing or potential future freight rail operations by St. Paul and Pacific Railroad (SPP), the current operator of and common carrier for the SCBRL, or the Santa Cruz, Big Trees and Pacific Railway (SCBG), which currently operates freight on the SCBRL for SPP as a sub-contractor, would be temporally separated from passenger operations and would be conducted during periods when ZEPRT passenger trains are not operated. Interface between the ZEPRT service and the SCBG's existing seasonal Felton-Santa Cruz Beach Train passenger excursions over approximately one mile of the SCBRL between the west end of the Santa Cruz Wye and Beach Boardwalk in Santa Cruz will be further evaluated as the ZEPRT Project advances. A proposed future intercity passenger service from the San Francisco Bay Area to Santa Cruz was envisioned in the 2024 *California State Rail Plan*, which would interline on the SCBRL between Pajaro and Santa Cruz. This service may be studied in a future phase of the federal Corridor Identification and Development Program (Corridor ID) by the State of California as part of a broader Central Coast passenger rail expansion initiative. This interface will be tracked and confirmed as the ZEPRT Project advances.

Travel Time

Initial operations modeling conceptually identified end-to-end travel time for a daily passenger ZEPRT rail service operating on 30-minute headways over the 22-mile SCBRL corridor between Pajaro Station and Natural Bridges Drive (Santa Cruz) Station. End-to-end travel times for operation over the single-track network including up to five meet-pass events between passenger trains at sidings as well as stops at seven intermediate stations en route can range from approximately 45 to 70 minutes in each direction, based on the outputs of the initial operations modeling. This travel time is affected by the ZEPRT rail alignment (including track geometry in and on approach to curves which is a determining factor for maximum operating speeds) and the number and locations of proposed network infrastructure improvements, including stations and sidings that accommodate meet-pass events between trains. End-

to-end ZEPRT travel time will be confirmed through additional engineering and rail operations analysis and stakeholder coordination as the Project advances. Ultimately, a confirmed end-to-end ZEPRT travel time will be influenced by and fully dependent upon the characteristics of the ZEPRT rail alignment and adjacent trail alignment; locations of sidings, terminal tracks, and stations; passenger vehicle operating characteristics; safety and multimodal interface at highway-rail grade crossings and at locations where the SCBRL interfaces with roadway alignments; adjacent land use; and other considerations. and other considerations.

Passenger Rail Vehicles

Based on recent rail transit industry experience, characteristics of the SCBRL corridor and proposed rail alignment, assessment of existing and emerging equipment options and technologies for implementation in the U.S. market, consideration of ridership potential in Santa Cruz County, and ongoing stakeholder and public outreach, it was determined that modern, multiple-unit, zero-emission trainsets that meet FRA safety and performance requirements would be the most compatible for the ZEPRT service. While a specific vehicle model will be confirmed as the ZEPRT Project advances, the Stadler FLIRT trainset with two passenger cars permanently coupled to a power car has been selected for preliminary study purposes. This is pictured below and was recently implemented on the San Bernardino County Transportation Authority (SBCTA) / Metrolink Arrow service between San Bernardino and Redlands, California.

Figure ES-7.1 San Bernardino County Transportation Authority Stadler FLIRT Vehicle



Source: SCCRTC

Features of this trainset include:

- Capacity for approximately 116 seated passengers plus 12 folding seats and 120 standing passengers
- Interoperability with commuter rail and freight railroad operations
- Multiple propulsion options (i.e., battery, hydrogen, diesel, and hybrid)
- Quiet operation with hydrogen or battery propulsion
- Level boarding and fully Americans with Disabilities Act (ADA) compliant to accommodate multiple mobility device types and bicycles
- Variety of interior amenity possibilities for comfort and convenience

Conceptual operations planning identified a potential fleet size of seven trainsets to accommodate regularly scheduled ZEPRT services (note that it is possible to couple and operate two of these trainsets together to create a longer, four-car variation) and spares required during periods of maintenance. Fleet requirements will be confirmed as the ZEPRT Project advances.

Layover and Maintenance Facility

A facility where ZEPRT trainsets can be stored during periods of non-operation and where routine cleaning, inspection, refueling/recharging, and maintenance would occur on service tracks and in a shop is anticipated for development in the Watsonville area. The site location along the SCBRL corridor and specific configuration and requirements for the facility will be confirmed as the ZEPRT Project advances.

Figure ES-7.2 Sonoma-Marín Area Rail Transit Maintenance Facility



Source: SCCRTC

Network Infrastructure

The process to conceptually identify network infrastructure required to support the ZEPRT service on the SCBRL, and as identified in this *Project Concept Report*, was iterative and included a conceptual engineering assessment and rail corridor safety assessment focused largely on bridges, rail and track structure, and highway-rail and pedestrian-rail grade crossings on the Pajaro-Santa Cruz corridor and conceptual operations planning activities.

The conceptual engineering activity included general field observations and a conceptual evaluation of railroad network infrastructure, and bridge inspections and rating assessments were completed between Santa Cruz and Pajaro. A total of 28 out of 33 existing bridge structures were recommended for full replacement due to condition or capacity deficiencies, functionality needs, and/or maintenance and operation considerations. The ZEPRT Project preliminarily recommends conceptual bridge types and layouts for each bridge to be replaced and replacement/rehabilitation strategies. In most situations, separate parallel rail and trail bridges in the SCBRL corridor are supported on separate substructures. However, in constrained segments, conceptual bridge designs may include combined bridge substructures or bridge connections parallel to, but outside, of the SCBRL rail corridor.

The conceptual operations planning activity included operations modeling of ZEPRT and was designed to support a passenger rail service through network infrastructure and capacity improvements on the SCBRL between Pajaro and Santa Cruz that would include the following:

- Rehabilitated or new rail and track structure (on the main track, existing and new sidings, and connections to other railroads).
- Rehabilitated or new bridges and other drainage and retaining wall structures.
- New wayside signal system and Positive Train Control overlay to control train movements and an additional measure of operational safety.
- Rehabilitated or new active warning devices, surfaces, and interface at public highway-rail and pedestrian-rail grade crossings.
- New passenger stations and platforms.

Network infrastructure required for the ZEPRT service and related details by infrastructure type and location will be confirmed as the Project advances.

ES-8.0 Initial Environmental Screening

The ZEPRT Project concept includes an initial environmental screening to identify potential constraints and considerations that may impact planning, design, permitting, construction, and implementation of the ZEPRT Project. This high-level analysis reviewed known sensitive environmental resources along the SCBRL and ZEPRT Project corridor between Pajaro and Santa Cruz, including the habitat for several threatened and endangered species, wetlands, riparian areas, cultural resources, hazardous materials sites, and areas likely subject to flooding or coastal erosion. The ZEPRT Project alignment is adjacent to a number of protected lands, including the Harkins Slough unit of the Watsonville Slough Ecological Reserve, Watsonville Slough Farms, Gallighan Slough, the Long-Toed Salamander Ecological Reserve, and is adjacent to others. The Project alignment is directly adjacent to many parks, including Manresa State Beach, La Selva Beach, Aptos Village Park, New Brighton Beach State Park, Twin Lakes State Beach, and Neary Lagoon among others. The screening also assessed land use compatibility; proximity to disadvantaged communities; and potential for noise, vibration, and visual impacts associated with passenger rail and trail operations on the SCBRL.

Preliminary findings indicate that while there are localized constraints — particularly at bridge crossings, urban infill locations, and along segments of the SCBRL corridor in or adjacent to sloughs and coastal areas and sensitive ecological areas — many impacts are likely to be reduced through ZEPRT Project design refinement, early coordination with applicable regulatory agencies (e.g., California Coastal Commission, U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, California Department of Fish and Wildlife, Central Coast Regional Water Quality Control Board, etc.) and avoidance, minimization and mitigation measures. The environmental screening results will inform the scope of required future California Environmental Quality Act (CEQA)/National Environmental Policy Act (NEPA) documentation and associated consultations and help prioritize areas for early study. It is anticipated that a project-level environmental document will be prepared as the next step in ZEPRT Project development, which will be supported by the planning and design outcomes of the ZEPRT Project, targeted technical studies, stakeholder consultation, and agency and public review and input.

ES-9.0 Initial Conceptual ZEPRT Project Cost

An industry standard methodology and tools were leveraged to develop an initial opinion of probable conceptual capital cost and baseline annual operations and maintenance cost for the ZEPRT service. While these costs will be refined and finalized as the ZEPRT Project advances, preliminary conceptual estimates and the assumptions for their development are presented below.

Capital Cost Assumptions and Estimate

The preliminary cost estimate to design, construct, and implement ZEPRT service between Santa Cruz and Pajaro was based on conceptual level engineering design developed for the Project to date, with contingency applied. It includes all network and infrastructure elements (i.e., track and track structure, bridges, wayside signal system, grade crossing signals, stations, layover and maintenance facility, vehicle procurement, etc.). While at-grade and elevated ZEPRT alignments were considered on the segment of the SCBRL corridor along Beach Street and the Beach Boardwalk, the cost estimate assumed an at-grade alignment for ZEPRT over the length of the SCBRL corridor between Pajaro and Santa Cruz. The Beach Street area of the project requires additional refinement and coordination with stakeholders, including the Seaside Company, SCBG, and other beach area stakeholders, to address pedestrian access and local roadway network changes, the cost of which is not included in the ZEPRT project cost estimate.

Capital costs were estimated using an Average Unit Bid Cost Estimate, which uses unit price data collected over a broad range of relevant local, regional, and national projects, and applies the weighted average unit price to develop a rough order of magnitude cost. The cost estimate, calculated using the FRA Standard Cost Category Workbook, is presented below in 2025 dollars.

The estimated cost includes certain grading and construction costs for segments of the Coastal Rail Trail where the trail is within the SCBRL corridor right-of-way but excludes costs for major trail bridges and structures and costs for the construction of the trail where it is located outside of the SCBRL right-of-way.

The estimated cost also includes a contingency line item typical of a project at the early phases of design. The contingency is intended to account for the risks associated with the environmental process and final design, as well as changes that may occur to the Project as development advances. As these subsequent phases advance, contingency is a tool for the agency to account for changes that increase cost as needed, or to reduce overall project costs if risks are retired without additional costs.

Table ES-1 Preliminary Opinion of Probable Conceptual Capital Cost (2025 Dollars)

Cost Category	Estimated Cost (Millions)
Guideway & Track Elements	\$729.3
Stations	\$80.3
Support Facilities	\$253.6
Sitework & Special Conditions	\$740.2
Systems	\$152.5
Construction Subtotal	\$1,955.9
Right-of-Way, Land & Other Improvements	\$215.7
Vehicles	\$145.4
Professional Services	\$684.6
Subtotal	\$1,045.6
Contingency	\$1,283.3
Total Project Cost	\$4,284.8

Operating Cost Assumptions and Estimate

The preliminary rough order-of-magnitude (ROM) cost estimate presented below to operate and maintain the ZEPRT service between Santa Cruz and Pajaro on 30-minute headways with 45 minutes of end-to-end runtime (6 a.m. to 10 p.m. daily) was based on transit industry averages for peer U.S. operations in the Federal Transit Administration (FTA) National Transit Database and conceptual level engineering design and operations planning developed for the Project to date. It includes all operations and maintenance elements (i.e., infrastructure maintenance, vehicle operations and maintenance, labor, general administration, etc.) and is presented in 2025 dollars. While this estimate includes routine infrastructure maintenance, it excludes major maintenance or rehabilitation of structures.

The average estimated annual operating expense is \$34 million. However, annual operating expenses may be higher due to the historical experience of Santa Cruz METRO labor agreements and the uncertainty around hydrogen-fueled train operations, a technology which is undergoing rapid development and change. To account for these variables, a contingency of +20 percent has been applied to the average estimated annual operating expense. A conceptual range of annual operating expenses in 2025 dollars is shown in Table 2 below.

Table ES-2 Average ROM Estimate for Annual Operating Expenses (2025 Dollars)

ZEPRT Operating Headway	Average Annual Operating Expense Without Contingency	Average Annual Operating Expense Including Contingency
30 Minutes	\$34 Million	\$41 Million

ES-10.0 Potential ZEPRT Project Next Steps

Potential next steps that SCCRTC and stakeholders can consider for strategic advancement of the ZEPRT Project in the short-term horizon include the following:

- **Complete the *Project Concept Report* for the Current Phase of the ZEPRT Project:** SCCRTC will complete and document the key understandings and outcomes of the analysis, study, and outreach conducted for the current phase of the ZEPRT Project in this *Project Concept Report* and use that to inform and progress future project activities and phases. With the SCCRTC Commission's approval, and subject to available funding, the ZEPRT Project would continue to advance preliminary engineering and environmental review.
- **Perpetuate Broad Stakeholder Engagement and Coordination to Catalyze Consensus and Maintain Momentum for the ZEPRT Project:** Leverage momentum by cooperatively identifying and defining needs, issues, challenges, and opportunities related to ZEPRT passenger rail implementation between Pajaro and Santa Cruz and to collect further inputs to define next steps and confirm scope and schedule for the Project. Key stakeholders include state agencies such as California Department of Transportation (Caltrans), California State Transportation Agency (CalSTA), California Coastal Commission (CCC), and CPUC; local agencies such as Santa Cruz METRO, Transportation Agency for Monterey County (TAMC), and other local jurisdictions (e.g., cities of Watsonville, Capitola, and Santa Cruz); local universities and colleges (e.g., UC Santa Cruz and Cabrillo College); railroads that operate in or connect to the SCBRL (i.e., SPP, SCBG [operator of Beach Train excursions], and Union Pacific Railroad); adjacent landowners; significant employment centers; local communities and the public in Santa Cruz County and Pajaro in Monterey County.
- **Confirm End-to-End Travel Time and Network Infrastructure Required to Support a Reliable and Competitive Transportation Option:** Initial operations modeling conceptually identified end-to-end travel time for a daily passenger ZEPRT rail service operating on 30-minute headways over the 22-mile SCBRL corridor between Pajaro Station and Natural Bridges Drive (Santa Cruz) Station. End-to-end travel times for operation over the single-track network including meet-pass events between passenger trains at sidings and stops at seven intermediate stations enroute can range from approximately 45 to 70 minutes in each direction, based on the outputs of the initial operations modeling. This travel time is affected by the ZEPRT rail alignment (including track geometry in and on approach to curves) and the number and locations of proposed network infrastructure improvements, including sidings that accommodate meet-pass events between trains and stations. An important next step is to confirm end-to-end ZEPRT travel time through additional engineering and rail operations analysis and stakeholder coordination — and the network infrastructure required to support a reliable and competitive transportation option — as the Project advances.
- **Develop an Optimized Travel Demand Forecast Benefitting from Opportunities for Transit-Oriented Development and Intensifications of Uses Along the Corridor:** An optimized ZEPRT ridership scenario would involve updating the Santa Cruz County Model and Direct Ridership Model to account for high level land use changes necessary for desired transit-oriented development (TOD) results. The model results would be iteratively refined to achieve maximum ridership outcomes and other project benefits like greenhouse gas emissions reduction and new

housing. This new ridership scenario would be focused on achieving higher ridership levels that could incorporate potential land use and surface transit/bike/pedestrian service changes around ZEPRT stations, maximizing TOD, implementing park-and-ride facilities, reconfiguring Santa Cruz METRO feeder routes, and improving bicycle and pedestrian infrastructure around stations.

- **Develop a Detailed Alternative for Meeting Long-Term Objectives of Stakeholders in the Beach Flats Area of the City of Santa Cruz:** The SCBRL alignment running along Beach Street from the San Lorenzo River to the traffic roundabout at Pacific Avenue carries significant complexities due to overlapping issues: rail alternatives, visitor-serving uses, parking, circulation, and coastal constraints. Alternatives for the alignment along Beach Street identified in the *Project Concept Report* will require further study to resolve land use, circulation, and regulatory trade-offs along this corridor. Additional study and stakeholder coordination in the environmental phase will mitigate the risk of potential prolonged disputes, permitting delays, and funding challenges. As part of the environmental review process, SCCRTC can work with local stakeholders to conduct a focused study of the corridor and traffic circulation network to evaluate land use, safety, transportation, and operational considerations. The study will consolidate critical issues such as pedestrian and vehicular circulation, emergency access to the Boardwalk, the Boardwalk's operations and functionality, long-term recreational access, parking requirements, the location of the ZEPRT station, and the future modifications of the recreational Beach Train operations into a coordinated framework, providing clarity on benefits and trade-offs. This framework will help guide the selection of a preferred alignment that is consistent with the community and City of Santa Cruz's vision for the future of the Beach Flats area and that builds stakeholder consensus.
- **Continue Coordination with Stakeholders in the Walker Street and Downtown Areas of Watsonville:** The existing SCBRL is located within Walker Street and roadway and railway traffic comingle through parts of Watsonville. This alignment presents constraints related to vehicle movement, intersection conflicts, limited right-of-way to accommodate street, rail, and bicycle and pedestrian use, and challenges with providing for sufficient tangent track to support a new platform at the historic Downtown Watsonville Depot location. Various alternatives were considered preliminarily for the conceptual ZEPRT rail and trail alignment through Walker Street and Downtown Watsonville. A final rail alignment that meets the objectives of the ZEPRT Project will be defined through future analysis and stakeholder coordination as the ZEPRT Project advances.
- **Begin Early Environmental Activities to Advance Towards National Environmental Policy Act (NEPA) / California Environmental Quality Act (CEQA) Process:** Early coordination with the federal lead agency on appropriate level of NEPA documentation for the ZEPRT Project will be critical. As design refinements continue to be made, environmental input will be considered. The design team will look for engineering/design solutions to avoid highly sensitive resources. Identification of the proposed project (including options) for analysis in the environmental document, and the reasons for rejecting an alternative or options, will be clearly defined.
- **Continue Resiliency Planning for Both Rail and Trail Along the SCBRL:** SCCRTC was awarded a Caltrans Sustainable Transportation Planning Grant to develop a plan for climate resilience of the ZEPRT corridor. Technical analysis of existing conditions and climate hazards will inform project concepts at the four most vulnerable locations along the ZEPRT corridor: Pajaro River Rail Bridge,



Harkins Slough Rail Crossing, La Selva/Manresa bluffs, and Capitola bluffs. The project concepts will be developed for short-term (2030), medium-term (2050) and long-term (2100) climate projections that consider protection, accommodation, and/or retreat strategies from climate hazards at these vulnerable locations.

- **Identify Potential Federal, State, and Local Funding Sources and Other Options for Phased Advancement of ZEPRT Project that Aligns with Federal, State, and Local Priorities and Programs:** The phasing of the ZEPRT Project could be advanced to meet both local demand for passenger and freight rail services while also maximizing public benefits and funding competitiveness by aligning with federal and state visions for intercity and regional passenger rail inclusive of the ZEPRT corridor as identified in the 2024 *California State Rail Plan* and in the federal Corridor Identification and Development (Corridor ID) program launched in 2024. Given the substantial capital investment required for full-service implementation, the ZEPRT Project may be advanced through a series of prioritized, high-value investments, each representing an individual project or a set of interoperable improvements with independent utility. Collectively, these projects would build toward the full system vision by improving infrastructure and capacity along the SCBRL.

1.0 Introduction

This Final *Project Concept Report* of the Santa Cruz County Regional Transportation Commission (SCCRTC) Zero Emission Passenger Rail and Trail (ZEPRT) Project (the Project) presents conceptual planning and design and outcomes developed for the proposed implementation of a new daily passenger rail service and an adjacent multi-use trail facility operating on the SCCRTC-owned Santa Cruz Branch Rail Line (SCBRL) corridor between Pajaro and Santa Cruz, California.

The current phase of ZEPRT Project development and related background, analysis and related assumptions, findings, and potential next steps — as developed in 2024-2025 through robust coordination and outreach between SCCRTC and other agency and railroad stakeholders, local communities, and the public — are identified and described in this document.

The Project concept presented in this document also supports momentum for the development of the ZEPRT service on the SCBRL between Pajaro and Santa Cruz, and a foundation from which to support future planning, design, and environmental activities for the project. The scope of the final ZEPRT alignment and related infrastructure improvements, operating and equipment plans, and project schedule and strategies for funding project development in a phased manner will be confirmed during future development of the ZEPRT Project.

2.0 Project Background and Description

2.1 Project Description

The ZEPRT Project being advanced by SCCRTC proposes a new high-capacity zero emissions passenger rail service on approximately 22 miles of the SCBRL, extending from Pajaro (in Monterey County) just south of the City of Watsonville (in Santa Cruz County) to the west side of the City of Santa Cruz (in Santa Cruz County) in the north. The Project also proposes 12 miles of Coastal Rail Trail Segments 13-20 (as envisioned in the *Monterey Bay Sanctuary Scenic Trail Network Master Plan*) primarily within the SCBRL right-of-way from Pajaro through Watsonville and La Selva Beach to Rio Del Mar Boulevard in Aptos. It also includes the Capitola Trestle portion of Coastal Trail Segment 11 in Capitola.

The new zero emissions passenger rail service will take advantage of a publicly owned rail right-of-way to provide all-day service connecting the most populated areas of Santa Cruz County to each other and to the greater region. At Pajaro, existing Amtrak and planned expanded regional service to the north and south will provide a seamless intercity travel option for riders on the Central Coast. The dedicated right-of-way will bypass highly congested State Route 1 and local arterials and reconnect cities and communities. The Project will also link the SCBRL to the California State Rail Network and San Jose Diridon Station — where connections can be made to Caltrain and Altamont Corridor Express commuter trains and Capitol Corridor intercity passenger trains — via the Highway 17 Express (an Amtrak Thruway bus service), which is included in the *California State Rail Plan*.

The new trail segments will nearly complete the 32-mile Coastal Rail Trail, which provides a dedicated bicycle/pedestrian travel facility and is a part of the California Coastal Trail, by developing 12 miles of the trail that are not yet constructed or under development. The Coastal Rail Trail will also serve the future passenger rail stations on the SCBRL.

Benefits of the ZEPRT Project include:

- Launching of a high-capacity and environmentally friendly zero-emissions passenger rail service and stations that will reduce local travel times and improve transit system reliability.
- Connecting the most populated areas of Santa Cruz County to the California State Rail Network at Pajaro, as envisioned in the 2024 *California State Rail Plan* and other state and local planning initiatives, to allow for rail connections to the San Francisco Bay Area, Sacramento, Gilroy, and other major population centers within the State of California.
- Improving transit as well as pedestrian and bicycle connections to community activity centers, thus supporting the local economy and providing better access between housing, jobs, and other destinations.
- Providing 12 miles of new multi-use bicycle and pedestrian trail to enhance local bicycle and pedestrian safety and connectivity.
- Catalyzing core connectivity, as the SCBRL passes within one mile of approximately half of Santa Cruz County's population, over 90 parks, 40 schools, and other destinations.
- Reducing vehicle miles traveled, congestion, and greenhouse gas emissions in Santa Cruz County.

2.2 ZEPRT Project Study Area

The SCBRL is a continuous linear transportation corridor that spans approximately 32 miles of Santa Cruz County's coast from Pajaro (Watsonville Junction) in Monterey County and Watsonville in South County to Santa Cruz and Davenport on the north coast. The Project rail corridor study area specifically consists of approximately 22 miles of the SCBRL between Pajaro and Natural Bridges Drive on the west side of Santa Cruz. A map of the study area is shown in Figure 2.1 below.

Figure 2.1 ZEPRT Project Rail and Trail Corridor Study Area Map



Source: HDR

2.3 SCBRL Corridor History and Uses

The earliest antecedent of the SCBRL came into existence scarcely a generation after 1849 California statehood. The approximately 21-mile Pajaro-Watsonville-Aptos-Capitola-Santa Cruz rail line through Santa Cruz County was started in 1873 and completed by the Santa Cruz Railroad in 1876.¹ The narrow-gauge railroad connected to the standard-gauge Southern Pacific Railroad (SP) at Pajaro (known also as Watsonville Junction by the railroads). SP connected to the western end of the first Transcontinental Railroad in Oakland, providing a vital transportation link to the nation. The Santa Cruz Railroad was purchased by SP in 1881, converted to standard-gauge in 1883, operated by SP under subsidiary Pajaro

¹ Whaley, Derek R.: Santa Cruz Trains: Railroads of the Santa Cruz Mountains, 2017

and Santa Cruz Railroad starting in 1884, formally merged into SP in 1888, and extended approximately 11 miles from Santa Cruz west to Davenport in 1905.^{2,3}

The SCBRL has primarily served freight operations since its inception. Freight trains on the line from Santa Cruz County have hauled out agricultural products, timber, lumber, cement, and aggregates. Freight trains into Santa Cruz County have also brought coal, lumber, building materials, and other commodities. The 2009 closure of a cement plant located in Davenport at the end of the rail line reduced freight tonnage on the rail line by over 90%. Currently, freight service is operating in the Pajaro/Watsonville area and consists of lumber, fuels, building materials, food products, and agricultural products. And locally, the potential demand for freight rail services on other segments of the SCBRL has also been identified, as has been the ability of the SCBRL and related freight operations to aid in future emergency response to natural disasters in Santa Cruz County. At the state level, California identified in the 2024 *California State Rail Plan* the critical importance that freight railroads play in the role of safe and efficient goods movement and economic competitiveness and highlighted related freight-focused state funding programs that target safety, capacity, mobility, and resiliency on freight-only and shared-use freight and passenger corridors (like the SCBRL).

There has also previously been passenger service on the SCBRL. Regularly scheduled passenger service was discontinued in 1938, yet seasonal Sun Tan Special trains operated from San Francisco, Oakland, and San Jose around the Santa Cruz Mountains via Pajaro and on the SCBRL to Santa Cruz until 1959.^{4,5} SP operated regular daily passenger service from San Jose to Santa Cruz via Los Gatos and Felton over the Santa Cruz Mountains on another rail line roughly parallel to the current State Route 17 corridor (not a part of the SCBRL) until 1940.⁶ Travelers between Santa Cruz and San Jose availed themselves of bus service or the automobile after that date. The Santa Cruz, Big Trees and Pacific Railway (SCBG) has operated a passenger excursion train over a segment of this line between Felton in the San Lorenzo Valley and the Santa Cruz Wye and thence over a short segment of the SCBRL to the Beach Boardwalk since 1985.⁷

California and Santa Cruz County voters approved Proposition 116 in 1990 to expand passenger rail transportation, making funding available to buy the rail line. SCCRTC worked with then-owner SP in the early 1990s to explore the possibility of purchasing the approximately 32-mile-long rail line between Pajaro, Santa Cruz, and Davenport, or a portion thereof, to institute passenger rail service. Before the appraisals and analysis were completed, in 1996, SP was acquired by Union Pacific Railroad (UP). The Major Transportation Investment Study (MTIS) for the Watsonville to Santa Cruz Corridor was completed in 1998. Based on the results of the MTIS, SCCRTC selected a program of projects for the corridor which included acquisition of the SCBRL for future transportation purposes, including passenger and freight rail as well as a bicycle and pedestrian path (the Coastal Rail Trail).

SCCRTC began negotiations with UP in 2001 to acquire the SCBRL as a community asset and for a broader range of transportation uses. Senate Bill 465 was approved by the state legislature in 2001 giving SCCRTC

² McCaleb, Charles S.: "The Santa Cruz Railroad," *The Western Railroader*, 1975

³ Whaley, Derek R.: *Santa Cruz Trains: Railroads of the Santa Cruz Mountains*, 2017

⁴ Whaley, Derek R.: *Santa Cruz Trains: Railroads of the Santa Cruz Mountains*, 2017

⁵ McCaleb, Charles S.: "The Santa Cruz Railroad," *The Western Railroader*, 1975

⁶ Whaley, Derek R.: *Santa Cruz Trains: Railroads of the Santa Cruz Mountains*, 2017

⁷ Ibid.

the authority necessary to develop transportation projects on the SCBRL. The SCCRTC unanimously approved a letter of intent with UP to purchase the rail line right-of-way in 2004. The SCCRTC voted unanimously to enter into a purchase and sale agreement with UP for the SCBRL in 2010 that included commitments to continue freight service and initiate recreational passenger rail service. The California Transportation Commission (CTC) approved acquisition of the SCBRL for public ownership in 2011, and on October 12, 2012, the SCCRTC successfully completed the acquisition, thereby transferring ownership of the SCBRL between railroad Milepost 0.43 at Pajaro (connection with the UP Watsonville Junction Yard and UP Coast Subdivision near the Salinas Road grade crossing) and Milepost 31.390 at Davenport (including the intermediate Santa Cruz Wye in Santa Cruz) from the private sector to the people of Santa Cruz County. When the SCCRTC completed acquisition of the SCBRL, UP retained a freight easement, which was transferred to successor freight rail operators that have been designated as a common carrier by the U.S. Surface Transportation Board (STB).

SCCRTC holds an administrative, coordination, and license agreement with an operator for freight and recreational passenger rail service. SCCRTC first selected Iowa Pacific Holdings (IPH) and its Santa Cruz & Monterey Bay Railway (SC&MB) as the designated operator in 2012. SC&MB operated freight and recreational passenger service between Pajaro and Santa Cruz. SCCRTC later selected Minnesota-based Progressive Rail as the designated operator for the SCBRL in 2018. The Surface Transportation Board (STB) then designated St. Paul & Pacific Railroad (SPP), a short line subsidiary of Progressive Rail, as the common carrier for the SCBRL. SPP initially provided freight service directly, and it retains common carrier status on the SCBRL. Since 2021, the local SCBG has been providing day-to-day service on the SCBRL in Pajaro and Watsonville under an agreement with Progressive Rail. The balance of the SCBRL between Watsonville, Santa Cruz, and Davenport does not currently host freight and passenger rail operations, save for a short segment between the north end of the Santa Cruz Wye and the Boardwalk in Santa Cruz used by the SCBG seasonal Santa Cruz Beach Trains to and from Felton through a trackage rights agreement that was initially established with SP and has been transferred to SPP.

Prior to the 2023 commencement of this ZEPRT Project phase, SCCRTC engaged in planning projects that studied the feasibility for adaptive reuse of the SCBRL as an alternative transportation corridor and contemplated various rail and trail initiatives on and adjacent to the SCBRL.

2.4 Summary of Outcomes from Past Studies of the SCBRL Corridor

Since the acquisition of the SCBRL right-of-way in 2012, SCCRTC and other state and local agencies have conducted studies that contemplated the development of a passenger rail transit service and trail within or adjacent to the SCBRL right-of-way. A high-level summary of outcomes from these studies — which also provide an important basis for development of the current SCCRTC ZEPRT Project — are presented below.

2.4.1 Passenger Rail Transit Feasibility Study (2015)

SCCRTC completed the *Rail Transit Feasibility Study* (RTFS) in 2015 to analyze potential rail transit service scenarios on the rail right-of-way between the west side of Santa Cruz and Watsonville and to identify potential station locations that could serve Santa Cruz County. The study included a detailed analysis of the SCBRL and discussed how different rail transit service options could improve mobility and accessibility for

communities along the corridor. Input was solicited from the public and other stakeholders on the goals, objectives, and performance measures following a triple bottom line framework of economy, equity, and the environment. Data on potential ridership, capital and operation/maintenance costs, travel times and other performance measures were used to evaluate the various service scenarios.

The RTFS laid groundwork for future planning and analysis pertaining to the identification, evaluation, and comparison of high-capacity public transit service options. Key outcomes from the RTFS included:

- The approximately 32-mile SCBRL right-of-way offers a continuous corridor to provide short- and long-distance travel needs. Adding new mobility options that expand travel choices would help address mobility needs within and between the most heavily populated parts of Santa Cruz County.
- Transit service would have the potential to improve connectivity between communities within the County and connect with other passenger rail services to adjoining counties, the San Francisco Bay Area, and Southern California.
- For those commuting between Watsonville and Santa Cruz, transit service would provide a reliable and cost-effective alternative to commuting along congested State Route 1 offering emission, and energy reductions and position the community to be more competitive for transportation funding that is increasingly requiring greenhouse gas (GHG) reduction strategies.
- The RTFS laid the groundwork for discussions on service types, station locations, and vehicle types. Community input received included the following:
 - Provide a transit service that includes Watsonville and regional connections at Pajaro.
 - Interest in lighter, smaller, quieter, more efficient, low or zero emission vehicles.
 - Input on frequency of service ranged from desire for frequent service to concerns about too many trains a day impacting neighborhoods.
 - Capacity for vehicles to accommodate bicycles.
 - Input on station locations: consider Depot Park station for the Santa Cruz station, consider the Westside Santa Cruz station near Natural Bridges Drive to be the primary University of California-Santa Cruz (UCSC) station instead of Bay Street.
 - Requests for affordable fares; requests that fares cover a higher percentage of the operations and maintenance costs; and requests for a unified fare card that works on local buses.
 - Opposition to any type of rail service focused on the number of daily trains and impacts to neighborhoods, cost, low ridership projections, horn noise, and impacts to rail trail.
- The RTFS provided rail transit service information on capital costs, operations and maintenance costs, potential funding sources, ridership estimates, travel times, governance options, implementation activities, and timeframe.

2.4.2 Unified Corridor Investment Study (2019)

SCCRTC developed the *Unified Corridor Investment Study* (UCS) in 2019 to identify multimodal transportation investments that could provide the most-effective use of the three primary cross-county corridors — State Route 1, Soquel Avenue/Soquel Drive/Freedom Boulevard, and the SCBRL right-of-way — with the goal to better serve the community's transportation needs. In November 2016, a sales tax

measure (Measure D) was passed that provided funds for transportation projects in Santa Cruz County and directed SCCRTC to evaluate future transportation uses of the SCBRL.

The UCS utilized performance-based planning and scenario analysis utilizing a triple bottom line framework of economy, equity, and the environment. The UCS provided an analysis of options for the rail right-of-way as required by Measure D by evaluating SCBRL corridor scenarios that included rail transit and trail, bus rapid transit and trail, and a trail only scenario, each combined with a package of other projects on State Route 1 and Soquel Avenue/Freedom Boulevard.

The Preferred Scenario identified in this study emphasized regional projects that included State Route 1 and Soquel Avenue/Freedom Boulevard improvements. For the SCBRL, the Regional Transportation Commission directed SCCRTC staff to:

- Protect the rail right-of-way for a high-capacity public transit service and facilities next to a bicycle and pedestrian trail.
- Continue to consider passenger rail service options on the rail right-of-way consistent with Proposition 116 requirements.
- Work jointly with the Santa Cruz Metropolitan Transit District (METRO) to develop a scope of work for additional analysis of high-capacity public transit alternatives on the SCBRL including their cost, operations, and funding plans and a plan to protect METRO's current funding sources.

Key outcomes from the UCS also included next steps to contemplate in future study:

- Continue to utilize the triple bottom line of sustainability framework of economy, equity, and environment for decision making in developing the goals, objectives, and performance measures for future study.
- Where feasible, utilize a quantitative performance-based planning analysis for evaluation of alternatives.
- Provide capital and operations and maintenance costs for the transit alternatives evaluated.
- Develop a funding plan for the locally preferred alternative.
- Protect the rail corridor for high-capacity public transit use and an adjacent bicycle and pedestrian facility, by maintaining the railroad tracks and allowing freight and excursion (non-commuter) passenger service on the railroad.
- Continue the development of the Coastal Rail Trail along the SCBRL right-of-way.
- Continue to consider passenger rail service options on the rail right-of-way consistent with Proposition 116 requirements and with consideration of other high-capacity public transit options.
- Collaborate with Santa Cruz METRO to develop a proposal to evaluate transit alternatives along the SCBRL.
- Support the development of an integrated transit network, which includes a dedicated transit facility on the rail right-of-way that incorporates the latest technologies.

2.4.3 Transit Corridor Alternatives Analysis, Rail Network Integration Study, and Transit Corridor Alternatives Analysis Business Plan (2020-2021)

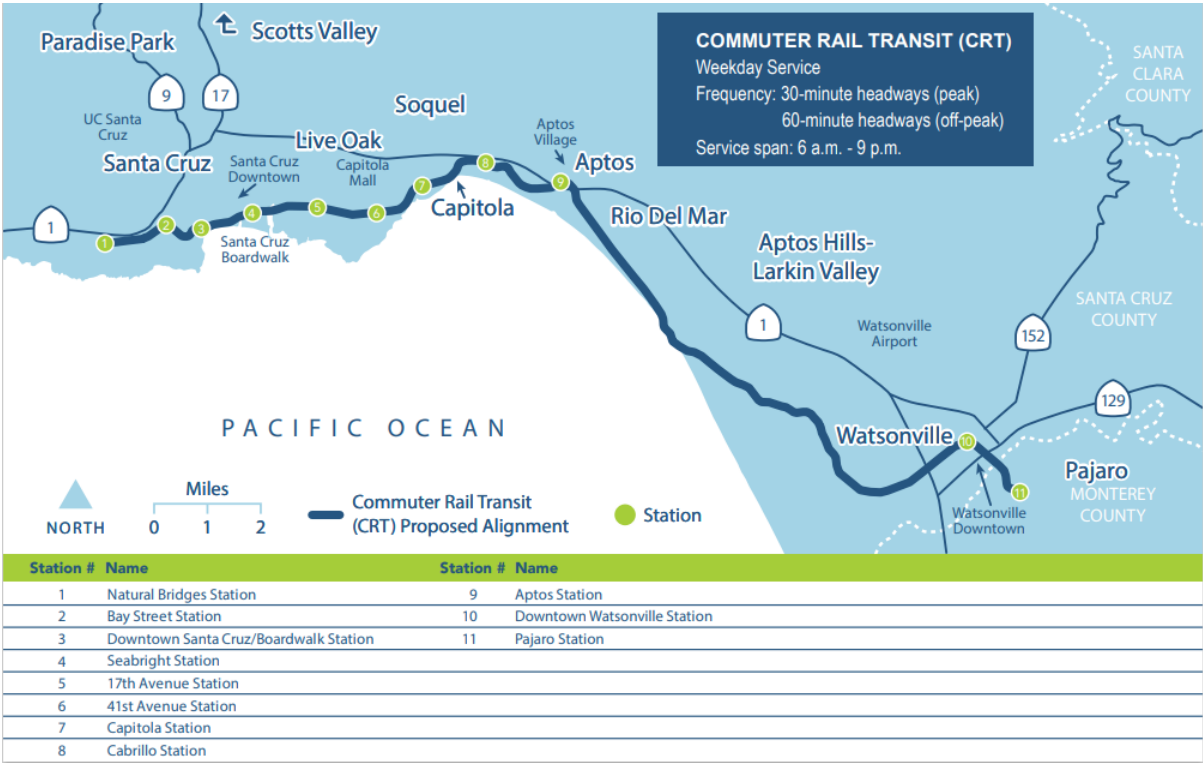
The *Transit Corridor Alternatives Analysis* (TCAA), *Rail Network Integration Study* (RNIS), and *Transit Corridor Alternatives Analysis Business Plan* (TCAA Business Plan) were developed by SCCRTC during 2020-2021 to evaluate high-capacity transit investment options and identify a locally preferred transit system that utilizes all or part of the length of the SCBRL right-of-way. The TCAA/RNIS analyzed various transit alternatives to identify a locally preferred alternative that provides the greatest benefit to Santa Cruz County residents, businesses, and visitors in terms of the triple bottom line goals of improving economy, equity, and the environment. The study area included the most populous locations and congested transportation infrastructure sections of Santa Cruz County — from Pajaro in Monterey County, north through Watsonville in Santa Cruz County, and to the western edge of the City of Santa Cruz. The TCAA/RNIS also considered the integration of the locally preferred alternative with future intercounty and interregional rail connections to Salinas, Monterey, Gilroy, San Francisco Bay Area, and beyond. Key activities from the TCAA/RNIS included:

- Evaluation and comparison of a range of high-capacity public transit service options — including commuter rail transit, light rail transit, bus-rapid transit, and autonomous road train — that can coexist with a bicycle and pedestrian trail along or within the SCBRL right-of-way.
- Planning for an integrated transit network for Santa Cruz County utilizing all or part of the SCBRL right-of-way as a dedicated continuous transit facility.
- Identification of potential governance options for transit service.
- Community, partner agency, SCCRTC, and Santa Cruz METRO involvement in the decision-making process.
- Identification of opportunities to enhance high-capacity transit investment and improve quality of life via strategically located transit-oriented land development in urbanized areas.
- Development of a strategic business plan for the selected alternative, including a prototypical cash flow analysis of environmental clearance, right-of-way, design, construction, operations, and maintenance.
- Identification of how the SCBRL rail corridor enhances public access to the Monterey Bay National Marine Sanctuary at several key locations consistent with objectives of the California Coastal Act.
- Identification of electric passenger rail as the Locally Preferred Alternative (LPA) for implementation of a rail transit service on the SCBRL corridor between Pajaro and Santa Cruz (Natural Bridges Drive). The *TCAA Business Plan* identified one proposed CRT option operating from 6 a.m. to 9 p.m. on weekdays on 30-minute headways (peak periods) and 60-minute headways (off-peak periods) that serve 11 stations, as shown in Figure 2.2 below. The TCAA also identified one proposed LRT option operating from 6 a.m. to 9 p.m. on weekdays with 30-minute headways all day that serves 15 stations, as shown in Figure 2.3 below. The *TCAA Business Plan* identified zero emissions Commuter Rail Transit (CRT) and Light Rail Transit (LRT) vehicles powered by electricity, battery, or hydrogen fuel cell under development globally to illustrate a potential universe of options that were operational in 2020. However, the TCAA did not make a decision as to whether the preferred rail option would be CRT or LRT. Rail network infrastructure required to support implementation of



CRT or LRT was identified only at an early conceptual level, with a deeper understanding of required investment deferred to more robust corridor assessments, planning, and design in a future study phase.

Figure 2.2 Proposed CRT Option Identified in TCAA



Source: HDR

Figure 2.3 Proposed LRT Option Identified in TCAA



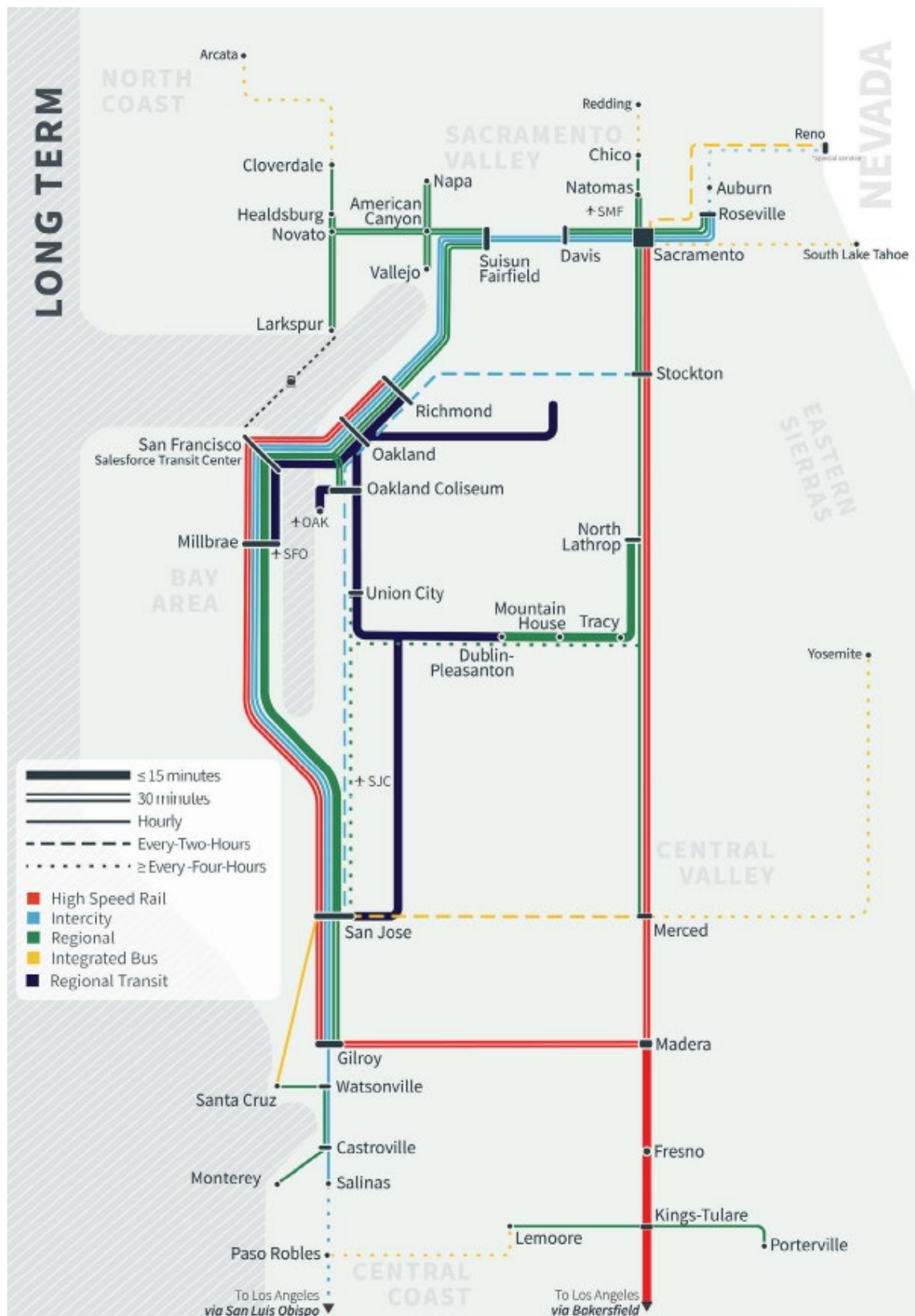
Source: HDR

2.4.4 California State Rail Plan (2018, 2024)

The *California State Rail Plan* (SRP) developed by Caltrans Division of Rail and Mass Transportation (DRMT) in 2018 and updated by Caltrans Division of Rail (DOR) in 2024 provided a framework for investing in California's integrated rail network and set the stage for new and better rail and community connections throughout the state. The plans outlined a strategy for developing a state-of-the-art rail system that will help Californians achieve greenhouse gas reduction and air quality goals while boosting economic growth and helping to create more livable communities. The SRP vision described an integrated network that provides a faster, more frequent, and connected service for moving both people and goods. A statewide rail system offers a viable alternative to driving for both local and long-distance trips for all California residents and visitors, including those who lack access to or cannot afford automobiles, and for people who choose not to drive. The SRP vision provided a framework for realizing the full potential of the existing rail network while helping to reduce highway congestion.

The SCBRL links to existing and proposed new passenger rail services on the statewide rail system extending from San Diego to Los Angeles, the San Francisco Bay Area, Sacramento, and past the northern border of California. The 2024 SRP outlined several regional rail service implementation and expansion goals inclusive of the Central Coast region that will provide integrated connections to the broader statewide transportation network. Near-term regional goals (to be attained by 2028) include initiation of limited regional or intercity service between San Jose and Salinas via Gilroy with integrated bus connections to Santa Cruz, Monterey, and San Luis Obispo. In the Mid-Term, to be attained by 2034, frequency would be increased. The Long-Term service goal, to be attained by 2050, includes hourly rail service to Santa Cruz and Monterey. This would connect to the statewide rail system at a new Pajaro/Watsonville Station, with hourly service from San Jose to Salinas and service from Salinas to San Luis Obispo operating every four hours. Connections between Central Coast communities and the proposed California High-Speed Rail network would be provided in Gilroy, thus providing access to and from broader regions in Northern California and Southern California (See Figure 2.4 below). All three horizons maintain the existing integrated bus service between Santa Cruz and San Jose via State Route 17, with service envisioned to increase to every hour in the long term.

Figure 2.4 California State Rail Plan, Northern California Service — Long-Term (2050) Vision



Source: Caltrans

As part of ongoing state rail implementation planning efforts, Caltrans has refined the rail network integration through partnership with local planning agencies throughout the state. To advance implementation, Caltrans has awarded Network Integration funding to agencies across the state in recent years, including the SCCRTC and the Transportation Agency for Monterey County (TAMC, which is currently planning for the extension of existing passenger rail service from Gilroy south to Salinas via Pajaro/Watsonville), to refine service goals, analyze alternatives, and advance the development of the mid- and long-term service goals identified in the 2018 SRP and refined in the 2024 SRP. This funding and state direction were an integral part of the TCAA/RNIS developed by SCCRTC during 2020. The Locally Preferred Alternative identified in the TCAA/RNIS determined the type of transit service that would connect Santa Cruz County at Pajaro to the future statewide rail network and also impacted how the regional service would connect with statewide service. Inputs from the TCAA/RNIS were used to inform the passenger network strategy presented in the 2024 SRP.

Key considerations made in the 2018 and 2024 California SRPs that were used to support the previous SCCRTC TCAA/RNIS and will be used to support the current Zero Emission Passenger Rail and Trail Project include:

- Connecting and updating the transportation system built on rail networks and highways from the 19th and 20th centuries. The status quo is not enough to support this growing economy and meet its robust economic and environmental future needs.
- The SRP facilitates networkwide coordination through scheduled, or “pulsed,” transfers between systems and transit types. Pulse scheduling enables connecting services at hubs to be linked together to allow optimal onward travel consistently throughout the day with minimal transfer times.
- The SRP emphasizes universal accessibility, competitive travel time and service frequencies, integration at stations with first/last mile solutions, and a clean and energy efficient transportation system.
- The SRP prioritizes zero and near-zero emissions technologies, including battery electric or hydrogen fuel cell train sets.
- The SCBRL is identified in the SRP as part of the Central Coast geographic service area between San Jose in the north and San Luis Obispo in the south, including the UP Coast Subdivision and Santa Cruz and Monterey Branch Lines.
- Establish a hub station at Pajaro/Watsonville that provides hourly connections between Santa Cruz and the San Francisco Bay Area.
- The SRP assesses a changing funding landscape, including the influence of the Senate Bill 1 (SB 1) transportation package, California’s Cap-and-Trade Program for reducing GHG emissions, and newly created Infrastructure Investment and Jobs Act (IIJA) sources such as the Federal-State Partnership for Intercity Passenger Rail (FSP-National) and Corridor Identification and Development (Corridor ID) programs.

For more details about the activities and outcomes of these prior planning efforts, please reference the specific studies on the SCCRTC website: [Rail - SCCRTC](#).⁸ The Final 2024 *California State Rail Plan* released on January 7, 2025, is available on the Caltrans website: [California State Rail Plan | Caltrans](#).⁹

2.4.5 Corridor Identification and Development Program

Expansion of intercity rail service to Santa Cruz was designated for future study by the State of California as part of a broader Central Coast passenger rail expansion initiative under the Corridor Identification and Development Program (Corridor ID), a federal initiative launched in 2023 to identify and advance a pipeline of new or expanded intercity passenger corridors nationwide through a three-step project development process and to position them for construction funding and implementation. The Step 1 scoping phase of the Central Coast Corridor ID Project was completed by Caltrans with support from SCCRTC and other local agencies in 2025. Step 2 is the next phase planned, and it consists of producing a Service Development Plan for the Central Coast, which spans from San Jose to San Luis Obispo via Salinas, with extensions to Santa Cruz and Monterey.

2.5 Primary Activities of ZEPRT Project

Primary activities developed for the ZEPRT Project are presented in this Draft Concept Report via the following chapters:

- Chapter 1 – Introduction (previous chapter)
- Chapter 2 – Project Background and Description (this chapter)
- Chapter 3 – Project Preliminary Draft Purpose and Need
- Chapter 4 – Stakeholder and Public Engagement
- Chapter 5 – Current SCBRL Rail Corridor and Infrastructure Characteristics
- Chapter 6 – Train Operations on SCBRL Corridor
- Chapter 7 – SCBRL Infrastructure Evaluation for ZEPRT Project
- Chapter 8 – Conceptual Rail Corridor Safety Assessment
- Chapter 9 – Preliminary Environmental Screening
- Chapter 10 – Conceptual ZEPRT Ridership and Revenue Forecast
- Chapter 11 – Conceptual Rail Vehicle Technology and Performance Requirements
- Chapter 12 – Conceptual Passenger and Freight Rail Interface Assessment
- Chapter 13 – Conceptual Rail Transit and Trail Alignment
- Chapter 14 – Conceptual Network Infrastructure Improvements
- Chapter 15 – Conceptual Rail Transit Stations
- Chapter 16 – Conceptual Rail Transit Layover and Maintenance Facility
- Chapter 17 – Conceptual Rail Transit Operations and Equipment Plans
- Chapter 18 – Initial Opinion of Probable Conceptual Capital and Operations and Maintenance Costs
- Chapter 19 – Conceptual Initial Risk Analysis and Risk Register

⁸ SCCRTC Rail <https://www.sccrtc.org/projects/rail/>

⁹ Caltrans California State Rail Plan <https://dot.ca.gov/programs/rail/california-state-rail-plan>

- Chapter 20 – Potential ZEPRT Project Next Steps
- Chapter 20 – Potential ZEPRT Project Next Steps

3.0 Project Preliminary Draft Purpose and Need

3.1 Background

The SCBRL is a continuous transportation corridor that spans approximately 32 miles of Santa Cruz County from the community of Pajaro in northern Monterey County to Davenport on the north coast. The study area includes 22 miles of the SCBRL right-of-way from Pajaro to Natural Bridges Drive on the west side of Santa Cruz and runs parallel to the often-congested State Route 1 while connecting to regional and state rail lines in Pajaro in Monterey County.

In 2012, SCCRTC acquired the rail line, which has been a transportation corridor since the mid-1870s, bringing it into public ownership. SCCRTC has an administration, coordination, and licensing agreement with a short line rail operator that provides freight service along the SCBRL.

In 2015, SCCRTC completed the RTFS, which included a broad technical analysis of several public transportation service scenarios (developed based on input from the public), ridership projections, capital and operating cost estimates, review of vehicle technologies, and evaluation of funding options. Service scenarios were evaluated against multiple goals and objectives identified by the community and compared to other rail transit systems in the U.S. The report also discussed integration with other rail corridor uses, connectivity to bus and other rail services, and identified feasible options for further analysis, environmental clearance, engineering, and construction.

In 2021, the TCAA and the RNIS evaluated the feasibility of rail transit service on the SCBRL. The TCAA/RNIS established the planning-level data-driven basis for the project's Purpose and Need supported by feedback from collaboration with multiple agencies, elected officials, and public input. The TCAA/RNIS analyzed various transit alternatives leading to the identification of a locally preferred alternative being zero-emissions Electric Passenger Rail that provides the greatest benefit to Santa Cruz County residents, businesses, and visitors in terms of the triple bottom line goals of improving economy, equity, and the environment.

The Monterey Bay Sanctuary Scenic Trail Network (MBSST) is a proposed 50-mile bicycle and pedestrian pathway along the coast of Santa Cruz County, from the San Mateo County line in the north to the Monterey County line at Pajaro. The MBSST merges plans for a bicycle/pedestrian trail along the rail line, including coastal alignments and neighborhood spurs, into a connected network that will overlap and converge to provide safe and convenient travel choices. The Trail Network system's "spine" is intended to be the continuous Coastal Rail Trail, a bicycle and pedestrian trail largely within the 32-mile SCBRL right-of-way, adjacent to railroad tracks. The Trail Network will connect to other modes of transportation, like bus and rail. Some of the segments of the Coastal Rail Trail have been completed, while others are either under construction, in environmental review, or in planning.

The preliminary draft Purpose and Need statement identified below for the current SCCRTC ZEPRT Project was developed using the information derived from the TCAA/RNIS and informed by additional

coordination with SCCRTC and the Project PDT and inputs from public outreach in 2023 and 2024. The preliminary draft Purpose and Need will provide the foundation for the development of a formal final Purpose and Need statement during the development of environmental work later in the ZEPRT Project.

3.2 Project Needs

The current state of Santa Cruz County's transportation infrastructure is strained and unable to effectively serve the community. The existing transportation network is an impediment to a stronger local economy, improved environmental and public health, improved equity and a better quality of life.

- **Diverse Transportation Needs Not Fully Met and Slow Transit Travel Times:** Commuters, youth, seniors, low-income individuals, people with disabilities, businesses, and visitors have a diverse set of transportation needs which are not being fully met by the current transportation system. Many local residents cannot drive, or do not have the income needed to own a vehicle and are dependent on transit service which at present is infrequent with slow service times.
- **Deficiencies in Roadway Travel and Insufficient Non-auto Centered Alternative Travel Options:** Local roads and highways are increasingly congested while the Santa Cruz County population continues to grow which results in ever increasing roadway travel times, increasing economic losses due to time spent in traffic, and increased on-road vehicle emissions. Due to roadway congestion, on-road transit service times are lengthy, which makes transit less attractive to those with personal vehicles. The SCBRL corridor provides a critical link as an alternative to congested roadways between Watsonville and Santa Cruz.
- **Vehicle Miles Traveled (VMT) Reduction Mandates:** State mandates require reductions in how much people drive and provision of expanded transit is needed to support reductions in VMT.
- **Greenhouse Gas (GHG) Emission Reduction Mandates:** The California Sustainable Communities and Climate Protection Act of 2008 (SB 375) requires the establishment of regional greenhouse gas emission targets, California Senate Bill 32 (2016) requires the reduction of greenhouse gas emissions by 40% below 1990 levels by 2030, and California Assembly Bill 1479 (2022) requires reaching carbon neutrality by 2045. The transportation sector is one of the largest contributors to GHG emissions accounting for approximately 40% of emissions statewide.
- **Bicycle and Pedestrian Linkages Missing and Safety Concerns:** Bicycle and pedestrian facilities do not provide continuous linkage between communities in Santa Cruz County. For example, the current system of bicycle and pedestrian facilities in Santa Cruz County has gaps between Rio Del Mar and Pajaro. The SCBRL corridor provides a unique opportunity for continuous bicycle and pedestrian connectivity and user experience. Active transportation facilities are needed to support not only community connection but also community health. On-road bicycle and pedestrian facilities include safety risks due to traffic proximity.

3.3 Project Purpose

The ZEPRT Project's fundamental purpose is to support and improve equitable multimodal transportation options in Santa Cruz County. Constituent elements of the project purpose include the following (numbering not meant to indicate priority):

- Provide increased access to convenient, accessible, and reliable public travel options.
- Improve transit connections to community activity centers supporting the local economy and providing better access between housing and jobs.
- Integrate with plans for future land use.
- Reduce transit travel times and improve transit system reliability.
- Enhance bicycle and pedestrian connectivity and safety.
- Promote alternative transportation modes to increase overall transportation system capacity and reliability, improve health and reduce mortality.
- Provide a critical link between the cities of Watsonville and Santa Cruz and communities in between as an alternative to congested roadways.
- Reduce vehicle miles traveled and associated GHG emissions.

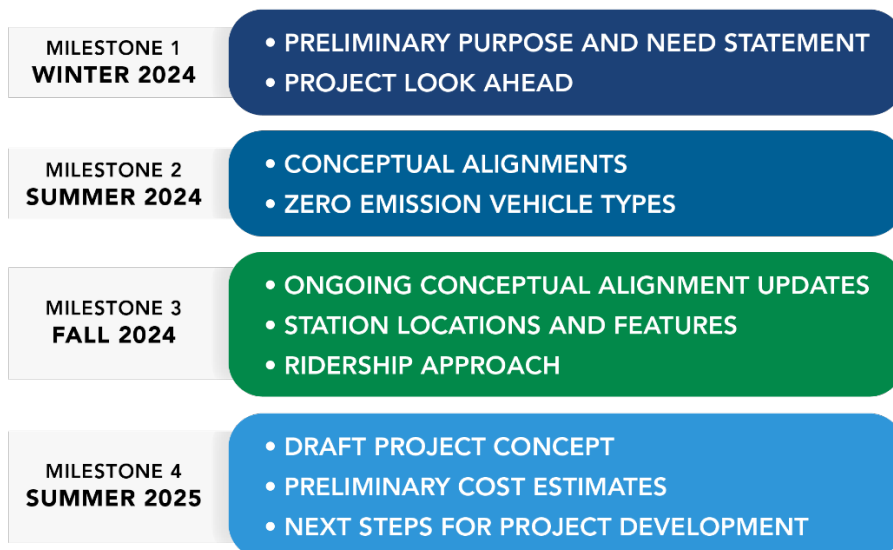
4.0 Stakeholder and Public Engagement

4.1 Introduction

Robust stakeholder engagement and public outreach are critical to understanding the needs, issues, challenges, and opportunities for a transformative transportation project and as inputs to support project development. This approach was employed during development of the ZEPRT Project Concept and related *Project Concept Report* in 2024-2025, with outreach tactics tailored to each of the Project's four major milestones, as shown in Figure 4.1 below.

Figure 4.1 Project Concept Engagement Milestones

PROJECT CONCEPT REPORT Milestones and Engagement Opportunities



Source: HDR

Community input has played a crucial role in shaping the development of the ZEPRT Project. Outreach events and activities conducted since early 2024 have included nine in-person community meetings, four virtual open houses, seven information sessions, office hours on three days, more than 60 stakeholder meetings, and widespread outreach and notification efforts along the SCBRL corridor and adjacent communities between Pajaro and Santa Cruz. These engagement efforts resulted in approximately 500 in-person connections, dozens of touchpoints with key stakeholders, and more than 5,000 people reached through virtual events to-date.

The ZEPRT Project has collected more than 1,500 comments from community members and hundreds of input points through interactive engagement activities. Key themes from this community feedback include:

- Preference for efficient, reliable, quiet, and fast passenger rail service
- Desire for completion of the trail and strong interest in ensuring high-quality, continuous, and safe trail facilities
- Desire for improved connectivity to downtowns, employment centers, key community centers and recreation, and the broader state rail system as well as the west side of Santa Cruz
- Support for the most efficient, least expensive rail and trail alignments
- Preference for efficient, reliable, and quiet multiple unit passenger rail vehicles
- Requests for transparency on project costs and benefits
- Concerns related to Project cost estimate, fares, feasibility, funding, environmental impacts, and noise
- Expressed desire for investing in underserved communities, and in particular providing access to affordable, reliable, safe transportation, and economic benefits
- Interest in preservation of the SCBRL railroad corridor
- Interest in ridership projections and comparisons to other passenger rail systems

Activities conducted for each of the ZEPRT Project's four major milestones and related outcomes are identified and described in the sections that follow.

4.2 Milestone 1 — Overview

In February 2024, SCCRTC launched public engagement and outreach activities for the ZEPRT Project to present and gather community feedback on the project's preliminary purpose and need.

Engagement activities conducted during 2024 for Milestone 1 included:

- February 1 – SCCRTC Presentation and Public Hearing
- February 5-March 4 – Virtual Open House
- February 12 – Open House at Ramsay Park Family Center in Watsonville
- February 13 – Open House at Live Oak Grange in Santa Cruz
- February 23 – SCCRTC Table at Watsonville Farmers Market in Watsonville
- February-March – Various briefings and presentations to local city councils and agencies in the Project area

4.1.1 Milestone 1 — Open House Public Awareness and Notifications

SCCRTC implemented notification and awareness activities for the virtual and in-person open houses, as follows:

- **Email Blasts:** SCCRTC distributed email blasts to those signed up for project-related emails and to its general interest email list, one sent on January 26 and a reminder sent on February 7.
- **Stakeholder Outreach:** The Project team contacted representatives from stakeholder groups about the open houses, which included 44 representatives from active transportation groups, agencies, chambers of commerce, community-based organizations, neighborhood associations, school districts, and others throughout Santa Cruz County.
- **Newspaper Ads:** SCCRTC also ran an advertisement in the *Santa Cruz Sentinel* on February 5 and in Spanish in *The Pajaronian* on February 9.
- **Media:** SCCRTC distributed a news release to local Santa Cruz County media outlets, and articles were published in the *Santa Cruz Sentinel* on January 30 and on *Santa Cruz Local* on February 29. Lastly, KSQD included open house information in a radio interview on February 2.
- **Social Media:** SCCRTC announced the virtual and two in-person open houses on its social media on January 26, and the graphic was reposted by partner organizations, Scotts Valley Chamber of Commerce and Coast Connect.

4.1.2 Milestone 1 — Open House Purpose and Format

These were the first community open houses for the ZEPRT Project Concept phase and served to involve community members in the development of the preliminary purpose and need statement, which would guide the project moving forward. Both in-person and virtual open houses were available to the public and included the same materials, sharing a project overview, project details, information about connectivity to regional rail and trail networks, project schedule, and the preliminary purpose and need statement. Both also included options to provide feedback on the preliminary purpose and need or general project feedback. For in-person open houses, members of the project and consultant team were available to answer questions and further discuss the project's elements.

The first open house was held on February 12, 2024, at Ramsay Park Family Center in Watsonville and had 38 attendees. The second event was held on February 13, 2024, at Live Oak Grange in Santa Cruz and had 60 attendees. Both open houses took place from 6:00 p.m. to 7:30 p.m. The SCCRTC also hosted a virtual open house where attendees could learn about the ZEPRT Project and give feedback from February 5 to March 4, 2024. The virtual open house had 231 total visitors.

4.1.3 Milestone 1 — Community Feedback Summary

Participants at both the in-person and virtual open houses were invited to share their comments on the purpose and need statement and submit additional questions or comments on the ZEPRT Project.

Participant feedback from the open houses agreed with many aspects of the preliminary project purpose and need statement. Comments showed a desire for increased access to convenient, reliable, sustainable, and low-emission public travel options, and expressed that alternatives to driving are needed due to

current congestion. Many comments showed support for first and last-mile connections via bus or bicycle, and some participants desired bicycle parking near rail stops and dedicated space for bicycles on trains.

Participants at the virtual open house were asked if the preliminary purpose and need statement fits their vision for the community, and out of 47 total submissions, around 81% of commenters said yes, 15% of commenters said no, and 4% did not respond to this question.

Key themes that arose from comments include:

- Need for equitable rail and transit options for those who are transit-dependent (i.e., people with disabilities, seniors, youth, students, low-income populations, other underrepresented communities, etc.) or who cannot walk, bike, or drive themselves.
- Importance of safety and security for public transit users, both on the train and at stations.
- Desire for more opportunities for travel to local destinations (i.e., shopping, employment centers, entertainment, educational institutions).
- Support for a project providing possible opportunities for transit-oriented and high-density development and housing along the SCBRL rail line.
- Support for key transit connections (such as to the San Francisco Bay Area, Cabrillo College, UC-Santa Cruz, and numerous other destinations within and outside Santa Cruz County).
- Desire for low operational cost to ensure continual funding and affordability for future service.
- Support for zero emission aspect of the project and opinion that more options for transportation will help to lower Vehicle Miles Traveled (VMT) and greenhouse gas emissions (GHG) from high levels of traffic congestion.
- Need for alternative modes of travel to divert traffic from State Route 1 in Santa Cruz County.
- Desire for design to account for other modes of travel near rail stations (i.e., bike, bus, walking, rideshare, etc.).
- Desire to see rail and transit services become more frequent and reliable, and easier to use.
- Support for SCCRTC outreach to the Spanish-speaking population and transit-dependent communities.

4.3 Milestone 2 — Overview

In June and July 2024, SCCRTC conducted public engagement and outreach activities for the second Project Concept milestone. Engagement efforts focused on presenting information and gathering community feedback on the ZEPRT Project's initial conceptual rail and trail alignment, initial analysis of potential rail vehicle types, and key elements of the project.

Engagement activities conducted during 2024 for Milestone 2 included:

- June 6 – SCCRTC Presentation and Public Hearing
- June 6-July 18 – Virtual Open House
- June 24 – In-person Open House in Watsonville
- June 25 – In-Person Open House in Santa Cruz
- July 12 – Tabling at Watsonville Farmers Market in Watsonville

- May-August – Various briefings and presentations to stakeholders and partner agencies in the Project area

The first in-person open house was held on June 24, 2024, at the Civic Plaza Community Room in Watsonville and had more than 20 attendees. The second event was held on June 25, 2024, at Live Oak Grange in Santa Cruz and had approximately 100 attendees. Both open houses took place from 6:00 p.m. to 7:30 p.m. There was also an option for a virtual open house to learn about the project and give feedback on the project from June 6 to July 18, 2024, which had 1,231 total users.

4.1.4 Milestone 2 — Open House Awareness and Notifications

SCCRTC implemented notification and awareness activities for the virtual and in-person open houses, as follows:

- **Email Blasts:** SCCRTC distributed email blasts to those signed up for project-related emails and to its general interest email list, one sent on June 6 and a reminder for the virtual open house sent on July 12.
- **Stakeholder Outreach:** The ZEPRT Project team contacted representatives from stakeholder groups via phone and email about the open houses, which included more than 200 representatives from active transportation groups, agencies, chambers of commerce, community-based organizations, neighborhood associations, school districts, and more throughout Santa Cruz County.
- **Newspaper Ads:** SCCRTC also ran advertisements in the *Santa Cruz Sentinel* on May 26 and June 16, in *Good Times Santa Cruz* on June 19, and in Spanish in *The Pajaronian* on June 14 and June 21.
- **Media:** SCCRTC distributed a news release to local Santa Cruz County media outlets, and articles were published in *Lookout Santa Cruz* on July 1, in *Santa Cruz Local* on June 1, and in *Mass Transit Magazine* on June 5.
- **Social Media:** SCCRTC announced the virtual and two in-person open houses on their social media (i.e., Facebook, Instagram, Nextdoor, and X) on June 6 and posted a reminder on June 21.

4.1.5 Milestone 2 — Stakeholder and Partner Agency Outreach

The ZEPRT Project team held briefings and presentations for several project stakeholders and partner agencies between May and August 2024 to share project information and seek feedback specifically related to the initial conceptual alignment and proposed rail vehicle types. These stakeholders and partner agencies included:

- California Coastal Commission
- California Public Utilities Commission
- Caltrans
- City of Capitola
- City of Santa Cruz
- City of Watsonville
- County of Santa Cruz
- Pajaro Regional Flood Management Agency

- Santa Cruz METRO
- Santa Cruz, Big Trees and Pacific Railway (Roaring Camp)
- SCCRTC Bicycle Advisory Committee
- SCCRTC Elderly and Disabled Transportation Advisory Committee
- SCCRTC Interagency Technical Advisory Committee
- Scotts Valley City Council
- The Seaside Company (Santa Cruz Beach Boardwalk)
- Visit Santa Cruz County

4.1.6 Milestone 2 — Open House Purpose and Format

Open houses served to provide project background, present the initial conceptual rail and trail alignment for community input, and gather preliminary feedback on proposed rail vehicle types being considered for the ZEPRT Project. Both in-person and virtual open houses were available to the public and included the same materials and options to provide feedback.

For in-person open houses, members of the project and consultant team were available to answer questions and further discuss the project's elements. The open houses also included large format maps of the proposed initial conceptual rail and trail alignment as well as interactive boards where attendees could share feedback on proposed rail vehicle types and general feedback on the proposed rail and trail alignment.

4.1.7 Milestone 2 — Summary of Community Feedback

More than 500 comments and feedback notes were collected during the public engagement period related to the passenger rail vehicle types and initial conceptual alignment of the ZEPRT passenger rail service and trail. Additionally, more than 130 general comments were received via the virtual open house and more than 35 received via email.

Key takeaways related to passenger rail transit vehicle types include:

- A community preference for multiple unit vehicles, followed by light rail vehicles. Locomotive hauled vehicles were not as preferable by the community.
- Interest in a vehicle that is efficient, reliable, and quiet.
- Interest in a vehicle that provides flexibility (in connection to other systems, with freight rail service, to accommodate growing capacity, etc.).

Key takeaways related to the initial conceptual rail and trail alignment include:

- Specific feedback on the trail alignment and configuration, including a desire to keep the trail within or as close as possible to the rail corridor, interest in connections from the rail system to the trail, concerns about trail width, and bicycle and pedestrian safety on the trail.
- Need to ensure system funding opportunities, including state and federal funds.
- Significant feedback on station locations.
- Concerns for grade crossings, safety, and noise impacts.
- Numerous site-specific concerns and suggestions.

4.2 Milestone 3 — Overview

In fall 2024, SCCRTC launched Milestone 3 engagement activities for the Project Concept phase, focused on sharing updates and continuing to gather input on conceptual rail and trail alignment options, project funding opportunities, ridership modeling approach, station locations and features, bridge structures, and noise impacts for the ZEPRT Project.

Engagement and outreach activities conducted during 2024 for Milestone 3 included:

- Informational Community Sessions
 - October 23 – Funding and Service
 - October 28 – Ridership Approach
 - December 16 – Grade Crossings, Noise, and Quiet Zones
- November 7-December 20 – Virtual Open House
- November 12 – In-Person Community Workshop, Watsonville
- November 13 – In-Person Community Workshop, Santa Cruz
- December 5 — SCCRTC Presentation and Public Hearing
- December 13 — Tabling at Watsonville Farmers Market, Watsonville
- October-December – Various stakeholder and partner agency briefings/presentations in the Project area

4.2.1 Milestone 3 — Public Awareness and Notifications

SCCRTC implemented the following public awareness and notification activities for Milestone 3:

- **Email Blasts:** Six email blasts were distributed to the project database and the SCCRTC's general interest email list on October 9 and 29; November 8, 12, and 22; and December 16.
- **Stakeholder Outreach:** More than 200 Santa Cruz County stakeholders from active transportation groups, public agencies, chambers of commerce, community-based organizations, neighborhood associations, and school districts were contacted via phone and email about the Community Workshops and encouraged to participate.
- **Newspaper Ads:** One English advertisement ran in the *Santa Cruz Sentinel* on November 12 and a Spanish advertisement ran in *The Pajaronian* on November 8.
- **Media:** Two news releases were distributed to local Santa Cruz County media outlets on October 29 and November 12.
- **Social Media:** Nine Facebook, seven Instagram, three Nextdoor, and eight X (formerly Twitter) posts were utilized for widespread promotion of all engagement events, totaling to 27 posts from late October to early December 2024.

4.2.2 Milestone 3 — Stakeholder and Partner Agency Outreach

The ZEPRT Project team held briefings and presentations for several stakeholders and partner agencies between October and December 2024 to share updates and seek feedback. Stakeholder and partner agencies included:

- City of Santa Cruz

- Friends of the Rail and Trail (FORT)
- Santa Cruz METRO
- Santa Cruz, Big Trees and Pacific Railway (Roaring Camp)
- SCCRTC Bicycle Advisory Committee
- The Seaside Company (Santa Cruz Beach Boardwalk)
- U.S. Army Corps of Engineers

4.2.3 Milestone 3 — Informational Community Sessions

Three Informational Community Sessions were held to share topic-specific updates and answer questions from the public. Sessions were held in the evenings beginning at 6 p.m. in a hybrid format with a virtual option via Zoom and an option for participants to view the session from SCCRTC's conference room in Santa Cruz. Each session included live Spanish interpretation and was recorded and posted on the ZEPRT Project webpage.

- October 23 – Funding and Service
- October 28 – Ridership Approach
- December 16 – Grade Crossings, Noise, and Quiet Zones

4.2.4 Milestone 3 — Community Workshop and Virtual Open House

Two interactive, in-person Community Workshops were held in mid-November 2024 as well as a virtual open house that was available from November 7 through December 20, 2024. The public engagement events included the same information and opportunities to provide feedback. Materials were provided in both English and Spanish.

The first Community Workshop was held on November 12, 2024, at Henry J. Mello Center in Watsonville and had approximately 50 attendees, while the second event was held on November 13, 2024, at Live Oak Community Center in Santa Cruz and had approximately 85 attendees. These events took place from 6 p.m. to 7:30 p.m. and included Spanish interpreters.

Both workshops included a presentation providing an overview of Milestone 3 focusing on conceptual alignment updates, station locations and amenities, and Quiet Zones. A recording of the presentation was posted on the virtual open house and on the ZEPRT Project website. In addition, board exhibits were displayed with project information and ZEPRT Project team members were available to answer questions and further discuss project elements. Large format maps displayed conceptual alignment options for areas where significant refinements were made since Milestone 2 in summer 2024. Community members were encouraged to provide comments on the maps directly. Lastly, interactive activities were also included to solicit community feedback on preferred station locations and amenities.

The virtual open house was available to all community members at [ZEPRT.com](https://zeprt.com) as an interactive, self-guided public meeting enabling visitors to learn more about the project and Milestone 3 updates and activities to gather feedback. The virtual open house was open continuously from November 7 to December 20, 2024, and attracted over 2,200 total users.

4.2.5 Milestone 3 — Community Feedback Summary

More than 360 comments and hundreds of activity feedback submissions were received from community members throughout Milestone 3 engagement. The following bullets summarize the key takeaways of feedback received throughout Milestone 3 engagement for the ZEPRT Project.

- **General Comments**
 - Support for the Project.
 - Concerns regarding Project cost, operations, feasibility, and environmental impacts.
 - Comments and questions related to Project costs, sales and property tax impacts, ridership projections, etc.
 - Interest in more detail regarding Project costs and funding, ridership forecasting projections and schedule, as well as greater transparency.
- **Station Locations**
 - **General Station Preferences on the SCBRL Corridor**
 - Participants favored stations at 41st Avenue (Capitola), Pacific Avenue/Beach Street (Santa Cruz), Aptos, and Park Avenue (Capitola).
 - Several additional stations identified during Milestone 2 were popular, including 7th Avenue (Santa Cruz), Almar Avenue (Santa Cruz), and those with beach access such as Seascapes Beach, Seacliff, and Manresa Beach stations.
 - **Watsonville Stations**
 - Dialogue on the inclusion of two Watsonville stations: a Downtown Watsonville station and a second station at Ohlone Parkway.
 - **Cabrillo College Station**
 - Input split between options to keep station in existing SCBRL right-of-way or straighten alignment and shift station closer to State Route 1.
 - Those who support shift support proximity to Cabrillo College and the concern for safety of the rail alignment's curves in that area.
 - **Santa Cruz Stations**
 - Interest in including stations at 7th Avenue, Almar Avenue, and Natural Bridges Drive in the Santa Cruz area.
 - **Santa Cruz End of Line Station**
 - Community preference was for service to a West Side Santa Cruz station.
 - Many participants felt strongly that service to the West Side is a must.
- **Station Amenities**
 - Strong interest in safety-conscious design (incorporating lighting, security, and location), Americans with Disabilities Act (ADA) compliant level boarding, shelter and seating, bike parking, connectivity to other transit modes, and public restrooms.
 - Many indicated that they would walk or bike to a station to access the train.
 - Bike riders overwhelmingly responded they would prefer to bring their bikes on the train than leave them locked at the station
- **Rail and Trail Alignment**
 - Concern for noise impacts and support for implementing Quiet Zones on the ZEPRT rail alignment.
 - Safety for trail users and a desire to keep trail in the SCBRL rail right-of-way.
 - Desire for further detail and engagement for specific areas of the Project alignment.
 - Concern regarding perceived cost, and a strong preference for the least expensive alignment alternatives.
 - Location-specific alignment feedback

- Beach Street/Boardwalk Area in Santa Cruz: Support for an at-grade option as being the least disruptive.
- Jade Street Park Trail Options: Support for keeping the trail in the SCBRL right-of-way or, as an alternative, routing it along Jade Street, Brommer Street, and Thompson Street.
- Sumner Avenue Trail: Concern for safety of the trail on the roadway and general project concerns from the neighborhood.
- Coastal Rail Trail Segments 17 and 18 Options: Support for building safe bike routes along Beach Street to Lee Road or Walker Street.
- Near Cabrillo College: Support for rail and trail alignments that provide connections to the campus and address student needs.

4.3 Milestone 4 — Overview

In spring 2025, SCCRTC launched Milestone 4 engagement activities for the Project Concept phase. Milestone 4 engagement activities focused on sharing updates and gathering input for development of the project concept, including the conceptual rail and trail alignment, ridership projections, station locations and design, operations, and project costs estimates. Engagement conducted in the spring included information sharing and feedback solicitation for inclusion in the Draft Project Concept.

On June 12, 2025, the project's Milestone 4 virtual open house was launched, followed by the July 31, 2025 release of the Draft *Project Concept Report*. Engagement over the summer focused on providing information about the draft project concept, offering opportunities for the public to ask questions of the project team and collecting community input on the Draft *Project Concept Report*.

Engagement and outreach activities conducted during 2025 for Milestone 4 included:

- March 4 – Capitola Town Hall
- Informational Community Sessions
 - March 12 – Railroad Bridge Infrastructure
 - April 1 – Conceptual Alignment and Operations
 - June 9 – Ridership Projections and Cost Estimates
 - July 22 – Conceptual Station Design
- Community Events
 - April 22 – Earth Day Event, Cabrillo College (Aptos Campus)
 - April 23 – Earth Day Event, Cabrillo College (Watsonville Campus)
 - April 27 – Watsonville's Earth Day Event
 - May 21 – Rail Trail Segment 7 Phase II Ribbon Cutting, Santa Cruz
 - June 27 – Watsonville Farmers Market
 - July 30 – Highway 1 Auxiliary Lane and Bus-on-Shoulder Project Ribbon Cutting, Santa Cruz
 - August 5 – City of Santa Cruz National Night Out
 - August 8 – City of Watsonville National Night Out
 - August 9 – Watsonville Back to School Barbeque and Resource Fair
 - August 16 – Comunidad en Movimiento - Semillas de Bienestar, Watsonville
- Community Workshops
 - May 12 – Walker Street Stakeholder Meeting, Watsonville

- May 12 – Community Workshops, Watsonville
- May 14 – Community Workshop, Santa Cruz
- SCCRTC Commission Meetings
 - June 12 – Presentation
 - August 7 – Presentation and Public Hearing
- June 12-August 22 – Virtual Open House
- July 31 – Draft *Project Concept Report* Release
- June-August – Various In-Person and Virtual Office Hours
- March-August – Various stakeholder and partner agency briefings/presentations

4.3.1 Milestone 4 — Public Awareness and Notifications

SCCRTC implemented the following public awareness and notification activities for Milestone 4 in 2025:

- **Email Blasts:** 12 email blasts were distributed by SCCRTC to the project’s email distribution list on April 1 and 28; May 5; June 4, 10, 12, and 17; July 14, 25, 31 (two emails distributed); and August 13.
- **Paid Radio Advertisements:** 28 Spanish-language advertisements ran on two radio channels, 102.5 KDON-FM and La Tricolor 99.5 (KLOK-FM), running twice a day for a week on each channel from July 28 to August 3.
- **Digital Newspaper Ads:** Two newsletter ads ran in *The Pajaronian* and *Lookout Santa Cruz* publications and were distributed on August 1. Two digital ads ran on *The Pajaronian* and *Lookout Santa Cruz* websites from July 18 to August 15.
- **Media:** Two news releases were distributed to local Santa Cruz County media outlets to promote the in-person community workshops (May 5) and summer engagement activities (June 12).
- **Mailers:** 1,216 postcards were mailed to Watsonville, Santa Cruz, and Walker Street stakeholders within 300 feet of the proposed project in Watsonville and Santa Cruz to promote the in-person community workshops.
- **Social Media:** A total of 65 organic and paid posts ran on SCCRTC’s accounts across multiple social media platforms in July and August, including three paid advertisements on Facebook and Instagram.

4.3.2 Milestone 4 — Stakeholder and Partner Agency Outreach

Between March and August 2025, the ZEPRT project team held briefings and presentations with the stakeholders and partner agencies listed below to share updates and seek feedback.

- California Coastal Commission
- City of Santa Cruz
- City of Watsonville
- County of Santa Cruz
- SCCRTC Bicycle Advisory Committee
- SCCRTC Elderly and Disabled Transportation Advisory Committee
- SCCRTC Interagency Technical Advisory Committee
- Santa Cruz, Big Trees and Pacific Railway (Roaring Camp)

- Santa Cruz Metro
- The Seaside Company

Commission Working Groups

At the March 20, 2025, meeting, SCCRTC Commissioners voted to form two working groups for the purpose of understanding and resolving key project alignment challenges, specifically in the Watsonville and Santa Cruz areas, in order to further advance the Project Concept. The two working groups met regularly from late March through May, which also often included site visits to provide a firsthand view of proposed locations for the rail and trail alignments and coordination with local stakeholders. Details of the two working groups included:

- South County Working Group
 - Commissioners: De Serpa, Hernandez, Montesino and Quiroz-Carter
 - Focus: Developing preferred rail and trail alignments through Downtown Watsonville as well as the trail segment 17-19 alignments (San Andreas to West Beach Street and Downtown Watsonville), considered proposed downtown station locations, and location of the trail bridge over the Pajaro River.
- North County Working Group
 - Commissioners: Keeley, Koenig, Martinez and Schiffrin (alternate)
 - Focus: Understanding end-of-line station alternative options in Santa Cruz (Natural Bridges Drive and Depot Park) and proposed at-grade and elevated alignment options on Beach Street in Santa Cruz including operational and regulatory constraints, and sought stakeholder feedback to identify challenges, opportunities and solutions.

4.3.3 Milestone 4 — Informational Community Sessions

Four Informational Community Sessions were held to share topic-specific updates and answer questions from the public in 2025. Sessions were held in the evenings, from 3:30-5:00 p.m. or 6:00-7:15 p.m. in a hybrid format with a virtual option via Zoom and an option for participants to view the session from SCCRTC's conference room in Santa Cruz. Each session included live Spanish interpretation and was recorded and posted on the ZEPRT project webpage.

- March 12 – Railroad Bridge Infrastructure
- April 1 – Conceptual Alignment and Operations
- June 9 – Ridership Projections and Cost Estimates
- July 22 – Conceptual Station Design

4.3.4 Milestone 4 — In-Person Community Workshops

Two interactive, in-person Community Workshops and a Walker Street Stakeholder Workshop were held in mid-May 2025. The Watsonville Community Workshop was held on May 12 at the Civic Plaza in Watsonville at 6:00 p.m. and had approximately 40 attendees. A stakeholder meeting for Walker Street businesses and residents was also held on May 12 in the afternoon. The Santa Cruz Community Workshop was held on May 14 at London Nelson Community Center in Santa Cruz at 6:00 p.m. and had approximately 40 attendees. Both events provided materials in English and Spanish and included Spanish interpreters.

The Watsonville workshops included a presentation providing an overview of conceptual rail and trail alignments and Downtown Watsonville station location options. The Santa Cruz workshop included a

presentation providing an overview of Beach Street conceptual alignment, Beach Flats traffic circulation, end-of-line stations options, and the Santa Cruz West Side rail alignment. At all three workshops, board exhibits were displayed with project information and ZEPRT Project team members were available to answer questions and further discuss project elements. Large format maps displayed conceptual alignment and station location options for areas where specific community feedback was desired. Community members were encouraged to fill out interactive surveys based on the information detailed in the presentations to solicit community feedback on rail alignment options, station locations, trail alignments, and bridge locations over the Pajaro River between Pajaro and Watsonville.

4.3.5 Milestone 4 — Virtual Open House

The virtual open house was available to all community members at [ZEPRT.com](https://zeprt.com) as an interactive, self-guided public meeting enabling visitors to learn more about the Project Concept with activities to gather feedback. The virtual open house included information on the conceptual rail and trail alignment, ridership projections, station locations and design, operations, and project costs and funding. The virtual open house was open continuously from June 12 through August 22, 2025, and attracted over 1,000 total users.

4.3.6 Milestone 4 — Virtual and In-Person Office Hours

SCCRTC hosted a series of office hours, offering in-person (Watsonville and Santa Cruz) and virtual options on different days and times over the summer. The office hours provided an opportunity for community members to talk directly with ZEPRT project team members one-on-one, ask questions and share input on the Draft Project Concept. The project team met with individuals as well as various community and special interest groups during the project office hours. The in-person and virtual office hours were held on June 23 and 24, and August 4 and 5, and an additional virtual option was held on July 23.

4.3.7 Milestone 4 — Community Feedback Summary

More than 500 comments and activity feedback submissions were received from community members throughout the Milestone 4 engagement period, including on the Draft *Project Concept Report* that was posted on July 31, 2025. The following bullets summarize the key takeaways of feedback received throughout Milestone 4 engagement for the ZEPRT Project.

- **General Comments**
 - Frustration from South County and disadvantaged communities that the broader project community benefits aren't understood well or promoted better
 - Concerns about travel time (i.e., time windows to board train, number of passengers during commute hours, station to destination time versus car)
- **Rail Corridor and Alignment**
 - Questions about designing the system to accommodate both freight and passenger rail
 - Interest in preservation of the SCBRL railroad corridor
 - Interest in further understanding how the rail trail and other activities in the Beach Flats area of Santa Cruz could complement each other
 - Interest in rail access to the west side of Santa Cruz for UC Santa Cruz commuters
- **Trail**
 - Preference to prioritize completion of the trail quickly
 - Concerns around safety of trail segments not located in the rail corridor
- **Cost and Funding**

- Concerns about project cost estimate and how the project would be funded
- Questions about funding source viability and local funding needs
- Support for advancing the project to gain further understanding of how it could be funded as part of the *California State Rail Plan*
- Interest in trip cost per rider information based on the conceptual cost estimates
- **Equity**
 - Eagerness from Watsonville/South County and low-income communities for the economic and transportation opportunities the rail and trail project would provide
 - Concerns regarding right-of-way impacts and encroachments
- **Ridership**
 - Interest in ridership projections and comparisons to other systems
- **Stations**
 - Interest in advancing Depot Park as an end of line station option in Santa Cruz
 - Suggestions on station locations and connectivity, including additional or relocated stations
- **System Technology**
 - Interest in Personal Rapid Transit (PRT) as an affordable alternative to the project
 - Desire for Bus Rapid Transit (BRT) as more affordable transit option

5.0 Current SCBRL Rail Corridor and Infrastructure Characteristics

5.1 Introduction

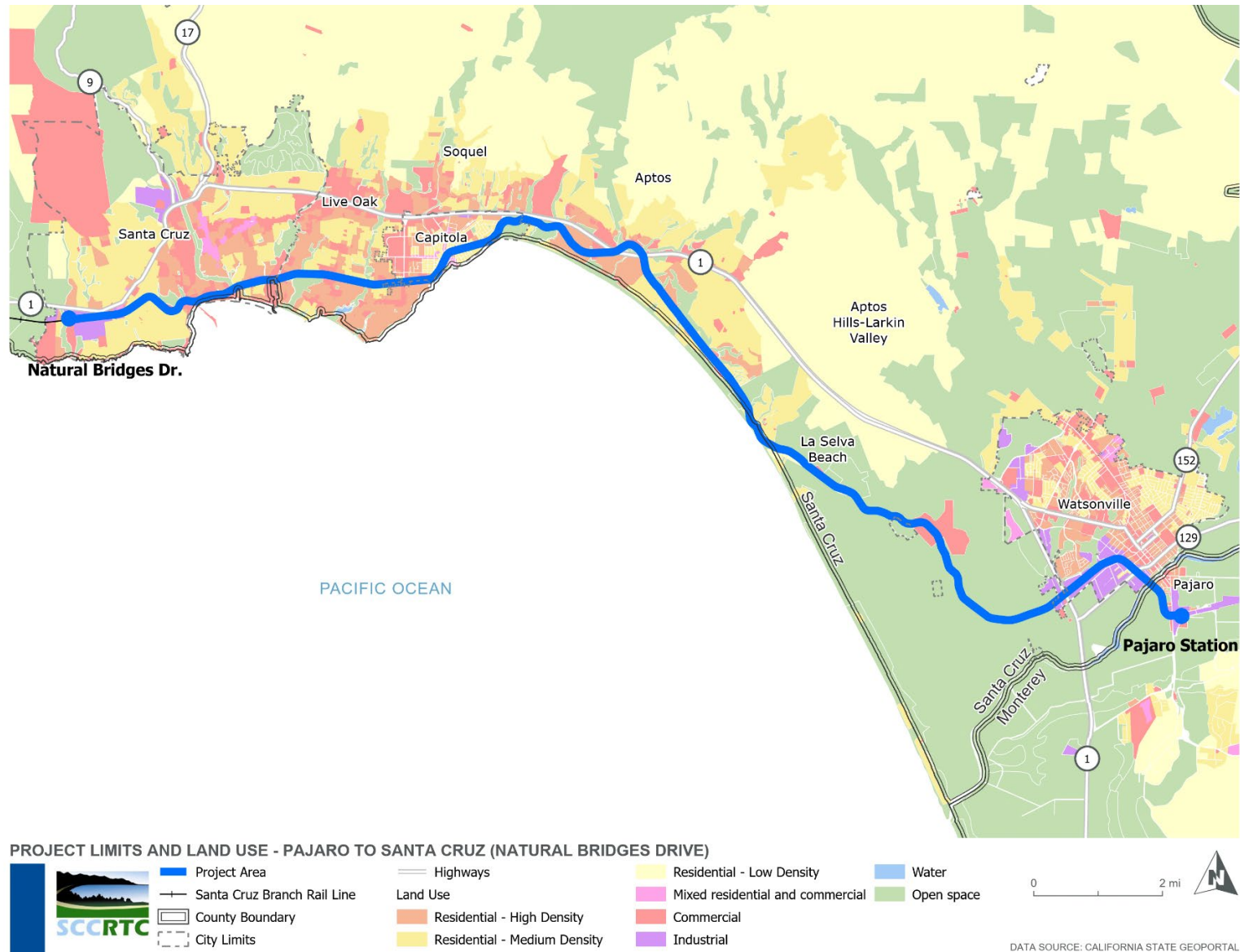
This section presents a general description of the characteristics of the SCBRL corridor between Pajaro and Santa Cruz, based on an assessment of past SCBRL passenger rail studies, data and inputs provided by SCCRTC for the ZEPRT Project, analysis of available Google Earth Pro aerial images and Street View imagery, and corridor site observation activities undertaken for the Project in 2023-2024.

5.2 Adjacent Land Use and Community Interface

The ZEPRT Project rail corridor study area consists of approximately 22 miles of the SCBRL between Pajaro and Natural Bridges Drive on the west side of Santa Cruz. Many Santa Cruz County communities developed along the SCBRL corridor starting in the late 19th century. Santa Cruz County's population density is among the highest in California, and about half of the County's total population of approximately 270,000 lives within one mile of the SCBRL corridor.¹⁰ A map of general current land use types, communities, and principal locations along the Project study area is shown in Figure 5.1 below.

¹⁰ Santa Cruz Branch Rail Line Rail Transit Feasibility Study Final Report (2015): Santa Cruz Regional Transportation Commission

Figure 5.1 Adjacent Land Use and Community Interface in the Project Rail Corridor Study Area Map



5.3 Multimodal Transportation Network Interface

The SCBRL currently interfaces with a robust multimodal transportation network on the corridor segment between Pajaro and Santa Cruz — including freeways, principal arterials, and minor roadways; roadways with bicycle lanes; recreation trails used by bicyclists and pedestrians; and Santa Cruz METRO buses and paratransit. Additional connections are anticipated as the Coastal Rail Trail and other trails are developed within, adjacent, or across the SCBRL corridor. Additional details related to the multimodal transportation network and the SCBRL corridor will be presented later in the ZEPRT Project.

5.4 Rail Network and Infrastructure

5.4.1 Rail Network Configuration

The SCBRL is at present suited to light-density, slow-speed freight and recreational passenger railroad operations. The SCBRL consists of one main track between Pajaro and Santa Cruz. Siding tracks where freight railcars can be stored, switched, or staged and industry tracks that are used to serve shippers and receivers of freight also exist along the SCBRL in Watsonville and Santa Cruz. Most industrial trackage on the SCBRL is located in Watsonville. A wye exists in Santa Cruz where trains and railcars can be turned, as well as connecting to the Santa Cruz, Big Trees and Pacific Railroad (SCBG) line to Felton. Yard tracks at Pajaro (Watsonville Junction) — owned by Union Pacific Railroad (UP) and not part of the SCBRL — are used to interchange freight cars between the designated operator on the SCBRL and UP.

5.4.2 Right-of-Way

The SCBRL right-of-way in general is a linear corridor typically 35 to 80 feet wide, although it varies from as narrow as 15 feet to as wide as 185 feet. SCCRTC owns most of the SCBRL right-of-way in fee; however, there are some easements with underlying property owners. The SCBRL corridor operates within the footprint of Walker Street in Watsonville, Beach Street in Santa Cruz, and through the Santa Cruz Beach Boardwalk in Santa Cruz where the right-of-way is also used as a Boardwalk access road. SCCRTC owns additional property outside of, and immediately adjacent to, the SCBRL operating right-of-way.

A representative view of SCBRL right-of-way of average width — approximately 50 feet wide, west of Seabright Avenue in Santa Cruz — is presented in Figure 5.2 below.

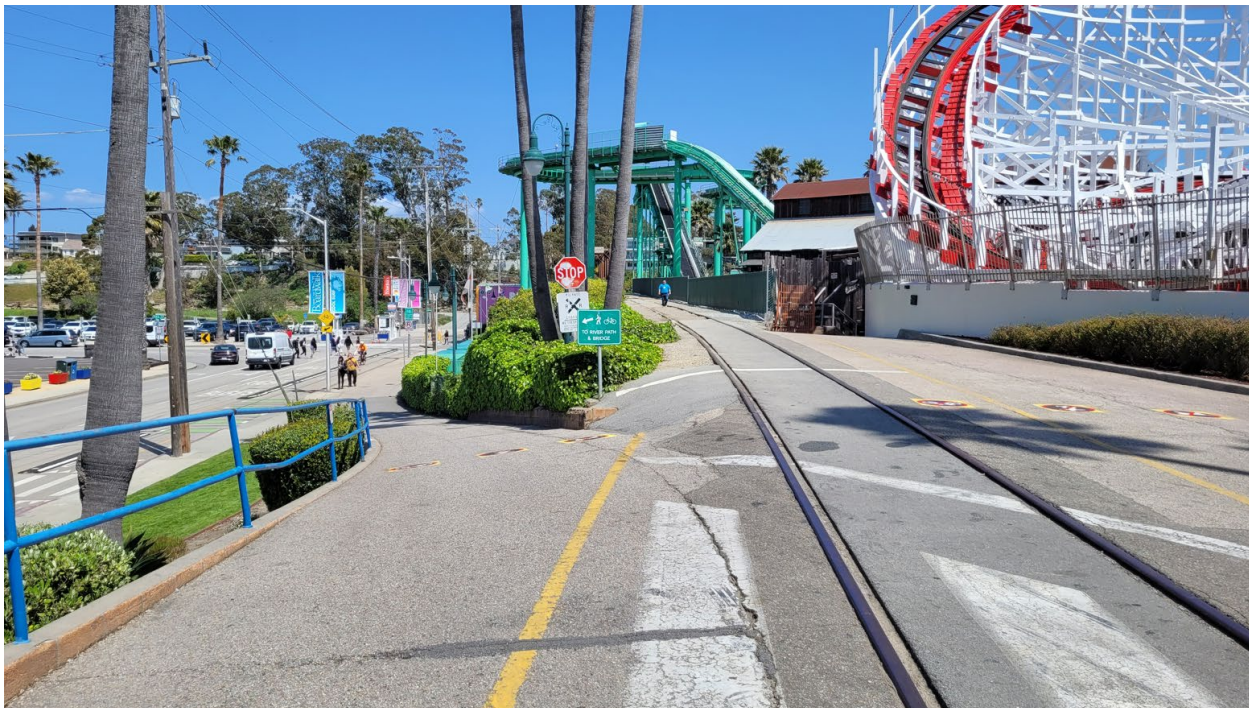
Figure 5.2 Right-of-Way of Average Width on SCBRL



Source: HDR

A representative view of narrow SCBRL right-of-way and related constraints at the Santa Cruz Beach Boardwalk in Santa Cruz is presented in Figure 5.3 below.

Figure 5.3 Narrow Right-of-Way on SCBRL



Source: HDR

5.4.3 Track and Track Structure

Approximately two-thirds of the track on the SCBRL between Pajaro and Santa Cruz consists of 90 pound per yard jointed rail installed over 100 years ago; the balance of the rail is a mixture of sizes ranging from 110 pound per yard to 136 pound per yard jointed rail installed between 1950 and 2015. Most of the heavier sections are secondhand (relay) rail repurposed from other segments of the Southern Pacific Railroad (SP) network. Main track switches in locations where connections are made to freight shippers and to other railroads are manual and must be thrown by hand. Timber ties and crushed rock ballast are used on main tracks; however, the crushed rock ballast is fouled by dirt and overgrown by weeds in some locations. A representative view of the existing track structure with 90 pound per yard rail, timber ties, and crushed rock ballast is shown in Figure 5.4 below.

Figure 5.4 Representative Track Structure on SCBRL



Source: HDR

5.4.4 Bridges and Other Drainage Structures

There are approximately 35 bridges and drainage structures that have been identified on the SCBRL between Pajaro and the west side of Santa Cruz, including 25 known bridges and 10 known major culverts, which were installed between 1903 and 2015; however, the truss bridge at Milepost 15.89 in Capitola (Figure 5.5 below) was originally constructed in 1890 and relocated to the site in 1904. Note that there are additional minor drainage structures on the SCBRL corridor, which are not included in these counts.

Bridge types on the SCBRL generally include steel girders, steel trusses, concrete box girders, and timber trestles. A representative view of a concrete box girder bridge at Woods Lagoon (Milepost 18.84) is presented in Figure 5.6 below and a steel girder bridge at Aptos Creek (Milepost 12.71) on the SCBRL is

presented in Figure 5.7 below. A representative view of a timber trestle type bridge at Riverside Avenue in Capitola (Milepost 15.74) on the SCBRL is presented in Figure 5.8.

Figure 5.5 Steel Truss Bridge at Soquel Creek in Capitola (Milepost 15.89) on the SCBRL



Source: Adobe Stock

Figure 5.6 Concrete Box Girder Type Bridge at Woods Lagoon (Milepost 18.84) on the SCBRL



Source: HDR

Figure 5.7 Steel Girder Type Bridge at Aptos Creek and Soquel Drive (Milepost 12.71) on SCBRL



Source: Google Earth Pro

Figure 5.8 Timber Trestle Type Bridge at Riverside Avenue in Capitola (Milepost 15.74) on SCBRL



Source: HDR

Culvert types on the SCBRL include reinforced concrete pipes, corrugated metal pipes, and concrete arch culverts.

Table 5.1 below identifies all known bridges and other major drainage structures on the SCBRL corridor, their railroad milepost location, the feature crossed, existing structure type, and year built. Additional minor drainage infrastructure is also present on the SCBRL corridor.

Table 5.1 Bridges and Other Drainage Structures on SCBRL Corridor

Location	SCBRL Railroad Milepost	Feature Crossed	Existing Structure Type	Year Built, if Known
Pajaro	0.86		Timber trestle	1940
Pajaro / Watsonville	1.06	Pajaro River	Timber trestle and through plate girder	1950
Watsonville	4.01		Corrugated metal pipe culvert	
West of Watsonville	4.45	Watsonville Slough	Open deck timber Trestle	1932
West of Watsonville	4.87	Harkins Slough	Timber trestle	1909
West of Watsonville	5.42		Timber trestle	1904
West of Watsonville	5.54		Timber trestle	1923
West of Watsonville	6.01		Timber trestle	1926
West of Watsonville	6.14		Timber trestle	1926
West of Watsonville	6.25		Timber trestle	1909
West of Watsonville	6.31		Corrugated metal pipe culvert	
West of Watsonville	6.34		Steel pipe culvert	
East of La Selva Beach	8.32		Timber trestle	1916
La Selva Beach	8.49		Concrete pipe culvert	
La Selva Beach	9.54		Corrugated metal pipe culvert	
La Selva Beach	8.64	San Andreas Road Underpass	Post-tensioned concrete bridge Timber trestle	1975 1932
La Selva Beach	9.09	Leonard Gulch / La Selva Beach	Deck Plate Girder on steel trusses	2015
Rio Del Mar	10.45		Timber Trestle	1928
Rio Del Mar	11.16		Timber trestle	1928
Aptos	12.30	State Route 1 / Cabrillo Highway Underpass	Steel beams	1948
Aptos	12.34	Valencia Creek	Steel viaduct	1969
Aptos	12.39	Soquel Drive Underpass	Deck plate girder	1925
Aptos	12.71	Aptos Creek, Soquel Drive, and Spreckels Drive	Steel deck girder and through plate girder	
Aptos	12.83	State Route 1 / Cabrillo Highway Underpass	Through plate girder	1948
Aptos	13.14		Corrugated metal pipe culvert	
Aptos	13.84		Concrete arch culvert	

Location	SCBRL Railroad Milepost	Feature Crossed	Existing Structure Type	Year Built, if Known
Capitola	14.85	New Brighton Beach Underpass	Concrete box girder	1971
Capitola	15.89	Capitola Avenue, Soquel Creek and Wharf Road	Timber trestle, deck truss, Concrete box girder	1904, 1971
Capitola	16.95		Corrugated metal pipe culvert	
Capitola	17.30	Rodeo Gulch	Concrete box girder	1977
Live Oak	18.25		Concrete arch culvert	
Santa Cruz	18.84	Woods Lagoon	Concrete box girder	1970
Santa Cruz	19.43	San Lorenzo River	Through steel truss and deck plate girder	1904
Santa Cruz	22.29		Timber trestle	1928

Source: SCCRTC, SCBRL Alignment and Bridge Evaluation and Repair/Rehabilitation or Replacement Recommendation Report (Patterson & Associates, Inc. 2012), and SCBRL Track Chart (2018)

5.4.5 Roadway and Pedestrian Crossings

There are approximately 80 intersections of the multimodal transportation network and the SCBRL between Pajaro and the west side of Santa Cruz. Public and private roadway crossings of the SCBRL are either grade separated or exist at-grade and the conditions and materials of the at-grade crossings vary. Similarly, there are grade separated and at-grade crossings between pedestrian facilities (e.g., sidewalks, trails) and the SCBRL; many of which occur at the same location as a road crossing.

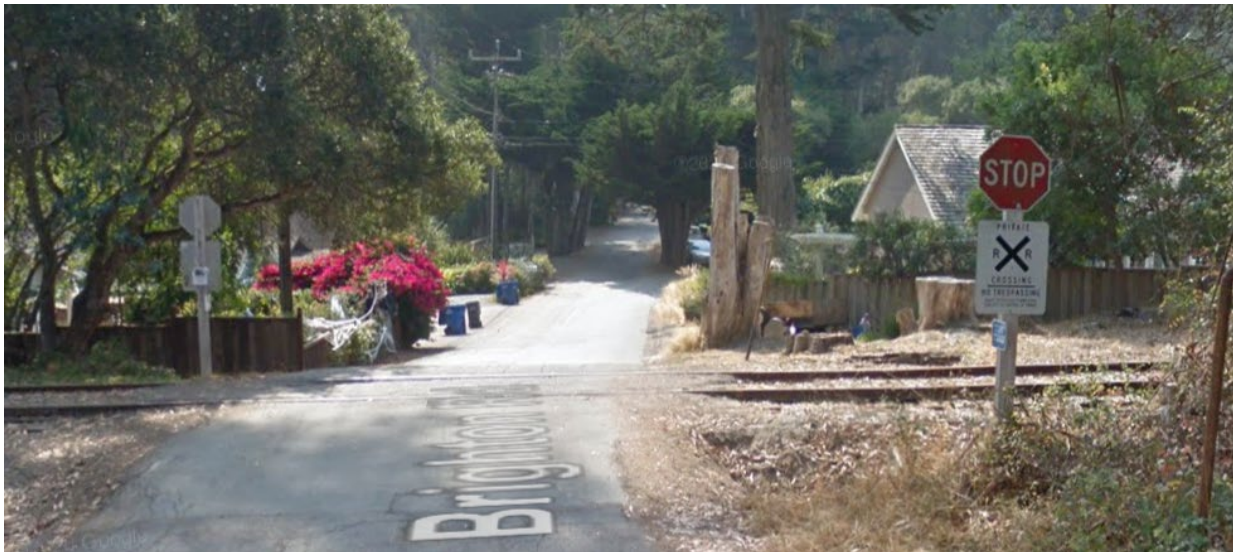
At-grade crossings are protected by safety treatments that include either passive warning devices (e.g., railroad crossbucks and stop signs) or active warning devices (e.g., flashing light signals, flashing lights signals with gates). Representative views of a public at-grade crossing of the SCBRL protected by active warning devices and a private at-grade crossing protected by passive warning devices are presented in Figures 5.9 and 5.10, respectively.

Figure 5.9 Representative Public At-Grade Roadway Crossing with Active Warning Devices at 17th Avenue in Santa Cruz (Milepost 17.83)



Source: HDR

Figure 5.10 Representative Private At-Grade Roadway Crossing with Passive Warning Devices at New Brighton Road (Milepost 14.09)



Source: Google Maps

Table 5.2 below identifies all existing roadway and pedestrian crossings of the SCBRL corridor, their railroad milepost location and USDOT crossing number, whether they are public or private crossings, and the types of warning devices present.

Table 5.2 Roadway and Pedestrian Crossings on SCBRL Corridor

Grade Crossing Name	Location	SCBRL Railroad Milepost	USDOT Crossing Number	Grade Crossing Type	Existing Warning Devices
Private Railroad Access Road	Pajaro (Watsonville Junction)	0.15 (on UP in Watsonville Junction Yard Area)	752362M	At-Grade	Stop signs with private railroad crossing signs
Salinas Road	Pajaro	0.32	752368D	At-Grade	Flashing light cantilever signals with gates
Berry Co-Op (Private Crossing)	Pajaro	0.46	752370E	At-Grade	Stop signs with private railroad crossing signs
Levee Crossing (Private Crossing)	Pajaro	0.97	752371L	At-Grade	
Front Street	Watsonville	1.20	752372T	Track embedded in pavement of Walker Street Shared with Center Left Turn Lane MP 1.06 to 1.67	Railroad crossing crossbucks
West Riverside Drive / State Route 129	Watsonville	1.27	752375N		Flashing light signals with gates
Second Street	Watsonville	1.52	752376V		Flashing light signals with gates
West Beach Street	Watsonville	1.67	752379R		Flashing light cantilever signals with gates
Ohlone Parkway	Watsonville	2.26	752389W	At-Grade	Flashing light cantilever signals with gates
State Route 1 / Cabrillo Highway	Watsonville	2.61	768290J	Road Over Rail	N/A
Lee Road	Watsonville	2.73	768289P	At-Grade	Railroad crossing crossbucks with stop signs
Private Farm Road (Private Crossing)	West of Watsonville	3.32	768287B	At-Grade	
Private Farm Road (Private Crossing)	West of Watsonville	3.94	768286U	At-Grade	

Grade Crossing Name	Location	SCBRL Railroad Milepost	USDOT Crossing Number	Grade Crossing Type	Existing Warning Devices
Buena Vista Drive	East of La Selva Beach	6.87	768283Y	At-Grade	Flashing light signals only on one side of the road
Peaceful Valley Drive (Private Crossing)	East of La Selva Beach	7.12	768282S	At-Grade	Stop signs with private railroad crossing signs
Spring Valley Road – KOA Crossing	East of La Selva Beach	7.74	768281K	At-Grade	Flashing light signals with gates and Stop sign for adjacent intersection
San Andreas Road	East of La Selva Beach	8.51	768279J	Rail Over Road	N/A
Private Driveway	La Selva Beach	8.71	768278C	At-Grade	Private crossing
Margarita Road – Private Beach Access (Private Crossing)	La Selva Beach	8.96	768276N	Rail Over Road	Road crossing under the La Selva Beach Trestle
Camino Al Mar – Private Road	Rio Del Mar	9.25	768275G	At-Grade	
Private Road	Rio Del Mar	9.38	768274A	At-Grade	
Camp St. Francis (Private Crossing)	Rio Del Mar	9.61	768273T	At-Grade	Stop signs with private railroad crossing signs
Private Pedestrian Trail to Park	Rio Del Mar	9.76	768272L	At-Grade Pedestrian Crossing	No visible signs
Eva Seascapes Pedestrian Path	Rio Del Mar	10.01	912078N	At-Grade	Flashing light signals
Seascapes Boulevard	Rio Del Mar	10.32	912079V	At-Grade	Flashing light signals with gates
Clubhouse Drive	Rio Del Mar	10.81	768271E	At-Grade	Flashing light signals with gates
Rio Del Mar Boulevard	Rio Del Mar	12.03	768270X	Road Over Rail	Road bridge with separate pedestrian bridges on each side.

Grade Crossing Name	Location	SCBRL Railroad Milepost	USDOT Crossing Number	Grade Crossing Type	Existing Warning Devices
State Route 1 / Cabrillo Highway	Aptos	12.31	768269D	Rail Over Road	Warning signs for 15 feet-2 inches (westbound) and 15 feet-1 inch (eastbound) vertical clearance
Soquel Drive	Aptos	12.39	768268W	Rail Over Road	Warning signs 13 feet-9 inches (westbound) and 14 feet (eastbound) vertical clearance
Trout Gulch Road	Aptos	12.50	768267P	At-Grade	Flashing light signals with gates
Parade Street	Aptos	12.55	968196X	At-Grade	Flashing light signals with gates
Aptos Creek Road	Aptos	12.63	768265B	At-Grade	Flashing light signals with gates
Soquel Drive	Aptos	12.70	768264U	Rail Over Road	Warning signs 14'-6" vertical clearance
State Route 1 / Cabrillo Highway	Aptos	12.84	768263M	Rail Over Road	Warning signs 15 feet-6 inches eastbound vertical clearance. No warning signs for westbound vertical clearance.
State Park Drive	Aptos	13.18	768262F	At-Grade	Flashing light signals with gates
Mar Vista Drive	Aptos	13.32	768261Y	At-Grade	Flashing light signals with gates
Estates Drive (Private Crossing)	Aptos	13.71	768260S	At-Grade	Stop sign but no private crossing sign
New Brighton Road (Private Crossing)	Aptos	14.09	768258R	At-Grade	Stop signs with private railroad crossing signs
New Brighton State Beach Access Road	Capitola	14.68	768257J	At-Grade	Warning signs 14 feet-1 inch vertical clearance
Grove Lane	Capitola	15.13	768256C	At-Grade	Stop signs with private railroad crossing signs

Grade Crossing Name	Location	SCBRL Railroad Milepost	USDOT Crossing Number	Grade Crossing Type	Existing Warning Devices
Monterey Avenue	Capitola	15.52	768255V	At-Grade	Flashing light cantilever signals with gate
Capitola Avenue	Capitola	15.73	768254N	Rail Over Road	N/A
Riverview Avenue	Capitola	Unknown	Unknown	Rail Over Road	Warning signs 9 feet-8 inches vertical clearance and limited horizontal clearance
Wharf Road	Capitola	15.81	768253G	Rail Over Road	No warning signs
Pedestrian Crossing	Capitola	15.99	970971N	At-Grade Pedestrian	No warning signs
47th Avenue	Capitola	Unknown	768252A	At-Grade	Flashing light signals with gate
41st Avenue	Capitola	16.75	768251T	At-Grade	Flashing light cantilever signals with gate
38th Avenue	Capitola	16.88	768250L	At-Grade	Flashing light cantilever signals with gate
30th Avenue	Capitola	17.21	768249S	At-Grade	Flashing light signals
17th Avenue	Live Oak	17.87	768248K	At-Grade	Flashing light cantilever signals with gate
Pedestrian Crossing	Live Oak	18.10	970972V	At-Grade Pedestrian Crossing	Trail at end of El Dorado Avenue No warning signs visible
Pedestrian Crossing	Live Oak	18.14	970973C	At-Grade Pedestrian Crossing	No warning signs visible
7th Avenue	Santa Cruz	18.42	768247D	At-Grade	Flashing light signals with gates
Private Road	Santa Cruz	18.67	768245P	Rail Over Road	N/A
Pedestrian Pathway	Santa Cruz	18.73	768244H	Rail Over Road	N/A

Grade Crossing Name	Location	SCBRL Railroad Milepost	USDOT Crossing Number	Grade Crossing Type	Existing Warning Devices
Seabright Avenue	Santa Cruz	19.22	768242U	At-Grade	Wig-wag signal for southbound traffic but no signs. No signals or signs for northbound traffic. Activated no right turn sign on westbound Murray Street
Mott Avenue	Santa Cruz	19.05	768241M	At-Grade	Railroad crossing crossbucks but no stop or yield sign. There is a closely spaced stop sign at an adjacent intersection
East Cliff Drive	Santa Cruz	19.24	768240F	Road Over Rail	N/A
Santa Cruz Riverwalk Pedestrian	Santa Cruz	19.31	970974J	Rail Over Road	Stop signs and private railroad crossing signs
Boardwalk Pedestrian Crossing	Santa Cruz	19.41	768239L	At-Grade Pedestrian	Stop signs and private railroad crossing signs
Boardwalk Pedestrian Crossing	Santa Cruz	19.49	768238E	At-Grade Pedestrian	Stop signs and private railroad crossing signs
Boardwalk Pedestrian Crossing	Santa Cruz	19.53	768237X	At-Grade Pedestrian	Stop signs and private railroad crossing signs
Boardwalk Pedestrian Crossing	Santa Cruz	19.60	970975R	At-Grade Pedestrian	Stop sign and private railroad crossing sign
Cliff Street Pedestrian Crossing	Santa Cruz	19.71	768233V	At-Grade Pedestrian	Pedestrian crossing and cycle track crossing with bike crossing hazard sign
Westbrook Street	Santa Cruz	19.77	768232N	Track embedded in pavement of Beach Street MP 19.71 to 19.97	Railroad crossing crossbucks and stop sign for the intersection
Main Street	Santa Cruz	19.83	768231G		Railroad crossing crossbucks and stop sign for the intersection

Grade Crossing Name	Location	SCBRL Railroad Milepost	USDOT Crossing Number	Grade Crossing Type	Existing Warning Devices
Pacific Avenue	Santa Cruz	19.97	768230A	Concrete Panels	Flashing light signals with gates. Track passes through roundabout.
West Cliff Drive	Santa Cruz	20.02	768229F	Road Over Rail	N/A
California Street	Santa Cruz	20.75	768150G	At-Grade	Flashing light signals with gates
Bay Street	Santa Cruz	20.79	768151N	Road Over Rail	Flashing light signals with gates
Lennox Street	Santa Cruz	20.87	768152V	Road Over Rail	Railroad crossing crossbucks but no stop or yield sign
Dufour Street	Santa Cruz	21.02	768154J	At-Grade	Railroad crossing crossbucks but no stop or yield sign
Bellevue Street	Santa Cruz	21.08	768155R	At-Grade	Railroad crossing crossbucks but no stop or yield sign
Younglove Avenue	Santa Cruz	21.14	768156X	At-Grade	Railroad crossing crossbucks but no stop or yield sign
Seaside Street	Santa Cruz	21.18	768157E	At-Grade	Railroad crossing crossbucks but no stop or yield sign. There is a closely spaced stop sign at an adjacent intersection
Rankin Street	Santa Cruz	21.20	768158L	At-Grade	Railroad crossing crossbucks but no stop or yield sign. There is a closely spaced stop sign at an adjacent intersection
Almar Avenue	Santa Cruz	21.40	768159T	At-Grade	Flashing light cantilever signals with gates
Fair Avenue	Santa Cruz	21.45	768160M	At-Grade	Flashing light cantilever signals with gates
Swift Avenue	Santa Cruz	21.59	768161U	At-Grade	Flashing light cantilever signals with gates
Natural Bridges Drive	Santa Cruz	22.20	768162B	At-Grade	Flashing light signals but only southbound traffic has a gate

Grade Crossing Name	Location	SCBRL Railroad Milepost	USDOT Crossing Number	Grade Crossing Type	Existing Warning Devices
Shaffer Road	Santa Cruz	22.48	970977E	At-Grade Pedestrian	Private crossing with no signs and guardrail across the street north of the crossing; however, there is a pedestrian crossing with no visible signs

Source: Federal Railroad Administration (FRA) Grade Crossing Inventory on Office of Safety website; California Public Utilities Commission (CPUC) Rail Crossing Inventory; Google Earth Pro imagery

5.4.6 Wayside Signal Systems, Asset Protection Devices, and Communications System

There are not any wayside signal or train control systems that provide authority or protection for train operations (e.g., Centralized Traffic Control or Positive Train Control), asset protection devices (e.g., devices that detect dragging equipment on moving trains), or communications systems (e.g., radio system for dispatching train operations) currently in place to support rail operations on the SCBRL.

5.4.7 Utility Interface

There are multiple locations between Pajaro and Santa Cruz where third-party utilities — electrical, gas, water and sewer, and fiber infrastructure — cross the SCBRL right-of-way above ground or underground or are situated within or immediately adjacent to the SCBRL right-of-way.

5.4.8 Rail Corridor Safety and Security

Infrastructure exists along the SCBRL between Pajaro and Santa Cruz to mitigate trespassing and vandalism along the corridor. No Trespassing signage has been installed near highway-rail and pedestrian-rail grade crossings and fencing, lighting, and other treatments have been installed at intermediate corridor locations. However, there are multiple minimally improved pedestrian crossings along the SCBRL.

5.4.9 Station and Platform Facilities

There are no station and platform facilities currently in place to support passenger rail operations on the SCBRL between Pajaro and Santa Cruz. Historic railroad station facilities exist at Watsonville (onsite and owned by a private party) and Capitola (moved offsite and owned by a private party), and a historic railroad freight house exists at the north end of the Santa Cruz Wye at Santa Cruz (onsite and owned by the city). These facilities have been retired from railroad use and repurposed for alternative purposes.

5.4.10 Rail Operations and Maintenance Support Facilities

There are no facilities currently in place to support passenger or freight rail operations and rail network infrastructure and equipment maintenance on or immediately adjacent to the SCBRL.

6.0 Train Operations on SCBRL Corridor

6.1 Introduction

The SCCRTC does not operate any freight or passenger trains on the SCBRL corridor directly; rather, it has established an administrative, coordination, and license agreement with an operator to provide freight and recreational passenger rail service. SCCRTC selected Minnesota-based Progressive Rail as its designated operator and common carrier under agreement in 2018. St. Paul & Pacific Railroad (SPP) — a short line subsidiary of Progressive Rail initially provided freight service directly — and since 2021, the Felton-based Santa Cruz, Big Trees and Pacific Railway (SCBG) has been providing day-to-day freight service on the SCBRL as a third-party contractor under an agreement and through coordination with Progressive Rail. A summary of known current and potential future freight and passenger rail operations is presented below.

6.2 Freight Rail Operations

Short line railroad SCBG currently provides regular freight rail service over a 3-mile segment of the SCBRL in Pajaro and Watsonville. Operations typically occur on weekdays and are tailored to the demands of local customers. Current freight shippers and receivers on the SCBRL at Watsonville, as of 2024, included Del Mar Foods, Lineage Logistics, Martinelli's, Big Creek, and Agron. Railcar interchange is facilitated with UP at its Watsonville Junction Yard on the UP Coast Subdivision in Pajaro. Freight currently handled on SCBRL includes agricultural products, food products, lumber, building materials, and other commodities. Train operations over SCBRL are made at speeds not exceeding 10 miles per hour.

Freight trains are not precluded from operating over the balance of the SCBRL from Watsonville to Aptos, Capitola, Santa Cruz, and Davenport, but as of July 2025, there are currently no freight operations over that segment. Various segments of the SCBRL have been undergoing repairs advanced by SCCRTC needed to address damages from winter storms in recent years. An interchange connection with the SCBRL and the SCBG-owned line between Felton and Santa Cruz exists at the north leg of the SCBRL Santa Cruz Wye.

SCBRL provides the only freight rail access to Santa Cruz County and SPP and SCBG continue to identify opportunities to expand service to existing customers and to new customers. While not currently used, SCBG also has industry track connections to rail shippers on its Felton Line within Santa Cruz, which may potentially receive freight service again in the future if the SCBRL is reopened for freight operations between Watsonville and Santa Cruz. These potential opportunities will be confirmed as the ZEPRT Project advances.

6.3 Passenger Rail Operations

Passenger train operations are presently limited to SCBG / Roaring Camp seasonal Santa Cruz Beach Trains to and from Felton. These excursion trains operate over an approximately 1.5-mile segment of the SCBRL in Santa Cruz from the north end of the Santa Cruz Wye where a connection is made with the SCBG, over the west and east legs of the Santa Cruz Wye connecting to the SCBRL main track, and on the SCBRL main track between the wye and the Santa Cruz Beach Boardwalk to the east. All SCBG operations on the SCBRL are made at speeds not exceeding 10 miles per hour.

On the days the Beach Trains operate during the 2025 season, starting in March, they are scheduled to depart Felton (Roaring Camp) for the Boardwalk at 10 a.m. and 2 p.m. and depart from the Beach Boardwalk for Felton at 12 noon and 4 p.m.¹¹ There is not a station for the Beach Train in Santa Cruz; rather, passengers board trains on a segment of the SCBRL main track in pavement immediately adjacent to the entrance to the Beach Boardwalk, as shown in Figure 6.1 below. These trains are staged on the SCBRL main track for approximately one hour from the time a southbound train arrives in Santa Cruz until it departs as a northbound train for Felton. The train ride between Felton and Santa Cruz is approximately 8 miles long and takes about one hour each way.

Figure 6.1 Santa Cruz Beach Train on SCBRL at the Beach Boardwalk



Source: HDR

In addition to future implementation of the ZEPRT passenger rail service between Pajaro and Santa Cruz, a proposed future intercity passenger service from the San Francisco Bay Area to Santa Cruz envisioned in the 2025 *California State Rail Plan* (which would interline on the SCBRL between Pajaro and Santa Cruz) and which will be studied in a future phase of the separate federal Corridor Identification and Development Program (Corridor ID) by the State of California as part of a broader Central Coast passenger rail expansion initiative, will also be confirmed as the ZEPRT Project advances.

¹¹ Roaring Camp Railroads, Santa Cruz Beach Train. <https://roaringcamp.com/excursions/santa-cruz-beach-train-2>

7.0 SCBRL Infrastructure Evaluation for ZEPRT Project

This chapter presents the approach to, and the outcomes of, a preliminary conceptual evaluation of existing railway infrastructure on the SCBRL between Pajaro and Natural Bridges Drive in Santa Cruz to assess the SCBRL's potential to host the passenger rail service envisioned for the ZEPRT Project. The infrastructure evaluated by the ZEPRT Project team included existing track and track structure, bridges, and highway-rail and pedestrian-rail grade crossing warning devices and crossing configurations.

7.1 Approach and Assumptions for Infrastructure Evaluation

Like the condition of a roadway or a building, the condition of railroad infrastructure naturally deteriorates over time. The ZEPRT Project evaluated the existing SCBRL infrastructure, including track, right-of-way features (such as drainage), bridges and other structures, and grade crossings, to assess its suitability for use by regularly scheduled passenger trains. The evaluation process provided baseline information for an assessment of whether the existing infrastructure could be reused in its current condition, required rehabilitation prior to reuse, or required complete replacement.

Existing bridges along the SCBRL were a primary focus of the evaluation for the ZEPRT Project, since they are key components of the infrastructure and since bridge rehabilitation or replacement are often expensive. Several of the existing bridges were evaluated in detail, including new inspections. The ZEPRT Project also performed calculations to assess the load carrying capacity of several structures.

7.1.1 Existing Track and Track Structure Evaluation

The existing track and civil facilities were evaluated through walking surveys along the SCBRL as well as hi-rail trips performed over a two-day period in December 2023. These reviews covered the length of the SCBRL from Pajaro to Natural Bridges Drive in Santa Cruz. These field reviews were performed by ZEPRT Project staff experienced in track inspection and maintenance. Record data from SCCRTC, such as track charts indicating dates of certain maintenance activities as well as prior inspection reports, supplemented the field reviews and supported the conceptual evaluation of the existing infrastructure.

The nature and condition of the existing infrastructure and the eventual, likely infrastructure design parameters and reliability requirements of the ZEPRT Project's regularly scheduled passenger rail service implied that most or all of the existing infrastructure would need to be reconstructed as part of the ZEPRT Project. Thus, the ZEPRT Project team assessed that more detailed inspections, such as ultrasonic testing of the existing rail, rail profile measurements, gauge restraint measurement, and geometry testing of the existing track were not warranted, since essentially all the track would be reconstructed. Because none of the existing infrastructure is serviceable for the ZEPRT project, a detailed list of the existing infrastructure's condition is not included in this report.

7.1.2 Existing Railroad Bridge Structures Evaluation

This section briefly summarizes the general approach and assumptions for evaluating existing railroad bridges on the SCBRL corridor between Pajaro and Natural Bridges Drive in Santa Cruz for future ZEPRT

passenger and freight rail service. The evaluation developed for the ZEPRT Project to date only covers existing railroad bridges and does not include other structures.

The first step for evaluating existing railroad bridges involved obtaining past as-built plans and inspection records from SCCRTC. The available as-built plans were reviewed along with online Google Earth Pro Street View imagery of each structure, where available, to confirm existing bridge configuration and to determine accessibility. In addition, past inspection records were examined to identify known structural, low clearance, and embankment approach issues.

An initial field overview tour of the SCBRL corridor via hi-rail vehicles was conducted in December 2023 by the ZEPRT Project team to, among other activities, assess the existing configuration, overall condition, and access approach for subsequent bridge inspections. In addition, various structures were discussed with SCCRTC in the field to understand their perspective and preference for replacement, where applicable.

Prior to mobilizing inspection teams to each railroad bridge, the field inspectors developed an access approach and inspection criteria for each structure. In addition, traffic control plans were developed for some of the bridges over roadways to keep inspectors safe from traffic underneath, including at Bridge 12.39 over Soquel Drive and Bridge 12.71b over Soquel Drive. Since use and availability of hi-rail access equipment were limited, the ZEPRT Project field inspectors primarily used industrial rope access techniques to reach areas of each railroad bridge where not accessible by foot.

AREMA manual recommendations and freight railroad industry practice for inspection criteria were followed, as these existing bridges are not currently in operation and do not have a known governing Bridge Safety Management Plan (BSMP) following FRA's Part 237 Bridge Safety Regulation. The following inspection criteria were used:

- *AREMA Handbook for Railway Bridge Inspection*, 2nd Edition (2017)
- *AREMA Manual for Railway Engineering* (2022):
 - Timber – Section 7-3.1.4
 - Concrete – Section 8-19.2.5
 - Steel – Section 15-7.2.6

The following inspection approaches were used:

Bridge Cursory Inspections

- Bridges pre-identified for replacement by SCCRTC due to poor condition or comprised of a construction material, such as treated timber, which is identified as potentially unsuitable for future ZEPRT passenger operations, received a cursory inspection:
 - Existing timber bridges – 0.86, 1.06a, 1.06c, 4.45, 4.87, 5.42, 5.54, 6.01, 6.14, 6.25, 8.32, 8.64b, 10.45, 11.16, 15.89b, and 15.89d.
 - Existing steel truss bridges – 15.89c and 19.43a.
 - Existing steel girder bridges – 1.06b and 19.43b.
- A cursory inspection was completed from the bridge deck and ground levels to verify and document basic conditions from previous inspection reports provided by SCCRTC.

Bridge Load Capacity Rating Inspections

- Bridges that could possibly be kept in service received a rating inspection:
 - Existing concrete bridges – 8.64a, 14.85, 15.89a, 15.89e, 17.30, and 18.84.
 - Existing steel girder bridges – 12.34, 12.39, 12.71a/b.
 - Rating inspections document the following, where applicable:
 - Actual sections and details conform to the as-built drawings. The inspection should verify that repairs, strengthening, or other modifications have not occurred; if they have, dimensions should be recorded to determine accurate section properties and dead loads.
 - Type of bridge deck (open or ballast deck) and material used.
 - An Open Deck bridge has treated timber bridge ties, designed as a structural member, supported directly on the superstructure which could consist of treated timber or steel stringers, steel beams or girders, or concrete beams.
 - A Ballast Deck bridge has a normal track section, rail, OTM, track ties, and ballast supported on decking material consisting of treated timber, steel plates, or concrete.
 - An estimate of any additional dead load that has been added to the structure.
 - Position of the track, relative to the centerline of the structure.
 - Superelevation of the track across the bridge.
 - Degree of curvature of the track across the bridge.
 - Horizontal and vertical alignment of the track over the bridge.
 - Uneven settlement of piers or abutments (end bents).
 - Concrete condition (spalls, cracking, lost concrete, rust-colored efflorescence).
 - Reduction in steel reinforcement area, visible reinforcement.
 - Steel member corrosion, section loss, or fatigue cracks.
 - Loose rivets, bolts, hardware or connections in steel members.
 - Crooked or damaged members.
 - Cracked welds or other connections.

The following railroad bridges were not included in the current ZEPRT Project scope of work for inspections or consideration in this report, along with the recommendation:

- Bridge 9.09 over La Selva Beach – recently rehabilitated, keep in service.
- Bridge 12.30 over State Route 1 – slated for imminent replacement, designed by others.
- Bridge 12.83 over State Route 1 – slated for imminent replacement, designed by others.

Field Inspections

Field inspections were completed in February 2024 by the ZEPRT Project team and documentation of the field inspections included notes and photos. Upon completion of the field work, the inspection results and past as-built plans were utilized for completing detailed span load capacity ratings as identified below:

- Bridge 12.34 over Valencia Creek
 - Spans 1, 2, and 4 – 30' steel deck plate girder span with open deck treated timber bridge ties.
 - Span 3 – 126' steel deck plate girder span with open deck treated timber bridge ties.
- Bridge 12.39 over Soquel Drive

- Span 1 – 59' steel deck plate girder span with open deck treated timber bridge ties.
- Bridge 12.71a over Aptos Creek
 - Span 1 – 34' steel deck plate girder span with open deck treated timber bridge ties.
 - Span 2 – 126' steel deck plate girder span with open deck treated timber bridge ties.
- Bridge 12.71b over Soquel Drive
 - Span 3 – 69' steel thru-plate girder span with open deck treated timber bridge ties.

Load Capacity Ratings

The rated capacities of existing railroad bridge spans are quantified with calculations by a process defined in AREMA Chapter 15, Part 7.3, titled Rating Existing Steel Bridges. Normal load capacity ratings are for loads that can be carried by the structure for its expected service life. The intent of a Normal capacity rating is to limit the stresses in the structure to those which it would have typically been designed to carry on a daily basis, while providing a consistent factor of safety. Maximum capacity ratings are for loads that can be carried at infrequent intervals. The Maximum capacity rating provides a reduced factor of safety and, if frequent maximum loads are allowed, a reduced structure life would be expected.

Caltrain live load demand train consists, including both freight and passenger, were tentatively assumed for comparison to rated member capacities. There are two Caltrain freight consists under consideration:

1. One SD-45 type six-axle locomotive with six 263,000 pound freight cars
2. One SD-45 type six-axle locomotive with six 286,000 pound freight cars.

The Caltrain passenger consist includes a single four-axle Caltrain locomotive with five passenger cars. Train speeds were assumed to be 60 mph for the passenger train consist and 25 mph for the freight train consist. When corridor-specific live load consists and train speeds are determined in a future evaluation for the ZEPRT Project, the live load demand effects should be updated and re-compared to the rated capacities.

Outcomes

An inspection memo package was developed by the ZEPRT Project team for each existing railroad bridge on the SCBRL between Pajaro and Natural Bridges Drive in Santa Cruz and provided to SCCRTC in June 2024. Each package included a summary of inspection results, rating results (if applicable), and potential recommendations, as well as appendices addressing as-built plans (if available), field inspection notes, selected field photos, rating calculations (as applicable), and tentative live load demand train consists (as applicable). The recommendations were also supported by a draft Conceptual Design Criteria for Railroad Structures developed by the ZEPRT Project team.

7.1.3 Approach and Assumptions for Highway-Rail and Pedestrian-Rail Grade Crossing Signals and Surfaces Evaluation

At-grade highway-rail crossings are intersections where a railway line and a roadway used by vehicles, bicyclists, and pedestrians cross at the same level, rather than using a bridge, tunnel, or viaduct. These crossings are common in both urban and rural areas and can be found on public roads, private roads, trails, and industrial access routes.



The primary function of at-grade crossings is to allow for safe and efficient interaction between rail and road traffic. They can be equipped with various warning features such as one or many of the elements identified below:

- Flashing light signals at crossing
- Gates (two-quadrant or four-quadrant) at crossing
- Bells or other audible warning device at crossing
- Signage at and on approach to crossing
- Pavement markings at and on approach to crossing
- Traffic signal preemption systems (connected to adjacent traffic signals to clear roadway traffic before a train arrives)
- Wayside horns at or near the crossing
- Physical impenetrable barriers including roadway medians and other elements at or near the crossing

These features aim to reduce the risk of collisions and improve safety for motorists, pedestrians, and train crews.

In the State of California, the California Public Utility Commission (CPUC) is responsible for at-grade crossing safety, based largely on General Orders (GOs) promulgated by the CPUC and Federal Railroad Administration (FRA) rules, while the FRA is responsible for regulatory oversight of the railroads and much of the rail infrastructure including the signal system and other elements. FRA also requires states like California to develop and maintain Grade Crossing Action Plans to help reduce crossing accidents; CPUC also manages the Federal Highway Administration (FHWA) Section 130 Program in California that prioritizes and recommends crossings for federal safety funding.

The CPUC has primary regulatory authority over rail safety in California, and the CPUC enforces both federal and state laws through its Rail Safety Division (RSD). The CPUC also issues GOs containing requirements, such as:

- GO 72-B – Construction standards for crossings
- GO 75-D – Warning device requirements
- GO 88-B – Procedures for altering crossings

All new grade crossings as well as changes and upgrades of existing grade crossings must be approved by the CPUC.

The local roadway jurisdictions, such as cities and counties, and the state own and maintain the roadways at public crossings. They are also responsible for collaborating with CPUC and the railroads on crossing improvements. Furthermore, they are also responsible for traffic signal integration and right-of-way related issues.

Based on the existing FRA Office of Safety Grade Crossing Inventory database and field surveys conducted by the ZEPRT Project team, there are approximately 80 existing crossings of the SCBRL corridor between

Pajaro and Natural Bridges Drive in Santa Cruz — approximately 45 public crossings and approximately 35 private crossings. A list of known public and private grade crossings on the SCBRL and their characteristics — including SCBRL milepost, USDOT crossing number, warning devices, and other details — can be found in Table 8.2 in this report.

Public and private rail crossings on the SCBRL differ significantly in terms of access, ownership, maintenance, and regulatory oversight. Public crossings are open to all road users and are typically located on city streets, highways, or rural roads. These are owned and maintained by public agencies in coordination with the railroad and are subject to oversight by the CPUC. Public crossings often include active or automatic warning devices like flashing light signals and gates and are eligible for federal and state safety funding. Any modifications to these crossings require formal CPUC approval.

In contrast, private crossings are restricted to specific users such as landowners or businesses. They are maintained by the property owner and the railroad, often with fewer automatic warning devices depending on usage and agreements. While private crossings must still comply with CPUC safety standards, they are not eligible for public safety funding. These crossings on the SCBRL are found on access roads to private residences and property, farms, industrial sites, and other adjacent railroad property outside of the operating corridor right-of-way.

Table 7.1 below presents the differences between public and private grade crossings.

Table 7.1 Differences Between Public and Private Grade Crossings

Feature	Public Crossing	Private Crossing
Access	Open to the general public	Restricted to specific users (e.g., landowners, businesses)
Ownership	Roadway owned and maintained by a public agency (i.e., city, county, or state)	Roadway typically owned by a private party (e.g., a landowner or business)
Maintenance Responsibility	Shared between the public agency and the railroad	Typically the responsibility of the private property owner and the railroad
Regulatory Oversight	Regulated by CPUC; eligible for federal/state safety funding	Subject to CPUC safety standards but not eligible for public safety funding
Warning Devices	Often includes active devices (i.e., flashing light signals, gates, and bells)	May have minimal or no warning devices, depending on usage and agreements
Permitting and Changes	Requires CPUC approval for modifications	Changes may still require CPUC review, especially if safety is impacted
Examples	Crossings on city streets, highways, or rural roads	Crossings to access farms, industrial sites, or private residences

Source: HDR

7.2 Conceptual Evaluation Findings

This section presents the findings of a preliminary evaluation of existing railway infrastructure on the SCBRL between Pajaro and Natural Bridges Drive in Santa Cruz to assess its potential to host the passenger rail service envisioned for the ZEPRT Project. These findings were used to support development of a conceptual rail corridor safety assessment on the SCBRL corridor (presented in Chapter 8 of this report), a conceptual rail transit and trail alignment in the SCBRL corridor (presented in Chapter 13 of this report), a list of conceptual network infrastructure improvements on the SCBRL corridor to support development of the ZEPRT Project (presented in Chapter 14 of this report), and an initial opinion of probable capital and operations and maintenance cost for the ZEPRT Project (presented in Chapter 18 of this report).

7.2.1 Track and Track Structure

This section summarizes the initial conceptual evaluation findings for the existing railroad track and track structure on the SCBRL corridor between Pajaro and Natural Bridges Drive in Santa Cruz for future passenger and freight rail service.

During field observation activities undertaken for the ZEPRT Project during 2023-2024, it was noted that most of the existing rail on the SCBRL main track consists of older, smaller rail (approximately two-thirds of it is 90 pounds per yard) that is likely suitable for low-speed freight trains but would not be adequate for the operations of faster and more frequent ZEPRT passenger trains; most of this rail was manufactured approximately 100 years ago. Much of the rail is worn on the head, where railcar wheels contact the rail. The rail joints — locations where rails are linked together with additional splice bars bolted in place — are also worn, meaning that it is more difficult to maintain tension in the bolts and support for the rail.

The SCBRL is constructed entirely with wood ties. Data from track charts provided by SCCRTC indicate partial tie replacement was last performed on the SCBRL corridor in 2003. Based on field reconnaissance, it appears that approximately one-third of the ties were replaced at this time. The remaining two-thirds of the ties are from before 2003.

Drainage along the SCBRL track has been compromised over time, with many trackside drainage channels blocked by siltation, debris, or vegetation. One effect of the drainage channel conditions is that fine soil particles tend to accumulate within the rock ballast that normally supports the ties, weakening the track structure, ultimately manifesting as degraded track geometry. However, the fine soil particles in the track also prevent water (generally rainwater) from drainage from the track, not only further softening the track structure, but also accelerating deterioration of the existing wood ties.

As examples, existing track conditions on the SCBRL in Watsonville and east of the San Lorenzo River bridge in Santa Cruz are shown in Figures 7.1 and 7.2 below, respectively.

Figure 7.1 Existing Track Conditions in Watsonville



Source: HDR

Figure 7.2 Existing Overgrown Track Conditions East of the San Lorenzo River Bridge in Santa Cruz



Source: HDR

These types of conditions would not by themselves prevent the operation of hi-rail vehicles or potentially even infrequent freight service on the existing track, though some level of maintenance or rehabilitation may be a necessary pre-requisite in various areas. Over time and absent maintenance, conditions will continue to deteriorate. However, the current condition of the existing infrastructure dictates that, without substantial rehabilitation, the existing infrastructure would not support frequent passenger train operations as contemplated by the ZEPRT Project. Alternately, rather than rehabilitating the existing track, the operational requirements of the ZEPRT Project may necessitate complete reconstruction of the existing track structure. This is particularly necessary where the Project proposes changes in the track

alignment. This approach is discussed in more detail in Chapter 13 (Conceptual Rail Transit and Trail Alignments) and Chapter 14 (Conceptual Network Infrastructure Improvements).

7.2.2 Existing Railroad Bridge Structures

While the conceptual bridge evaluation and design effort for the ZEPRT Project is ongoing and will continue beyond the development of this initial draft concept report, this section summarizes the initial conceptual evaluation findings for the existing railroad bridges on the SCBRL corridor between Pajaro and Natural Bridges Drive in Santa Cruz for future passenger and freight rail service. The conceptual bridge evaluation and design effort will be completed as the ZEPRT Project advances.

Three overall criteria were used to evaluate existing railroad bridges:

- Condition
- Calculated Load Rating
- Functionality

In general, if the existing structure is in relatively satisfactory condition and can be maintained in the future, the existing structure should be considered for keeping in place for future use especially when built using concrete or steel materials. Otherwise, poor structural conditions indicating a need for extensive rehabilitation to support future trains or use of a material at high risk of fire damage like treated timber substructure and spans, may require bridge replacement.

In order to meet the SCRRTC requirements to prioritize operating safety for the ZEPRT passenger service, essential functional features, cost effectiveness, and low maintenance, the approach to keeping existing railroad structures in service for the ZEPRT Project also considered operational conditions including anticipated low-volume freight traffic with restricted axle loads and a regular volume of ZEPRT passenger trains with relatively light axle loads.

Freight interchange traffic could theoretically be load-restricted by SCRRTC to 263,000 pound freight car consists and 20 mph operating speeds over the SCBRL if existing railroad bridges have limited Normal and Maximum rated capacities that cannot support heavier demand loads but are still in a good state of repair and functionality and can support the anticipated ZEPRT passenger train consist demands. This restriction would also need acceptance by UP, because the freight easement was retained when SCBRL was sold to SCRRTC.

Functionality considerations include track horizontal and vertical curvature over the structure; presence of an existing open deck track and inability to surface or raise the track; roadway horizontal clearance underneath the structure (as applicable), including needs for sidewalks, bike lanes, and/or future roadway lanes; roadway vertical clearance underneath the structure (as applicable); and hydraulic capacity under the existing structure (as applicable).

If any of the above factors suggest replacement of the structure is warranted, replacement should be strongly considered to occur early in the line's restoration process to avoid costly phasing, temporary shoofly tracking, and/or track outages for replacement after ZEPRT passenger and/or freight rail service begins.

Due to satisfactory existing condition and functionality, the following existing precast prestressed concrete double cell box beam bridges are intended to be kept in service, with rehabilitation and maintenance as necessary, for future operation. Due to a lack of as-built drawings, there is no capacity rating available for these bridges, as internal reinforcing steel and prestressing steel cannot be determined or verified. However, these bridges are considered to be of relatively modern construction, following past Union Pacific Railroad and previous Southern Pacific Railroad bridge standards, with a likely design live load of between Cooper E-65 and E-72 given the 1970's construction dates.

- Bridge 14.85 over New Brighton Beach Road
- Bridge 17.30 over Rodeo Gulch

Due to satisfactory existing condition and functionality, the existing bridge over San Andreas Road (Bridge 8.64a) consists of a single cast-in-place post-tensioned concrete U-girder span and is intended to remain in service, with rehabilitation and maintenance as necessary, for the ZEPRT Project. There are multiple inconsistent as-built drawings showing differing span dimensions and internal steel configurations; as a result, there is no capacity rating available for this bridge, as internal reinforcing steel and prestressing steel cannot be determined or verified. However, the multiple as-built drawings consistently show a design live loading of Cooper E-72 which is typically adequate for the stresses created by the Caltrain loading used for this analysis and is considered to be relatively modern construction.

Due to satisfactory existing condition and functionality, the existing bridge over Woods Lagoon (Bridge 18.84) consists of multiple precast prestressed concrete single-cell box beam spans and is intended to remain in service, with rehabilitation and maintenance as necessary, for future operations. The as-built drawings show a design live loading of Cooper E-72 and is considered to be of relatively modern construction. In addition, the spans were rated in December 2022 and included a controlling Normal rating of E-62 and Maximum rating of E-72, likely adequate for the proposed tentative freight demands and tentative ZEPRT passenger demands. This bridge was previously analyzed in July 2023 by others and identified as being seismically deficient, potentially requiring retrofitting as a part of the ZEPRT Project, prior to passenger service being re-established.

Timber members are increasingly difficult to source, typically consisting of large dimensional lumber that needs to be harvested from forests with the larger trees sufficient to cut into the required bridge member sizes and meet the requisite timber strength standards. These are currently only available from Canada, or via Southern Yellow Pine from the Southeast U.S. and are becoming more costly. Environmental considerations for use of wood preservatives further increase costs and decrease availability. Since timber members rot and decay over time, each member needs to be replaced eventually, more frequently in humid climates, even with treatment applied and good maintenance. In general, the existing timber bridges in this corridor have not been well maintained since freight and/or passenger rail service ceased and decay continues to progress in primary members (i.e., stringers, caps, posts, and piles) and secondary members (i.e., walkways, bracing, backwalls, and wingwalls), as noted during the cursory bridge inspections. Some timber bridges also exhibit fire damage. SCCRTC has stated that it desires bridges with minimal maintenance needs and reduced risk of in-service failures which results in replacement of existing timber bridges prior to ZEPRT passenger service being established to avoid costly member replacements, future impacts to operations, and increased costs for future eventual full bridge replacements. Due to poor

material condition, increasing maintenance needs and costs, and SCCRTC preference, the following existing timber bridges on the SCBRL are intended for replacement. A brief explanation of some of the bridges follows this list to further explain the replacement needs:

- Bridge 0.86 over drainage
- Bridge 1.06a/c over Pajaro River
- Bridge 4.45 over Watsonville Slough
- Bridge 4.87 over Harkins Slough
- Bridge 5.42 over drainage
- Bridge 5.54 over drainage
- Bridge 6.01 over drainage
- Bridge 6.14 over drainage
- Bridge 6.25 over drainage
- Bridge 8.32 over drainage
- Bridge 8.64b over drainage
- Bridge 10.45 over Bush Gulch
- Bridge 11.15 over Dry Creek
- Bridge 15.89b over Riverview Avenue and Soquel Creek
- Bridge 15.89d over Soquel Creek

West of Watsonville, the existing timber Bridge 4.45 over Watsonville Slough is regularly inundated by flood waters. In order to mitigate the flood risk to the tracks and embankment at the bridge crossing and minimize damage to adjacent landowners, it is proposed that the SCBRL main track be raised by about 10 feet, which also necessitates bridge replacement, as the existing timber bridge cannot be raised by that amount and needs to become longer if raised to maintain the existing hydraulic opening.

At the Pajaro River crossing in Watsonville, there is the potential that the existing track will be raised by 8 to 10 feet, corresponding with the planned levee raise for additional flood protection, currently in the pre-construction, engineering and design phase with construction originally planned in 2025, along the Pajaro River. The existing Bridge 1.06b consists of steel through-plate girder spans with an open timber tie deck, supported by steel pipe piles and concrete caps, and has been raised in the past, but as-built plans do not reflect the original design details or the raised design details adequately to determine current capacity or whether there's available capacity to raise the bridge further. The existing open timber tie deck makes future track surfacing and track profile adjustments difficult, with no ability to adjust the track over the bridge with fixed deck ties. The east end of the existing bridge was damaged during a past earthquake, with the existing foundation piles failed/settled and a temporary steel pony bent installed away from the original span bearing location, resulting in cantilevered girder ends. Lastly, the existing steel through-plate girders and components (i.e., floor beams, stringers, and connections) exhibit heavy corrosion losses, reducing member capacity, as noted during the cursory bridge inspection. The bridge was previously rated in August 2021 and included a controlling Normal rating of E-64 but did not include any losses due

to corrosion. With corrosion losses considered, the tentative freight demands and possibly the tentative ZEPRT passenger demands would exceed the reduced Normal rating. As a result, existing Bridge 1.06b over Pajaro River needs to be replaced in conjunction with the planned levee raise, as well as replacement of the adjacent timber bridges Bridge 0.86 and Bridge 1.06a/c due to the extended track raise and runoff distance in addition to the requirement to reduce risk from retaining existing timber bridges in service. The existing at-grade SCBRL main track interface with the roadway environment in Walker Street to the west has been evaluated further by the ZEPRT Project team separately.

In Aptos, the existing Bridge 12.34 over Valencia Creek consists of multiple steel deck plate girder spans with open deck treated timber bridge ties, sharing an abutment with Bridge 12.39 to the west. The existing treated timber open deck makes future track surfacing and track profile adjustments difficult, with no ability to adjust the track over the bridge with fixed deck ties. The existing spans are supported by tall steel pony bents on concrete piers. The adjacent Bridge 12.30 over State Route 1 is being replaced, which includes a 1- to 2-foot track raise that will ultimately extend over Bridge 12.34 once the profile is restored between the two structures, further necessitating replacement. The bridge was rated with current conditions incorporated, including moderate corrosion losses. The analysis resulted in a controlling Normal rating of E-66 and Maximum rating of E-116, exceeding both the tentative freight demands and tentative ZEPRT passenger demands. While the rated capacity appears to be able to support future freight and passenger train service, the height of the existing steel pony bents, the fixed nature of the treated timber open deck, and the need to replace Bridge 12.39 over Soquel Drive with a longer span and shifting the shared abutment results in a recommendation that this bridge be replaced.

In Aptos, the existing Bridge 12.39 over Soquel Drive consists of a single steel deck plate girder span with an open timber tie deck, sharing an abutment with Bridge 12.34 to the east. The existing roadway underneath includes a non-standard low vertical clearance of 13 feet-9 inches and the span low chord has been struck by vehicles multiple times. The horizontal clearance from each roadway white fog line to the face of each existing concrete tall abutment is approximately 1 foot, leaving very little room for pedestrians or bikes. The bridge was rated with current conditions incorporated, including moderate corrosion losses and vehicle impact damage to the lower span chord. The analysis resulted in a Normal rating of E-25 and Maximum rating of E-37, exceeded by the tentative freight demands and tentative ZEPRT passenger demands. Santa Cruz County intends to widen the roadway to include bike lanes and sidewalks and requested increasing the vertical clearance underneath to 15 feet-6 inches for the ZEPRT Project. As a result of the increased risk for not meeting vertical clearance standards, and planned future roadway and pedestrian accessibility, this bridge is recommended to be replaced.

In Aptos, the existing Bridge 12.71a over Aptos Creek consists of multiple steel deck plate girder spans with a treated timber open deck, sharing a pier with Bridge 12.71b to the west. The existing treated timber tie open deck makes future track surfacing and track profile adjustments difficult, with no ability to adjust the track over the bridge with fixed deck ties. The existing spans are supported by tall steel pony bents on concrete piers. The adjacent Bridge 12.83 over State Route 1 is being replaced with a 1- to 2-foot track raise that will ultimately extend over Bridge 12.71a and Bridge 12.71b once the profile is restored between the two structures, further necessitating replacement. The bridge was rated with current conditions incorporated, including moderate corrosion losses. The analysis resulted in a controlling Normal rating of E-64 and Maximum rating of E-113, exceeding both the tentative freight demands and tentative ZEPRT

passenger demands. While the rated capacity appears to be able to support future train service, the height of the existing steel pony bents, the fixed nature of the treated timber tie open deck, and the need to replace Bridge 12.71b over Soquel Drive with a longer span and shifting the shared abutment results in a recommendation to replace the bridge.

In Aptos, the existing Bridge 12.71b over Soquel Drive consists of a single steel through plate girder span with a treated timber tie open deck, sharing a pier with Bridge 12.71a to the east. The existing roadway underneath includes a relatively low, non-standard vertical clearance of 14 feet-6 inches and the span low chord has been struck by vehicles multiple times. The horizontal clearance from the apparent roadway white fog line to the face of existing concrete tall abutment is approximately 2 feet, leaving very little room for pedestrians or bikes. The bridge was rated with current conditions incorporated, including moderate corrosion losses and vehicle impact damage to the lower span chord. The analysis resulted in a Normal rating of E-52 and Maximum rating of E-82, with the Normal rating exceeded by the tentative freight demands. The adjacent Bridge 12.83 over State Route 1 is being replaced with a 1- to 2-foot track raise that will ultimately extend over Bridge 12.71a and Bridge 12.71b once the profile is restored between the two structures, further necessitating replacement. Santa Cruz County intends to widen the roadway to include bike lanes and an additional sidewalk and also requested increasing the vertical clearance underneath to 15 feet-6 inches for the ZEPRT Project. As a result, this bridge is slated for replacement.

In Capitola, the existing Bridge 15.89c over Soquel Creek consists of a wrought iron deck truss with an open timber tie deck. The existing truss and components (i.e., floor beams, stringers, and connections) exhibit moderate corrosion losses, reducing member capacity, as noted during the cursory bridge inspection. The bridge was previously rated in August 2012 and included a controlling Normal rating of E-27 but has not been updated for current losses due to corrosion. Without current corrosion losses considered, the truss floor system Normal and Maximum capacity ratings are already exceeded by the assumed freight demands and tentative ZEPRT passenger demands. An issue unique to this crossing is the additional functional requirement by SCCRTC to provide room and support for the proposed adjacent trail bridge within the existing SCBRL right-of-way width, which varies, but is as narrow as 50 feet wide total. In order to fit a trail bridge adjacent to the railroad bridge within the existing right-of-way, the existing track needs to shift by about 8 feet to the north, requiring complete replacement of the entire bridge crossing, including Bridge 15.89a (over Capitola Avenue), Bridge 15.89b (over Riverview Avenue and Soquel Creek), Bridge 15.89c (over Soquel Creek), Bridge 15.89d (over Soquel Creek), and Bridge 15.89e (over Wharf Road).

In Santa Cruz, the existing Bridge 19.43a over the San Lorenzo River consists of two steel through truss spans, each with an open timber tie deck. Sharing a pier to the west, the existing Bridge 19.43b over the paved Santa Cruz Riverwalk consists of a steel deck plate girder span with open timber tie deck. The current approach proposed is for this crossing to replace the bridge in line and continue to facilitate an at-grade rail alignment through the Beach Boardwalk and Beach Street. For this crossing, there is also the potential to re-align the track to the north, away from the amusement park log ride overcrossing to the west. Since the track would be re-aligned at a larger skew to the river and raised up in that instance, the existing railroad bridges cannot be reused. The existing bridge spans are severely corroded from exposure to brackish sea water, as confirmed during the cursory bridge inspection, and need to be replaced regardless of track realignment.

Refer to the summary in Table 7.2 below for the overall approach for each existing railroad bridge on the SCBRL as part of the ZEPRT Project, including rough existing span configurations and background information.

Table 7.2 Summary of Overall Approach for Existing SCBRL Railroad Bridges for the ZEPRT Project

	Current SCBRL Milepost	Crossing Name / Type	Original Bridge Description	Year Constructed	Existing Span Type	Existing Substructure Type	Existing Deck	Approach for ZEPRT Project
1	0.86	Drainage	14 panel OD trestle	1940	Treated Timber	Treated Timber Pile	Open	Replace
2	1.06a	Pajaro River	13 panel OD trestle	1950	Treated Timber	Treated Timber Pile	Open	Replace
3	1.06b	Pajaro River	5 - 60' TPG-OD	1906	Steel Thru-Plate Girder	Concrete	Open	Replace
4	1.06c	Pajaro River	6 panel OD trestle	1950	Treated Timber	Treated Timber Pile	Open	Replace
5	4.45	Watsonville Slough	4 panel OD trestle	1932	Treated Timber	Treated Timber Pile	Open	Replace
6	4.87	Harkins Slough	13 panel BD trestle	1909	Treated Timber	Treated Timber Pile	Ballast	Replace
7	5.42	Drainage	1 panel BD trestle	1904	Treated Timber	Treated Timber Pile	Ballast	Replace
8	5.54	Drainage	9 panel BD trestle	1923	Treated Timber	Treated Timber Pile	Ballast	Replace
9	6.01	Drainage	6 panel BD trestle	1926	Treated Timber	Treated Timber Pile	Ballast	Replace
10	6.14	Drainage	2 panel BD trestle	1926	Treated Timber	Treated Timber Pile	Ballast	Replace
11	6.25	Drainage	8 panel BD trestle	1909	Treated Timber	Treated Timber Pile	Ballast	Replace
12	8.32	Drainage	1 panel BD trestle	1916	Treated Timber	Treated Timber Pile	Ballast	Replace
13	8.64a	San Andreas Road UX	PT concrete BD	1975	Concrete	Concrete	Ballast	Keep
14	8.64b	Drainage	8 panel OD trestle	1932	Treated Timber	Treated Timber Pile	Open	Replace
15	9.09	Leonard Gulch La Selva Beach	30', 60', 30', 70', 5 - 30' DPG-OD	1927	Steel Deck Plate Girder	Steel / Concrete	Open	Keep (NIC)

	Current SCBRL Milepost	Crossing Name / Type	Original Bridge Description	Year Constructed	Existing Span Type	Existing Substructure Type	Existing Deck	Approach for ZEPRT Project
16	10.45	Drainage (Bush Gulch)	16 panel BD trestle	1928	Treated Timber	Treated Timber Pile	Ballast	Replace
17	11.16	Drainage (Dry Creek)	16 panel BD trestle	1928	Treated Timber	Treated Timber Pile	Ballast	Replace
18	12.30	Hwy 1 / Cabrillo Hwy UX	2 - 44' steel beam BD skewed	1948	Steel Beam	Concrete	Ballast	Replace (NIC)
19	12.34	Valencia Creek	Steel DPG OD	1969	Steel Deck Plate Girder	Concrete	Open	Replace
20	12.39	Soquel Drive Undercrossing	60' DPG-OD	1925	Steel Deck Plate Girder	Concrete	Open	Replace
21	12.71a	Aptos Creek	Steel DPG OD	1969	Steel Deck Plate Girder	Concrete	Open	Replace
22	12.71b	Soquel Drive UX	Steel TPG OD		Steel Thru-Plate Girder	Concrete	Open	Replace
23	12.83	Hwy 1 / Cabrillo Hwy UX	2 - 68'-8" TPG-BD	1948	Steel Thru-Plate Girder	Concrete	Ballast	Replace (NIC)
24	14.85	New Brighton Beach Undercrossing	2 span concrete	1971	Concrete	Steel / Concrete	Ballast	Keep
25	15.89a	Capitola Avenue	3 span concrete	1970	Concrete	Concrete	Ballast	Replace
26	15.89b	Soquel Creek	15 panel OD trestle	1904	Treated Timber	Treated Timber Pile	Open	Replace
27	15.89c	Soquel Creek	148'-6" DTP-OD	1903	Steel Deck Truss	Concrete	Open	Replace
28	15.89d	Soquel Creek	OD trestle	1904	Treated Timber	Treated Timber Pile	Open	Replace
29	15.89e	Wharf Road	1 span concrete	1971	Concrete	Concrete	Ballast	Replace
30	17.3	Rodeo Gulch	8 span concrete	1977	Concrete	Concrete	Ballast	Keep

	Current SCBRL Milepost	Crossing Name / Type	Original Bridge Description	Year Constructed	Existing Span Type	Existing Substructure Type	Existing Deck	Approach for ZEPRT Project
31	18.84	Woods Lagoon	7 span concrete	1970	Concrete	Concrete	Ballast	Keep
32	19.43a	San Lorenzo River	2 - 120' TTR-OD	1904	Steel Thru Truss	Concrete	Open	Replace
33	19.43b	San Lorenzo River	60'-3" DPG-OD	Unknown	Steel Deck Plate Girder	Concrete	Open	Replace

Source: SCCRTC and HDR, 2025

The FRA Railroad Bridge Safety Standards, 49 CFR Part 237, require track owners to adopt and implement a Railroad Bridge Safety Management Program (BSMP) for management of existing structures subject to railroad loading. At this time, SCCRTC does not have a BSMP adopted for the entire line from Pajaro to Natural Bridges Drive in Santa Cruz. For the portion in service between Pajaro and Watsonville, the current operator should have a BSMP in place for the management of two existing bridges (Bridge 0.86 and Bridge 1.06) subject to freight railroad loading. For future passenger and freight rail service, SCCRTC needs to develop a corridor-wide BSMP and perform a detailed inspection of reused railroad bridge structures:

Evaluation of each railroad bridge is ongoing and will be documented in separate more-detailed conceptual design memos addressing existing condition, rated capacity, and functionality, as well as the conceptual layout and type of the proposed replacement bridges. This approach is discussed in more detail in Chapter 14 (Conceptual Network Infrastructure Improvements).

7.2.3 Highway-Rail and Pedestrian-Rail Grade Crossing Signals and Surfaces

This section summarizes the initial conceptual evaluation findings for the existing highway-rail and pedestrian-rail grade crossing signals and surfaces on the SCBRL corridor between Pajaro and Natural Bridges Drive in Santa Cruz for future passenger and freight rail service.

As noted by the ZEPRT Project team during field observation on the SCBRL in 2024 and 2025, only the Pajaro to Watsonville and the Beach Boardwalk to the wye in Santa Cruz which currently experience regular train operations. As a result, out of the approximately 45 public at-grade crossings on the SCBRL between Pajaro and Natural Bridges Road in Santa Cruz, many are located on a segment of the corridor over which passenger and freight trains do not currently operate, as of July 2025. It was further noted that some grade crossing infrastructure has also been damaged or vandalized.

An example of a public grade crossing infrastructure on a currently inactive segment of the SCBRL is shown in Figure 7.3 below.

Figure 7.3 Example Public Crossing at Spring Valley Road (SCBRL Milepost 7.74)



Source: HDR

According to inputs from SCCRTC, approximately 15 grade crossings on the SCBRL corridor have been upgraded or have a current warning system that was installed since 2000. However, some of this new infrastructure is already approaching the end of its life, yet there is the potential for some of the existing hardware to be reused provided it meets the design and operational requirements for the ZEPRT passenger service. Examples of newer grade crossing infrastructure on the SCBRL are shown in Figures 7.4 and 7.5 below.

Figure 7.4 Example of Newer Grade Crossing Equipment Bungalow at Aptos Creek (SCBRL Milepost 12.63)



Source: HDR

Figure 7.5 Example of Newer Cantilever for Grade Crossing Flashing Light Signals and Signage at Fair Avenue in Santa Cruz (SCBRL Milepost 21.43)



Source: Google Maps

The ZEPRT Project team noted that the approximately 35 private grade crossings on SCBRL may have passive grade crossing protection (e.g., railroad crossbuck, stop sign, etc.) but do not have any active warning devices. While some private at-grade crossings are for vehicles, most of them on the SCBRL corridor are pedestrian crossings. An example is shown in Figure 7.6 below.

Figure 7.6 Example of Private Crossing at the Beach Boardwalk in Santa Cruz (SCBRL Milepost 19.68)



Source: HDR

It was noted during the conceptual evaluation and the companion rail corridor safety assessment (see Chapter 8 for more details) conducted for the ZEPRT Project in 2024-2025 that existing grade crossing signal, warning device, and crossing surface infrastructure on the SCBRL at many locations may therefore be insufficient or potentially beyond repair for use in the future ZEPRT Project. This approach is discussed in more detail in Chapter 14 (Conceptual Network Infrastructure Improvements).

The actual location, type, and scope of improvements to warning devices and surfaces at highway-rail and pedestrian-rail grade crossings (including repair, reconfiguration, and replacement) between Pajaro and Natural Bridges Drive in Santa Cruz would be subject to further stakeholder and community coordination and to future grade crossing field diagnostics meetings with CPUC, local roadways jurisdictions, SCCRTC, and other parties as the ZEPRT Project advances.

8.0 Conceptual Rail Corridor Safety Assessment

A conceptual rail corridor safety assessment of the SCBRL corridor between Pajaro and Natural Bridges Drive in Santa Cruz was conducted for the ZEPRT Project and is presented in this chapter. The assessment conceptually evaluated operational safety and federal and state regulatory requirements of a rail transit service and trail within the SCBRL right-of-way and at points of intersection with the multimodal transportation network.

The conceptual assessment includes analysis and conceptual recommendations for highway-rail and pathway-rail grade crossing locations, rail transit system operation and wayside control requirements (e.g., Centralized Traffic Control, Positive Train Control, etc.), grade crossing active warning device and potential Quiet Zone options, and separation measures and infrastructure between the conceptual rail transit and trail alignments.

8.1 Approach for Rail Corridor Safety Assessment

The conceptual assessment of the SCBRL corridor developed for the ZEPRT Project leveraged inputs from stakeholder and community engagement; desktop analysis of publicly available data, information, and resources from federal and state agencies and peer rail transit agencies; corridor observation activities from publicly accessible property off of the SCBRL corridor; and context of federal and state regulatory oversight in matters related to rail corridor safety presented in the sections that follow.

8.1.1 Federal Safety Oversight

Federal safety oversight, by the Federal Railroad Administration (FRA), Federal Transit Administration (FTA), or both, will occur as follows:

- Rail Crossing Quiet Zones: As presented in detail in Section 8.2.3, FRA has exclusive jurisdiction over the Quiet Zone process and will be a mandatory participant for grade crossing diagnostic reviews.
- Rail Accessibility Approval: FRA and FTA will review the Project's Rail Accessibility Reports for stations. These reports will describe a plan to accommodate federal accessibility guidelines per the Americans with Disabilities Act (ADA) in the context of level-boarding requirements contained in the ADA.
- Code of Federal Regulations (CFR) pertaining to railroad track and signal infrastructure, primarily in Title 49. The FRA governs basic railroad safety requirements as stated in the various CFR sections, and FRA will inspect constructed track and signal assets in the context of the railroad's maintenance practices:
 - 49 CFR Part 213 – Track Safety Standards, focuses on the condition and maintenance of railroad tracks.
 - 49 CFR Part 217 – Railroad Operating Rules, focuses on railroad rules and procedures.
 - 49 CFR Part 218 – Railroad Operating Practices, sets the minimum requirements for railroad rules and practices.

- 49 CFR Part 229 – Railroad Locomotive Safety Standards: safety standards specific to the manufacture of locomotives.
- 49 CFR Part 236 – Signal and Train Control System, the installation, inspection, maintenance, and repair of signaling and train control systems.
- 49 CFR Part 238 – Passenger Equipment Safety Standards
- 49 CFR Part 239 – Passenger Train Emergency Preparedness
- 49 CFR Part 243 – Training, Qualification, and Oversight for Safety-Related Railroad Employees
- 49 CFR Part 270 – System Safety Program

8.1.2 State Safety Oversight

The California Public Utilities Commission (CPUC) Rail Safety Division (RSD) provides safety oversight of railroads, rail transit systems, and highway-rail crossings within the State of California. The RSD is organized into three units:

- Rail Crossings and Engineering Branch
- Railroad Operations Safety Branch
- Rail Transit Safety Branch

The CPUC's regulations are presented as a set of General Orders issued by the CPUC that apply to specific industries. Their purpose is to establish standards, requirements, and procedures with the goal of protecting public safety. Other governing resources include the Public Utilities Code and the CPUC Rules of Practices and Procedure (Rules).

Specific to railroad safety purview of the RSD, the following CPUC General Orders (GOs) are relevant to the rail transit oversight within the state:

- GO 22-B – Reports of Accidents on Railroads
- GO 26-D – Clearances on Railroads and Street Railroads as to Side and Overhead Structures, Parallel Tracks, and Crossings
- GO 72-B – Standard Types of Pavement Construction at Railroad Grade Crossings
- GO 75-D – Standards for Warning Devices for At-Grade Highway-Rail Crossings
- GO 88-B – Modification of an Existing Rail Crossing
- GO 118-A – Construction, Reconstruction, and Maintenance of Walkways and Control of Vegetation
- GO 143-B – Design, Construction, and Operation of Light Rail Transit Systems
- GO 161 – Transportation of Hazardous Materials by Rail
- GO 175-A – Rules and Regulations Governing Roadway Worker Protection
- GO 176 – Rules for Overhead 25 kV Railroad Electrification Systems for a High-Speed Rail System

Table 8.1 below identifies the role for each RSD unit and specific General Orders or Rules that each unit relies upon for safety oversight.

Table 8.1 CPUC RSD Units and General Orders and Rules Relevant to Rail Transit

CPUC RSD Unit	Role	Relevant General Orders, Rules
Rail Crossings and Engineering Branch	Evaluate the safety of public rail crossings and review proposed crossing construction	• Rules 3.7 to 3.11 • GO 26-D • GO 72-B • GO 75-D • GO 88-B • GO 118-A
Railroad Operations Safety Branch	Federally certified inspectors of freight railroads; railroads comply with both federal and state railroad safety regulations	• GO 22-B • GO 26-D • GO 118-A • GO 161 • GO 175-A
Rail Transit Safety Branch	Safety and security regulatory authority over all rail transit agencies	• GO 22-B • GO 72-B • GO 118-A • GO 143-B • GO 176

8.2 Conceptual Assessment and Recommendations

This section presents a conceptual assessment of the approximately 22 miles of the SCBRL corridor between Pajaro and Natural Bridges Drive in Santa Cruz and points of interface with the multimodal transportation network at highway-rail and pedestrian-rail grade crossings and intermediate corridor locations. General conceptual recommendations for consideration during development of the ZEPRT Project are also identified; actual improvement projects by type and location will be confirmed as the ZEPRT Project advances.

8.2.1 Highway-Rail and Pathway-Rail Grade Crossings

The location and characteristics of known current public and private crossings of the SCBRL between Pajaro and Natural Bridges Drive in Santa Cruz is shown in Table 8.2 below. This data is based largely on the publicly available FRA grade crossing data, and the final number of crossings and details may be different.

Table 8.2 Known Current Public and Private Crossings of the SCBRL Corridor

Grade Crossing Name	Location	SCBRL Railroad Milepost	USDOT Crossing Number	Grade Crossing Type	Existing Warning Devices
Private Railroad Access Road	Pajaro (Watsonville Junction)	0.15 (on UP in Watsonville Junction Yard Area)	752362M	At-Grade	Stop signs with private railroad crossing signs
Salinas Road	Pajaro	0.32	752368D	At-Grade	Flashing light cantilever signals with gates
Berry Co-Op (Private Crossing)	Pajaro	0.46	752370E	At-Grade	Stop signs with private railroad crossing signs
Levee Crossing (Private Crossing)	Pajaro	0.97	752371L	At-Grade	
Front Street	Watsonville	1.20	752372T	Track embedded in pavement of Walker Street Shared with Center Left Turn Lane MP 1.06 to 1.67	Railroad crossing crossbucks and Stop sign for the intersection
West Riverside Drive / State Route 129	Watsonville	1.27	752375N		Flashing light signals with gates
Second Street	Watsonville	1.52	752376V		Flashing light signals with gates
West Beach Street	Watsonville	1.67	752379R		Flashing light cantilever signals with gates
Ohlone Parkway	Watsonville	2.26	752389W	At-Grade	Flashing light cantilever signals with gates
State Route 1 / Cabrillo Highway	Watsonville	2.61	768290J	Road Over Rail	N/A

Grade Crossing Name	Location	SCBRL Railroad Milepost	USDOT Crossing Number	Grade Crossing Type	Existing Warning Devices
Lee Road	Watsonville	2.73	768289P	At-Grade	Railroad crossing crossbucks with stop signs
Private Farm Road (Private Crossing)	West of Watsonville	3.32	768287B	At-Grade	
Private Farm Road (Private Crossing)	West of Watsonville	3.94	768286U	At-Grade	
Buena Vista Drive	East of La Selva Beach	6.87	768283Y	At-Grade	Flashing light signals only on one side of the road
Peaceful Valley Drive (Private Crossing)	East of La Selva Beach	7.12	768282S	At-Grade	Stop signs with private railroad crossing signs
Spring Valley Road – KOA Crossing	East of La Selva Beach	7.74	768281K	At-Grade	Flashing light signals with gates and Stop sign for the adjacent intersection
San Andreas Road	East of La Selva Beach	8.51	768279J	Rail Over Road	N/A
Private Driveway	La Selva Beach	8.71	768278C	At-Grade	Private crossing
Margarita Road – Private Beach Access (Private Crossing)	La Selva Beach	8.96	768276N	Rail Over Road	Road crossing under the La Selva Beach Trestle

Grade Crossing Name	Location	SCBRL Railroad Milepost	USDOT Crossing Number	Grade Crossing Type	Existing Warning Devices
Camino Al Mar – Private Road	Rio Del Mar	9.25	768275G	At-Grade	
Private Road	Rio Del Mar	9.38	768274A	At-Grade	
Camp St. Francis (Private Crossing)	Rio Del Mar	9.61	768273T	At-Grade	Stop signs with private railroad crossing signs
Private Pedestrian Trail to Park	Rio Del Mar	9.76	768272L	At-Grade Pedestrian Crossing	No visible signs
Eva Seascape Pedestrian Path	Rio Del Mar	10.01	912078N	At-Grade	Flashing light signals
Seascape Boulevard	Rio Del Mar	10.32	912079V	At-Grade	Flashing light signals with gates
Clubhouse Drive	Rio Del Mar	10.81	768271E	At-Grade	Flashing light signals with gates
Rio Del Mar Boulevard	Rio Del Mar	12.03	768270X	Road Over Rail	Road bridge with separate pedestrian bridges on each side.
State Route 1 / Cabrillo Highway	Aptos	12.31	768269D	Rail Over Road	Warning signs for 15 feet-2 inches (westbound) and 15 feet-1 inch (eastbound) vertical clearance
Soquel Drive	Aptos	12.39	768268W	Rail Over Road	Warning signs 13 feet-9 inches (westbound) and 14 feet (eastbound) vertical clearance
Trout Gulch Road	Aptos	12.50	768267P	At-Grade	Flashing light signals with gates

Grade Crossing Name	Location	SCBRL Railroad Milepost	USDOT Crossing Number	Grade Crossing Type	Existing Warning Devices
Parade Street	Aptos	12.55	968196X	At-Grade	Flashing light signals with gates
Aptos Creek Road	Aptos	12.63	768265B	At-Grade	Flashing light signals with gates
Soquel Drive	Aptos	12.70	768264U	Rail Over Road	Warning signs 14 feet-6 inches vertical clearance
State Route 1 / Cabrillo Highway	Aptos	12.84	768263M	Rail Over Road	Warning signs 15 feet-6 inches eastbound vertical clearance. No warning signs for westbound vertical clearance.
State Park Drive	Aptos	13.18	768262F	At-Grade	Flashing light signals with gates
Mar Vista Drive	Aptos	13.32	768261Y	At-Grade	Flashing light signals with gates
Estates Drive (Private Crossing)	Aptos	13.71	768260S	At-Grade	Stop sign but no private crossing sign
New Brighton Road (Private Crossing)	Aptos	14.09	768258R	At-Grade	Stop signs with private railroad crossing signs
New Brighton State Beach Access Road	Capitola	14.68	768257J	At-Grade	Warning signs 14 feet-1 inch vertical clearance
Grove Lane	Capitola	15.13	768256C	At-Grade	Stop signs with private railroad crossing signs
Monterey Avenue	Capitola	15.52	768255V	At-Grade	Flashing light cantilever signals with gate

Grade Crossing Name	Location	SCBRL Railroad Milepost	USDOT Crossing Number	Grade Crossing Type	Existing Warning Devices
Capitola Avenue	Capitola	15.73	768254N	Rail Over Road	N/A
Riverview Avenue	Capitola	Unknown	Unknown	Rail Over Road	Warning signs 9 feet-8 inches vertical clearance and limited horizontal clearance
Wharf Road	Capitola	15.81	768253G	Rail Over Road	No warning signs
Pedestrian Crossing	Capitola	15.99	970971N	At-Grade Pedestrian	No warning signs
47th Avenue	Capitola	Unknown	768252A	At-Grade	Flashing light signals with gate
41st Avenue	Capitola	16.75	768251T	At-Grade	Flashing light cantilever signals with gate
38th Avenue	Capitola	16.88	768250L	At-Grade	Flashing light cantilever signals with gate
30th Avenue	Capitola	17.21	768249S	At-Grade	Flashing light signals
17th Avenue	Live Oak	17.87	768248K	At-Grade	Flashing light cantilever signals with gate
Pedestrian Crossing	Live Oak	18.10	970972V	At-Grade Pedestrian Crossing	Trail at end of El Dorado Avenue No warning signs visible
Pedestrian Crossing	Live Oak	18.14	970973C	At-Grade Pedestrian Crossing	No warning signs visible
7th Avenue	Santa Cruz	18.42	768247D	At-Grade	Flashing light signals with gates
Private Road	Santa Cruz	18.67	768245P	Rail Over Road	N/A
Pedestrian Pathway	Santa Cruz	18.73	768244H	Rail Over Road	N/A

Grade Crossing Name	Location	SCBRL Railroad Milepost	USDOT Crossing Number	Grade Crossing Type	Existing Warning Devices
Seabright Avenue	Santa Cruz	19.22	768242U	At-Grade	Wig-wag signal for southbound traffic but no signs No signals or signs for northbound traffic Activated no right turn sign on westbound Murray Street
Mott Avenue	Santa Cruz	19.05	768241M	At-Grade	Railroad crossing crossbucks but no stop or yield sign. There is a closely spaced stop sign at an adjacent intersection
East Cliff Drive	Santa Cruz	19.24	768240F	Road Over Rail	N/A
Santa Cruz Riverwalk Pedestrian	Santa Cruz	19.31	970974J	Rail Over Road	
Boardwalk Pedestrian Crossing	Santa Cruz	19.41	768239L	At-Grade Pedestrian	Stop signs and private railroad crossing signs
Boardwalk Pedestrian Crossing	Santa Cruz	19.49	768238E	At-Grade Pedestrian	Stop signs and private railroad crossing signs
Boardwalk Pedestrian Crossing	Santa Cruz	19.53	768237X	At-Grade Pedestrian	Stop signs and private railroad crossing signs
Boardwalk Pedestrian Crossing	Santa Cruz	19.60	970975R	At-Grade Pedestrian	Stop sign and private railroad crossing sign
Cliff Street Pedestrian Crossing	Santa Cruz	19.71	768233V	At-Grade Pedestrian	Pedestrian crossing and cycle track crossing with bike crossing hazard sign

Grade Crossing Name	Location	SCBRL Railroad Milepost	USDOT Crossing Number	Grade Crossing Type	Existing Warning Devices
Westbrook Street	Santa Cruz	19.77	768232N	Track embedded in pavement of Beach Street MP 19.71 to MP 19.97	Railroad crossing crossbucks and stop sign for the intersection
Main Street	Santa Cruz	19.83	768231G		Railroad crossing crossbucks and stop sign for the intersection
Pacific Avenue	Santa Cruz	19.97	768230A	Concrete Panels	Flashing light signals with gates. Track passes through roundabout.
West Cliff Drive	Santa Cruz	20.02	768229F	Road Over Rail	N/A
California Street	Santa Cruz	20.75	768150G	At-Grade	Flashing light signals with gates
Bay Street	Santa Cruz	20.79	768151N	Road Over Rail	Flashing light signals with gates
Lennox Street	Santa Cruz	20.87	768152V	Road Over Rail	Railroad crossing crossbucks but no stop or yield sign
Dufour Street	Santa Cruz	21.02	768154J	At-Grade	Railroad crossing crossbucks but no stop or yield sign
Bellevue Street	Santa Cruz	21.08	768155R	At-Grade	Railroad crossing crossbucks but no stop or yield sign
Younglove Avenue	Santa Cruz	21.14	768156X	At-Grade	Railroad crossing crossbucks but no stop or yield sign
Seaside Street	Santa Cruz	21.18	768157E	At-Grade	Railroad crossing crossbucks but no stop or yield sign. There is a closely spaced stop sign at an adjacent intersection

Grade Crossing Name	Location	SCBRL Railroad Milepost	USDOT Crossing Number	Grade Crossing Type	Existing Warning Devices
Rankin Street	Santa Cruz	21.20	768158L	At-Grade	Railroad crossing crossbucks but no stop or yield sign. There is a closely spaced stop sign at an adjacent intersection
Almar Avenue	Santa Cruz	21.40	768159T	At-Grade	Flashing light cantilever signals with gates
Fair Avenue	Santa Cruz	21.45	768160M	At-Grade	Flashing light cantilever signals with gates
Swift Avenue	Santa Cruz	21.59	768161U	At-Grade	Flashing light cantilever signals with gates
Natural Bridges Drive	Santa Cruz	22.20	768162B	At-Grade	Flashing light signals but only southbound traffic has a gate
Shaffer Road	Santa Cruz	22.48	970977E	At-Grade Pedestrian	Private crossing with no signs and guardrail across the street north of the crossing; however, there is a pedestrian crossing with no visible signs

Source: Federal Railroad Administration (FRA) Grade Crossing Inventory on Office of Safety website; California Public Utilities Commission (CPUC) Rail Crossing Inventory; Google Earth Pro imagery

8.2.2 Grade Crossing Active Warning Devices

The system required for the ZEPRT passenger service over the SCBRL between Pajaro and Natural Bridges Drive in Santa Cruz must meet current safety, operational, and regulatory standards, including implementation of important highway-rail and pathway-rail grade crossing active warning devices. These systems — identified in the following section — are essential for enhancing safety and interface with the multimodal transportation environment, achieving regulatory compliance, and managing train movements.

In California, active warning devices are safety systems installed at highway-rail grade crossings to alert road users — including vehicle drivers, pedestrians, and bicyclists — of an approaching train. These devices are designed to reduce the risk of collisions by providing clear, timely, and unmistakable warnings.

The California Public Utilities Commission (CPUC), through General Order 75-D, regulates the standards for these devices to ensure consistency and effectiveness across the state.

The most common types of active warning devices include flashing light signals, automatic gates, and audible bells.

More advanced configurations may include cantilevered mast arms with additional train-activated lights for motorists, No Right Turn signs, and advance warning signals like Prepare to Stop signs. These devices are often supplemented with illumination, pavement markings, and signage to enhance visibility and compliance, especially at night or in complex traffic environments.

These systems function by detecting an approaching train through track circuitry or other train detection technologies. Once a train is detected, the system activates the warning sequence: lights begin to flash, bells sound, and gates lower to block vehicle access to the tracks. In some cases, the system is also interconnected with nearby traffic signals to ensure vehicles clear the crossing before a train arrives, a process known as signal preemption.

CPUC mandates that all active warning devices must conform to the California Manual on Uniform Traffic Control Devices (CA MUTCD). This ensures that the design, placement, and operation of these devices are consistent with statewide traffic control standards, promoting uniformity and predictability for all road users.

The active warning devices are a critical component of California's rail safety strategy. By combining visual, auditory, and physical barriers, they significantly reduce the likelihood of accidents at rail crossings and help protect the public from train-related hazards.

8.2.3 Quiet Zones

In addition to the highway-rail and pathway-rail grade crossing active warning devices identified in the previous section, there may be the potential to pursue Quiet Zones (QZs) over discrete segments of the SCBRL corridor between Pajaro and Santa Cruz through multiparty stakeholder and community coordination as part of the implementation of the ZEPRT passenger rail service (note that there are not currently any QZs on the SCBRL). This potential will be confirmed as the ZEPRT Project advances. The

typical components of a QZ and related process for establishing them are conceptually identified and described in this section.

A QZ refers to a segment of a railroad line that has one or more consecutive public highway-rail grade crossings at which train horns are not routinely sounded for at-grade crossings. However, other federal regulations and train operation policies do require the locomotive horn to be used within a QZ in circumstances such as when a locomotive passes the end of a separate train. The train engineer may also use the train horn within a QZ when dangerous conditions are perceived, such as the presence of trespassers walking down the tracks or crossing a rail corridor in between grade crossings or when a car is stopped on the tracks. Railroad construction activities within a QZ require the locomotive engineer to sound the train horn as an added safety measure. Under normal conditions within the quiet zone, train horns will not be used. At the date of QZ establishment, a No Train Horn sign is posted on the roadway approaches to crossings within a QZ.

The FRA issued the Train Horn Rule in 2006 which addresses the use of train horns at public at-grade crossings. The Rule states that all trains must sound their horns, in the pattern of two long, one short, and one long sounding of the train horn, at all public crossings; however, the Rule also includes provisions for communities to establish QZs wherein locomotive horns are not routinely sounded. A QZ is not required; however, many communities throughout the U.S. have established a QZ to mitigate the impact of train horns.

A QZ is established by the government entity with jurisdiction over the roadway (Roadway Authority), which must take the lead in following the processes established by the FRA for creating a QZ. In most instances, the Roadway Authority is a municipal agency. In cooperation with the railroad and the CPUC, the Roadway Authority assumes responsibility for implementing safety improvements to the crossing(s) that reduce the risk to crossing users and compensate for the absence of train horns.

The term “risk index” refers to the predicted cost to society of casualties that are expected to result from collisions at an individual crossing. The two components of a risk index are: 1) Predicted cost of fatalities; and 2) Predicted cost of injuries. These costs are based on a formula published by the United States Department of Transportation (USDOT). Three key QZ risk indices are key to the establishment of a Quiet Zone:

- **Quiet Zone Risk Index (QZRI):** The average risk index for all public crossings in a proposed QZ, taking into consideration the increased risk caused by the absence of train horns and any decrease in risk attributable to the implementation of risk-reduction safety measures as defined in the Train Horn Rule.
- **Nationwide Significant Risk Threshold (NSRT):** The average Risk Index of all public, gated highway-rail grade crossings in the U.S. at which train horns are routinely sounded.
- **Risk Index with Horns (RIWH):** A measure of risk to the motoring public when locomotive horns are routinely sounded at every public highway-rail grade crossing within a QZ.

A QZ is achieved by constructing or implementing safety measures that reduce the QZRI to a threshold below the NSRT or RIWH. The FRA Rule describes two categories of safety measures that can be

implemented to establish a QZ: Supplemental Safety Measures and Alternative Safety Measures, as described below.

Supplementary Safety Measures

Supplementary Safety Measures (SSM) are engineering improvements which, when installed at crossings within a QZ, would reduce the risk of a collision at the crossing. SSMs are installed to reduce the risk level either to the level that would have existed if the train horn were sounded (compensating for the lack of the train horn) or to a level below the NSRT. The Train Horn Rule specifies the following basic SSMs:

- Four-quadrant gate system, with or without an exit gate management system (see example in Figure 8.1 below)
- Gates with medians or channelization devices
- One-way streets equipped with gates that fully block the street
- Temporary closures
- Permanent closure
- Grade separation

Figure 8.1 Example Four-Quadrant Grade Crossing System



Source: FRA Grade Crossing Toolkit

Fourteen variations and/or combinations of these SSMs are approved for use by the FRA. The online FRA Quiet Zone Calculator uses a code number that corresponds with each of the 14 SSMs, as presented in Table 8.3 below). The CPUC does not allow the use of SSMs that include “gates without vehicle presence detection.”

Table 8.3 Supplementary Safety Measure Options Within FRA Quiet Zone Calculator

SSM Code	SSM Description	CPUC Allows
1	Temporal (Nighttime) Closure of a Public Highway-Rail Grade Crossing	Yes
2	Permanent Closure of a Public Highway-Rail Grade Crossing	Yes
3	Grade Separation of a Public Highway-Rail Grade Crossing	Yes
4	Four-Quadrant Gates Upgrade from Two-Quadrant gates, No Vehicle Presence Detection	No
5	Four-Quadrant Gates Upgrade from Two-Quadrant Gates, with Medians and no Vehicle Presence Detection	No
6	Four-Quadrant Gates Upgrade from Two-Quadrant Gates, with Vehicle Presence Detection	Yes
7	Four-Quadrant Gates Upgrade from Two-Quadrant Gates, with Medians and Vehicle Presence Detection	Yes
8	Four-Quadrant Gates New Installation, No Vehicle Presence Detection	No
9	Four-Quadrant Gates New Installation with medians and no Vehicle Presence Detection	No
10	Four-Quadrant Gates New Installation with Vehicle Presence Detection	Yes
11	Four-Quadrant Gates New Installation with Medians and Vehicle Presence Detection	Yes
12	Mountable Medians with Reflective Traffic Channelization Devices	Yes
13	Non-Traversable Curb Medians with or without Channelization Devices	Yes
14	One-Way Streets with Gates	Yes

Alternative Safety Measures

Alternative Safety Measures (ASM) are described in the Train Horn Rule as a safety system or procedure provided by the appropriate traffic control authority which, after individual review and analysis, is determined by the FRA to be an effective substitute for the locomotive horn at specific highway-rail grade crossings. ASMs include:

- Modified Supplementary Safety Measures (Modified SSMs):** An SSM that has in some way been adjusted to accommodate unique circumstances existing at a specific highway-rail grade crossing and no longer conforms to the SSM requirements. Modified SSMs are considered ASMs. An example would be traffic channelization devices that due to a nearby intersection are only 45 feet in length instead of the required 60 feet or where a median is installed but there is a commercial driveway within 60 feet of the gate.

- **Engineering Alternative Safety Measures:** Engineering improvements other than modified SSMs include improvements that address underlying geometric conditions, including sight distance, that are a source of increased risk at the crossing.
- **Non-Engineering Alternative Safety Measures:** Photo enforcement, or a consistent and systematic program of traffic law enforcement, public education programs, or a combination thereof, that produces a measurable reduction of risk at designated QZ highway-rail grade crossings.

Using the FRA's online Quiet Zone Calculator, the applicant must demonstrate that the QZRI resulting from implementation of either SSMs or ASMs qualifies as a quiet zone. Determination of ASM or SSM implementation precedes selection of the method of Quiet Zone establishment. The FRA Rule describes two methods of establishing a QZ:

- Public Authority Designation
- Public Authority Application to FRA

Public Authority Designation is the preferred approach from the standpoint of streamlined implementation and less stringent monitoring requirements, although both methods are described as follows:

Public Authority Designation, § 222.39 (a)

With the Public Authority Designation method, the Roadway Authorities must demonstrate that the implementation of SSMs "reduces the risk index to a level that is equal to or less than the national average risk at gated crossings with horns, or the risk is reduced enough to compensate for the loss of the safety benefit afforded by a train sounding its horn."

To qualify for the Public Authority Designation Method, each public crossing within a New QZ must at a minimum be equipped with gates and constant warning time devices.

If an SSM is applied at every crossing, then the designation does not rely on the calculations or the risk numbers. It is necessary to maintain the railroad warning signs and RXR pavement markings as the quiet zone could be rescinded if a sign or a pavement marking is missing in the future.

A QZ Designation using SSMs at every crossing requires the reaffirmation letter be sent to the FRA and QZ Stakeholders every five years instead of every three years if any crossing is not treated with an SSM. A QZ Designation using SSMs at all but one crossing still allows for a QZ Designation, but this requires reaffirmation every three years instead of every five years and is based on the risk numbers.

The Train Horn Rule options for Public Authority Designation are summarized in Table 8.4 below.

Table 8.4 Summary of Public Authority Designation (PAD) Options

PAD Option	Description	Reporting Requirements Periodic Updates of Inventory Forms
Option 1	A QZ may be designated if the existing QZRI is less than the NSRT. With this option, no crossing upgrades would be necessary.	Every 2.5 to 3 years
Option 2	A QZ may be designated if SSMs are instituted at one or more crossings within the QZ and results in a reduction of the QZRI to a level below the NSRT, or to the risk level which would exist if locomotive horns sounded at all crossings within the QZ.	Subject to Annual Review by FRA Periodic updates required every 2.5 to 3 years
Option 3	A QZ may be designated if SSMs are applied to every public at-grade crossing within the QZ.	Every 4.5 to 5 years

Public Authority Application to FRA, § 222.39 (b)

The “Application” method, which would employ ASMs or Modified SSMs, is desirable only as a last resort if the requirements of the QZ Designation method cannot be met. The FRA Rule imposes stringent compliance requirements on ASM QZ.

Regardless of the selected method, certain notices are required to be issued by the applicant during the process: a Notice of Intent and a Notice of Establishment.

The Notice of Intent would be issued early in the QZ development process. This Notice provides for a 60-day comment period for railroads, state agencies and other stakeholders to provide input on a proposed QZ.

The Notice of Establishment (NOE) is issued after construction and CPUC inspection of Crossing ASMs/SSMs. The NOE stipulates the day upon which railroads would cease routine sounding of train horns at crossings within a QZ.

8.2.4 Rail Transit System and Wayside Control Requirements

The system required for the ZEPRT passenger service must meet current safety, operational, and regulatory standards, including implementation of important signaling and train control technologies over the SCBRL between Pajaro and Natural Bridges Drive in Santa Cruz. These systems — identified in the sections that follow — are essential for ensuring safety, regulatory compliance, managing train movements, and enabling efficient service delivery.

Wayside Signal Systems

Wayside signal systems are fixed installations located along the rail network that convey movement authority to train operators. These systems typically use color light signals to indicate track occupancy status, route alignment, and permissible operating speeds. In a modern passenger rail context, wayside signals are integrated with interlockings and track circuits to provide real-time information about track

conditions and train positions. They serve as the primary visual interface for train crews in territory governed by fixed block signaling.

Centralized Traffic Control

Centralized Traffic Control System (CTCS) is a supervisory system that enables dispatchers to manage train movements across a defined territory remotely from a central operations center. CTCS integrates with field equipment such as signals, switches, and track circuits to allow remote control and monitoring. The system provides real-time visibility into train locations and infrastructure status, enabling efficient routing, conflict resolution, and schedule adherence. CTCS also generates movement authorities that are enforced through the wayside signal system.

Positive Train Control

Positive Train Control (PTC) is a federally mandated safety overlay designed to prevent specific types of accidents, including train-to-train collisions, overspeed derailments, unauthorized train movements through misaligned switches, and incursions into established work zones. PTC systems use a combination of technologies including wireless communications, onboard computers, and back-office servers to continuously monitor train movements and enforce safe operating parameters. PTC enhances safety by providing automatic intervention if a train operator fails to respond appropriately to signal indications or operating limits.

There are a couple of potential technologies that may be suitable, and they include Interoperable Electronic Train Management System (I-ETMS) and E-ATC (Enhanced Automatic Train Control). The I-ETMS is interoperable with adjacent railroads and foreign trains can enter the commuter line, and commuter trains can enter other railroads. For a system with E-ATC, trains and locomotives entering the passenger rail network must be equipped with compatible onboard automatic train protection equipment. And passenger trains on a given system would have to be equipped with a second onboard automatic train protection system in order to move outside of the passenger rail network.

Interoperable Electronic Train Management System Overlay

The I-ETMS is a type of PTC architecture developed to be interoperable across multiple railroads. It can be implemented as an overlay on new or existing CTCS infrastructure. I-ETMS integrates with the CTCS to receive movement authorities and track data, which it uses to calculate safe braking curves and enforce limits of authority. The system supports interoperability with freight and passenger railroads operating on shared corridors, in compliance with federal interoperability requirements. This system uses radio signals to communicate with the trains.

Most freight, passenger, and commuter rail operations in the U.S. west of the Mississippi River use I-ETMS. Some of the commuter railroads that use I-ETMS include:

- Metra (Chicago, Illinois)
- Caltrain (San Carlos, California)
- North County Transit District COASTER (San Diego, California)
- Tri-Rail (South Florida)
- FasTracks (Denver, Colorado)

Enhanced Automatic Train Control

E-ATC uses coded track circuits to send modulated electrical pulses sent through the rails to convey signal aspects and track occupancy information. These systems enable continuous communication between the wayside infrastructure and onboard equipment, allowing for cab signaling and automatic train protection. These coded track circuits are integrated with E-ATC. Examples of similar implementations include:

- Sonoma-Marín Area Rail Transit (San Francisco Bay Area, California)
- CapMetro Rail (Austin, Texas)
- Utah Transit Authority FrontRunner (Salt Lake City, Utah)
- TriMet (Portland, Oregon)
- Denton County Transportation Authority A-train (Fort Worth, Texas)

These systems demonstrate the viability of coded track circuits in modern commuter rail applications, particularly in corridors with mixed traffic or constrained rights-of-way. This system can be designed and constructed in compliance with federal interoperability requirements.

8.2.5 Other Rail Transit System and Wayside Safety Measures

Other measures may be considered during development of the ZEPRT Project to enhance safety across the SCBRL corridor and are described in the section that follows.

Right-of-way fencing serves as a foundational physical barrier to prevent unauthorized access to a rail corridor. This fencing delineates the operational boundary of the railway and is designed to deter vehicles, pedestrians, bicyclists, and animals from entering the track area at places other than public crossings. Standard fencing materials include welded wire mesh or chain-link, often with anti-climb features in high-risk zones. Properly installed and maintained fencing reduces the likelihood of trespassing, enhances safety for the public and rail operations, and supports regulatory compliance.

Closed-circuit television (CCTV) systems provide continuous surveillance of critical areas along the rail corridor, such as stations, grade crossings, maintenance facilities, bridges, and known trespassing locations. These systems enable real-time monitoring by security personnel and support post-incident investigations through recorded footage. CCTV also acts as a deterrent to unauthorized activity and can be integrated with intelligent video analytics to detect and alert operators to unusual behavior, such as individuals loitering near the tracks or attempting to breach fencing.

Trespassing mitigation programs encompass a combination of public education, enforcement, and engineering strategies aimed at reducing unauthorized access to the rail corridor. These programs often involve partnerships with local law enforcement, schools, and community organizations to raise awareness about the dangers of trespassing.

Outreach campaigns may include signage, school presentations, community outreach, and media engagement. Additionally, enforcement efforts such as targeted patrols and citations reinforce the importance of compliance with safety regulations.

Countermeasures are site-specific interventions designed to address recurring trespass incidents or high-risk locations. These may include pedestrian barriers, motion-activated lighting, acoustic deterrents, and

vegetation management to improve visibility. In some cases, grade separation (e.g., pedestrian overpasses or underpasses) may be implemented to eliminate at-grade crossings entirely. The selection of countermeasures is typically informed by risk assessments; incident data; and input from stakeholders, CPUC, and the community to ensure that resources are directed to areas with the greatest safety impact.

8.2.6 Separation Measures and Infrastructure Between Rail Transit and Trail Alignments

On corridors that accommodate active railroad lines and trails — as is proposed for the SCBRL between Pajaro and Santa Cruz as part of the ZEPRT Project — it is desirable to maintain separation between trail users and the active railroad tracks, and to discourage pedestrians from entering upon active railroad tracks. The Project anticipates typical ZEPRT passenger train speeds on the SCBRL of approximately 40 miles per hour, and in some areas as high as 60 miles per hour. To provide separation between the trail and active rail line, it has been assumed that there would be a fence between the track and the trail. The concepts presented in the *Monterey Bay Sanctuary Scenic Trail Network Master Plan* document show a low fence between the track and trail, 4 feet tall.

The trail concepts envision several locations where the trail crosses the SCBRL at grade. In these areas, the trail crossing would be equipped with flashing light signals, crossing gates, and bells to discourage trail users from crossing the tracks in front of trains. Similarly, at highway-rail grade crossings, the flashing light signals, crossing gates, and bells would discourage pedestrians from entering upon railroad tracks when trains are approaching. However, when no trains are approaching and the crossing active warning equipment is not operating (i.e., lights are not flashing, gates are in the raised position, and bells are not ringing), a person could, theoretically, enter upon the railroad tracks without a physical barrier in the form of crossing gates. The absence of a physical barrier is inevitable, since CPUC GO26-D prescribes a minimum 17-foot-wide clear space (8 feet-6 inches each side of the track centerline, with greater clearances required at curves) in which trains can operate. Where there is no physical barrier (particularly at at-grade crossings), signage warning against trespassing has been typical U.S. rail industry practice in this situation.

Depending upon the topography at a given location, there may also be grading or drainage features between the trail and track that further help to separate trail users from the active rail line. For example, the basic trail section includes a 2-foot-wide shoulder between the pathway and the fence. There may also be shallow ditches in this space to facilitate drainage. And, where SCBRL right-of-way widths allow, the SCCRTC and other stakeholders may elect to locate the trail farther from the track to increase the separation between trail users and trains.

9.0 Preliminary Environmental Screening

9.1 Introduction

This chapter discusses the results of environmental screening of the ZEPRT Project concept and methodology used for this evaluation and key assumptions underlying the analysis. The environmental screening is preliminary and identifies potential environmental constraints along and adjacent to the project alignment. The screening does not identify environmental impacts, which will be addressed in the future National Environmental Policy Act/California Environmental Quality Act (NEPA/CEQA) review when the project description is further developed during advancement of the ZEPRT Project.

The extent of the ZEPRT Project concept is not a precise delineation of footprints. As the concept is refined during Project development, preliminary engineering will be conducted, and some of the environmental constraints or risks identified through the environmental screening may be avoided or otherwise addressed. Thus, the analysis herein is an early identification of potential environmental constraints that may be associated with the ZEPRT Project concept as it advances.

9.1.1 Environmental Study Area

A conceptual buffer of 200 feet was applied around the ZEPRT Project concept extent, including potential passenger rail stations and a maintenance facility. The environmental study area was divided into four segments along the SCBRL, as identified and described below:

- Segment 4 from a point between Peaceful Valley Drive and Buena Vista Drive to Pajaro/Watsonville Junction.
- Segment 3 from a point just south of Rio Del Mar Boulevard to a point between Peaceful Valley Drive and Buena Vista Drive.
- Segment 2 from the San Lorenzo River to just south of Rio Del Mar Boulevard (about in line with Kingsbury Drive).
- Segment 1 from just east of Natural Bridges Drive to the San Lorenzo River.

Detailed map books of the various resource areas discussed in this chapter are provided in Appendix B.

9.1.2 Data Limitations

The environmental data presented in this chapter was limited to a conceptual desktop study. No field surveys, reconnaissance, or field verifications were conducted. Geospatial data cannot be assumed to identify all environmental constraints or issues. Additional verification of the quality and accuracy of geospatial data will be done as part of the NEPA/CEQA process in the future. For the purposes of this analysis, publicly available geospatial data were used.

9.2 Agricultural Farmlands

Methods used for determining the ZEPRT Project's proximity to agricultural farmlands included mapping and comparing the proposed rail and trail alignments and associated stations and maintenance facility to the locations of designated Important Farmlands and Williamson Act lands.

The presence of agricultural farmland in the project study area was determined by overlaying ArcGIS files of the project alignment, proposed stations and maintenance facility, and the 200-foot study area over the California Department of Conservation's Farmland Mapping and Monitoring Program (FMMP) data. The FMMP rates agricultural land according to soil quality and irrigation status within several designations: Prime farmland, Unique farmland, farmland of statewide importance, farmland of local importance, and Grazing land. The FMMP additionally identifies Urban and Built-Up Land, and Other land.

The California Land Conservation Act of 1965, commonly referred to as the Williamson Act, is a state policy administered at the local government level, intended to preserve agricultural and open space lands through contracts with private landowners and associated tax reductions. A Williamson Act contract limits the possibility of converting agricultural land to non-agricultural use for a rolling period of 10 years in return for lower property taxes. Of California's 58 counties, 52 have executed contracts under the Williamson Act program, including Santa Cruz County. Segments 3 and 4 include lands enrolled in the Williamsons Act.

The Williamson Act was amended in August 1998 to establish Farmland Security Zones, which, in return for a 20-year contract commitment, grants property owners greater tax reductions. Santa Cruz County is currently participating in the Farmland Security Zone program (California Department of Conservation, 2024).

9.2.1 Segment 4: Between Peaceful Valley Drive and Buena Vista Drive to Pajaro/Watsonville Junction

The Segment 4 study area for agricultural farmlands extends from a point between Peaceful Valley Drive and Buena Vista Drive, just north of the San Andreas Road/Buena Vista Drive wye, to the Watsonville Junction south of the city of Watsonville in the unincorporated Monterey County community of Pajaro. This segment includes two proposed stations (Downtown Watsonville and Pajaro), a ZEPRT passenger rail maintenance facility, and a 200-foot corridor on each side of the ZEPRT alignment and facilities.

Between the San Andreas Road/Buena Vista Drive wye and the Watsonville Junction, the rail and trail alignment study areas diverge, with the rail alignment following the existing SCBRL railroad right-of-way through Watsonville and the trail turning south along San Andreas Road before veering northeast to follow West Beach Street into Watsonville. In Watsonville, the trail turns southeast to follow Rodriguez Street before crossing the Pajaro River on a new trail bridge to the existing levee road at Pajaro Park where the trail will continue southwest back into the SCBRL railroad right-of-way. From here, the study areas for both rail and trail follow the same alignment between the Pajaro River and the terminus of the trail at Salinas Road adjacent to the existing grade crossing. The Segment 4 rail alignment study area continues beyond Salinas Road and around UP's Watsonville Junction Yard to end approximately 0.2 miles southeast of the Salinas Road/Railroad Avenue intersection.

Northwest of Watsonville Slough, along the existing railroad right-of-way, the rail alignment study area crosses lands classified as Other, with some small areas of Prime farmland. The trail alignment study area, following San Andreas Road and West Beach Street, crosses large areas of Prime farmland. While the surrounding lands in the study area are classified as Prime and Unique farmland, the ZEPRT rail and trail alignments are situated within existing rail and roadway rights-of-way and are not expected to permanently convert any Prime or Unique farmland. There are a few agricultural areas enrolled in the Farmland Security Zones per Williamson Act, which are near the proposed maintenance facility along the trail alignment, and another smaller area adjacent to the Pajaro River. There are other areas of Prime Agricultural Lands south of Zils Road that are Williamsons Act lands.

Between Watsonville Slough and the city of Watsonville, the rail alignment study area, including the proposed ZEPRT maintenance facility site, is located on Prime farmland. Development of the maintenance facility site would permanently convert Prime farmland to a developed use. Land within the urbanized city of Watsonville is primarily classified as Urban and Built-Up, with some areas classified as Other.

South of the Pajaro River, the combined rail and trail study area lands' FMMP classifications largely consist of Urban and Built-Up Land, with smaller areas of Prime farmland. The proposed Pajaro station site is on land classified as Urban and Built-Up, surrounded by Prime farmland.

9.2.2 Segment 3: Just South of Rio Del Mar Boulevard to Between Peaceful Valley Drive and Buena Vista Drive

The Segment 3 agricultural farmlands study area includes the contiguous rail and trail alignments just south of Rio Del Mar Boulevard to a point between Peaceful Valley Drive and Buena Vista Drive, just north of the San Andreas Road/Buena Vista Drive wye, and a 200-foot corridor on each side of the ZEPRT alignments and facilities.

Segment 3 traverses large areas of FMMP-designated Urban and Built-Up and Other lands within the unincorporated Santa Cruz County communities of Aptos, Rio del Mar, and La Selva Beach. Agricultural lands, including some areas of Prime and Unique farmland and Non-Prime lands enrolled in Williamson Act, divide Rio del Mar and La Selva Beach. South of La Selva Beach, areas of Prime and Unique farmland are present, together with areas of Urban and Built-Up and Other lands, in and adjacent to the Segment 3 study area between La Selva Beach and the San Andreas Road/Buena Vista Drive wye.

9.2.3 Segment 2: San Lorenzo River to Just South of Rio Del Mar Boulevard (About in Line with Kingsbury Drive)

The Segment 2 study area for agricultural farmlands includes the largely contiguous ZEPRT rail and trail alignments from the San Lorenzo River to just south of Rio Del Mar Boulevard, five proposed ZEPRT stations (Seabright, 17th Avenue, Capitola, Cabrillo, and Aptos), and a 200-foot corridor on each side of the alignments and facilities. Alternatives are still being considered for the alignment between Thompson Avenue and 47th Avenue due to the constrained width of the railroad corridor right-of-way through this area, with the final alignment to be refined and confirmed through future analysis and stakeholder coordination as the ZEPRT Project advances so that it meets the objectives of the ZEPRT Project

Segment 2 is within the urbanized areas of the incorporated cities of Santa Cruz and Capitola and unincorporated Santa Cruz County. No designated agricultural or Williamson Act lands are present, and the FMMP identifies all lands within the Segment 2 study area as either Urban and Built-Up Lands or Other, in this case applied to parklands and open space areas such as New Brighton State Beach in Capitola and Aptos Village County Park in unincorporated Aptos.

9.2.4 Segment 1: Just East of Natural Bridges Drive to the San Lorenzo River

The Segment 1 study area for agricultural farmlands includes the contiguous rail and trail alignments between Natural Bridges Drive and the San Lorenzo River, two proposed ZEPRT stations (Natural Bridges Drive and Beach Street / Downtown Santa Cruz), and a 200-foot corridor on each side of the ZEPRT alignments and facilities.

No agricultural resources are present in Segment 1 as it traverses the incorporated city of Santa Cruz. All lands within the 200-foot study area of the Segment 1 alignment are designated Urban and Built-Up Lands by the FMMP.

9.3 Biological and Aquatic Resources

This section evaluates potential biological and aquatic resources in the study area and discusses the biological and aquatic resource constraints that could occur during construction of the ZEPRT Project and within each project segment. This is a preliminary screening, not a detailed NEPA/CEQA environmental review. The concept discussed is an early idea that may change and is not the final build alternative or exact footprint. As planning continues, the concept will be refined and further engineering developed, addressing some constraints and risks. Therefore, this screening serves as an initial identification of possible environmental issues or opportunities linked to this concept.

Segment-specific constraints were analyzed using a compiled geographic information system (GIS) database from several biological monitoring programs with mapping datasets. These included the National Hydrography Dataset, the National Wetlands Inventory, U.S. Fish and Wildlife Service (USFWS) Critical Habitat, National Marine Fisheries Service (NMFS) Critical Habitat, and California Natural Diversity Database (CNDDDB). These maps provide information on land cover, potential special-status species habitat, wetland habitat, aquatic habitat, and unique vegetative communities and conservation areas.

9.3.1 Segment 4: Between Peaceful Valley Drive and Buena Vista Drive to Watsonville Junction

The study area splits into two separate paths for the trail and Segment 4 rail and covers both aquatic and terrestrial habitat types. The vegetation in Segment 4 includes annual grassland, barren, pasture, urban, cropland, perennial grass, valley foothill riparian, coastal oak woodland, coastal scrub, eucalyptus, lacustrine, saline emergent wetland. Several special-status species have been reported either in the right-of-way for Segment 4 or immediately adjacent to the right-of-way. California red-legged frog critical habitat occurs in the study area north of Harkins Slough, in Watsonville Slough Ecological Reserve, and in Gallighan Slough. California red-legged frog habitat is also documented north and south of the right-of-

way in the study area, and there may be crossings in the Ecological Reserve and Gallighan Slough. In Watsonville along the SCBRL and Walker Street, include habitat for state-listed bank swallow and the special-status western bumble bee. Monterey hitch, a fish species of special concern, has been documented in the Pajaro River where the SCBRL crosses over the river in Watsonville. The river is also considered critical habitat for federally listed steelhead. The study area around Gallighan Slough is Coastal and Valley freshwater marsh habitat, and between Harkins Slough and Watsonville Slough has the potential for federally listed robust spineflower.

The study area and right-of-way in Segment 4 occur in a developed area due to the presence of the existing railroad, but there is potential for federally and state-listed species constraints to the project. The study area, particularly in the wetland marsh habitats around Gallighan, Harkins, and Watsonville Sloughs, has the potential for California red-legged frog and robust spineflower.

9.3.2 Segment 3: Just South of Rio Del Mar Boulevard to Between Peaceful Valley Drive and Buena Vista Drive

The study area for Segment 3 spans the region from Aptos to Watsonville and covers predominantly terrestrial habitat types with potential access to aquatic habitat. The vegetation in Segment 3 includes annual grasses, urban, coastal scrub, valley foothill riparian, barren, closed-cone pine-cypress, cropland, eucalyptus, and coastal oak woodland. Several special-status species have been reported either in the right-of-way for Segment 3 or immediately adjacent to the right-of-way. In Aptos, western bumble bee has the potential to occur in the right-of-way. Monarch butterflies have been documented using the closed-cone pine-cypress habitat for overwintering during their migration at the end of Margarita Road at La Selva Beach. Further south near Watsonville on San Andreas Road, several federally listed amphibian species have the potential to occur. These include California tiger salamander, California red-legged frog, and Santa Cruz long-toed salamander. Sections of the study area and right-of-way near the southern extent of Segment 3 are considered critical habitat for California red-legged frog. The Santa Cruz Long-Toed Salamander Ecological Reserve and Ellicott Slough National Wildlife Refuge are also in the study area and in sections of the right-of-way where environmental study area Segment 3 meets Segment 4.

The study area and right-of-way in Segment 3 occur in a developed area due to the presence of the existing railroad, but there is potential for federally listed species related constraints to the project through wildlife crossings of listed amphibians. The study area, particularly in the regions around the southern extent of the segment and ecological reserves, have the potential for California red-legged frog, California tiger salamander, and Santa Cruz long-toed salamander.

9.3.3 Segment 2: San Lorenzo River to Just South of Rio Del Mar Boulevard (About in Line with Kingsbury Drive)

The study area for Segment 2 spans the region of the San Lorenzo River mouth in Santa Cruz to Aptos and covers both aquatic and terrestrial habitat types. The vegetation in Segment 2 includes coastal oak woodland, valley foothill riparian, lacustrine, urban, barren, coastal scrub, eucalyptus, redwood, montane hardwood-conifer, and annual grasses. Several special-status species have been reported either in the right-of-way for Segment 2 or immediately adjacent to the right-of-way. Two federally listed salmonid

species, coho salmon and steelhead, either have historic habitat or the potential to occur in the San Lorenzo River, Soquel Creek, Arana Gulch, Aptos Creek, and Valencia Creek. Federally listed tidewater goby occurs primarily in brackish lagoons along the coast and has the potential to occur in Aptos Creek, Soquel Creek, Rodeo Creek, and the San Lorenzo River (Podlech 2019; USFWS 2005). The San Lorenzo River is also documented habitat for the southern coastal roach subspecies (previously considered Monterey roach [Baumsteiger and Moyle 2019]), a California species of special concern. East of the San Lorenzo River in Santa Cruz, there are two special-status invertebrates, including monarch butterfly (proposed threatened under the federal Endangered Species Act) and the Zayante band-winged grasshopper (federally endangered). Valley foothill riparian habitat north of Schwan Lagoon has the potential for Santa Cruz tarplant. Other special-status species in the right-of-way include yellow rail, Behren's snail-eating beetle, Townsend's big-eared bat, obscure bumblebee, and pallid bat. Eulachon (a species of smelt) observations are reported in the Segment 2 study area on CNDDDB, but NMFS considers the southern distinct population segment range to end around the Mad River in Humboldt County (NMFS 2022). The CNDDDB records for eulachon in the Santa Cruz region are over 100 years old and may be misidentified for longfin smelt, a close relative with more recent observations in the Santa Cruz region (Garwood 2017).

The study area and right-of-way in Segment 2 occur in a developed area due to the presence of the existing railroad, but there is potential for federal listed species constraints to the project. In-water construction and impacts to the waterways of the San Lorenzo River, Rodeo Creek, Soquel Creek, Aptos Creek, and Valencia Creek should be avoided, if possible, as these waterways may have major constraints on the project due to several federally endangered fish species.

9.3.4 Segment 1: Just East of Natural Bridges Drive to the San Lorenzo River

The study area for the Segment 1 rail spans the region east of Natural Bridges to the San Lorenzo River mouth in Santa Cruz and covers both aquatic and terrestrial habitat types. The vegetation in Segment 1 includes coastal oak woodland, coastal scrub, urban, barren, and lacustrine. State-listed tricolored blackbird has the potential to occur in the study area at the terminal end of Segment 1 and adjacent to the Neary Lagoon Wildlife Refuge. State-listed Santa Cruz kangaroo rat has the potential to occur in the right-of-way in the same vicinity, approximately 250 feet south of the Neary Lagoon Wildlife Refuge. Near Bay Street, there are documented observations of state-listed species including bank swallow and California black rail. Two federally listed salmonids, coho salmon (central California Coast Evolutionary Significant Unit) and steelhead (central California Coast Distinct Population Segment), have designated critical habitat in the San Lorenzo River. While not designated critical habitat, federally listed tidewater goby have the potential to occur in the San Lorenzo River and have been documented in the lagoon (Podlech 2019; USFWS 2005). Other notable special-status species in the study area include western snowy plover, Santa Cruz black salamander, California brackishwater snail, moestan blister beetle, globose dune beetle, hoary bat, sandy beach tiger beetle, western bumble bee, maple-leaved checkerbloom, woodland woollythreads, and Monterey vagrant shrew.

The study area and right-of-way in Segment 1 occur in a developed area due to the presence of the existing railroad, but there is potential for federally listed species, state-listed species, and other special-status species constraints to the ZEPRT Project. In-water construction and impacts to the waterways of the

San Lorenzo River should be avoided, if possible, as these waterways may have major constraints on the project due to several endangered fish species.

9.4 Cultural Resources

A constraints analysis was conducted during the ZEPRT Project to inventory previously identified cultural resources that intersect Segment 4 through Segment 1. Cultural resources include precolonial or historical objects, buildings, structures, sites, areas, places, records, or manuscripts.

Cultural resources may be *historical resources*, which are those listed, or eligible for listing, in the California Register of Historical Resources (CRHR), or those listed in the historical register of a local jurisdiction (county or city) unless the preponderance of the evidence demonstrate that the resource is not historically or culturally significant. Cultural resources may also be those listed, or historic properties eligible for listing, in the National Register of Historic Places (NRHP). Cultural resources include those properties that have been identified as eligible for inclusion in a qualified local register and may include recorded, but not evaluated, resources.

For this analysis, a California Historical Resources Information System (CHRIS) records search, a review of the Sacred Lands Files (SLF) maintained by the Native American Heritage Commission (NAHC), and a public records search were conducted for the project. These efforts are described below.

9.4.1 Methods

California Historical Resources Information System Records Search

A cultural resources records search was conducted at the CHRIS Northwest Information Center (NWIC) located at Sonoma State University in Rohnert Park, California, on July 1, 2025 (NWIC File No.: 24-2066) for the ZEPRT Project. The NWIC, an affiliate of the Office of Historic Preservation, serves as the official state repository for cultural resource records and reports in Santa Cruz and Monterey Counties. The purpose of the records search was to identify any previously recorded cultural resources and cultural resource studies that intersect the project footprint or are within a 200-foot radius of the ZEPRT Project footprint (study area).

The records search results found 148 studies and 93 previously recorded cultural resources are in the study area. Of the 93 previously recorded resources, 30 intersect with the project footprint (Table 9.1). Of the 30 previously recorded resources within the project footprint, 12 are archaeological sites or have an archaeological component, and 18 are built-environment resources. Five resources span more than one segment.

Table 9.1 CHRIS Results for Previously Recorded Cultural Resources Intersecting Segments 4 through 1

P Number	Resource Description	Age	Built or Archaeological	NRHP/CRHR Eligibility	Segment
P-27-004178	Pajaro River Levee	Historic	Built	Ineligible	Segment 4
P-27-004264	Santa Cruz Railroad	Historic	Built	Appears Eligible	Segment 4
P-27-004275	Southern Pacific Railroad	Historic	Built	Ineligible	Segment 4
P-44-000010	Historic occupation site; large precolonial shell midden	Precolonial, Historic	Archaeology	Unevaluated	Segment 2
P-44-000085	Occupation site	Precolonial	Archaeology	Unevaluated	Segment 1
P-44-000122	Precolonial shell midden	Precolonial	Archaeology	Unevaluated	Segment 2
P-44-000154	Precolonial coastal terrace occupation site	Precolonial, Historic	Archaeology	Unevaluated	Segment 2
P-44-000156	Precolonial shell midden	Precolonial	Archaeology	Unevaluated	Segment 4
P-44-000157	Precolonial shell midden; historic trash scatter	Precolonial, Historic	Archaeology	Unevaluated	Segment 4
P-44-000174	Precolonial shell midden	Precolonial	Archaeology	Unevaluated	Segment 3
P-44-000224	Precolonial occupation site with shell midden, historic features and debris related to the Southern Pacific Railroad, lumber, and apple picking industries	Precolonial, Historic	Archaeology	Unevaluated	Segment 2
P-44-000274	Precolonial occupation site; historic debris	Precolonial, Historic	Archaeology	Unevaluated	Segment 1
P-44-000286	Precolonial shell midden; historic debris	Precolonial, Historic	Archaeology	Unevaluated	Segment 1
P-44-000302	Precolonial midden	Precolonial	Archaeology	Unevaluated	Segment 1
P-44-000377	Southern Pacific Railroad	Historic	Built	Ineligible	Segments 1, 2, 3, 4
P-44-000395	Watsonville Historic District	Historic	Built	Unevaluated	Segment 4
P-44-000404	Old Segment of Highway 129	Historic	Built	Unevaluated	Segment 4
P-44-000406	Highway 1	Historic	Built	Unevaluated	Segments 2, 4
P-44-000469	7992 Aptos Wharf Road Parcel	Historic	Built	Ineligible (7N)	Segment 2
P-44-000514	Aptos Village Historic District	Historic	Built	Appears eligible; Listed	Segment 2
P-44-000537	403 Trout Gulch Road	Historic	Built	Ineligible	Segment 2
P-44-000733	Precolonial midden	Precolonial	Archaeology	Unevaluated	Segment 4
P-44-001100	Old Riverview Historic District	Historic	Built	Listed (1S)	Segment 2
P-44-001146	San Lorenzo River Trestle Bridge	Historic	Built	Appears Eligible	Segments 1, 2
P-44-001253	Segment of the abandoned Union Pacific Railroad	Historic	Built	Unevaluated	Segment 4
P-44-001254	Santa Cruz Wastewater Treatment Facility	Historic	Built	Ineligible	Segment 1
P-44-001276	Pajaro River Levee	Historic	Built	Ineligible	Segment 4

P Number	Resource Description	Age	Built or Archaeological	NRHP/CRHR Eligibility	Segment
P-44-001292	South Aptos Underpass; Bridge 36 0003	Historic	Built	Ineligible	Segment 2
P-44-001293	The North Aptos Underpass; Bridge 36 0012	Historic	Built	Ineligible	Segment 2
P-44-001294	Santa Cruz Railroad	Historic	Built	Appears Eligible; Listed	Segments 1, 2, 3, 4

Native American Heritage Commission

On June 27, 2025, the ZEPRT Project team sent a letter to NAHC requesting a search of its SLF records within the vicinity of the project footprint. NAHC is the official state repository of Native American sacred location records in California. The NAHC sent a response letter received on July 7, 2025, stating that the SLF search produced positive results. NAHC also provided a list of 34 Native American contacts for Monterey and Santa Cruz Counties who might have knowledge of cultural resources in the project footprint or in the general vicinity.

Additional Sources Consulted

In addition to the SLF and CHRIS records searches, the ZEPRT Project team reviewed the Caltrans Historic Bridge Inventory database for District 5 bridges, NRHP-listed properties provided by the National Parks Service, City of Santa Cruz Archaeological Sensitive Areas Map, and City of Santa Cruz historic buildings and the Santa Cruz County Designated Historic Resources (Santa Cruz County 2025) within 200 feet of the project footprint.

9.4.2 Results

Cultural Resources Study Area

The project has a cultural resources study area for archaeological and built-environment resources. The cultural resources study area encompasses the project components, including the trail, railroad alignment, stations, and maintenance facility, as well as a 200-foot buffer zone surrounding all ZEPRT Project components.

The study area for Segment 4 includes all project components plus a 200-foot buffer between Peaceful Valley Drive and Buena Vista Drive to Watsonville Junction. The study area for Segment 3 includes all project components plus a 200-foot buffer just South of Rio del Mar Boulevard to between Peaceful Valley Drive and Buena Vista Drive. The study area for Segment 2 includes all project components plus a 200-foot buffer at the San Lorenzo River to just South of Rio Del Mar Boulevard (about in line with Kingsbury Drive). The study area for Segment 1 encompasses all project components, along with a 200-foot buffer, extending east from Natural Bridges Drive to the San Lorenzo River.

Segment 4: Between Peaceful Valley Drive and Buena Vista Drive to Watsonville Junction

As a result of the NWIC records search, 26 cultural resources were identified in the Segment 4 study area. Of those 26 resources, eight intersect a portion of the ZEPRT Project components. There are five built-environment resources that intersect with Segment 4. These consist of the Santa Cruz Railroad (P-44-

001294), the Southern Pacific Railroad Harkins Slough Trestle (P-44-000377), State Route 129 in Santa Cruz County (P-44-000404), State Route 1 (P-44-000406), and ESA-PVWA-MN-02 (P-44-001253). In addition, the Caltrans Historic Bridge Inventory included one historic-age bridge in Segment 4. The Santa Cruz Railroad appears eligible for a register; State Route 129, State Route 1, and ESA-PVWA-MN-02 were not previously evaluated; and the Southern Pacific Railroad Harkins Slough Trestle appears not eligible for a register. In addition, the West Watsonville bridge was not previously evaluated. Three archaeological sites intersect with Segment 4. These three resources include a precolonial shell midden (P-44-000156), a precolonial shell midden and historic trash scatter (P-44-000157), and a precolonial midden (P-44-000733). These archaeological resources have not been evaluated for the NRHP or CRHR.

Segment 3: Just South of Rio Del Mar Boulevard to Between Peaceful Valley Drive and Buena Vista Drive

As a result of the NWIC records search, four cultural resources were identified in the Segment 3 study area. Of those four resources, three resources intersect a portion of the ZEPRT Project footprint. One built-environment resource intersects with Segment 3, which is the Santa Cruz Railroad (P-44-001294). One archaeological resource intersects with Segment 3. This resource consists of a precolonial shell midden (P-44-000174). P-44-000174 has not been evaluated for the NRHP or CRHR.

Segment 2: San Lorenzo River to Just South of Rio Del Mar Boulevard (About in Line with Kingsbury Drive)

As a result of the NWIC records search, 56 cultural resources were identified in the Segment 2 study area. Of those 56 resources, nine resources intersect a portion of the ZEPRT Project footprint. There are five built-environment resources that intersect with Segment 2. These consist of the Santa Cruz Railroad (P-44-001294), the San Lorenzo River Trestle Bridge (P-44-001146), Judge Rice House (P-44-000469), Aptos Village Historic District (P-44-000514), and the Old Riverview Historic District (P-44-001100). The Old Riverview Historic District is listed, and the other four resources appear eligible for listing. Four archaeological resources intersect with Segment 2 that include a large precolonial shell midden and historic occupation site (P-44-000010), a precolonial shell midden (P-44-000122), a precolonial coastal terrace occupation site (P-44-000154), and a precolonial occupation site with shell midden and historic features and debris (P-44-000224). P-44-000010 and P-44-000224 were previously recommended ineligible for listing on the NRHP but were not evaluated for the CRHR. P-44-000122 and P-44-000154 have not been evaluated for the NRHP or CRHR.

According to the City of Santa Cruz Archaeological Sensitive Areas map, there are no areas of high archaeological sensitivity within the Santa Cruz city limits from the San Lorenzo River to near Lake Avenue. However, the portion of Segment 2 within the city limits is mostly considered sensitive for archaeological resources and archaeological sites could be encountered in these areas. Archaeological sites can also occur outside of areas considered sensitive.

Segment 1: Just East of Natural Bridges Drive to the San Lorenzo River

As a result of the NWIC records search, 16 cultural resources were identified in the Segment 1 study area. Of those 16 resources, six intersect a portion of the ZEPRT Project components. Four are archaeological resources, and two are historic era-built-environment resources. There are two built-environment resources

that intersect with Segment 1. These consist of the Santa Cruz Railroad (P-44-001294), and the San Lorenzo River Trestle Bridge (P-44-001146) both of which appear eligible for listing. There are four archaeological sites that intersect with Segment 1: a precolonial occupation site (P-44-000085), a precolonial occupation site with historic debris (P-44-000274), a precolonial shell midden and historic debris (P-44-000286), and a precolonial midden (P-44-000302). These four archaeological sites have not been evaluated for the NRHP or the CRHR.

According to the City of Santa Cruz Archaeological Sensitive Areas map, there are areas of high archaeological sensitivity from California Street at Bay Street to Beach Street along the alignment and along Beach Street to the San Lorenzo River. Areas between Natural Bridges Drive and Swift Street are also considered sensitive, and archaeological sites could be encountered there as well. Archaeological sites can also occur outside of areas considered sensitive.

9.5 Geology, Soils, Seismicity

This section identifies the potential geologic and seismic hazards that could affect the ZEPRT Project facilities based on publicly available information.

As the project design is further refined, a detailed geotechnical analysis will be performed if needed.

The study area is located entirely within the Monterey Bay region. Monterey Bay is underlain by water-bearing unconsolidated alluvium, stream channels, and basin sediments. The area has been cut by a complex series of high-angle thrust and strike slip northwest-trending faults, which has produced the northwest-trending ridge and valley systems. These areas are filled with Pleistocene to Holocene alluvium. The region consists of marine and nonmarine sedimentary strata. There are no important natural landmarks or major geologic features in the area.

The study area is not within a state-designated Alquist-Priolo Earthquake Fault Zone, and no known active or potential active surface expression of fault traces crosses the site (CGS 2024b). However, the entire study area is in a seismically active area of California, with major active faults in the areas including the San Andreas and Zayante-Vergales. The Zayante-Vergales Fault is the controlling fault for this project and can induce strong ground shaking within the project vicinity. The San Andreas Fault system also has displayed considerable activity in the past and is likely to do so in the future. In a seismically active area such as the San Francisco Bay Area, the possibility of future surface fault rupture occurring in areas where faults have not been mapped is small, but the possibility exists.

The principal seismic hazard in the proposed study area has the potential for moderate to severe ground shaking from earthquakes occurring on one or more regional active faults. To minimize potential damage from ground shaking, structures associated with this ZEPRT Project should meet maximum credible earthquake standards, as established by the California Building Code.

There are locations of moderate, high, and very high liquefaction hazards at certain locations. There is a possibility that lateral spreading may occur at any of the major creek channel crossings in the study area. There are specific areas of landslide hazards at various locations along the alignment.

9.5.1 Segment 4: Between Peaceful Valley Drive and Buena Vista Drive to Pajaro/Watsonville Junction

The geology of Segment 4 comprises marine sedimentary rocks and marine and nonmarine (continental) sedimentary rocks, consisting primarily of Pleistocene to Holocene alluvium (CGS 2025). The Zayante-Vergales and San Andreas Faults, the controlling faults for the study area, are approximately 4 miles and 6 miles northeast of the center of Segment 4, respectively. There is the potential for moderate to severe ground shaking in Segment 4 from earthquakes occurring on one or more of these regional active faults.

The general terrain along Segment 4 consists of gentle slopes presenting little or no potential for the formation of slumps, landslides, or earth flows. However, there is some potential for these conditions to occur along the stream banks and terrace margins, defined by the distribution of surficial deposits. There are areas of very high risk for liquefaction where the alignment crosses or is adjacent to Gallighan Slough, Harkins Slough, and the Pajaro River, in addition to areas of Watsonville east and west of State Route 1, north of West Beach Road, there is a possibility that lateral spreading may occur at any of the major creek channel crossings in Segment 4.

Slopes along Segment 4 near Gallighan Slough and Harkins Slough may pose local slump or landslide risks.

9.5.2 Segment 3: Just South of Rio Del Mar Boulevard to Between Peaceful Valley Drive and Buena Vista Drive

The geology of Segment 3 comprises marine sedimentary rocks and marine and nonmarine (continental) sedimentary rocks, consisting primarily of Pleistocene alluvium (CGS 2025).

The Zayante-Vergales and San Andreas Faults, the controlling faults for the study area, are approximately 3 miles northeast and 8 miles northeast of the center of Segment 3, respectively. As described previously, there is potential for moderate to severe ground shaking in Segment 3 from earthquakes occurring on one or more of these regional active faults.

The general terrain along Segment 3 consists of gentle slopes presenting little or no potential for the formation of slumps, landslides, or earth flows. However, there is some potential for these conditions to occur along the stream banks and terrace margins, defined by the distribution of surficial deposits. There are areas of very high risk for liquefaction where the alignment crosses an unnamed creek near Margarita Road, and there is a possibility that lateral spreading may occur at any of the major creek channel crossings in Segment 3.

Slopes along Segment 3 near Dry Creek Road, Appleton Drive, Bush Gulch, Santa Margarita Creek, and Paso Cielo may pose local slump or landslide risks.

9.5.3 Segment 2: San Lorenzo River to Just South of Rio Del Mar Boulevard (About in Line with Kingsbury Drive)

The geology of Segment 2 comprises marine sedimentary rocks and marine and nonmarine (continental) sedimentary rocks, consisting primarily of Pleistocene to Holocene alluvium and Pliocene sandstone (CGS 2025).

The Zayante-Vergales and San Andreas Faults, the controlling faults for the study area, are approximately 5 miles and 8 miles northeast of the center of Segment 2, respectively. As described previously, there is potential for moderate to severe ground shaking in Segment 2 from earthquakes occurring on one or more of these faults.

The general terrain along Segment 2 consists of gentle slopes presenting little or no potential for the formation of slumps, landslides, or earth flows. However, there is some potential for these conditions to occur along the stream banks and terrace margins, defined by the distribution of surficial deposits. There are areas of very high risk of liquefaction alignment where the alignment crosses Arana Gulch, Leona Creek, Rodeo Creek Gulch, Soquel Creek, Tannery Gulch, Aptos Creek, and Valencia Creek. There is a possibility that lateral spreading may occur at any of the major creek channel crossings in Segment 2.

Slopes along Segment 2 near the San Lorenzo River, Branciforte Creek, Woods Lagoon, Schwan Lagoon, Rodeo Creek, Soquel Creek, Noble Creek, Tannery Gulch, Borregas Creek, Aptos Creek, and Valencia Creek may pose local slump or landslide risk.

9.5.4 Segment 1: Just East of Natural Bridges Drive to the San Lorenzo River

The geology of Segment 1 comprises marine and nonmarine (continental) sedimentary rocks, consisting primarily of Pleistocene to Holocene alluvium (CGS 2025).

The Zayante-Vergales and San Andreas Faults are the controlling faults for the study area. The Zayante-Vergales Fault is approximately 5.5 miles northeast of the center of Segment 1 and the San Andreas Fault is approximately 9 miles northeast of the center of Segment 1. There is potential for moderate to severe ground shaking in Segment 1 from earthquakes occurring on one or more of these regional active faults.

The general terrain along Segment 1 consists of gentle slopes presenting little or no potential for the formation of slumps, landslides, or earth flows. However, there is some potential for these conditions to occur along the stream banks and terrace margins, defined by the distribution of surficial deposits. There are areas of very high risk of liquefaction along Beach Street and Bay Street, and where the alignment crosses the San Lorenzo River. There is a possibility that lateral spreading may occur at any of the major creek channel crossings in Segment 1.

Slopes along Segment 1 near Younger Lagoon, Moore Creek, Neary Lagoon Wildlife Refuge, and San Lorenzo Park may pose local slump or landslide risks.

9.6 Hazardous Materials and Wastes

An environmental database search was conducted during the ZEPRT Project by reviewing publicly accessible online records from the State Water Resources Control Board (SWRCB) GeoTracker database (2025) and the Department of Toxic Substances Control (DTSC) EnviroStor database (2025) in July 2025. The purpose of the environmental database search was to determine potential hazardous material impacts to project implementation. The environmental database search was conducted for the ZEPRT Project footprint and for properties within 200 feet of the ZEPRT Project footprint.

Adjacent (offsite) properties with a history of contaminant release(s) have the potential to affect nearby sites, including the ZEPRT Project footprint. Adjacent properties within 200 feet of the project footprint were assessed and listed under each applicable segment if identified as open or active. Adjacent properties that are inactive (with no indication of a release) or that have received Case Closure, a No Further Action, No Action (or similar) status were not included because they are considered remediated to the satisfaction of the oversight agency. Therefore, these properties are not considered risks to implementation of the ZEPRT Project (unless they have land use restrictions assigned to them, in which case they were listed in the tables provided in this section).

Several sites were identified during the environmental database search, which included SWRCB leaking underground storage tank (LUST) cleanup sites, SWRCB Cleanup Program sites, and DTSC sites. The following is a description of each site type.

- **SWRCB LUST cleanup sites.** This includes all underground storage tank (UST) sites that have had an unauthorized release (i.e., leak or spill) of a hazardous substance, usually fuel hydrocarbons, and are being (or have been) cleaned up.
- **SWRCB Cleanup Program sites.** This includes all “non-federally owned” sites that are regulated under SWRCB’s Cleanup Program or similar programs conducted by each of the nine Regional Water Quality Control Boards. Unauthorized releases detected at Cleanup Program sites are highly variable and include but are not limited to hydrocarbon solvents, pesticides, perchlorate, nitrate, heavy metals, and petroleum constituents.
- **DTSC sites.** These include a variety of sites under purview of DTSC. They include but are not limited to Federal Superfund, Evaluation, Formerly Used Defense sites, State Response, and Voluntary Cleanup sites.

Sections 9.5.1 through 9.5.4 contain open/active sites identified (per segment) during the environmental database search. These sites are shown in the hazardous materials map books in the appendix.

9.6.1 Segment 4: Between Peaceful Valley Drive and Buena Vista Drive to Pajaro/Watsonville Junction

Properties in the Segment 4 ZEPRT Project footprint with a history of contaminants are presented in Table 9.2 below.

Table 9.2 Properties in Segment 4 Project Footprint with A History of Contaminants

Name/Address	Within or Adjacent to Project Site	Case ID	Site Summary
Monterey Bay Sanctuary Scenic Trail, Segment 18, City of Watsonville Coastal Rail Trail Project Between Walker Street and Lee Road Watsonville, CA	Immediately adjacent to project site (Rail Segment 4)	SWRCB Cleanup Program Site (Case # T10000020836)	The site is listed with an <i>Informational Item/Review Complete as of 2/4/2023</i> status and impacts to soils. Contaminants listed as arsenic, chromium VI, diesel, gasoline, lead, other metals, total petroleum hydrocarbons, and waste oils, including motor, hydraulic and lubricating. A variety of site-management requirements apply and are listed in GeoTracker, including activities that are prohibited, which disturb the remedy and monitoring systems without approval, no excavation of contaminated soils without agency review and approval, residential uses prohibited, etc.
UP Row Adjacent to Granite Construction (Milepost 2.32) 866 West Beach Street Watsonville, CA	Immediately adjacent to project site (Rail Segment 4)	SWRCB Cleanup Program Site (Case # T10000002086)	The site is listed with a <i>Completed - Case Closed as of 9/1/2016</i> status and impacts to soils and groundwater. Contaminants are listed as arsenic, diesel, other metals, and waste oils, including motor, hydraulic and lubricating. A variety of site-management requirements apply and are listed in GeoTracker, including no excavation of contaminated soils without agency review and approval, residential uses prohibited, etc.

SWRCB = State Water Resources Control Board

The open/active sites listed above represent potential exposure risks to arsenic, chromium VI, diesel, gasoline, diesel, lead, other metals, Total Petroleum Hydrocarbons (TPH) and waste oils impacted media during soils disturbance activities.

9.6.2 Segment 3: Just South of Rio Del Mar Boulevard to Between Peaceful Valley Drive and Buena Vista Drive

Properties in the Segment 3 ZEPRT Project footprint with a history of contaminants are presented in Table 9.3 below.

Table 9.3 Properties in Segment 3 Project Footprint with A History of Contaminants

Name/Address	Within or Adjacent to Project Site	Case ID	Site Summary
Moreno Petroleum PFAS 33 Associated Lane Pajaro, CA	Immediately adjacent to project site (Rail Segment 3 and 4 Composite)	SWRCB Cleanup Program Site (Case # T10000017635)	The site is listed with an <i>Open – Site Assessment as of 6/7/2023</i> status and impacts to soils and groundwater. Contaminants listed as per- and PFAS and petroleum hydrocarbons. Remediation of residual petroleum hydrocarbons has occurred onsite. The petroleum contamination case was closed in February 2022 and a covenant with land use restrictions was recorded for this property in November 2021.
Sturdy Oil Card Lock 1110 West Beach Street Watsonville, CA	Immediately adjacent to project site (Rail Segment 3)	SWRCB Cleanup Program Site (Case # T1000000662)	The site is listed with an <i>Open – Site Assessment as of 3/3/2016</i> status and impacts to soils, sediments, and groundwater. Contaminant listed as diesel. Remediation is ongoing.

SWRCB = State Water Resources Control Board; PFAS = polyfluoroalkyl substances

The open/active sites listed above represent potential exposure risks to polyfluoroalkyl substances (PFAS), residual TPH and diesel-affected media during soils disturbance activities. In addition, Moreno Petroleum PFAS site footprint is subject to applicable covenant and environmental restrictions.

9.6.3 Segment 2: San Lorenzo River to Just South of Rio Del Mar Boulevard (About in Line with Kingsbury Drive)

Properties in the Segment 2 ZEPRT Project footprint with a history of contaminants are presented in Table 9.4 below.

Table 9.4 Properties in Segment 2 Project Footprint with A History of Contaminants

Name/Address	Within or Adjacent to Project Site	Case ID	Site Summary
Commercial Property 970 & 992 17th Avenue Santa Cruz, CA	Immediately Adjacent to project site (Rail Segment 2)	SWRCB Cleanup Program Site (Case # T10000023040)	The site is listed with an <i>Open – Site Assessment as of 2/18/2025</i> status. According to GeoTracker, regulatory oversight by the Santa Cruz County Environmental Health Division is ongoing. Remediation of shallow soils, implementation of vapor mitigation measures, and site-management practices have occurred/been implemented onsite. The site remains active with commercial and industrial uses.
Commercial Property 7994-7996 Soquel Drive Aptos, CA	Immediately Adjacent to project site (Rail Segment 2)	SWRCB Cleanup Program Site (Case # T10000018720)	The site is listed with an <i>Open – Site Assessment as of 4/21/2025</i> status. According to a March 2022 <i>Additional Soil Vapor Assessment</i> report, solvent compounds in soils were identified onsite during a Phase II Environmental Site Assessment conducted in 2019. Soil vapor and indoor air sampling were conducted in 2022. Additional sampling recommended in the 2022 report. Remediation activities are ongoing under purview of the County of Santa Cruz.
Former Capitola Manor 1098 38th Avenue Capitola, CA	Immediately Adjacent to Project site (Rail Segment 2)	SWRCB Cleanup Program Site (Case # T10000022485)	The site is listed with an <i>Open – Site Assessment as of 2/18/2025</i> status. The site has a history of agricultural and commercial uses. A Limited Phase II Investigation in 2022 identified low levels of TPH and trace amounts of arsenic and methyl parathion in soil. Additionally, benzene and TCE were found in soil gas at concentrations exceeding regulatory vapor intrusion screening levels. The Santa Cruz County Environmental Health Division oversees remediation of the site.

SWRCB = State Water Resources Control Board; TPH = total petroleum hydrocarbons; TCE = trichloroethylene

The open/active sites listed above represent potential exposure risks to low levels of TPH and trace amounts of arsenic and methyl parathion during soils disturbance activities and potential long-term vapor intrusion.

9.6.4 Segment 1: Just East of Natural Bridges Drive to the San Lorenzo River

Properties in the Segment 4 ZEPRT Project footprint with a history of contaminants are presented in Table 9.5 below.

Table 9.5 Properties in Segment 1 Project Footprint with A History of Contaminants

Name/Address	Within or Adjacent to Project Site	Case ID	Site Summary
Artisan Industrial Property 2541 Mission Street Santa Cruz, CA	Immediately adjacent to project site (Rail Segment 1)	SWRCB Cleanup Program Site (Case # T10000021558)	The site is listed with an <i>Open – Site Assessment as of 9/25/2024</i> status. According to an August 2024 Additional Site Assessment Report, the site contains residual lead and arsenic in soils. However, given onsite conditions, the report determined that residual impacts represent a low risk to site users.
Westside Village 844-850 Almar Avenue Santa Cruz, CA	Immediately adjacent to project site (Rail Segment 1)	SWRCB Cleanup Program Site (Case # T10000023368)	The site is listed with an <i>Open – Site Assessment as of 5/23/2025</i> status with benzene and PCE impacts to soil vapor. The site is planned for residential redevelopment. To address the potential for vapor intrusion from the identified VOCs, installation of a VIMS is proposed.

SWRCB = State Water Resources Control Board; PCE = perchloroethylene; VOCs = volatile organic compounds;

VIMS = vapor intrusion mitigation system

The open/active sites listed above represent potential exposure risks to residual concentrations of arsenic and lead during soil-disturbance activities and potential long-term vapor intrusion.

9.7 Hydrology and Water Resources

Federal Emergency Management Agency (FEMA) datasets were used to identify areas that are predicted to be inundated with water in the future. Flood information is based on the concept of the “100-year flood plain,” which is the area that statistically is likely to flood once in 100 years (but this has a small potential to be flooded in any given year). This is the regulatory standard and is used by federal agencies for regulating new development and requiring the purchase of flood insurance. Two other closely related concepts at the heart of several datasets are the floodplain and the floodway.

9.7.1 Segment 4: Between Peaceful Valley Drive and Buena Vista Drive to Pajaro/Watsonville Junction

The western portion of the study area of Segment 4 is predominantly outside of the 100-year floodplain, within FEMA Zone X (unshaded), areas of minimal flood hazard. The study area where Gallighan Slough meets the confluence of Harkins Slough is within the 100-year floodplain (FEMA Zone A and Zone AE) and remains predominantly within the 100-year floodplain (Zone AE and Zone AO), until the project crosses the Pajaro River at the Porter Drive bridge. FEMA Zone AO is the 100-year floodplain applicable to river or stream flood hazard areas where average flood depths are known. The trail crossing east of Dairy Road and San Andreas Road in Watsonville near the Watsonville Slough is also within the 100-year floodplain (FEMA Zone AE). A small portion of the project crosses the 500-year floodplain at West Beach Street. The 500-year floodplain is an area that statistically speaking is flooded once every 500 years but has a small potential to be flooded in any given year. Several other water features cross the ZEPRT Project alignment, including Gallighan Slough, but these water features are not within a FEMA flood zone.

The rail crossing near the confluence of Gallighan Slough and Harkins Slough as well as the trail crossing over the Watsonville Slough are within the 100-year floodplain (Zone AE). The proposed trail remains in the 100-year floodplain along Beach Road, as does the rail line, including the proposed maintenance facility east of State Route 1 and the Downtown Watsonville Station.

9.7.2 Segment 3: Just South of Rio Del Mar Boulevard to Between Peaceful Valley Drive and Buena Vista Drive

The study area of Segment 3 is predominantly outside of the 100-year floodplain, within FEMA Zone X (unshaded), areas of minimal flood hazard. South of Margarita Creek, the study area covers FEMA Flood Zone VE, a coastal Special Flood Hazard Area; however, the project right-of-way is outside of FEMA Zone VE. Several other water features and drainages cross the project alignment, including Bush Gulch, but these water features are not within a FEMA flood zone.

There are no project stations or portions of the trail or rail line in Segment 3 within the FEMA 100-year floodplain.

9.7.3 Segment 2: San Lorenzo River to Just South of Rio Del Mar Boulevard (About in Line with Kingsbury Drive)

The study area of Segment 2 is predominantly outside of the 100-year floodplain, within FEMA Zone X (unshaded), areas of minimal flood hazard. Segment 2 crosses the 100-year floodplain (FEMA zones A and AE at the Santa Cruz Harbor, Flood Zone A at Schwan Lagoon, and Zone AE at Rodeo Creek). The study area at Rodeo Creek also crosses FEMA Zone X (shaded), areas of moderate flood hazards. The study area in Capitola also crosses FEMA Zone VE, the coastal special flood hazard area (SFHA). The project crossing at Soquel Creek crosses the 100-year floodplain (FEMA Zone AE). The study area near Nobel Creek crosses FEMA Zone AE and X (shaded). The project crosses the 100-year floodplain (Zone AE) at Aptos Creek. Several other water features cross the project including Tannery Gulch and Borregas Creek but these water features are not within a FEMA flood zone.

There are no ZEPRT Project passenger rail stations in Segment 2 within the FEMA 100-year floodplain; however, the trail and rail line cross the 100-year floodplain at the San Lorenzo River, Santa Cruz Harbor, and Aptos Creek.

9.7.4 Segment 1: Just East of Natural Bridges Drive to the San Lorenzo River

The study area of Segment 1 is predominantly outside of the 100-year floodplain, within FEMA Zone X (unshaded), areas of minimal flood hazard. The central portion of Segment 1, including Chestnut Street, is within FEMA Zone A and FEMA Zone X (Shaded). FEMA Zone A is the 100-year floodplain where no known depths or base flood elevations. FEMA Zone X (shaded) is an area of moderate flood hazard, usually between the limits of the 100-year and 500-year floods. The area is subject to shallow flooding with average depths of less than one foot or drainage areas less than 1 square mile. The eastern terminus of Segment 1 crosses FEMA Zone A, VE, and Zone AE. FEMA Zone VE is a coastal SFHA within the 100-year floodplain with a high risk of flooding from storm surges and fast-moving water. At the San Lorenzo River, the project crosses FEMA Zone AE, the 100-year floodplain where base flood elevations are known. A small segment of the project also crosses the 500-year floodplain west of Pacific Street. Part of the study area is within FEMA Zone VE near the Santa Cruz Harbor; however, the project right-of-way is outside of FEMA Zone VE.

ZEPRT Project features within a FEMA 100-year floodplain include the western portion of the Beach Street / Downtown Station. The trail and rail line crossing over the San Lorenzo River is also within the 100-year floodplain. The Natural Bridges Drive Station site crosses the Arroyo Seco Canyon Drainage, but this water feature is not within the floodplain.

9.8 Land Use

Methods used for determining the types of land uses crossed by or within a 200-foot radius of the ZEPRT Project included mapping and comparison of the proposed rail and trail alignments and associated stations and maintenance facility to the Coastal Zone boundary and the land use designations within the study area.

The land use designations in the project study area were determined by overlaying ArcGIS files of the project alignment, proposed stations and maintenance facility, and the 200-foot-radius study area over the California Coastal Zone ¹² as well as the local jurisdictions' land use data. To identify existing land use in the study area, the ZEPRT Project team coded parcels from Regrid based on aerial imagery, Google Earth Street View, and Google maps to best identify the most recent existing land use (Regrid, 2025). This information was used to identify broad land use issues that may be associated with the proposed alignment.

9.8.1 Segment 4: Between Peaceful Valley Drive and Buena Vista Drive to Pajaro/Watsonville Junction

The Segment 4 land use study area extends from a point between Peaceful Valley Drive and Buena Vista Drive, just north of the San Andreas Road/Buena Vista Drive wye, to the Watsonville Junction south of the city of Watsonville in the unincorporated Monterey County community of Pajaro. This segment includes two proposed stations (Downtown Watsonville and Pajaro), a maintenance facility, and a 200-foot corridor on each side of the ZEPRT alignments and facilities.

Between the San Andreas Road/Buena Vista Drive wye and the Watsonville Junction, the rail and trail alignment study areas diverge, with the rail alignment following the existing railroad right-of-way through Watsonville and the trail turning south along San Andreas Road before veering northeast to follow West Beach Street into Watsonville. In Watsonville, the trail turns southeast to follow Rodriguez Street before crossing the Pajaro River on a new trail bridge to the existing levee road at Pajaro Park where the trail will continue southwest back into the SCBRL railroad right-of-way. From here the study areas for both rail and trail follow the same alignment between the Pajaro River and the terminus of the trail at Salinas Road adjacent to the existing grade crossing. The Segment 4 rail alignment study area continues beyond Salinas Road and around UP's Watsonville Junction Yard to end approximately 0.2 miles southeast of the Salinas Road/Railroad Avenue intersection.

The Segment 4 study area includes a larger proportion of agricultural and open space uses as well as the commercial, industrial, residential, and recreation uses that characterize the other segments. As described in Section 9.1, Agricultural Farmlands, the rail alignment study area northwest of Watsonville Slough, as well as the area between Watsonville Slough and the city of Watsonville, including the proposed maintenance facility site, is located on Prime Farmland. The trail alignment study area, following San

¹² The California Coastal Commission, established in 1972 by voter initiative (Proposition 20) and made permanent by the Legislature through the California Coastal Act of 1976, regulates land use in the coastal zone. Implementation of Coastal Act policies is accomplished primarily through the preparation of required local coastal plans (LCPs) that are carried out by each county and city located in whole or in part in the coastal zone.

Andreas Road and West Beach Street, also crosses large areas of Prime Farmland. Almost all of the Segment 4 study area north and west of Watsonville, until it crosses State Route 1, is in the Coastal Zone.

Within the city of Watsonville, study area land uses include large areas of industrial uses, as well as a mix of residential and commercial uses. The area along the Pajaro River is largely in undeveloped open space use.

South of the Pajaro River in Monterey County, the combined rail and trail study area land uses consist of the residential and commercial uses in the community of Pajaro, the industrial uses of the Watsonville Junction, and surrounding agricultural uses. This portion of Segment 4 is outside the Coastal Zone.

The ZEPRT Pajaro Station site is in a rural area surrounded by Prime Farmland and few developed uses.

9.8.2 Segment 3: Just South of Rio Del Mar Boulevard to Between Peaceful Valley Drive and Buena Vista Drive

The Segment 3 land use study area includes the contiguous rail and trail alignments just south of Rio Del Mar Boulevard to a point between Peaceful Valley Drive and Buena Vista Drive, just north of the San Andreas Road/Buena Vista Drive wye, Manresa Beach, and a 200-foot corridor on each side of the alignments and facilities.

Segment 3 traverses commercial, industrial, residential, and open space/recreation uses, particularly within the unincorporated Santa Cruz County communities of Aptos, Rio del Mar, and La Selva Beach. In addition, agricultural lands divide Rio del Mar and La Selva Beach within the Segment 3 study area. South of La Selva Beach, more agricultural land, together with areas of open space and single-family residential uses, occupy the Segment 3 study area between La Selva Beach and the San Andreas Road/Buena Vista Drive wye. All of the Segment 3 study area is in the Coastal Zone.

9.8.3 Segment 2: San Lorenzo River to Just South of Rio Del Mar Boulevard (About in Line with Kingsbury Drive)

The Segment 2 land use study area includes the largely contiguous rail and trail alignments from the San Lorenzo River to just south of Rio Del Mar Boulevard, five proposed ZEPRT stations (Seabright, 17th Avenue, Capitola, Cabrillo, and Aptos), and a 200-foot corridor on each side of the alignments and facilities.

Segment 2 crosses urbanized areas of the incorporated cities of Santa Cruz and Capitola, as well as the unincorporated Santa Cruz County community of Aptos. All of the Segment 2 study area, except approximately 0.5 mile in the area north of Corcoran Lagoon and the portion of the alignment that extends north of State Route 1 in the Soquel area, is within the Coastal Zone. The Aptos Station site is outside the Coastal Zone. As with Segment 1, land uses along Segment 2 comprise a mix of commercial, industrial, low- and medium-density residential, and open space/recreation uses. Large areas of open space/recreation uses are present within this segment's study area, including Schwan Lagoon, Jade Street Park, and New Brighton State Beach.

The Cabrillo station site would be within the New Brighton State Beach.

9.8.4 Segment 1: Just East of Natural Bridges Drive to the San Lorenzo River

The Segment 1 land use study area includes the contiguous rail and trail alignments between Natural Bridges Drive and the San Lorenzo River, two proposed stations (Natural Bridges Drive and Beach Street / Downtown), and a 200-foot corridor on each side of the ZEPRT alignments and facilities.

The Segment 1 study area is entirely within the incorporated city of Santa Cruz. With the exception of approximately 0.5 mile between Natural Bridges Drive and just east of Fair Avenue, all of the Segment 1 study area is in the Coastal Zone. In the Segment 1 study area, existing land uses comprise commercial, industrial, low- and medium-density residential, and open space/recreation uses, including Neary Lagoon and the Santa Cruz Beach Boardwalk. The proposed Beach Street / Downtown Station site is immediately adjacent to the Monterey Bay National Marine Sanctuary Exploration Center on one side and single-family residential uses on the other side. Land uses surrounding the other station sites consist primarily of low- and medium-density residential or commercial uses.

9.9 Major Public Utilities

Construction and operation of the ZEPRT Project may require the relocation of public utilities and network upgrades for electricity supply (if electrically powered trains are advanced), potentially affecting public utilities beyond the project footprint. Known major public utilities in the ZEPRT Project study area include public electrical distribution and transmission lines and natural gas pipelines. There may also be electrical substations, major water lines, and major sewer trunk lines, but this preliminary evaluation has not reviewed the potential for such utilities; this will be done during the environmental review phase.

9.9.1 Segment 4: Between Peaceful Valley Drive and Buena Vista Drive to Pajaro/Watsonville Junction

Electrical transmission lines are located along Segment 4 at Walker Street and along West Beach Street between Harvest Drive and Walker Street. Natural gas pipelines are located along Segment 4 along Buena Vista Drive between San Andreas Road and the Galligan Slough. Natural gas pipelines are also parallel to the train along San Andreas Road between Buena Vista Boulevard and Crest View Drive.

9.9.2 Segment 3: Just South of Rio Del Mar Boulevard to Between Peaceful Valley Drive and Buena Vista Drive

Construction and operation of the project may require relocation of the public electrical distribution lines identified along Segment 3, potentially resulting in impacts to utilities and utility services. Natural gas pipelines are not known to be located along Segment 3.

9.9.3 Segment 2: San Lorenzo River to Just South of Rio Del Mar Boulevard (About in Line with Kingsbury Drive)

Electrical distribution lines are located variously along Segment 2. Electrical transmission lines are located along Segment 2 at 30th Avenue. Natural gas pipelines are located along Segment 2 between Coronado

Street and Kennedy Drive, at State Route 1, and along Hillcrest Drive between Beachgate Way and Seacliff Drive.

9.9.4 Segment 1: Just East of Natural Bridges Drive to the San Lorenzo River

Electrical distribution lines exist at various locations along Segment 1. Electrical transmission lines are located along Segment 1 at the proposed Natural Bridges Drive Station and along Bay Street between California Street and Centennial Street. Natural gas pipelines are located along Segment 1 between Natural Bridges Drive and Swift Street and east of Almar Drive. Santa Cruz Wastewater Treatment Facility and Neary Lagoon Outfall are major wastewater facilities located within the study area.

9.10 Mineral Resources

Mineral extraction activities in Santa Cruz County are limited to primarily aggregate including sand, gravel, and crushed stone (CGS 2021a). Santa Cruz County is a designated mineral resource sector as identified by the California State Mining and Geology Board (SMGB), which formally recognizes significant mineral deposits in the county. The study area is in the Monterey Bay Production-Consumption (P-C) region and intersects within several Mineral Resource Zones (MRZs), as identified by SMGB (CGS 2021b).

The potential for construction and operation of the ZEPRT Project to result in diminished availability of a known mineral resource or loss of an important mineral recovery site is low. As the design progresses and during the CEQA/NEPA phase, the likelihood of loss of availability of a known mineral resource, or in the loss of a locally important mineral resource recovery site will be evaluated.

9.10.1 Segment 4: Between Peaceful Valley Drive and Buena Vista Drive to Pajaro/Watsonville Junction

Segment 4 is in the Monterey Bay P-C region.

No known mineral resources producers or occurrences exist near Segment 4. According to the *Santa Cruz County General Plan* and *Local Coastal Plan*, the study area along Segment 4 has not been designated as having a known mineral resource of value, and no extractive land uses are planned along Segment 4.

9.10.2 Segment 3: Just South of Rio Del Mar Boulevard to Between Peaceful Valley Drive and Buena Vista Drive

Segment 3 is in the Monterey Bay P-C region. The southern portion of Segment 3 is in MRZ-1, is in an area where available geologic information is inadequate to assign to any other mineral resource zone category. All other areas along Segment 3 have not been assigned a mineral resource zone category.

The only known mineral resource producer or occurrence near Segment 3 is Triumph Steel Co., an occurrence of iron, chromium, and titanium, located approximately 1,000 feet southwest of Segment 3.

According to the *Santa Cruz County General Plan* and *Local Coastal Plan*, the study area along Segment 3 has not been designated as having a known mineral resource of value, and no extractive land uses are planned along Segment 3.

9.10.3 Segment 2: San Lorenzo River to Just South of Rio Del Mar Boulevard (About in Line with Kingsbury Drive)

Segment 2 is in the Monterey Bay P-C region. Study areas along Segment 2 near the proposed Capitola Station are in MRZ-1, which are areas where little likelihood exists for the presence of significant construction aggregate resources. All other areas along Segment 2 are in MRZ-4, which are areas where available geologic information is inadequate to assign to any other mineral resource zone category.

The only known mineral resource producer or occurrence near Segment 2 is Twin Lakes Beach, an inactive gold mine, which is approximately 0.5 mile south of Segment 2 at 6th Avenue.

According to the *Santa Cruz County General Plan* and *Local Coastal Plan*, the study area along Segment 2 has not been designated as having a known mineral resource of value, and no extractive land uses are planned along Segment 2.

9.10.4 Segment 1: Just East of Natural Bridges Drive to the San Lorenzo River

Segment 1 is in the Monterey Bay P-C region. Study areas along Segment 1 between the proposed Beach Street Station and the eastern end of Segment 1 are in MRZ-1, where little likelihood exists for the presence of significant construction aggregate resources, and MRZ-3, which contains known or inferred construction aggregate resources of undetermined mineral resource significance. All other areas along Segment 1 are in MRZ-4, where available geologic information is inadequate to assign to any other mineral resource zone category.

The only known mineral resource producer or occurrence near Segment 1 is Neary Ranch, an occurrence of clay, which is approximately 100 feet north of Segment 1 at California Street. According to the *City of Santa Cruz 2030 General Plan* Land Use Designations, no extractive land uses are planned along Segment 1. Additionally, neither the *City of Santa Cruz 2030 General Plan* nor the *Santa Cruz County General Plan* and *Local Coastal Program* designated the study area along Segment 1 as having a known mineral resource of value.

9.11 Noise and Vibration

In general, receptors that could be highly sensitive to noise and vibration (during construction and operation) are residential areas, parks, open spaces, trails, beaches, and facilities such as schools, hospitals, theaters, religious centers, recording studios, and research facilities. It was not feasible to identify recording studios from desktop review only because this is typically determined during site-specific noise analysis that will be conducted during the CEQA/NEPA process.

For this analysis, GIS data were collected and used. No ambient noise measurements or field measurements were collected. As the engineering design progresses and during the CEQA/NEPA process, noise measurements will be conducted at noise-sensitive receptors and appropriate avoidance, minimization, and mitigation measures will be proposed to reduce noise and vibration.

9.11.1 Segment 4: Between Peaceful Valley Drive and Buena Vista Drive to Pajaro/Watsonville Junction

For the SCBRL rail line in Segment 4, the land uses are predominantly agricultural with industrial and commercial uses south of the proposed maintenance facility. There are some interspersed residential areas to the northeast of the intersection of San Andreas Road and Buena Vista Drive, intermittently along San Andreas Road between Gallighan Slough and Watsonville Slough, between Walker Street and West Front Street, and north of the proposed rail between Bishop Street and Jonathan Street. There are also large conservation areas such as the Watsonville Slough Ecological Reserve. There are smaller parks such as Marinovich Park, Muzzio Pocket Park, Pajaro Neighborhood Park, and Cayetano Park to name a few. There are also schools such as Pajaro Middle School.

For the trail alignment in Segment 4, it has similar land uses of predominantly agricultural uses in the northern part of Segment 4 and more industrial and commercial in the southern end. There are schools, such as the Watsonville Prep School.

9.11.2 Segment 3: Just South of Rio Del Mar Boulevard to Between Peaceful Valley Drive and Buena Vista Drive

Land uses in Segment 3 are predominantly residential areas with interspersed commercial and park and open space uses. There are agricultural lands toward the southern extent of Segment 3. There are several parks and beaches, such as, but not limited to, Seascape County Park, Manresa State Beach, La Selva Beach, and Seascape Golf Club. Ellicott Slough National Wildlife Refuge is also in Segment 3.

9.11.3 Segment 2: San Lorenzo River to Just South of Rio Del Mar Boulevard (About in Line with Kingsbury Drive)

Land uses in Segment 2 are predominantly residential with interspersed commercial and open spaces. There are several large park and open spaces such as, but not limited to, Twin Lakes State Beach, Simpkins Family Swim Center, Jade Street Park, Capitola Beach, Soquel Creek Park, New Brighton State Beach, McGregor Park, Seacliff State Beach, Aptos Village Parks, and the Forest of Nisene Marks State Park. There

are several faith-based centers and schools such as, but not limited to, Shoreline Middle School and Opal Cliffs Elementary School and Preschool.

9.11.4 Segment 1: Just East of Natural Bridges Drive to the San Lorenzo River

Segment 1 starts just east of the Natural Bridges Drive, which abuts the University of California, Santa Cruz. The University of California Santa Cruz Westside Research Park is within 500 feet of the rail line. The area along Segment 1 consists primarily of commercial, industrial, and residential uses. Residential uses are located between Almar Avenue and California Street and to the south of Bay Street between California Street and Pacific Avenue. There are several parks in the vicinity of the proposed stations and the rail line, including but not limited to, La Barranca Park, Neary Lagoon Park, Chestnut Park, Depot Site Park, Santa Cruz Beach Boardwalk and the beach/wharf, and Santa Cruz Riverwalk. There are also faith-based facilities in the study area.

9.12 Parks, Recreation, and Open Space

The types and locations of parks, recreation, and open spaces crossed by or within a 200-foot radius of the project alignment were determined through mapping and comparing the proposed rail and trail alignment and associated ZEPRT stations and maintenance facility over the land uses in the study area.

9.12.1 Segment 4: Between Peaceful Valley Drive and Buena Vista Drive to Pajaro/Watsonville Junction

The Segment 4 study area extends from a point between Peaceful Valley Drive and Buena Vista Drive, just north of the San Andreas Road/Buena Vista Drive wye, to the Watsonville Junction south of the city of Watsonville in the unincorporated Monterey County community of Pajaro. This segment includes two proposed ZEPRT stations (Downtown Watsonville and Pajaro), a ZEPRT maintenance facility, and a 200-foot corridor on each side of the alignments and facilities.

Between the San Andreas Road/Buena Vista Drive wye and the Watsonville Junction, the rail and trail alignment study areas diverge, with the rail alignment following the existing railroad right-of-way through Watsonville and the trail turning south along San Andreas Road before veering northeast to follow West Beach Street into Watsonville. In Watsonville, the trail turns southeast to follow Rodriguez Street before crossing the Pajaro River on a new bridge to the existing levee road at Pajaro Park where the trail will continue southwest back into the SCBRL railroad right-of-way. From here the study areas for both rail and trail follow the same alignment between the Pajaro River and the terminus of the trail at Salinas Road adjacent to the existing grade crossing. The Segment 4 rail alignment study area continues beyond Salinas Road and around UP's Watsonville Junction Yard to end approximately 0.2 mile southeast of the Salinas Road/Railroad Avenue intersection.

The Segment 4 study area includes a larger proportion of agricultural and open space uses. Although the trail alignment study area primarily follows roads through agricultural areas before reaching Watsonville, parts of the rail alignment study area are adjacent to protected areas of Gallighan Slough, Watsonville

Slough, and Watsonville Slough Farms. The alignment also crosses and is adjacent to a floodplain easement and wetlands reserve easement east of Harkins Slough.

Within the city of Watsonville, few parks or designated open space uses exist in the study area. East of Ohlone Parkway, portions of the Watsonville Slough Trail network roughly parallel the Ford Street rail alignment section of the study area. Marinovich Park and Community Center, Muzzio Park and Mosaic Art Center, and Rodriguez Park are in the trail study area in Watsonville. On the Pajaro River levee crown in Watsonville, both the rail and trail alignment study areas cross the Pajaro River Levee Trail, a multi-use bicycle and pedestrian trail.

Both the north and south banks of the Pajaro River in Pajaro consist of mostly undeveloped open space, with some trails. South of the Pajaro River, the study area includes Pajaro Park, a developed facility with a baseball field and basketball court, and Cayetano Park. Pajaro Middle School's athletic fields also adjoin the eastern side of the rail study area.

9.12.2 Segment 3: Just South of Rio Del Mar Boulevard to Between Peaceful Valley Drive and Buena Vista Drive

The Segment 3 study area includes the contiguous rail and trail alignments south of Rio Del Mar Boulevard to a point between Peaceful Valley Drive and Buena Vista Drive, north of the San Andreas Road/Buena Vista Drive wye, Manresa Beach, and a 200-foot corridor on each side of the ZEPRT alignments and facilities.

Segment 3 traverses additional open space/recreation uses, particularly within the unincorporated Santa Cruz County communities of Aptos, Rio del Mar, and La Selva Beach. Parks, recreation, and open space facilities in the Segment 3 study area include Seascapes Golf Club, Seascapes County Park, La Selva Beach, and Manresa State Beach. In the southern portion of the Segment 3 study area, the alignment is adjacent to the Santa Cruz Long-Toed Salamander Ecological Reserve on lands owned by the U.S. Fish and Wildlife Service, California Department of Fish and Game, and private land dedicated in conservation easements. The ZEPRT corridor would abut, but not interfere with, the existing Manresa State Beach and its parking lot.

9.12.3 Segment 2: San Lorenzo River to Just South of Rio Del Mar Boulevard (About in Line with Kingsbury Drive)

The Segment 2 study area includes the largely contiguous rail and trail alignments from the San Lorenzo River to just south of Rio Del Mar Boulevard, five proposed ZEPRT stations (Seabright, 17th Avenue, Capitola, Cabrillo, and Aptos), and a 200-foot corridor on each side of the alignments and facilities.

Segment 2 starts at the San Lorenzo River, a designated Natural Area, crosses the San Lorenzo River Walk East, and traverses urbanized areas of the incorporated cities of Santa Cruz and Capitola as well as the unincorporated Santa Cruz County community of Aptos. Large areas of open space/recreation use are present in this segment's study area, including the Santa Cruz Small Craft Harbor, Schwan Lagoon, Twin Lakes State Beach, Jade Street Park, Soquel Creek Park, China Beach, and New Brighton State Beach. In the community of Aptos, the study area includes Aptos Village County Park.

The Seabright station site would not directly affect existing park or recreation facilities. The Santa Cruz Small Craft Harbor and an adjoining bike/pedestrian trail are less than 500 feet from the station site. The

17th Street station site, as proposed, would be about the athletic field of Shoreline Middle School and Santa Cruz County's Simpkins Family Swim Center, also located at the middle school. The nearest of the Twin Lakes/Schwan Lagoon recreational trail facilities are less than 400 feet from the proposed station site.

The proposed Capitola Station site would be in a residential neighborhood with no nearby park or recreational facilities, and the proposed Cabrillo Station site would be within the New Brighton State Beach, approximately 60 feet from the nearest residence and 480 feet from the nearest campsite.

The proposed Aptos Station would be approximately 0.15 mile from the nearest existing park facilities, Aptos Village County Park.

9.12.4 Segment 1: Just East of Natural Bridges Drive to the San Lorenzo River

The Segment 1 study area includes the contiguous rail and trail alignments between Natural Bridges Drive and the San Lorenzo River, two proposed ZEPRT stations (Natural Bridges Drive and Beach Street / Downtown), and a 200-foot corridor on each side of the alignments and facilities.

The Segment 1 study area is entirely within the incorporated city of Santa Cruz. Neary Lagoon Park, La Barranca Park, and Neary Lagoon Wildlife Refuge are in the study area. Chestnut Park is within the study area nearby, and Depot Park is in the Segment 1 study area near the proposed Downtown station site.

The proposed Beach Street station site is immediately adjacent to an existing recreational facility, the Monterey Bay National Marine Sanctuary Exploration Center. The size and final configuration of the proposed station will determine whether the Exploration Center facility is affected.

Segment 1 parallels the northern edge of the Santa Cruz Beach Boardwalk amusement park within an existing rail alignment, crosses the San Lorenzo River Walk West, and ends at the San Lorenzo River, a designated Natural Area.

9.13 Safety and Security

This section provides an overview of at-grade rail crossings and the potential need for crossing safety improvements. As design for the ZEPRT Project progresses beyond the conceptual engineering level and additional stakeholder and community coordination occurs, it will be refined and more information on safety improvements will be developed.

Safety measures at at-grade crossings will be employed based on governing regulations and coordination with local jurisdictions. The safety measures may include, but are not limited to, a four-quadrant gate system, one-way street with gates, vehicular gate system (with and without medians), and some permanent closures of at-grade crossings.

9.13.1 Segment 4: Between Peaceful Valley Drive and Buena Vista Drive to Pajaro/Watsonville Junction

Within Segment 4, there are six principal at-grade crossings: Buena Vista Drive, Ohlone Parkway, West Beach Street and Walker Street, Walker Street and 2nd Street, Walker Street and Riverside Drive, and Salinas Road.

9.13.2 Segment 3: Just South of Rio Del Mar Boulevard to Between Peaceful Valley Drive and Buena Vista Drive

Within Segment 3, there are four principal at-grade crossings: Clubhouse Drive, Seascape Boulevard, Peaceful Valley Drive, and Camino Al Mar.

9.13.3 Segment 2: San Lorenzo River to Just South of Rio Del Mar Boulevard (About in Line with Kingsbury Drive)

Within Segment 2, there are 13 principal at-grade crossings: Mott Avenue, Seabright Avenue, 17th Avenue, 38th Avenue, 41st Avenue, 47th Avenue, Monterey Avenue, Grove Lane, Mar Vista Drive, State Park Drive, Aptos Creek Road, Parade Street, and Trout Gulch Road.

9.13.4 Segment 1: Just East of Natural Bridges Drive to the San Lorenzo River

Within Segment 1, there are eight principal at-grade crossings: Rankin Street, Younglove Avenue, Bellevue Street, Lennox Street, California Street and Bay Street, Fair Avenue, Almar Avenue, and Dufour Street.

9.14 Socioeconomics, Communities, and Community Resources

The presence and location of disadvantaged communities and community resources in the ZEPRT Project study area were determined by overlaying ArcGIS files of the project alignment, proposed stations and maintenance facility, and the 200-foot-radius study area over Senate Bill (SB) 535 census tract data indicating disadvantaged communities. SB 535 directs the California Environmental Protection Agency (CalEPA) to identify disadvantaged communities using “geographic, socioeconomic, public health, and environmental hazard criteria” including, but not limited to, locations that are “disproportionately affected by environmental pollution and other hazards that can lead to negative public health effects, exposure or environmental degradation” and have “concentrations of people that are of low income, high unemployment, low levels of home ownership, high rent burden, or low levels of educational attainment” (CalEPA 2022).

This information was used to identify disadvantaged communities that may be affected by construction and operational activities.

9.14.1 Segment 4: Between Peaceful Valley Drive and Buena Vista Drive to Pajaro/Watsonville Junction

The Segment 4 study area extends through southern Santa Cruz County, to the Watsonville Junction south of the city of Watsonville in the unincorporated Monterey County community of Pajaro. This segment includes two proposed stations (Downtown Watsonville and Pajaro), a ZEPRT maintenance facility, and a 200-foot corridor on each side of the alignments and facilities. The Segment 4 study area includes a greater proportion of agricultural uses, as well as the commercial, industrial, residential, and recreation uses that characterize the other segments. Pajaro Middle School, Watsonville Prep School, Watsonville Fire Station, and Westview Presbyterian Church are located here.

Within the Santa Cruz County portion of this segment, north and west of State Route 1, no disadvantaged communities are present. From the point where the alignments cross State Route 1 west of Watsonville to the rail terminus at Pajaro, both the rail alignment and the separate trail alignment study areas are in identified disadvantaged communities.

The two proposed stations (Downtown Watsonville and Pajaro) in Segment 4 are in disadvantaged communities. Although located near the general plan designated Downtown Central Core and Downtown Mixed-Use areas, the Downtown Watsonville site is fully surrounded by parcels designated for industrial uses.

The Pajaro Station site, although within an SB 535-identified disadvantaged community, is in a rural area surrounded by Prime Farmland and few developed uses. The nearest residential community is approximately 0.2 mile northwest of the proposed station site.

9.14.2 Segment 3: Just South of Rio Del Mar Boulevard to Between Peaceful Valley Drive and Buena Vista Drive

Segment 3 traverses commercial, industrial, residential, and open space/recreation uses, particularly in the unincorporated Santa Cruz County communities of Aptos, Rio del Mar, and La Selva Beach. In addition, agricultural lands divide Rio del Mar and La Selva Beach in the Segment 3 study area. South of La Selva Beach, more agricultural land, together with areas of open space and single-family residential uses, occupy the Segment 3 study area between La Selva Beach and the San Andreas Road/Buena Vista Drive wye. Community facilities in Segment 3 include Renaissance High Continuation School.

No identified disadvantaged communities are in the Segment 3 study area.

Because no disadvantaged communities are in the Segment 3 study area, none are expected to be divided, displaced, or physically affected in this segment of the proposed project alignment.

9.14.3 Segment 2: San Lorenzo River to Just South of Rio Del Mar Boulevard (About in Line with Kingsbury Drive)

The Segment 2 study area includes the largely contiguous rail and trail alignments from the San Lorenzo River to just south of Rio Del Mar Boulevard, five proposed ZEPRT stations (Seabright, 17th Avenue, Capitola, Cabrillo, and Aptos), and a 200-foot corridor on each side of the alignments and facilities. Other

community facilities include Shoreline Middle School, Opal Cliffs Elementary School and Preschool, Capitola Police Department, Central Fire District Station 4, and various faith-based facilities including, but not limited to, Aptos Foursquare Church and Bahais of Capitola.

Segment 2 crosses urbanized areas of the incorporated cities of Santa Cruz and Capitola, as well as the unincorporated Santa Cruz County community of Aptos. No identified disadvantaged communities are situated in the Segment 2 study area.

Because no disadvantaged communities are in the Segment 2 study area, none are expected to be divided, displaced, or physically affected in this segment of the proposed project alignment.

9.14.4 Segment 1: Just East of Natural Bridges Drive to the San Lorenzo River

The Segment 1 study area is entirely within the city of Santa Cruz and includes the contiguous rail and trail alignments between Natural Bridges Drive and the San Lorenzo River, two proposed stations (Natural Bridges Drive and Beach Street / Downtown), and a 200-foot corridor on each side of the alignments and facilities.

Existing land uses in the study area comprise commercial, industrial, low- and medium-density residential, and open space/recreation uses, including Neary Lagoon and the Santa Cruz Beach Boardwalk. Section 9.7.7, *Land Use*, describes these sites in greater detail. Community facilities in Segment 1 include various faith-based facilities.

Because there are no disadvantaged communities in the Segment 1 study area, none are expected to be divided, displaced, or physically affected in this segment of the proposed ZEPRT Project alignment.

9.15 Summary of Environmental Issues and Constraints by Segment

Table 9.6 below presents a summary of environmental constraints within the SCBRL corridor by segment. These constraints do not present all the possible environmental constraints but rather provide an understanding of the environmental setting and issues/concerns that will be dealt with in more detail during the CEQA/NEPA phase of the ZEPRT Project. As engineering progresses, the team will consider these environmental constraints to avoid and minimize environmental impacts to the degree practicable.

Table 9.6 Summary of Key Environmental Constraints for Segment 4: Between Peaceful Valley Drive and Buena Vista Drive to Pajaro/Watsonville Junction

Resource Topic	Key Environmental Constraints
Agricultural Farmlands	The study area contains Prime and Unique farmlands.
Biological and Aquatic Resources	Federally listed California red-legged frog, steelhead, robust spineflower have the potential to occur in the area. State-listed bank swallow has the potential to occur in the state area. Other non-listed special-status species also have the potential to occur in the area.
Cultural Resources	One existing NRHP-listed or eligible property (Santa Cruz Railroad) intersects the study area. Three known archaeological sites also exist in this segment.
Geology, Soils, Seismicity	The study area has the potential for moderate to severe ground shaking from earthquakes occurring on one or more active faults. There are areas of very high risk for liquefaction where the alignment crosses or is adjacent to Gallighan Slough, Harkins Slough, and the Pajaro River, in addition to areas of Watsonville east and west of State Route 1, north of West Beach Road.
Hazardous Materials and Wastes	Two sites were identified in the vicinity of Segment 4.
Hydrology and Water Resources	The Downtown Watsonville Station trail and rail alignments approaching the Pajaro River from the north, the trail and rail along West Beach Street, and the maintenance facility are within the 100-year floodplain along Beach Road. The rail crossing and the approaches to Harkins Slough are also within the 100-year floodplain.
Land Use	This segment includes urban mixed use (residential, commercial, and industrial) in Pajaro and Watsonville, agricultural west of Watsonville, and open space/conservation areas in the northern portion.
Mineral Resources	There are no known mineral producers or occurrences in the study area.
Noise and Vibration	There are schools, residential, and park uses near stations and the alignment.
Parks, Recreation, Open Space, and Community Facilities	Within the city of Watsonville, the alignment is adjacent to portions of the Watsonville Slough Trail network, Marinovich Park and Community Center, Muzzio Pocket Park and Mosaic Art Center, Rodriguez Park, the Pajaro River Levee Trail, Pajaro Neighborhood Park, and Cayetano Park. West and north of Watsonville, the rail alignment is adjacent to Watsonville Slough Farms, Watsonville Slough Ecological Reserve, and Gallighan Slough.
Public Utilities	The study area contains electrical distribution and transmission lines and natural gas pipelines.
Safety and Security	The study area contains six at-grade crossings, which will require safety measures.
Socioeconomics, Communities, and Community Resources	The proposed station at Downtown Watsonville and Pajaro and the rail and trail alignment within Watsonville are within SB 535 disadvantaged communities. Some of the community facilities include Pajaro Middle School, Watsonville Prep School, Watsonville Fire Station, Westview Presbyterian Church are located here.

NRHP = National Register of Historic Places; SB = Senate Bill

Table 9.7 Summary of Key Environmental Constraints for Segment 3: Just South of Rio Del Mar Boulevard to Between Peaceful Valley Drive and Buena Vista Drive

Resource Topic	Key Environmental Constraints
Agricultural Farmlands	The study area contains Prime and Unique farmlands.
Biological and Aquatic Resources	Federally listed California tiger salamander, California red-legged frog, and Santa Cruz long-toed salamander and Monterey spineflower have the potential to occur in the study area. Other non-listed special-status species also have the potential to occur in the study area. There are conservation areas for Santa Cruz County, CDFW, and USFWS at the southern extent of the segment.
Cultural Resources	One existing NRHP-listed or eligible property (Santa Cruz Railroad) intersects the study area. One known archaeological site also exists in this segment.
Geology, Soils, Seismicity	Potential for moderate to severe ground shaking from earthquakes occurring on one or more active faults. There are areas of very high risk for liquefaction where the alignment crosses an unnamed creek near Margarita Road.
Hazardous Materials and Wastes	Two sites are identified in the vicinity of Segment 3.
Hydrology and Water Resources	There are no project stations or segments of the trail or rail line in Segment 3 within the FEMA 100-year floodplain.
Land Use	This segment is adjacent to residential uses in the northern portion transitioning to agricultural and open space in the southern portion. This segment is within the Coastal Zone.
Mineral Resources	The only known mineral resource producer or occurrence near Segment 3 is Triumph Steel Co., an occurrence of iron, chromium, and titanium.
Noise and Vibration	There are residential areas, parks, and a wildlife refuge near the stations and the alignment.
Parks, Recreation, Open Space, and Community Facilities	Parks, recreation, open space, and community facilities adjacent to the alignment include Seascape Golf Club, Seascape County Park, Ellicott Slough National Wildlife Refuge, La Selva Beach, and Manresa State Beach.
Public Utilities	The study area includes electrical distribution and transmission lines.
Safety and Security	The study area includes four at-grade crossings, which will require safety measures.
Socioeconomics, Communities, and Community Resources	There are no SB 535 disadvantaged communities along Segment 3. Some of the community facilities include Renaissance High Continuation School.

CDFW = California Department of Fish and Wildlife; USFWS = U.S. Fish and Wildlife Service; NRHP = National Register of Historic Places; FEMA = Federal Emergency Management Agency; SB = Senate Bill

Table 9.8 Summary of Key Environmental Constraints for Segment 2: San Lorenzo River to Just South of Rio Del Mar Boulevard (About in Line with Kingsbury Drive)

Resource Topic	Key Environmental Constraints
Agricultural Farmlands	None.
Biological and Aquatic Resources	Federally listed salmonid species are present or may be present in the San Lorenzo River, Aptos Creek, Soquel Creek, Valencia Creek, and Arana Gulch. Federally listed tidewater goby has the potential to occur in the San Lorenzo River, Aptos Creek, Soquel Creek, and Rodeo Creek. Federally listed Zayante band-winged grasshopper has the potential to occur in the study area. Non-listed special-status species also have the potential to occur in the study area.
Cultural Resources	Four existing NRHP-listed or eligible properties (Santa Cruz Railroad, San Lorenzo Trestle Bridge, Old Aptos Creek Bridge, and Old Riverview Historic District) and a local inventory listed property (Judge Rice House) intersect the study area. Four known archaeological sites also exist in this segment.
Geology, Soils, Seismicity	There is potential for moderate to severe ground shaking from earthquakes occurring on one or more active faults. There are areas of very high risk of liquefaction alignment where the alignment crosses Arana Gulch, Leona Creek, Rodeo Creek Gulch, Soquel Creek, Tannery Gulch, Aptos Creek, and Valencia Creek.
Hazardous Materials and Wastes	There are three open/active sites identified in the vicinity of Segment 2.
Hydrology and Water Resources	No stations in this segment are in a 100-year floodplain. The trail and rail line cross the 100-year floodplain at the San Lorenzo River, Santa Cruz Harbor, and Aptos Creek.
Land Use	This segment crosses adjacent to extensive residential areas as well as open space/ recreational areas. The Cabrillo station site would be within 60 feet of the nearest residence and 480 feet from the nearest New Brighton State Beach campsite, potentially conflicting with existing residential and recreational uses. This segment is largely within the Coastal Zone.
Mineral Resources	The only known mineral resource producer or occurrence is Twin Lakes Beach, an inactive gold mine.
Noise and Vibration	There are schools, residential areas, and park uses near stations and the alignment.
Parks, Recreation, Open Space, and Community Facilities	Parks, recreation, open space, and community facilities adjacent to the alignment include the Santa Cruz Small Craft Harbor, Schwan Lagoon, Twin Lakes State Beach, Simpkins Family Swim Center, Jade Street Park, Capitola Beach, Soquel Creek Park, Escalon Beach, China Beach, New Brighton State Beach and Aptos Village County Park.
Public Utilities	Presence of electrical distribution and transmission lines and natural gas pipelines.
Safety and Security	The study area includes 13 at-grade crossings, which will require safety measures.
Socioeconomics, Communities, and Community Resources	There are no SB 535 disadvantaged communities along Segment 2. Some of the community facilities include Shoreline Middle School, Opal Cliffs preschool and Elementary Schools, Capitola Police Department, Central Fire District Station 4, and various faith-based facilities.

NRHP = National Register of Historic Places; SB = Senate Bill

Table 9.9 Summary of Key Environmental Constraints for Segment 1: Just East of Natural Bridges Drive to the San Lorenzo River

Resource Topic	Key Environmental Constraints
Agricultural Farmlands	None.
Biological and Aquatic Resources	Federally listed salmonid species and tidewater goby (potential) in the San Lorenzo River and several non-listed special-status species are known to occur in the project area. State-listed tricolored blackbird, Santa Cruz kangaroo rat, California black rail, and bank swallow have the potential to occur in the study area.
Cultural Resources	Four NRHP-listed or eligible properties (Santa Cruz Railroad, San Lorenzo Trestle Bridge, Santa Cruz Municipal Wharf, and the Coconut Grove Building) intersect the study area. Four known unevaluated archaeological sites also exist in the study area. Several areas of high sensitivity for archaeological resources are also located along this segment.
Geology, Soils, Seismicity	The study area has the potential for moderate to severe ground shaking from earthquakes occurring on one or more active faults. There are areas of very high risk of liquefaction along Beach Street and Bay Street and where the alignment crosses the San Lorenzo River.
Hazardous Materials and Wastes	Two open/active sites are in the vicinity of Segment 1.
Hydrology and Water Resources	Beach Street / Downtown Station and the western portion of the Beach Street Station are within the FEMA 100-year floodplain. The trail and rail line crossing over the San Lorenzo River is also within the 100-year floodplain.
Land Use	There are residential areas along the central part of this segment. This segment is largely within Coastal Zone.
Mineral Resources	The only known mineral resource producer (of clay) or occurrence near Segment 1 is Neary Ranch.
Noise and Vibration	There are residential and park uses near stations and the alignment. The UC Santa Cruz Westside Research Park is within 500 feet of the rail line.
Parks, Recreation, Open Space, and Community Facilities	The alignment is adjacent to Neary Lagoon Park, La Barranta Park, Neary Lagoon Wildlife Refuge, Chestnut Park, and Depot Park. The proposed Beach Street / Downtown Station site is immediately adjacent to an existing recreational facility, the Monterey Bay National Marine Sanctuary Exploration Center.
Public Utilities	The study area contains electrical distribution and transmission lines and natural gas pipelines.
Safety and Security	The study area contains eight at-grade crossings, which will require safety measures.
Socioeconomics, Communities, and Community Resources	No SB 535 disadvantaged communities exist along Segment 1. Community facilities include various faith-based facilities.

NRHP = National Register of Historic Places; FEMA = Federal Emergency Management Agency; UC = University of California; SB = Senate Bill

9.16 References

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10.0 Conceptual ZEPRT Ridership and Revenue Forecast

This chapter presents conceptual ridership forecasts and fare revenue estimates developed for the ZEPRT Project, which proposes a future passenger rail service on the SCBRL between Pajaro and Natural Bridges Drive in Santa Cruz.

Conceptual ridership forecasts were developed using a combination of the Santa Cruz County Travel Demand Model (SCC Model) and a Direct Ridership Model (DRM). The forecasts build on prior work led by the SCCRTC, including the *Rail Transit Feasibility Study* (2015) and the *Transit Corridor Alternatives Analysis* and the *Rail Network Integration Study* (2021). The conceptual ridership forecasts were used to inform initial fare revenue estimates for the ZEPRT Project.

Ridership forecasting plays a critical role in transportation planning. It involves analyzing current and historical data to estimate future passenger demand, helping agencies anticipate how many people will use a given transit service. Forecasting models account for various influencing factors such as population growth, economic conditions, seasonal variation, and travel preferences. These forecasts guide decisions about service levels, resource allocation, and infrastructure investment to ensure systems remain responsive to regional travel needs.

Ridership is one metric by which to evaluate transit system performance. However, as a single metric it does not capture all benefits typically associated with transit systems. Other common benefits associated with transit include its affordability as a mode of transportation compared to the cost of owning and operating a vehicle. Transit also commonly supports transportation system resiliency and can be a more sustainable travel mode with lower greenhouse gas emissions than vehicle travel.

This ridership chapter is organized into the following sections:

- **Ridership Approach:** Identifies the ZEPRT Project ridership forecasting methodology
- **Countywide Travel Patterns:** Describes current travel conditions within Santa Cruz County and their relation to the ZEPRT Project, as well as anticipated future land use and transportation changes
- **Ridership Results:** Presents potential ridership forecasts for the ZEPRT Project under a future forecast year scenario
- **Fare Revenue Forecasts:** Presents initial fare revenue estimates for the project based on potential passenger fares and ridership levels

10.1 Ridership Approach

The ZEPRT Project proposes passenger rail service on approximately 22 miles of the SCBRL from Pajaro to the City of Santa Cruz. The Project will utilize the existing publicly owned right-of-way of the SCBRL. The Project also includes the development of 12 miles of Coastal Rail Trail from Rio del Mar Boulevard through the City of Watsonville and community of La Selva Beach, as well as the Capitola Trestle portion. The ZEPRT Project corridor and Study Area for the ridership forecasting activity is shown in Figure 10.1 below.

Figure 10.1 ZEPRT Project Study Area

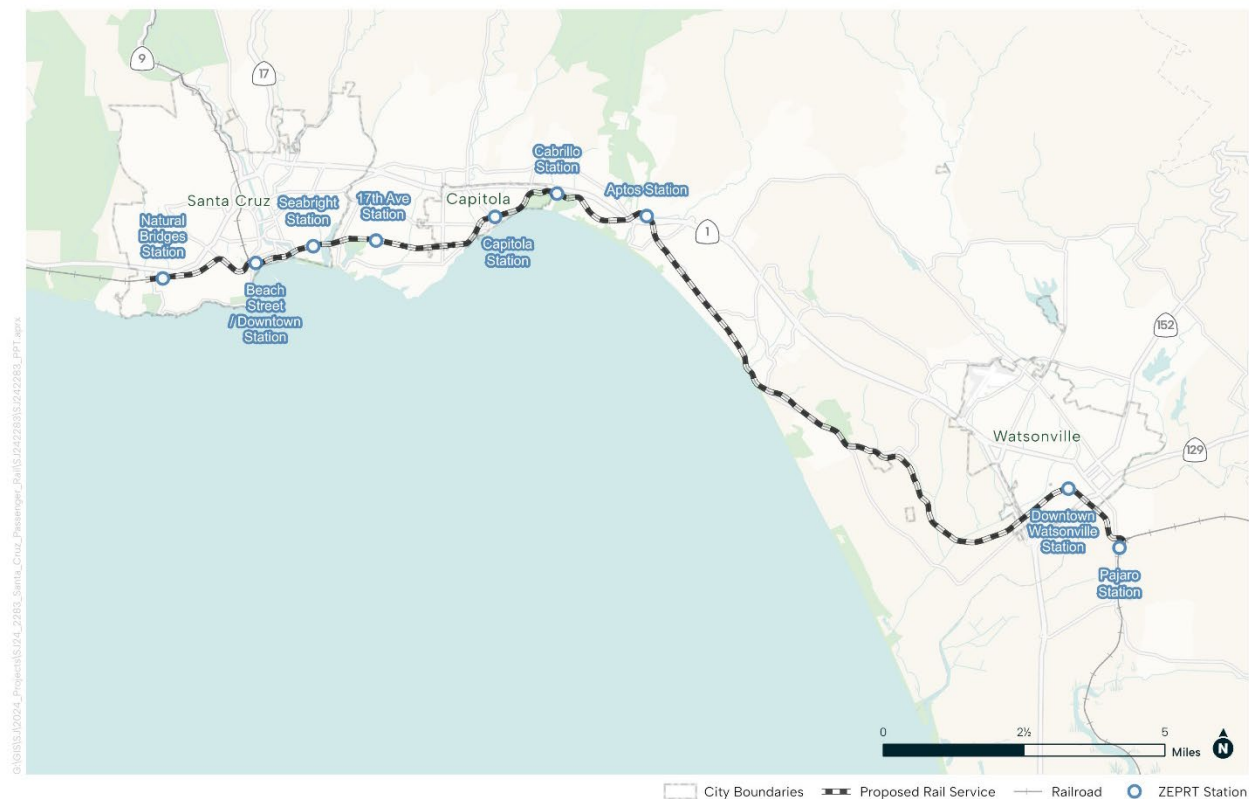


FIGURE 1
Study Area

Fehr&Peers

Source: Fehr & Peers

A regional travel demand model forecasts travel across a broad area such as a county or region. The Santa Cruz County (SCC) Model, developed for the SCCRTC, is a customized version of the regional travel model maintained by the Association of Monterey Bay Area Governments (AMBAG). It was designed to generate more detailed insights into local travel patterns within Santa Cruz County than the broader AMBAG model could provide.

A direct ridership model (DRM) is a custom statistical tool designed to estimate transit ridership based on factors such as station or stop characteristics, surrounding land use, and the quality of transit service and

competing travel modes. DRMs can vary in complexity from simple models predicting boardings at the line or station level using a few key variables, to more advanced systems that estimate origin-destination ridership segmented by market type or time of day. A DRM allows for refining the big-picture findings of a regional travel model and demonstrating the extent to which local factors influence ridership. For example, the SCC Model does not include parking supply or pricing data, but the DRM allows for the collection and incorporation of such data to better reflect local conditions.

Figure 10.2 below shows the strengths and weaknesses of the SCC Model and DRM separately, and their combined strengths when both are used.

Figure 10.2 Model Strengths and Weaknesses

CRITERIA	 OPTION 1 SCC Model	 OPTION 2 DRM	 OPTION 3 SCC Model with DRM
Regional Context			
Non-Commuter Trip Applicability			
Complementary & Competing modes			
Station Area Context			
Transit Network & Service Plan			
Parking Supply & Pricing			
Weekend & Seasonal Travel			
Transit Focus			

Model Sensitivity

Least **Most**

FIGURE 2
Model Strengths and Weaknesses

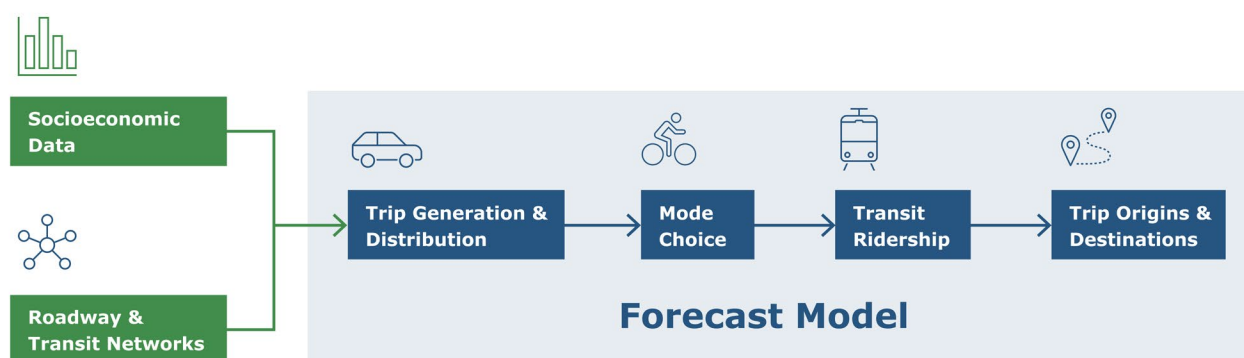
Fehr & Peers

Source: Fehr & Peers

10.2 Santa Cruz County Travel Model

The SCC Model was utilized to estimate ridership for the ZEPRT Project’s design year of 2045, which aligns with future statewide passenger rail planning and proposed passenger rail implementation horizons in the 2024 *California State Rail Plan*. The SCC Model is a four-step travel demand model built on the TransCAD platform, developed to project future travel patterns across both roadways and transit networks in Santa Cruz County. It is used to evaluate how shifts in population, employment, demographics, and transportation infrastructure influence local travel behavior. The typical process by which a travel demand model relies on land use and transportation inputs to develop ridership forecasts is shown in Figure 10.3 below.

Figure 10.3 Typical Process to Develop Ridership Forecasts in a Travel Demand Model Leveraging Land Use and Transportation Inputs



Source: Fehr & Peers

The SCC was most recently updated as part of the *Santa Cruz County General Plan* and VMT Mitigation Project to a base year of 2019 and the future year of 2045. The model draws data from multiple sources, including the U.S. Census, American Community Survey, and the year 2022 AMBAG regional travel demand model. The Santa Cruz County General Plan incorporates planned housing throughout Santa Cruz County. AMBAG is currently in the process of updating its Sustainable Communities Strategy (SCS) for a future forecast year of 2050. That process may result in some changes to future land use forecasts in the AMBAG region which includes San Benito, Monterey and Santa Cruz Counties. Land use forecasts for the updated AMBAG SCS are expected to be available in mid to late 2026 and may be appropriate to include in future ridership forecast efforts.

Additional data used for model estimation, calibration, and validation — originally incorporated in previous versions and retained as a basis for the most recent update — includes the 2012 California Household Travel Survey (CHTS), the 2012 METRO Transit On-Board Survey, and traffic counts collected by Caltrans and other agencies.

Figure 10.4 and Figure 10.5 provide an overview of the base year (2019) and future (2045) street network and transit routes in the SCC Model.

This map displays the geographic relationship between city boundaries, transit infrastructure, and roadway networks in the Santa Cruz, Capitola, and Watsonville area. The map includes the following elements:

- City Boundaries:** Indicated by light gray shaded regions for Santa Cruz, Capitola, and Watsonville.
- Year 2019 Transit Network:** Represented by thick green lines, showing a dense network within the city limits and connecting routes between them.
- Year 2019 Roadway Network:** Represented by thin gray lines, showing the broader regional road infrastructure.
- Geographic Features:** The San Lorenzo River is visible flowing through the area, and the Pacific Ocean is to the south.
- Highways:** Major roads are marked with numbered shields, including SR 9, SR 17, SR 1, SR 152, and SR 129.
- Scale and Orientation:** A scale bar at the bottom right indicates distances of 0, 2½, and 5 miles. A north arrow is also present.
- Legend:** Located at the bottom of the map, it defines the symbols for City Boundaries (light gray), Year 2019 Transit Network (thick green), and Year 2019 Roadway Network (thin gray).

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Figure 10.5 Year 2045 SCC Model – Roadway Network and Transit Network

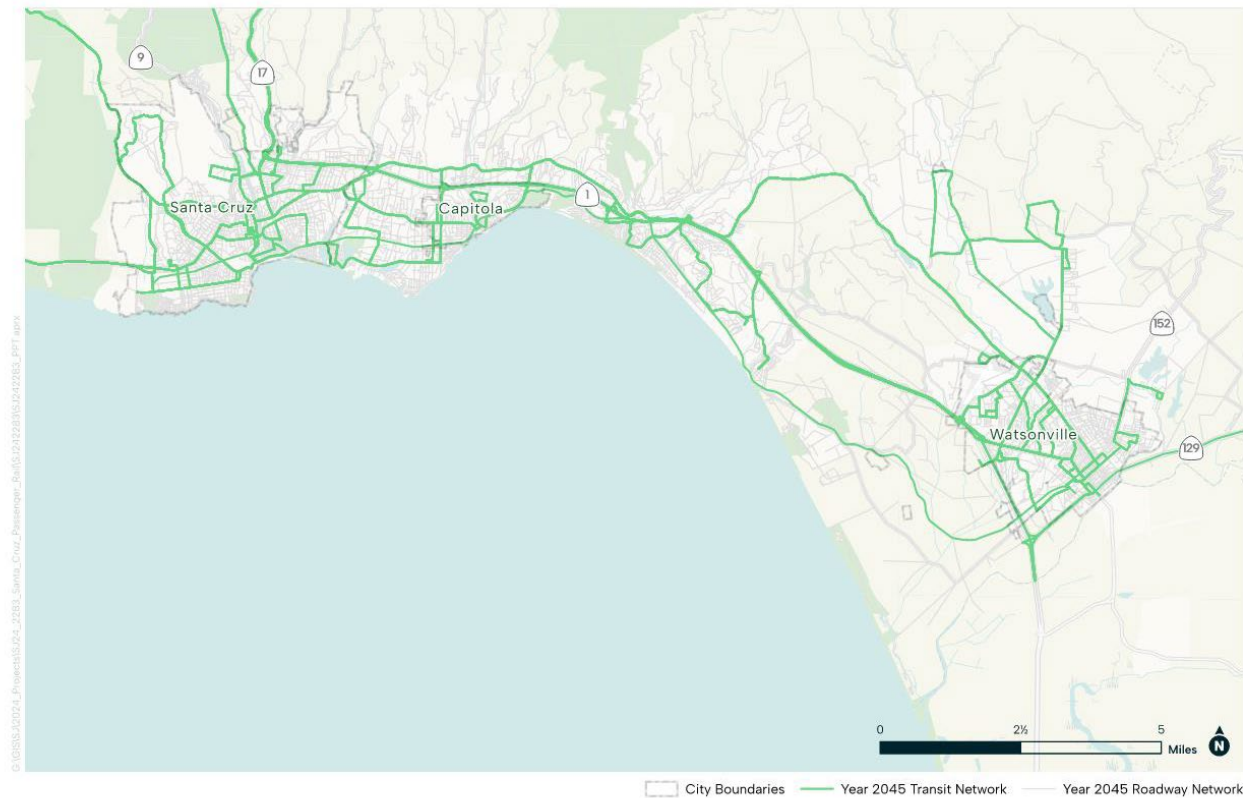


FIGURE 4

Year 2045 SCC Model – Roadway Network and Transit Network

Fehr & Peers

Source: Fehr & Peers

10.3 Direct Ridership Model

The Direct Ridership Model (DRM) was applied in conjunction with the SCC Model to refine station-level ridership forecasts. While the SCC Model captures regional travel demand and mode share dynamics, the DRM adds station-specific detail, accounting for localized land use, access characteristics, and contextual factors that influence transit ridership. The DRM is especially useful in scenarios where the travel demand model's zone resolution or network assumptions may not fully reflect future conditions near proposed stations.

The DRM is a regression-based statistical model that estimates transit ridership directly based on observed relationships between station-level characteristics and boarding activity. It uses inputs such as land use intensity, population and employment density, and the accessibility of surrounding areas (e.g., walk/bike access, park-and-ride availability, and bus connections). It also considers unique land uses — including major destinations like Cabrillo College, Santa Cruz Beach Boardwalk, and UC Santa Cruz — and accounts for weekend/recreational travel demand, interregional connections (e.g., to Pajaro), and post-COVID travel patterns.

In addition to the two models, several additional data sources were used to better understand current travel patterns within Santa Cruz County. Current travel conditions and associated data sources are further described in the following section.

10.4 Countywide Travel Patterns

A variety of data sources were collected to support ridership forecasting for the proposed ZEPRT service over the SCBRL. These data sources include “big data” sources like Replica and StreetLight which were used to estimate travel patterns and origin-destination flows. Santa Cruz METRO ridership data was used to understand current transit demand while traffic counts in Santa Cruz County were used to help validate the accuracy of Replica data.

These data sources were used to validate the assumptions used in the SCC Model and to help determine to what extent travel conditions in 2025 differ from the SCC Model base year of 2019. By comparing model inputs with observed data from sources like Replica and traffic counts, the model can be applied to better reflect real-world conditions.

10.4.1 Transit Ridership Data

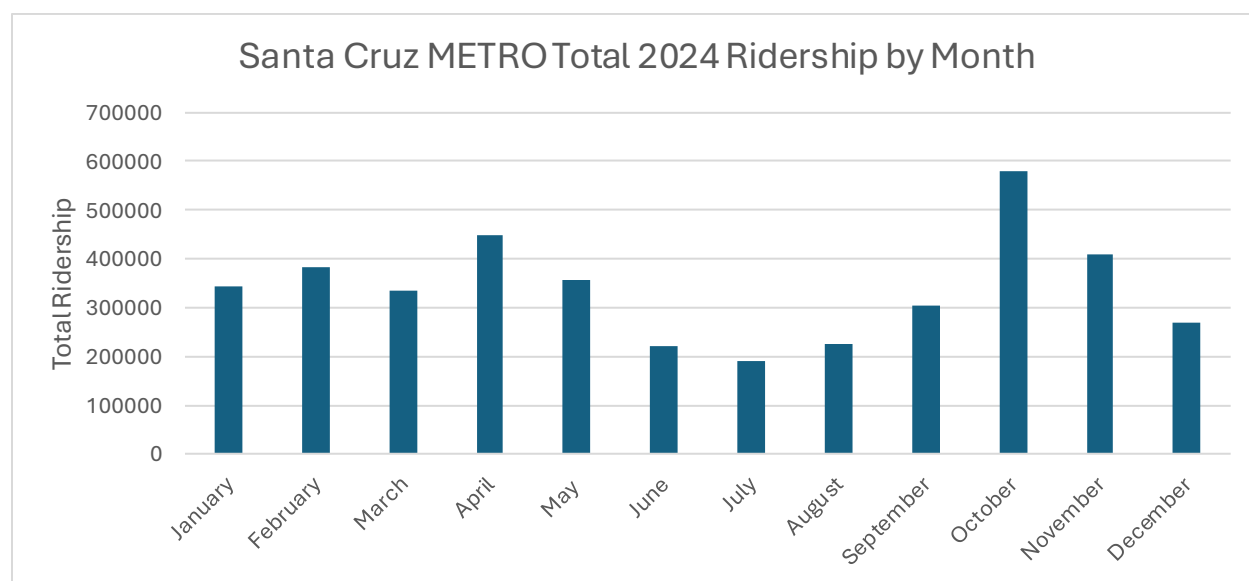
METRO operates 22 fixed-route bus routes across Santa Cruz County, serving over 4 million riders annually. To inform the development of effective transit alternatives and service plans for the proposed ZEPRT passenger rail service, it is essential to evaluate existing transit coverage, service levels, and ridership patterns.

Existing transit data was provided by Santa Cruz METRO, including weekend and weekday ridership data for each month in 2024 showing boardings and alightings for each stop.

Existing ridership data (as measured by boardings) shows that the average daily boardings for all METRO routes is 11,100. Of that total, 48% (or 5,300) of daily boardings are on routes serving UCSC. During the academic year (September to June), average daily ridership on all METRO routes is 12,200, whereas during the summer months in July and August, the average daily ridership is significantly lower at 6,500. Upon the initial review of the average daily ridership data, the stop level data by route was further analyzed to estimate transit origin-destination patterns.

Figure 10.6 below shows the total 2024 ridership by month. As mentioned above, during the summer months (June-August) the total ridership decreases as UCSC students are on summer break.

Figure 10.6 Santa Cruz METRO Total 2024 Ridership by Month



Source: Santa Cruz METRO

10.4.2 Traffic Count Data

Traffic count data in Santa Cruz County was used to understand existing vehicle demand and overall traffic flow patterns within Santa Cruz County. The Caltrans' Performance Measurement System (PeMS) database includes traffic count data along Highway 1 at multiple locations within the County. In addition, the County of Santa Cruz and City of Santa Cruz provided recent count data for several other locations in the County.

Caltrans PeMS data for September 2024 to December 2024 was used to compare against Replica data collected for the same time period. Replica data is further described below.

10.4.3 Location Based Services Data

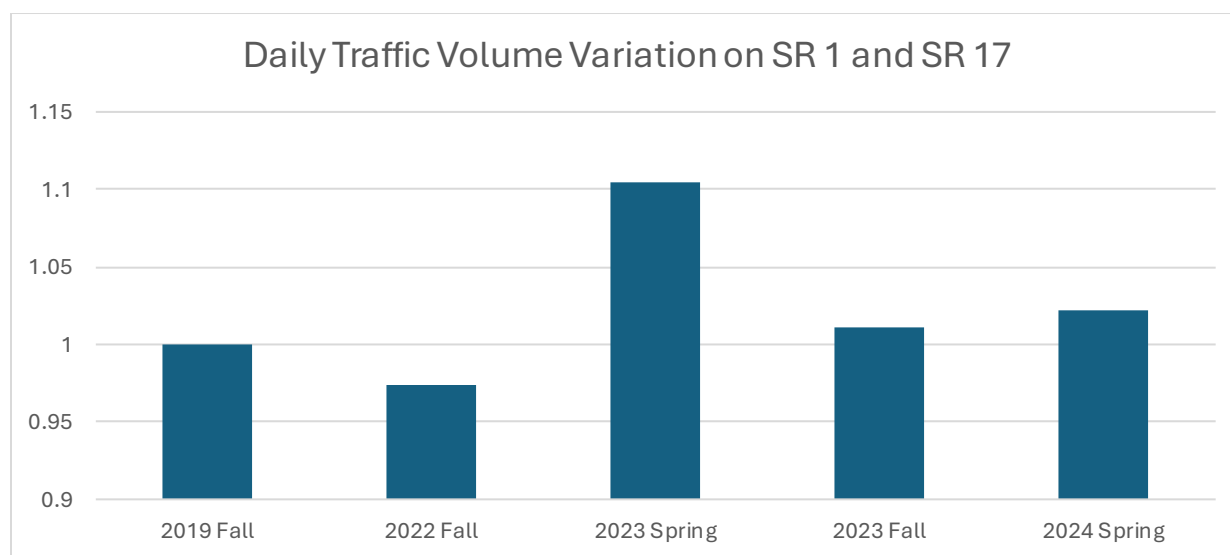
Replica

Replica is a modeled, anonymized dataset that estimates how people travel within a region. It uses proprietary inputs — such as de-identified mobile phone location signals, in-dash GPS data, point-of-interest aggregates, consumer/resident demographics, economic transaction data, and traffic/transit counts — which are often available in near real-time. Replica also integrates public data sources, including OpenStreetMap and digitized transit routes, to enrich information about the built environment. Combined through activity-based modeling with a synthetic population, these inputs enable highly granular, up-to-date insights into regional mobility. Each dataset includes details such as origin, destination, mode, purpose, and time of travel. Used by transportation planners and public agencies, Replica provides insights for infrastructure planning, transit analysis, and policy evaluation. Unlike raw GPS data, Replica data is not individually traceable and is released seasonally to reflect changing conditions.

At a countywide level, Replica was used to analyze seasonal travel patterns between Fall 2019 and Spring 2024. Replica produced seasonal link volumes by estimating a typical day in the corresponding season. The Replica results indicate that most locations experienced higher link volumes in the spring with increases typically ranging from 5% to 12%. This seasonal variation is likely driven by better weather, school breaks, and other seasonal events. The data also reveals a 12% increase in vehicle volumes from pre-COVID to post-COVID periods, particularly when comparing the link volumes between Fall 2019 and Fall 2023. Additionally, major corridors such as State Route 1 and State Route 17 consistently carried significantly higher volumes compared to other studied roadways such as Graham Hill Road, Mission Street, East Lake Avenue, and Riverside Road that function as arterial streets within Santa Cruz County. The network link volumes during these time periods were compared to PeMS volumes to verify the volumes from Replica.

Figure 10.7 shows a comparison of daily volumes on State Routes 1 and 17 across different seasons. The spring seasons have higher daily volumes than the fall seasons, with 2023 spring volumes about 10% higher than 2019 fall volumes.

Figure 10.7 Daily Traffic Volume Variation on State Routes 1 and 17 Indexed to Fall 2019

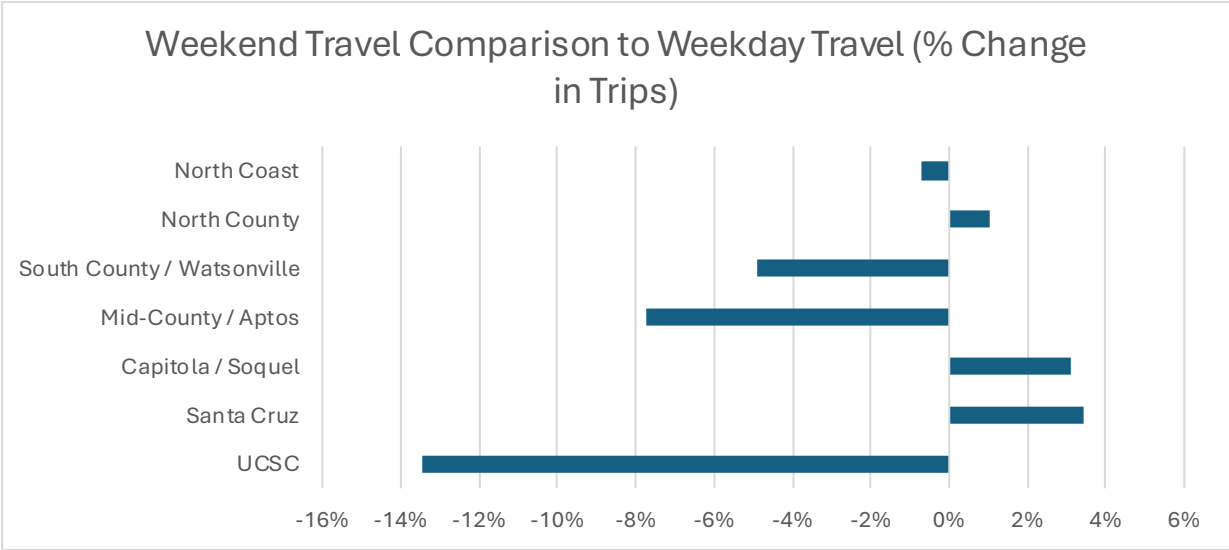


Source: Replica

Weekend Travel

Replica showed high activity levels in South Santa Cruz County/Watsonville and Santa Cruz, with both areas dominating regional travel during both weekdays and weekends. Total weekend trips were about 1% lower than weekday trips, indicating minimal overall variation. Notably, Capitola/Soquel and Santa Cruz showed a 3% increase in weekend travel, suggesting higher leisure or recreational travel (and visitors from outside of Santa Cruz County), while UCSC experienced a 13% drop in weekend travel, likely reflecting reduced campus-related activities. Other areas, such as South Santa Cruz County/Watsonville and Aptos/Mid-Santa Cruz County saw moderate weekend travel reductions, highlighting variations in travel purposes across the week, as shown in Figure 10.8 below.

Figure 10.8 2024 Weekend to Weekday Travel Comparison



Source: Replica

Origin-Destination Estimation

Replica’s origin-destination matrices were used for different zones along the ZEPRT Project corridor. These origin-destination matrices were used for getting the weekend to weekday relationship that was used to forecast weekend trips for the SCC Model. The origin-destination pairs from September 2024 to December 2024 were used to match with the zone structure previously used for the 2021 analysis. The seven zones used for the estimation are South Santa Cruz County/Watsonville, Mid-County/Aptos, Capitola/Soquel, Santa Cruz, UCSC, and North Santa Cruz County and North Coast.

Figure 10.9 below displays the segments from which data was obtained using Replica.

Figure 10.9 Road Segments Location Data Retrieved from Replica

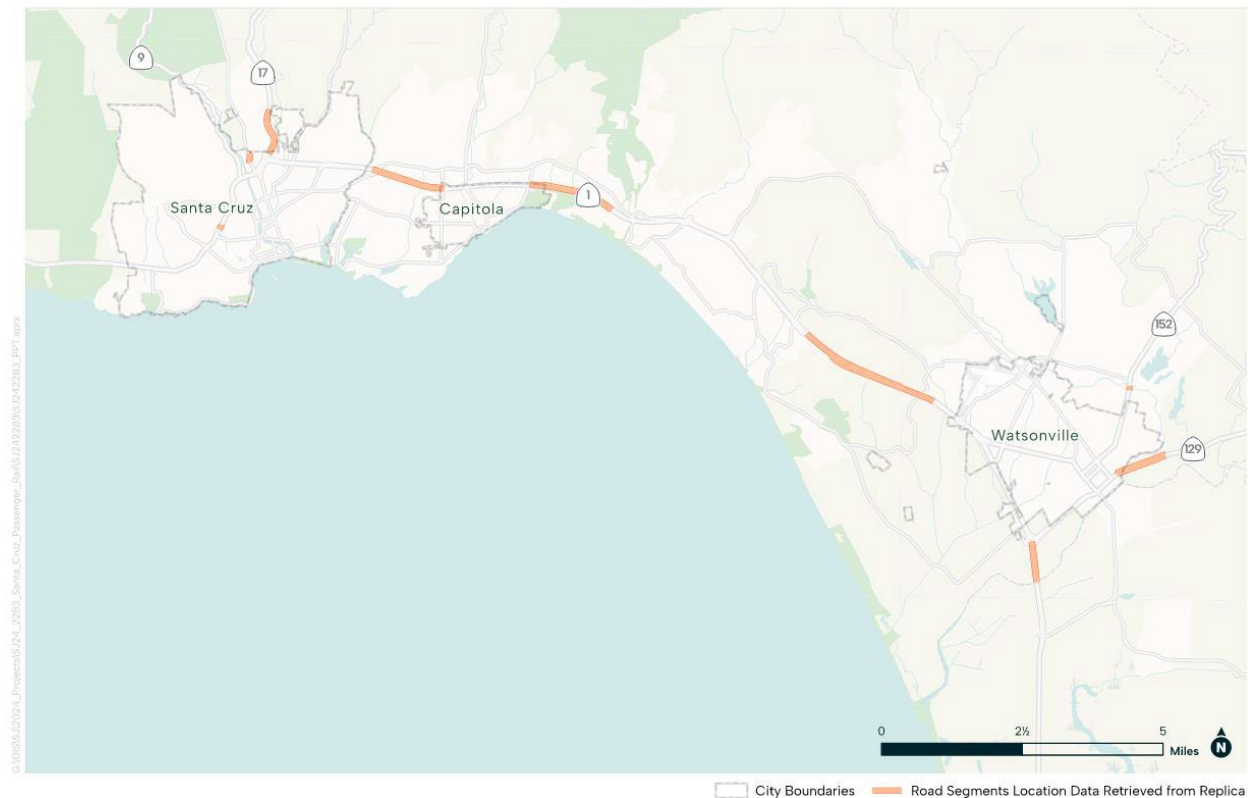


FIGURE 8

Road Segments Location Data Retrieved from Replica

Fehr&Peers

Source: Fehr & Peers

StreetLight Data

StreetLight Data was used as part of the alternatives analysis for passenger rail along the SCBRL, which is outlined in the Santa Cruz Transit Corridor Alternatives Analysis Ridership Forecasting report (January 2021). StreetLight Data was used to summarize model land use and trip tables within the same zones as part of the current analysis for the ZEPRT Project.

Similar to Replica, StreetLight Data is a third-party provider that uses anonymized location-based services (LBS) and GPS data to produce origin-destination (OD) tables for individual mobile devices. LBS data, sourced from mobile apps, captures both movement and stationary periods, offering a more complete picture of user activity compared to GPS data, which primarily tracks movement. This allows StreetLight to classify devices as residents, workers, or visitors within a specific area, determine home and work locations, and infer trip purposes based on observed travel patterns.

StreetLight Data offers detailed travel pattern information for specific study locations, including both geographic areas and individual road segments. These patterns are derived from anonymized cell phone

and GPS data and can be integrated with other data sources to estimate characteristics of travelers and infer trip purposes.

Analysis Zone Structure

The previous alternatives analysis used StreetLight data to support travel analysis across Santa Cruz County and adjacent counties using a customized zone structure. Within Santa Cruz County, analysis zones were created by aggregating SCC Model Travel Analysis Zones (TAZs) into broader geographic areas based on land use patterns and natural features such as major freeways, creeks and mountains. Additional regional zones covering neighboring counties like Santa Clara, Monterey, San Mateo, and Alameda were defined to capture travel between Santa Cruz and these surrounding areas.

Seven internal analysis zones were identified within Santa Cruz County, corresponding to the zones used for Replica data.

10.5 Future Land Use Changes

Table 10.1 below summarizes anticipated land use changes in Santa Cruz County between 2019 and 2045. This data is contained in the Base Year (2019) and Future Year (2045) version of the SCC Model. The population in Santa Cruz County is expected to increase by 6% from 2019 to 2045, and the employment is expected to increase by 15% from 2019 to 2045.

Table 10.1 SCC Model Land Use Total for Santa Cruz County

Category	2019	2045	Growth	% Growth
Households	95,900	109,600	13,700	14%
Population	272,300	290,000	17,700	6%
Employment	133,500	153,300	19,800	15%
Service Population (Employment and Population)	405,800	443,300	37,500	9%

Source: SCC Model, Fehr & Peers, 2025

As part of the forecasting process, planned growth in the County was reviewed. Applicable plans, such as the *Santa Cruz County General Plan*, *Downtown Watsonville Specific Plan*, *Santa Cruz Downtown Plan Expansion*, and other planned projects were reviewed. Some plans, such as the *Santa Cruz County General Plan*, were already included in the SCC Model. Other more recently adopted plans, such as the *Downtown Watsonville Specific Plan* (adopted in 2023) were not yet incorporated into the SCC Model and required modifications to several TAZs in Downtown Watsonville.

Other plans were not incorporated into the future version of the SCC Model because they were not adopted at the outset of the ridership forecasting process. For example, the *City of Santa Cruz Downtown Plan Expansion* was adopted in May 2025 by the Santa Cruz City Council. Because this project is now approved, it should be accounted for in future forecasts developed for the ZEPRT Project, including as part of the project’s environmental analysis.

Additionally, other land use changes still in the planning phase, such as the *Watsonville General Plan* update, are not yet reflected in the land use forecasts because that have not been adopted by the City of Watsonville.

Figure 10.10 below shows the future growth of population and employment density in Santa Cruz County by 2045. In Watsonville and Capitola, there is a greater increase in employment density than population density along the rail corridor. In Santa Cruz, there is a mix of increased population and employment density along the rail corridor.

Figure 10.10 Santa Cruz County Future Population and Employment Density

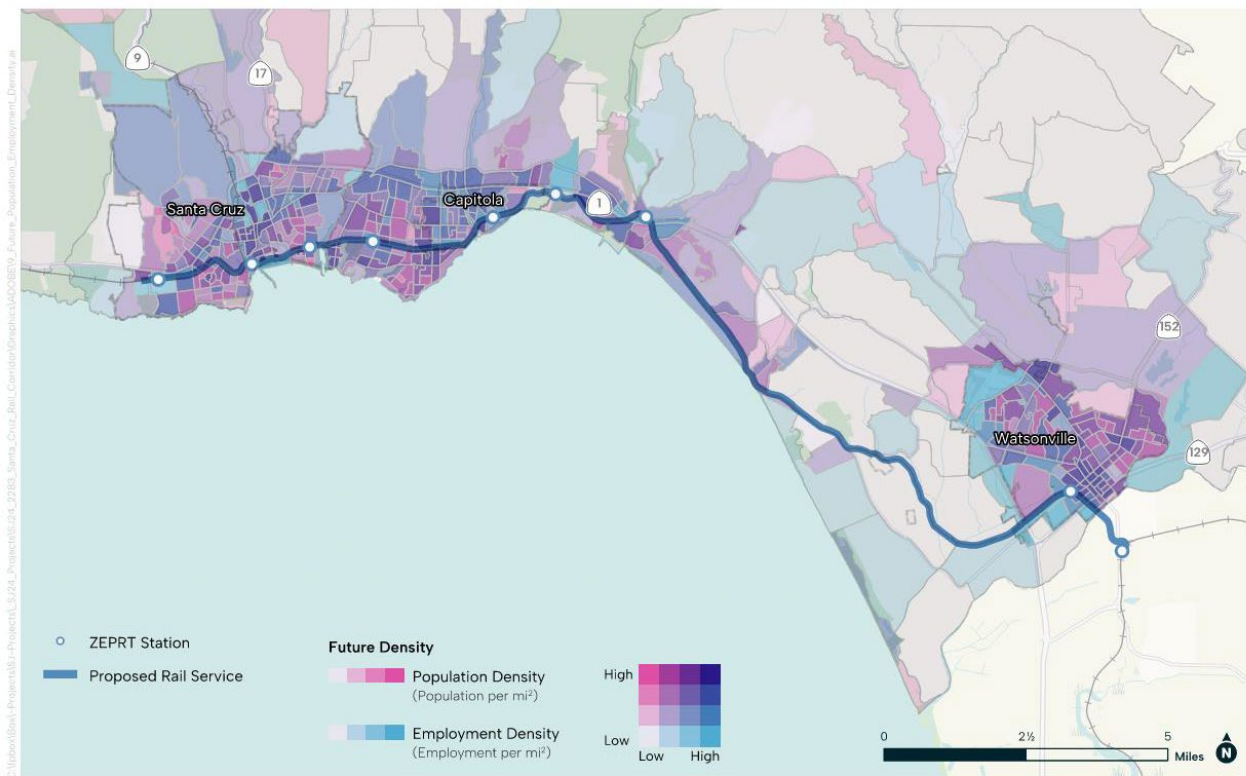


FIGURE 9
Future Population and Employment Density

Fehr & Peers

Source: Fehr & Peers

Figure 10.11 below shows the anticipated growth in Santa Cruz County. Most population and employment growth is located in Watsonville, Capitola, and Santa Cruz.

Figure 10.11 Santa Cruz County Future Population and Employment Growth

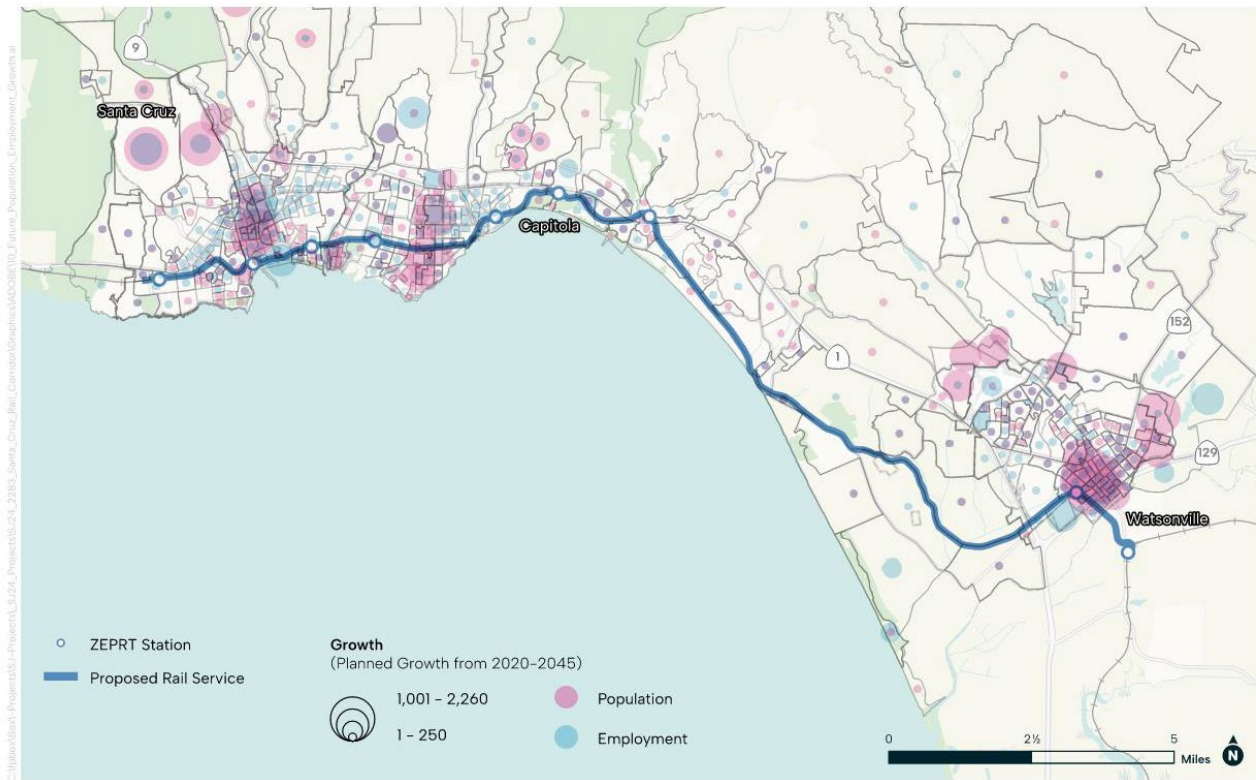


FIGURE 10
Future Population and Employment Growth

Fehr & Peers

Source: Fehr & Peers

10.6 Conceptual Ridership Forecasts

10.6.1 Prior Efforts

The Santa Cruz Branch Rail Line Rail Transit Feasibility Study (2015) examined the feasibility of various rail scenarios along the SCBRL corridor. Ridership forecasts were completed using the AMBAG Regional Travel Demand Model with a forecast horizon year of 2035. The Transit Corridor Alternatives Analysis (2021) identified the locally preferred alternative as Electric Passenger Rail, evaluating ridership using the updated Santa Cruz County (SCC) model with a forecast horizon year of 2040. As part of that effort, ridership forecasts were documented in the Santa Cruz Transit Corridor Alternatives Analysis Ridership Forecasting report (2021). This previous study was used as a starting point for ridership forecasts developed for the ZEPRT Project in 2025.

10.6.2 Santa Cruz County Travel Model Inputs

Before applying the SCC Model to develop ridership forecasts for the final alternatives, the model inputs and outputs were reviewed, and sensitivity tests were conducted to understand potential limitations.

The Santa Cruz County *North Coast Transportation Demand Management Plan* (TDM) was last updated in August 2023, incorporating a 2019 base year and a 2045 future year. Because the model was recently updated and validated for the base year, no additional sub-area base year validation was conducted for the ZEPRT Project at this stage.

However, the land use data and travel patterns from the updated model were compared to those in the previous 2019 model used for the *Santa Cruz Transit Corridor Alternatives Analysis* Ridership Forecasting report (2021) and the comparison was used to update the DRM adjustments.

10.6.3 SCC Model Assumptions and Inputs

Several steps were taken to incorporate the ZEPRT Project and incorporate external factors into the SCC Model, as identified in the sections that follow.

Rail Alignment / Passenger Rail Stations

Rail alignment and proposed passenger rail stations were revised to match the most recent conceptual plans for the ZEPRT Project. Table 10.2 below shows the list of proposed stations and their respective City / census-designated place (CDP).

Table 10.2 Proposed ZEPRT Passenger Rail Stations

Station	City / CDP
Pajaro Station	Pajaro
Downtown Watsonville Station	Watsonville
Aptos Station	Aptos
Cabrillo Station	Seacliff
Capitola Station	Capitola
17 th Avenue Station	Twin Lakes
Seabright Station	Santa Cruz
Beach Street / Downtown Station	Santa Cruz
Natural Bridges Drive Station	Santa Cruz

Source: SCCRTC and HDR

Rail Operations

Headways, speeds, and travel times between stations were updated based on the latest available information, values from the as-received model, and expert input. A 30-minute headway was assumed for both peak and off-peak periods with an estimated travel time of about 45 minutes from end to end as an initial basis for the conceptual ridership forecast. For the project, the route, headway, operating speed, and stop locations were coded into the model directly to match the planned ZEPRT Project operating parameters presented in Figure 10.12 below.

Figure 10.12 Planned ZEPRT Operating Parameters

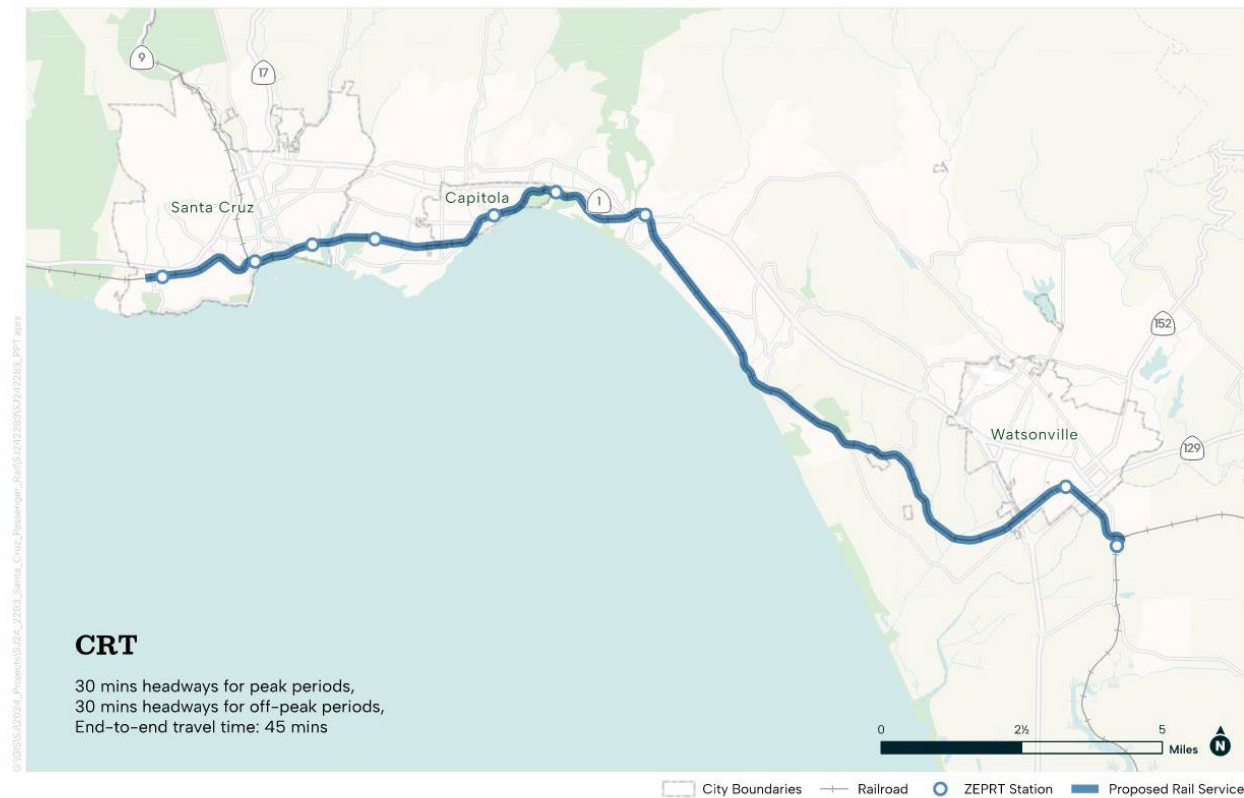


FIGURE 11

Proposed Operating Parameters

Fehr&Peers

Source: Fehr & Peers

Station Access / Park-and-Ride

Access coding was reviewed and modified to include consideration of walk and bike access and park-and-ride access. This park-and-ride demand is expected to be low; however, park-and-ride access, for the purpose of the conceptual ridership forecast, was assumed to be available at all stations even if minimal, though several stations have limited land available for designated park-and-ride lots.

Park-and-ride settings were updated to match the as-received model, with manual adjustments made to the walk access time for certain stations.

Table 10.3 below shows the stations along with potential park-and-ride locations that could have a designated park-and-ride facility in the future. Actual park-and-ride locations will be confirmed as the ZEPRT Project advances.

Table 10.3 Potential ZEPRT Station Park-and-Ride Locations

Station	Potential Park-and-Ride
Pajaro Station	Yes
Downtown Watsonville Station	Yes
Aptos Station	No
Cabrillo Station	Yes
Capitola Station	No
17 th Avenue Station	No (unless land is acquired)
Seabright Station	No
Beach Street / Downtown Station	No
Natural Bridges Drive Station	No

Source: Fehr & Peers, HDR

Mode Choice

Mode choice parameters were reviewed and adjusted to align with the community rail mode choice coefficients used in the SCC Model.

UCSC / Cabrillo College Enrollment

As shown by the existing transit ridership data, UCSC routes account for more than half of the existing total daily ridership on the entire transit network in Santa Cruz County. With the anticipated enrollment growth at UCSC, students are expected to continue to be one of the primary groups that ride transit in the future. Even though the ZEPRT service would not directly connect to the UCSC campus, it does include stops at the Beach Street / Downtown and the Natural Bridges Drive area to the south that allow students to make transfers to the existing UCSC routes, providing students with new transit options to travel between the campus and other parts of Santa Cruz County.

The model reflects the *UCSC 2021 Long-Range Development Plan*, with a future student population of 28,000 students for the 2040-2041 academic year.

The SCC Model land use data assumed a 12% growth in enrollment between 2019 and 2045. Based on review of the latest UCSC LRDP data (2020), the University is planning for an increase in enrollment from 19,500 in 2019 to 28,000 in 2040, equating to a 44% increase. To account for the additional growth anticipated at UCSC, the raw model ridership for the ZEPRT Project alternatives was separated for trips destined/originating at UCSC and further adjusted to account for the additional enrollment growth on campus.

Cabrillo College is currently updating its *Strategic Plan* for the College (2025-30). The Cabrillo College president indicated in May 2025 that Cabrillo College is planning to increase their enrollment from 8,200 students in 2025 to about 9,000 students by 2030.

The SCC Model does not include a direct transit connection between Cabrillo College and the rail station in the area. As part of the *SCCRTC 2045 Regional Transportation Plan for Santa Cruz County* (March 2022), a

new State Route 1 Bike / Pedestrian Bridge to connect New Brighton State Beach and Cabrillo College is planned. This bridge would also indirectly provide a bicycle / pedestrian connection to the proposed ZEPRT Cabrillo Station.

Weekend Ridership

Weekend travel activities are not included in the SCC Model. Replica and existing weekend transit ridership data from Santa Cruz METRO were used to develop a high-level estimate of weekend ridership for the ZEPRT Project.

The 2024 ridership for Bay Area Rapid Transit (BART) shows that its weekend ridership is about 49% of the weekday ridership. Caltrain’s *Annual Passenger Counts* report shows that its weekend ridership is about 36% of the weekday ridership in fiscal year 2024. Santa Cruz METRO data shows that weekend ridership on the existing bus network is about 60% of the average weekday ridership, with some seasonal variations, as shown in Table 10.4 below.

Table 10.4 Santa Cruz METRO 2024 Weekend Versus Weekday Ridership

Full Year	School Year (September to June)		Summer (July and August)
Average Daily Weekend Boardings (as a percent of average weekday boardings)	59.7%	57.2%	67.0%

Source: Santa Cruz METRO, Fehr & Peers, 2025

Other passenger rail systems were also contemplated to see their weekday versus weekend ridership. COASTER is a commuter train that serves San Diego County between Oceanside and Downtown San Diego along the Pacific Coast. SPRINTER is a hybrid rail service that serves San Diego County between Escondido and Oceanside. Based on the North County Transit District’s Annual Transit Operations Performance Report FY 2024, COASTER had almost the same number of average daily boardings on Saturdays (2,473) as on weekdays (2,521), whereas SPRINTER had about 60% of the average daily boardings on Saturdays compared to weekdays, as shown in Table 10.5 below.

Table 10.5 COASTER / SPRINTER Average Daily Boardings

	COASTER	SPRINTER
Weekday	2,520	5,760
Saturday	2,470	3,490

Source: North County Transit District, 2024

Therefore, as a base assumption weekend ridership is estimated to be approximately 50-60% of weekday ridership. More detailed weekend ridership forecasts could be developed as part of future ZEPRT Project phases to identify appropriate levels of weekend service for the SCBRL corridor.

Leisure / Recreational Travel

The SCC Model includes the Santa Cruz Beach Boardwalk, along with the beaches in Santa Cruz County, as special generators that attract trips. The visitor trips in the SCC Model were adopted from the AMBAG model. As the ZEPRT service operating on the SCBRL is anticipated to attract visitors / tourists, the main attractions in Santa Cruz County are incorporated into the SCC Model and reflected in the ridership forecasts.

Based on data provided by Visit Santa Cruz County, in June 2024, about 65% of visitors to Santa Cruz County were in-state visitors, with about 20% from the San Francisco Bay Area, and an additional 20% from the Sacramento / Central Valley area. In the SCC Model, visitors are coming from State Route 17 to the north, State Route 1 to the north and south, and State Route 152 and State Route 129 to the east.

10.7 Future Travel Conditions

To understand 2045 travel patterns, a comparison of the number of people traveling in a private vehicle versus taking transit was conducted for several origin-destination (OD) pairs. The following pairs were considered:

- Watsonville–Santa Cruz
- Capitola–Santa Cruz
- Aptos–UCSC

For the Watsonville–Santa Cruz pair, the transit ridership is equivalent to about 11% of people traveling by car between the zones. For the Capitola–Santa Cruz pair, the transit ridership is equivalent to about 19% of people traveling by car, and for the Aptos–UCSC pair, the transit ridership is equivalent to about 17% of people traveling by car. For these three OD pairs, the transit ridership is about 15% of people traveling by car, meaning there is a market for a service like the ZEPRT service within the region.

One notable OD pair is UCSC–Santa Cruz, as the transit ridership is equivalent to more than 50% of people traveling by car. This is also reflected in the high ridership of the UCSC transit lines of Santa Cruz METRO.

For the Watsonville–Santa Cruz pair, the rail ridership is equivalent to about 2% of people traveling by car between the zones. For the Capitola–Santa Cruz pair, the rail ridership is equivalent to about 1% of people traveling by car, and for the Aptos–UCSC pair, the rail ridership is equivalent to about 3% of people traveling by car. For these three OD pairs, the rail ridership is about 2% of people traveling by car. For the OD pairs that include UCSC as an origin or destination, rail accounts for about 3% of people traveling by car.

The SCC Model estimates that the overall transit mode share is about 8% of all trips for 2045.

Weekday Ridership

The weekday ridership was estimated based on the planned land use growth in the SCC Model, adjustments for UCSC and Cabrillo College, and park-and-ride adjustments. The alternative operates at 30-minute headways during the peak and off-peak and serves nine stations along the SCBRL corridor.

Weekend Ridership

The SCC Model does not have weekend ridership forecasts. The weekend ridership will be estimated as part of the Direct Ridership Model.

10.8 Direct Ridership Model Adjustments

The SCC Model ridership forecasts were further refined for the factors identified in the following sections.

UCSC / Cabrillo College

As noted above, students are expected to continue to be one of the primary groups that ride transit in the future. Based on the review of the results from the SCC Model, the SCC Model accounts for the UCSC students using the ZEPRT service, and no further adjustments were made.

Enhanced Connector Services

As mentioned above, the SCC Model does not include a direct transit connection between Cabrillo College and the rail station in the area. This analysis assumes that enhanced connector services would be provided to key destinations, such as Cabrillo College. Ridership adjustments were made using the DRM to reflect the potential effects of the ridership changes due to the enhanced connector network. These adjustments were made as informed by Replica and SCC Model total travel market OD data for key destinations like UCSC and Cabrillo College. A more detailed study would be required to fully define the connector service network.

Improved Multimodal Access Connections

As part of the ZEPRT Project, a trail will run alongside the SCBRL rail corridor in many areas like La Selva Beach, Rio del Mar, and Capitola. The proposed Coastal Rail Trail is not included in the SCC Model, so adjustments were made using the DRM to account for this connection. Similarly, new bicycle parking / bikeshare will be located at many ZEPRT stations to improve multimodal connections.

Pajaro Station / Regional Transfers

Pajaro Station ZEPRT ridership was estimated by factoring the ridership at nearby stations based on the differences in population and employment. The estimate is similar to previous forecasts prepared for the Transit Corridor Alternatives Analysis Study and for the Monterey Bay Regional Rail Ridership forecasts.

Transfers between the ZEPRT service and regional rail transit services were not included in the SCC Model forecasts due to the model area not covering interregional transit connections. The Transportation Agency for Monterey County (TAMC) prepared regional ridership forecasts as part of the Monterey Bay Area Rail Network Integration Study. The study area is from San Luis Obispo to San Francisco, and includes the Pajaro Station, which would be a transfer station that would provide access to the ZEPRT service.

Caltrans published the 2024 *California State Rail Plan* which includes the long-term (2050) vision of rail in the state. The long-term vision includes all-day intercity service between San Jose and San Luis Obispo, with transfers to a regional rail network connecting to Santa Cruz and Monterey. Figure 10.13 below shows the long term (2050) Northern California service map, with Watsonville serving as a hub for both intercity and regional rail, connecting it within Santa Cruz and Monterey Counties, and to the state from San Francisco/Sacramento down to Los Angeles.

Figure 10.13 2024 California State Rail Plan, Long Term Northern California Service Map

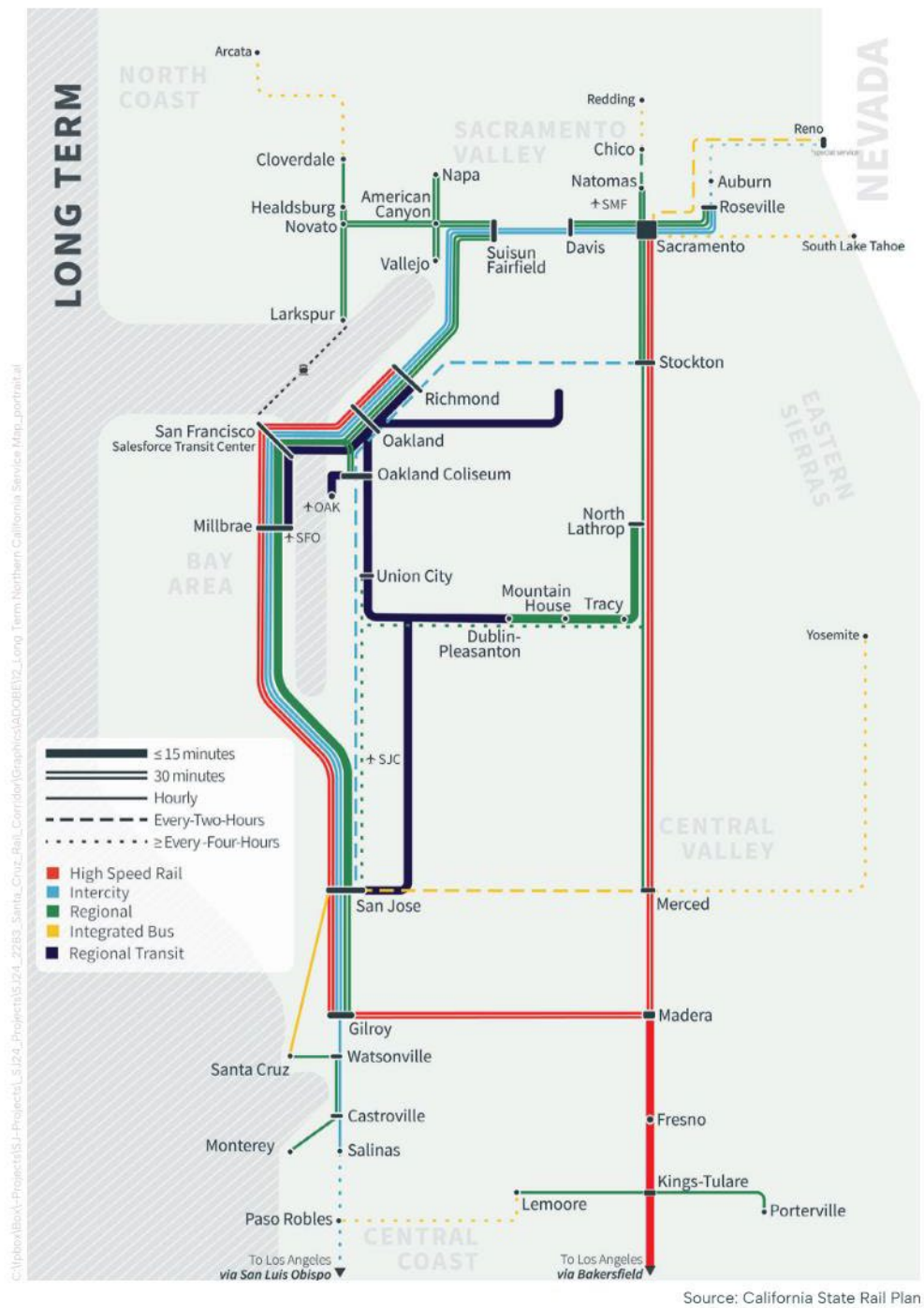


FIGURE 12

Long Term Northern California Service Map

Fehr&Peers

Source: Caltrans

California High-Speed Rail studies are underway to construct high-speed train service from the San Francisco Bay Area to the Los Angeles Basin and will eventually extend to Sacramento and San Diego with speeds of over 200 miles an hour. The nearest station to Santa Cruz County will be in Gilroy, approximately 20 rail-miles from the Pajaro Station.

Ridership estimates for Pajaro Station were developed based on prior studies as well as regional data travel data from Replica.

Post-Pandemic Travel Patterns

To account for post-pandemic travel patterns, Q3/Q4 2019 Santa Cruz METRO ridership data was compared with Q3/Q4 2024 data, as shown in Table 10.6 below. The 2024 ridership is about 80-90% of the 2019 ridership, so given how close the ridership is pre- and post-pandemic, no post-pandemic adjustments were made to the forecasted ridership.

Table 10.6 Santa Cruz METRO 2019 Versus 2024 Ridership

Category	2019	2024	2024 to 2019 Comparison
Total Q3 Boardings	901,000	719,000	79.7%
Total Q4 Boardings	1,401,000	1,258,000	89.9%

Source: Santa Cruz METRO, 2025

Weekend Ridership

As shown previously in Table 10.4, the Santa Cruz METRO weekend ridership in 2024 is about 60% of the average weekday ridership. To be conservative and to remain consistent with estimates in the 2021 Ridership Forecasting study, weekend ridership is estimated to be about 50-60% of the weekday ridership.

10.9 ZEPRT Conceptual Ridership Results

Weekday Ridership

The conceptual weekday ridership is shown below in Table 10.7 and is based on the adjustments made to the SCC Model and the postprocessing / adjustments as described in the sections above. Table 10.8 shows the conceptual weekday ridership ranges by ZEPRT station.

Table 10.7 Weekday ZEPRT Ridership Forecast Results

	Weekday
Operating Parameters	
Number of Stations	9
Frequency ¹ (Minutes)	30
Total Weekday Boardings (Typical Range)	4,800 (4,200-5,400)

Notes: Assumed 30-minute headways for peak and off-peak periods. Adjustments to account for multimodal connections (e.g., Coastal Rail Trail, bikeshare / bike parking, pedestrian infrastructure), improving connections to UCSC and Cabrillo College and for regional connections to Monterey, San Francisco, and San Luis Obispo.

Source: Fehr & Peers, 2025

Table 10.8 Weekday ZEPRT Ridership Ranges by Station

Station	Weekday Ridership
Pajaro Station	350-450
Downtown Watsonville Station	900-1,100
Aptos Station	250-400
Cabrillo Station	350-450
Capitola Station	450-550
17 th Avenue Station	400-500
Seabright Station	300-400
Beach Street / Downtown Station	1,050-1,300
Natural Bridges Drive Station	150-250
Total	4,200 – 5,400 boardings / day

Source: Fehr & Peers, 2025

Rail passengers would typically include commuters travelling to jobs throughout Santa Cruz County. Many jobs are in and around Downtown Santa Cruz. Commuters traveling to these jobs would typically board at rail stations nearest to their place of residence, including in Watsonville, Aptos and Capitola. Rail passengers also include those without access to a private automobile. These passengers would travel for multiple trip purposes, including commuting, shopping, and recreational trips.

Other population groups, such as disabled passengers, families and visitors, would board the system at various stations to get to their travel destinations. Because of its location near jobs, residential areas, and recreational destinations, the Beach Street Station would have the highest number of daily boardings in the system. The Downtown Watsonville Station would be located near many jobs and residential areas and would also have a high number of daily boardings.

About 350-450 daily boardings are forecast at the Pajaro Station. These boardings would typically be passengers travelling longer distances, such as residential locations in Monterey County to job centers in Santa Cruz County, or as transfers from other rails systems described above.

Weekend Ridership

The conceptual weekend ridership for the ZEPRT service is estimated to be approximately 50-60% of the conceptual weekday ridership, as shown in Table 10.9 below. Qualitative conceptual weekend ridership ranges by station are shown in Table 10.10 below.

Table 10.9 Weekend ZEPRT Ridership Forecast (in Boardings)

	Weekend
2045 Daily Boardings (Typical Range)	2,400 (2,100 – 3,200)

Source: Fehr & Peers, 2025

Table 10.10 Weekend ZEPRT Ridership Ranges by Station

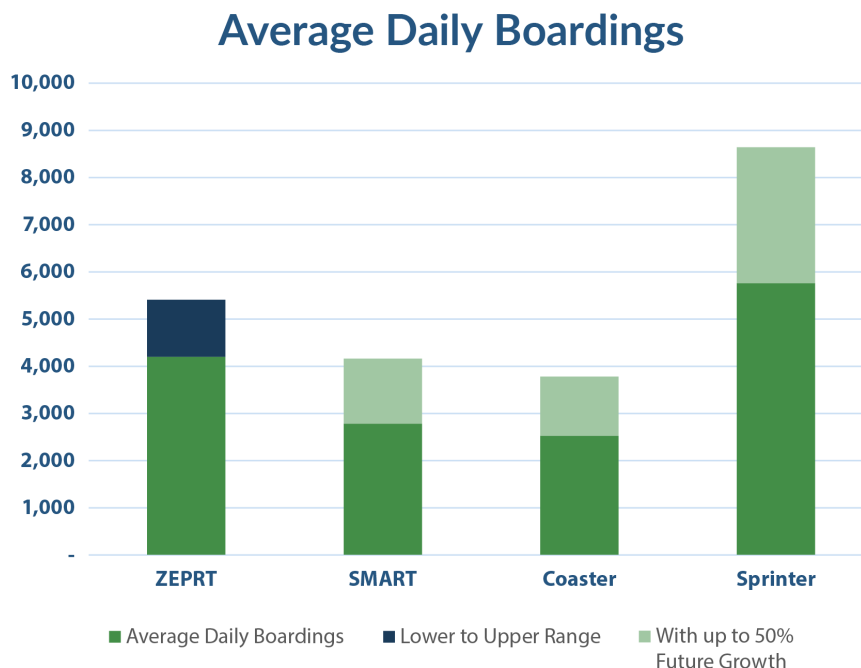
Station	Weekend Ridership
Pajaro Station	Low
Downtown Watsonville Station	Medium
Aptos Station	Medium
Cabrillo Station	Medium
Capitola Station	High
17 th Avenue Station	Medium
Seabright Station	Medium
Beach Street / Downtown Station	High
Natural Bridges Station	Medium

Source: Fehr & Peers, 2025

10.10 Comparison to Other Systems

The projected conceptual ridership for the ZEPRT service was compared to other peer rail systems, including the previously mentioned COASTER and SPRINTER systems. The Sonoma-Marín Area Rail Transit (SMART) was also contemplated, which is a commuter rail service between Larkspur and Santa Rosa in Marin and Sonoma counties. Figure 10.14 below shows the average daily boardings of ZEPRT, SMART, COASTER, and SPRINTER.

Figure 10.14 Average Daily Boardings Comparison

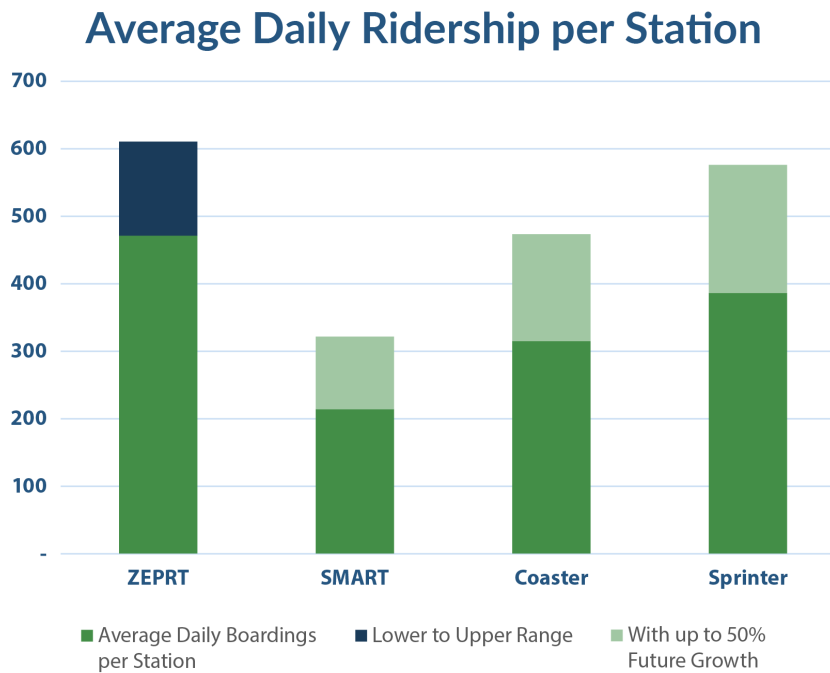


Source: Fehr & Peers, 2025

The 2045 forecasted daily boarding of ZEPRT is higher than the existing (2024) daily boardings of SMART and COASTER. Assuming a 50% growth for all three services, the SMART and COASTER average daily boardings approach the ZEPRT daily boardings, and the SPRINTER average daily boarding approaches almost 9,000 riders per day.

Figure 10.15 below shows the average daily boardings per station. The 2045 forecasted daily boarding for the ZEPRT service per station is higher than the existing (2024) daily boardings of the three services. With a 50% growth for the three services, SMART and COASTER are still below ZEPRT, with SPRINTER approximately matching ZEPRT.

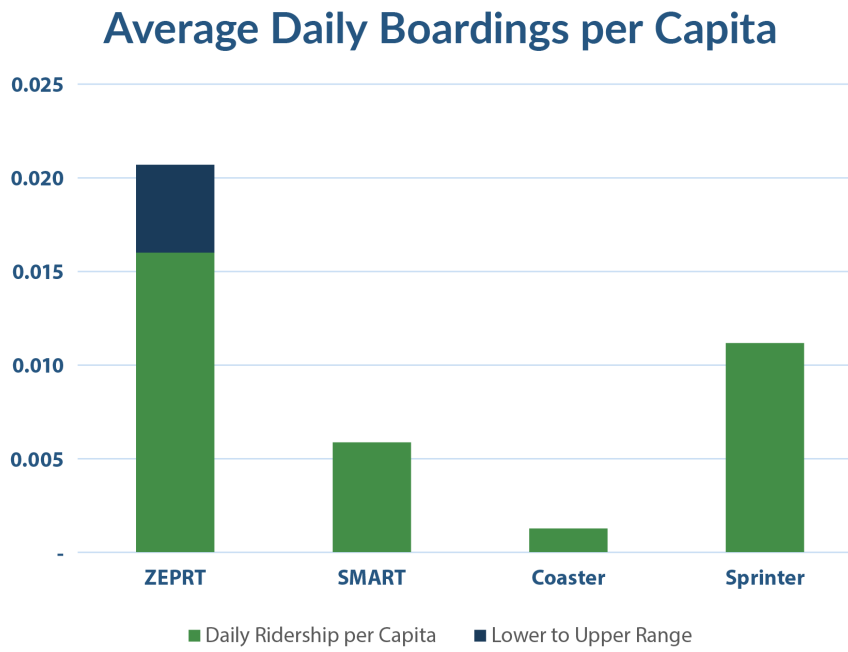
Figure 10.15 Average Daily Ridership per Station Comparison



Source: Fehr & Peers, 2025

Figure 10.16 below shows the average daily boardings per capita. The 2045 forecasted daily boarding of ZEPRT per capita is higher than the existing (2024) daily boardings per capita of the three services. As a note, the county population data was used to determine the per capita rate, whereas the populations of the cities with stations were used for the other three systems. A 50% growth rate to reflect future conditions was not applied, so this represents the most conservative values for the other three systems.

Figure 10.16 Average Daily Ridership per Capita Comparison



Source: Fehr & Peers, 2025

10.11 Strategies to Potentially Support Higher Ridership

The weekday and weekend ZEPRT conceptual ridership forecasts above reflect existing conditions and assumptions about future development. There are several strategies based on U.S. rail industry experience that could potentially encourage higher ridership for the ZEPRT service, including adding more park-and-ride lots at stations, implementing timed transfers at the Pajaro Station, improving the rail operations (e.g., decreasing the headways and increasing the hours of operation), and adding new or strengthening transit and multimodal (e.g., bicycle / pedestrian) connections to major local attractions like Cabrillo College, Capitola Mall, Downtown Santa Cruz, and UCSC.

Potential strategies for individual ZEPRT stations are listed in Table 10.11 below. These improvements primarily focus on improving the connections to and from the stations, with an emphasis on strengthening multimodal (i.e., transit, bicycle, and pedestrian) connections. The improvements are tailored to each station and its surrounding local context. For example, adding direct bus connections to Natural Bridges Drive and Beach Street / Downtown stations could encourage more UCSC students and visitors / tourists to use ZEPRT to travel both within and to transfer outside of Santa Cruz County. Similarly, adding park-and-ride infrastructure in auto-oriented areas like Pajaro and Watsonville could help encourage drivers to take rail to travel instead of driving along State Route 1.

Table 10.11 Potential Improvements by ZEPRT Station

Station Name	Potential Improvements
Pajaro Station	Park-and-ride, timed transfers
Downtown Watsonville Station	Bike parking, connections to new housing; park-and-ride
Aptos Station	Pedestrian access improvements
Cabrillo Station	New direct walk/bike connection to Cabrillo College, sidewalks, bike infrastructure, park-and-ride
Capitola Station	Better access to downtown, sidewalks on Park Avenue
17th Avenue Station	Bike parking; pedestrian access improvements
Seabright Station	Better sidewalks on Murray Street
Beach Street / Downtown Station	Direct bus connections, wayfinding/access improvements
Natural Bridges Drive Station	Direct bus connections, bike parking, bike infrastructure

Source: Fehr & Peers, 2025

The effect of bikeshare / multimodal connections was not thoroughly researched as part of the postprocessing, but a preliminary review of publicly available research is that bikeshare does tend to increase ridership at rail stations.

10.12 Key Conclusions of Conceptual ZEPRT Ridership Results

Based on the adjustments made in the SCC Model and DRM, the preliminary conceptual ZEPRT ridership forecasts indicate that weekday daily average ridership would be about 4,800 boardings and weekend daily average ridership would be about 2,400 boardings.

These conceptual ridership forecasts are made with the most recent data available but could be affected by unforeseen circumstances. Similarly, model limitations, calibration constraints, and assumptions about future transportation policies, service levels, and infrastructure investments can significantly influence outcomes. Therefore, the ridership forecast results should be supplemented with other scenario analyses and sensitivity testing to inform the decision-making process.

As described above, ridership is only one transit performance metric. The potential benefits of the system include its affordability compared to driving and its ability to help reduce greenhouse gas emissions. Transit can also support sustainable development around transit stations by allowing nearby residents and employees to travel to and from their destinations without driving.

10.13 Conceptual ZEPRT Fare Revenue Forecasts

Fare revenue is a key funding source for rail transit operations. Fares help cover the costs of ongoing operations and maintenance and are directly tied to system ridership levels.

This section presents potential fare revenue estimates for the ZEPRT service. The formulation of railway fares requires careful consideration of local and regional needs and anticipated future rider travel patterns. Commuter and passenger rail systems typically use either distance-based fares, zone-based fares, or flat fares. Additional fare structures distinguishing between peak/off-peak fares, discounted fares and fare-caps or daily maximums are also often used.

In the U.S., average passenger fares have remained relatively stable throughout the past two decades, slightly increasing each year, leading to an average commuter rail fare of \$4.39 in 2022 (U.S. Department of Transportation, Federal Transit Administration, National Transit Database). Locally, in Santa Cruz County, the Santa Cruz Metro charges \$2-\$7 per ride. Standard local fares are \$2, but some long distance or express fares are \$7 because of Amtrak use.

Santa Cruz County presents a unique context for fare revenue analysis. It is influenced by UCSC students, tourism, and diverse socioeconomic populations. UCSC has a population of over 20,000 students and staff, many who use public transportation to get around. The system's proximity to UCSC, as well as Cabrillo College, presents opportunities for more flexible fare products such as a semester pass and student discounts. Additionally, Santa Cruz experiences heavy seasonal tourism during weekends and summer months. Capitalizing on this, fare structures could incorporate family passes, day passes, and competitive travel times. Moreover, Watsonville and Live Oak have higher concentrations of low-income residents, highlighting the importance of inclusive and equitable fare policies like free or reduced fares.

The 2024 *California State Rail Plan* also has plans to create a future regional rail service between Santa Cruz and Pajaro called the Pajaro Interregional Connection. The *California State Rail Plan* also includes a long-term goal to connect Santa Cruz to Castroville/Monterey and Gilroy/San Francisco Bay Area. The transfers

to and from the San Francisco Bay Area will likely be higher than to and from Monterey. This will have a substantial influence on the design, performance, and ridership of the ZEPRT service. Regional rail connections provide an opportunity to partner with local rail and transportation services to boost long-distance and peak-hour ridership, creating an expansive and more accessible network of transportation that strengthens demand. Zone-based or distance-based fares, along with passes, would benefit from this network. For example, Santa Cruz METRO has partnered with Amtrak to operate the Highway 17 Express service. This regional express bus service, which runs between Downtown Santa Cruz and San Jose Diridon Station is a part of the Amtrak Thruway network. Thus, its schedules and tickets are integrated with intercity and long-distance Amtrak rail services.

10.13.1 Fare Structure Options

There are many approaches to fare structures, varying across transit systems. Below is a description for common fare structure approaches:

- **Distance-based fare:** users pay based on travel distance, commonly on top of a base price, distance-based fares are often based on zones
- **Flat fare:** one fixed price regardless of distance traveled

Additional variations to distance, zone or flat fares include:

- **Fare capping/passes:** passes offering unlimited rides for the allotted time-period or price
- **Peak/off-peak fares:** higher fares for peak travel periods, lower for off-peak periods
- **Discounted fares:** reduced rates for students, seniors, youth, low-income, and veterans

Distance-based and flat fares could work under any of the common fare structures above. BART in the San Francisco Bay Area is a distance-based system with an average fare of \$4.72. The Transportation Policy Research Center notes that variable fares — peak time/congestion pricing and distance of travel as additional strategies — can be used to increase transit reliance during peak vehicle congestion. Distance of travel pricing is discounts for short-distances to encourage transit to get to central business districts and discounts for long-distances to encourage transit for commuting. Table 10.12 below summarizes common fare types of transportation systems, providing reasons for choosing a certain fare structure and potential reasons to avoid certain fare structures.

Table 10.12 Summary Matrix of Different Fare Structures

Fare Type	Pros	Cons
Distance or Zone-Based	Revenue aligns with distance	Complex structure
Flat	Simple, easy to understand and use, good option for tourists and occasional riders	Undercharges longer trips
Fare Capping/Passes	Encourages frequent use	Risk of losing revenue if used to full potential
Peak/Off-Peak	Balances capacity by encouraging off-peak travel	Uncertain as peak travel periods fluctuate
Discounted	Promotes equity	Reduces per-trip revenue

Source: Fehr & Peers, 2025

Table 10.13 below summarizes fare examples from comparable systems, comparing fare type, fares, and pass options.

Table 10.13 Fare Examples from Comparable Systems

System	Characteristics	Fare Type	Adult Fare (One-Way)	Pass Options	Notes
SMART	Sonoma-Marín Area; 14 stops from Sonoma Airport to Windsor; ~45 mile corridor; ferry transfers at Larkspur	Zone-based	\$1.50/zone	31-Day Pass (\$117.00); Weekend Day Pass (\$10.00); Rail and Sail Combo ticket (\$10.00)	Clipper card or e-tickets; youth and seniors ride free; 50% discount for low income and disabled
NCTD COASTER	3 zones northbound and southbound between San Diego and Oceanside; ~41 mile corridor; connection to SPRINTER at Oceanside	Zone-based	\$5.00/ \$5.75/ \$6.50;	Day pass (\$6.00-\$15.00); Monthly pass (\$72.00-\$182.00);	50% discounts for youth, seniors, and disabled
NCTD SPRINTER	15 stops northbound and southbound between Oceanside and Escondido; ~22 mile corridor	Zone-based	\$2.50	Monthly pass (\$59)	N/A
TriMet WES	Serves Beaverton, Tigard, Tualatin, and Wilsonville in Oregon every 45 minutes between 5 stations; ~15 mile corridor	Flat fare	\$2.80	Day cap (\$5.60); monthly (\$100); 2.5 hour transfers	Discounts for veterans and youth
Austin CapMetro	10 stations from Leander to Downtown Austin, Texas; ~32 mile corridor	Flat, though tiered by local vs commuter service	Local: \$1.25; Commuter: \$3.50	Daily capping (local: \$2.50; commuter: \$7.00); monthly (local: \$41.25, commuter: \$96.25)	Student/low-income discounts; can purchase bikeshare in app
Santa Cruz Metro	6 routes between Downtown San José and Watsonville; connects to Caltrain and Amtrak at Diridon	Local bus with some express routes	\$2.00/ride (local), \$7.00/ride (express)	Numerous pass options	Youth ride free, discounts offered

Sources: Sonoma-Marín Area Rail Transit, 2025; North County Transit San Diego Railroad, 2025; TriMet, 2025; Capital Metropolitan Transportation Authority, 2025; Santa Cruz Metropolitan Transit District, 2025

The Sonoma-Marín Area Transit (SMART) is a zone-based passenger rail system that covers a wide range of cities in North Bay Area for relatively cheap as shown in Figure 10.17 below.

Figure 10.17 SMART Fare Table

SWIPE LEFT IF VIEWING ON A SMART PHONE	PAYING WITH CLIPPER CARD				PAYING WITH SMART E-TICKETS		
	ADULT (19 - 64)	YOUTH (0 - 18) SENIOR (65+)	CLIPPER START	DISABLED OR MEDICARE	ADULT (19 - 64)	YOUTH (0 - 18) SENIOR (65+)	DISABLED OR MEDICARE
Traveling within 1 zone 	\$1.50	Fare Free*	\$0.75	\$0.75	\$1.50	Fare Free*	\$0.75
Traveling within 2 zones 	\$3.00	Fare Free*	\$1.50	\$1.50	\$3.00	Fare Free*	\$1.50
Traveling within 3 zones 	\$4.50	Fare Free*	\$2.25	\$2.25	\$4.50	Fare Free*	\$2.25
Traveling within 4 zones 	\$6.00	Fare Free*	\$3.00	\$3.00	\$6.00	Fare Free*	\$3.00
Traveling within 5 zones 	\$7.50	Fare Free*	\$3.75	\$3.75	\$7.50	Fare Free*	\$3.75
	*No ticket needed						

Source: Sonoma-Marín Area Rail Transit, 2025

The North County Transit District (NCTD) COASTER is also a zone-based commuter rail system in San Diego that has a similar corridor size to SMART but is a bit more expensive. For those who often use the NCTD COASTER, the passes are more worth it for the price. The NCTD SPRINTER is a zone-based hybrid rail system in San Diego that covers a smaller corridor, but it is much cheaper than the COASTER. TriMet Westside Express Service (WES) in Oregon is a commuter rail system with the smallest corridor in this analysis, but is on the cheaper side, especially considering its flat fee. Austin Capital Metropolitan Transportation Authority (CapMetro) is a tiered-based commuter rail system covering 32 miles across Texas.

Pricing is relatively cheap as shown in Figure 10.18 below, and fare capping and bikeshare services that make frequent rides convenient.

Figure 10.18 Austin CapMetro Fare Table: Local and Commuter Fares

Time Frame	Price
Single Ride	\$1.25
Per Service Day (4 a.m. to 3:59 a.m.)	\$2.50
Per Calendar Month	\$41.25
Pickup Ride	\$1.25
Time Frame	Price
Single Ride	\$3.50
Per Service Day (4 a.m. to 3:59 a.m.)	\$7.00
Per Calendar Month	\$96.25

Note: Local fares on top in blue, commuter fares on bottom in red

Source: Capital Metropolitan Transportation Authority, 2025

The Santa Cruz METRO is a bus system that covers a large corridor through numerous counties in the region. Its cheap local prices and partnership with Amtrak make for convenient rides. All systems mentioned above offer discounts for youth, those with disabilities, and low-income riders.

10.14 Preliminary Conceptual ZEPRT Fare Revenue Forecasts

A potential conceptual example fare structure for the ZEPRT system was developed based on the following considerations:

- **General regional context:** Some regional context considered includes the characteristics of the ZEPRT and the areas the SCBRL corridor serves. The rail corridor passes through both urban areas, such as Watsonville and Santa Cruz, and less urban communities like Pajaro and Aptos. Higher population and employment growth is anticipated in Watsonville and Santa Cruz areas. Therefore, there is a need for a cost-effective alternative to driving along the frequently congested State Route 1. Other regional considerations include demographic factors, such as the proportion of elderly residents and students, as well as socioeconomic factors, including the percentage of the population living in poverty.
- **Tourism activity:** the ZEPRT service is expected to serve major tourist destinations, including the Santa Cruz Beach Boardwalk and Capitola. As a result, higher travel demand is anticipated during weekends and the summer season.

- **Commute travel patterns:** Some key commute travel patterns considered including commuting between the Watsonville and Santa Cruz areas as well as commuting to the San Francisco Bay Area via ZEPRT and its connection to other transit systems such as intercity buses and Amtrak Capitol Corridor trains.
- **Comparable transit systems:** Example transit systems considered including similar local passenger rail or transit systems such as Caltrain, BART, and SMART; bus services like the Intercity Bus from Santa Cruz METRO; and other regional transit providers such as North County Transit District (NCTD).

Table 10.14 below shows a potential fare structure for the ZEPRT service on the SCBRL corridor for a projected opening year of 2035 and projected future year of 2045. The opening year 2035 scenario assumed that the necessary funding was in place for 2025 and that the project would take 10 years (until 2035) to construct and implement. The projected future year 2045 scenario was assumed as a point in time 10 years post-2035 implementation and was used to conceptually identify a potential fare structure for the ZEPRT service as it matures.

Table 10.14 Potential Santa Cruz Rail Fare Structure Example: Flat Fare

Fare Type	Single Ride	Monthly Commuter Pass	Weekend Day Pass
Opening Year (2035)			
Regular Fare	\$5.00	\$120.00	\$10.00
Discounted Fare	\$2.50	\$60.00	\$5.00
Future Year (2045)			
Regular Fare	\$6.00	\$144.00	\$12.00
Discounted Fare	\$3.00	\$72.00	\$6.00

Source: Fehr & Peers, 2025

This potential fare structure assumes a flat fare model. In the opening year, the projected base fare will be \$5. The base fare is estimated by applying the approximately 20% fare increase observed over the past 10 years in nearby transit systems, such as Caltrain and BART, to Caltrain's current base fare of \$4, since Caltrain is a comparable passenger rail system located in the San Francisco Bay Area, north of Santa Cruz County.

An alternative to the base fare model presented above is a zone-based model, in which the fares depend on the number of zones a passenger crosses. Zone-based fares can more accurately reflect the cost of longer trips such as traveling from Pajaro and Watsonville to stations in the Santa Cruz area and may encourage short-distance travel within a zone since fare would be lower for intra-zone trips compared to crossing multiple zones.

However, the flat fare model offers several advantages that may make it more suitable for the proposed ZEPRT system. Flat fares simplify the fare collection process, which reduces operational complexity and makes it easier for passengers to understand the fare system. This is particularly important for the ZEPRT service because it serves major tourist attractions in the area and is expected to accommodate a high

volume of tourists. Having a straightforward fare system can improve the overall user experience and encourage ridership.

This zone-based structure assumes two zones based on the station distribution and their relative distances: one covering the Pajaro and Watsonville areas and the other covering the Capitola and Santa Cruz areas. This limits the differentiation benefits of a zone-based model and may make the fare difference between zones too small to justify the added complexity. Additionally, a significant number of commuters are anticipated to travel between Watsonville and Santa Cruz to avoid congestion on State Route 1, which requires crossing zones in a zone-based system. Higher costs for crossing zones may discourage commuters from using the rail system.

Table 10.15 below shows an alternative fare structure for the ZEPRT service with zone-based fare instead of flat fares. The breakdown of zones is shown below:

- **Zone 1:** Aptos Station, Cabrillo Station, Capitola Station, 17th Avenue Station, Seabright Station, Beach Street / Downtown Station, and Natural Bridges Drive Station.
- **Zone 2:** Pajaro Station and Downtown Watsonville Station.

As shown in Table 10.15 below, the base fares for traveling within one zone under the zone-based model are similar to the flat fare model presented in Table 10.14. However, the cost increases by \$1.50 when crossing two zones, following a structure similar to SMART.

Table 10.15 Alternative Santa Cruz Rail Structure with Zone-Based Fares

Fare Type	One Zone	Two Zones
Opening Year (2035)		
Regular Fare	\$5.00	\$6.50
Discounted Fare	\$2.50	\$3.25
Future Year (2045)		
Regular Fare	\$6.00	\$7.50
Discounted Fare	\$3.00	\$3.75

Source: Fehr & Peers, 2025

In addition to a flat fare model, the potential fare structure shown in Table 10.14 also assumes a 50% discount for youth, students, seniors aged 62 and over, individuals with disabilities, and low-income riders, similar to what is offered by transit agencies like SMART and NCTD.

A monthly commuter pass that provides unlimited rides could be available for weekday-only travel, priced at about \$120 for regular riders and \$60 for discounted fare riders. The cost of the pass is equivalent to 24 rides per month, or approximately three round trips per week. This is based on an assumption that a typical commuter travels to work at least three days per week and would begin to see cost savings starting on the fourth day of travel. If a typical commuter makes five round trips per week over four weeks, the monthly weekday pass could offer savings of approximately 40 percent.

To support tourism and leisure travel, a weekend day pass could also be available. The pass allows for unlimited travel on a single day, with the regular fare priced at \$10 and the discounted fare at \$5, which is equivalent to the cost of a round trip. This option is particularly suited for travel to popular destinations such as Downtown Watsonville Station, Capitola Station, and Beach Street / Downtown Station. If a weekend pass rider makes at least three trips a day by visiting more than one tourist attraction, which is a reasonable assumption given that the attractions in the area are close together, the monthly weekday pass could offer savings of at least 30 percent.

In addition to existing fare options such as discounted fares, monthly commuter passes, and weekday day passes, other potential fare types to consider for the ZEPRT service include group or family discounts for weekend travel.

This type of fare is already in use or planned by nearby transit systems. For example:

- Amtrak offers percentage-based discounts for groups of two to eight passengers traveling together on the same reservation.
- On the Capitol Corridor intercity service, Amtrak offers a 50% discount on up to five companion fares when purchased with one full-fare ticket.

A similar group or family fare option could potentially be added to the ZEPRT service fare structure after service begins, especially if ridership data or passenger surveys indicate a significant amount of group or family travel.

By the future year of 2045, the regular base fares could increase by approximately 20% to \$6, due to inflation and rising operational costs. Other fare categories would also be adjusted accordingly.

Table 10.16 shows estimated weekday and weekend daily ridership, annual ridership, and annual farebox revenue.

The preliminary daily weekday ridership for the future year is forecasted using the Santa Cruz County (SCC) travel forecasting model, with postprocessing adjustments applied. The opening year daily ridership is estimated as 60% of the future year ridership. Weekend ridership is estimated as 50% of weekday ridership. Annual ridership is calculated based on an average of 250 weekdays and 115 weekends and holidays per year. It is assumed that seasonal fluctuations in ridership due to tourist activity are accounted for in the average daily ridership forecast and carried through to the annual ridership calculation.

The potential ranges of annual farebox revenue are estimated based on anticipated ridership ranges, fare elasticity, rider demographic, and travel behavior assumptions. Farebox revenue is calculated in 2035 and 2045 dollars for the opening year (based on the assumption that funding is in place in 2025 and that it would take 10 years for the project to be constructed and implemented) and future year (assuming 10 years post-implementation as the service matures), respectively, as fares are adjusted to account for inflation and rising operational costs. When calculating farebox revenue from ridership, the fare elasticity factor applied a 0.3% reduction to ridership for every 1% increase in fare. For rider demographic, it was assumed that 53% of riders qualify for discounted fares, based on Santa Cruz METRO and Santa Cruz County Census data. According to the Santa Cruz METRO ridership report for the fourth quarter of FY24, 22% of intercity bus riders are youth, and 13% are either aged 62 or older or have a disability. Census data

shows that 13% of the county's population is low income. Applying this low-income percentage to the 54% of riders who are not youth, elderly, or disabled from the Santa Cruz METRO data, it was estimated that 7% of riders are low-income. It was also assumed that 20% of riders will purchase a weekday commuter pass or weekend day pass.

Table 10.16 Potential Annual Farebox Revenue

Fare Type	Weekday Ridership (in boardings)	Weekend Ridership (in boardings)	Annual Ridership (in boardings)	Annual Farebox Revenue
Opening Year (2035)	2.5K – 3.3K	1.1K – 2.1K	750K – 1,100K	\$2.8M – \$3.7M
Future Year (2045)	4.2K – 5.4K	2.1K – 3.2K	1,300K – 1,900K	\$5.1M – \$6.4M

Source: Fehr & Peers, 2025

10.15 Potential Additional Strategies for Generating Revenue

In addition to fares, some transit systems have considered other strategies to help support ongoing revenue streams. For example, TriMet's fare policy seeks a financially sustainable system that has a balance of ridership growth and passenger revenue. TriMet's *Strategic Financial Plan* will grow and maintain revenues by expanding service, increasing fares every four years, leverage electronic fare collection to reduce costs, and improve efficient fare enforcements.

DC Metro's all-day service model is improving revenue. Metro is expanding service and boosting frequency for longer hours during weekdays and weekends. Metro's fare policy in FY25 is to increase fares by 12.5% and reduce fare evasion with investment in new fare gates and increased enforcement.

Caltrain has supported transit-oriented development (TOD) efforts by leasing real estate for commercial, retail, solar, cell towers, or electric vehicle charging infrastructure as a revenue source. Caltrain's Go Pass is a deeply discounted annual unlimited pass for companies and students. It is intended to increase ridership and fare revenue.

Southeastern Pennsylvania Transportation Authority (SEPTA) offers exterior advertising and advertising at stations through wraps, banners, digital displays, among others. SEPTA will increase fares by 21.5% in September 2025. Additionally, SEPTA has reinstated parking fees and leased property through TOD. The TOD strategy would be less realistic for the ZEPRT corridor because it would be determined by local jurisdictions rather than the transit agency.

Potential general revenue maximizing strategies that can be considered during development of the ZEPRT Project are summarized in Table 10.17 below.

Table 10.17 Potential General Revenue Strategies

Revenue Strategies	Systems Used/Considered
Electronic Fare Collection	TriMet
All-Day Service Model	DC Metro
Transit-Oriented Development (TOD)	Caltrain, SEPTA
Advertising	SEPTA
Fare Enforcement	TriMet, DC Metro

Source: Fehr & Peers, 2025

10.16 Key Conclusions of Conceptual ZEPRT Fare Revenue Forecast Results

Fare structures are an important element to the development of a passenger or commuter rail system. With many different types of fare structures, each with their own benefits, detailed analysis of ridership and population data, and innovative strategies are necessary to create the most beneficial fare structure for all parties involved.

Key conclusions include:

- The unique context and demographics along the SCBRL and the proposed ZEPRT service provides opportunities for student fares and peak time pricing for heavy tourism seasons.
- Forecasted annual farebox revenue for the ZEPRT service ranges from \$2.8 million to \$3.7 million in the opening year (2035) and increases to \$5.1 million to \$6.4 million by the future year (2045).
- Innovative strategies for generating revenue could consider variable fares, advertisement, and support for TOD around planned ZEPRT station areas.

11.0 Conceptual Rail Vehicle Technology and Performance Requirements

The SCCRTC is evaluating the implementation of a new commuter-style passenger rail service on the SCBRL corridor between Pajaro and Natural Bridges Drive in Santa Cruz for the ZEPRT Project. Several vehicle design and rolling stock options are under consideration for the ZEPRT with the main goal of utilizing zero-emission technology to provide this service. An initial decision point for SCCRTC service is the selection of the most suitable vehicle type, which includes Locomotive-Hauled trains, Multiple-Unit (MU) trainset, and possibly Light Rail Vehicle (LRV) trainset. This choice will not only impact, but also be influenced by, other design decisions made throughout the SCBRL corridor design process for ZEPRT implementation, such as station platforms, signaling, and track layout.

11.1 Summary of Passenger Rail Vehicle Types

Passenger vehicle types available and considered for implementation in the U.S. market in general and for potential use on the ZEPRT service between Pajaro and Santa Cruz in particular are identified and described in the sections that follow.

11.1.1 Locomotive-Hauled Trains

Locomotive-hauled trains make up the bulk of mainline passenger equipment in North America. These trains feature a locomotive at one or both ends of the train that pull or push several passenger rail coaches. The large variety of designs available in the current market allows for a wide variety of applications, from high-capacity commuter to high-comfort long-distance services. An example of a conventional Locomotive-Hauled Train — on Caltrain at South San Francisco, California — is presented in Figure 11.1 below.

Figure 11.1 Conventional Locomotive-Hauled Train on Caltrain



Source: [Wikimedia Commons](#)



Conventional locomotive-hauled trains are Federal Railroad Administration (FRA) compliant and consist of individual pieces of equipment that can be coupled and uncoupled as desired to make trains of any length to accommodate capacity and performance needs. This operation is typically performed in a rail yard, as most North American equipment is fitted with manually operated couplers that must be operated by yard personnel. Furthermore, all electrical and air connections between each piece of equipment must be made manually.

The couplers on each piece of equipment in a locomotive hauled train are a standard Association of American Railroads (AAR) design which permits connection to any other piece of equipment that is fitted with the same coupler design. As a result, some operators often mix different types of rail cars and locomotives in a single train. To accommodate this capability, rail cars and locomotives must be designed to a common standard to ensure proper clearances between rail cars and locomotives when traveling through curves and switches.

There are two main applications of locomotive-hauled passenger rail equipment in North America. The most common is in high-capacity commuter rail service. A locomotive-hauled train can accommodate 1,000 or more seated passengers per train when using double-deck coaches that are configured for high passenger density travel. Commuter rail operators might run trains with a dozen or more trailing coaches during peak service and then downsize the consist to as few as two or three coaches for off-peak service. Station spacing on lines with this type of service and equipment are often greater than those for other train types.

Another application for this technology is long-distance service. The flexibility that is available in locomotive-hauled trains permits operators to offer a wide range of amenities onboard these trains, including premium seating cars, restaurant facilities, and sleeper cars. Both the range and the load hauling capability of a locomotive can only be matched by a multiple unit train on a fully electrified rail line.

Because of their weight and power requirements to provide high capacity and/or high-speed service, locomotives are generally powered using either diesel engines or overhead electrical catenary power. There are currently ongoing trials of both battery and hydrogen powered locomotives, but neither of these two propulsion systems can currently achieve the level of performance that would be required for effective commuter or long-distance passenger service.

The primary issue with the zero-emission locomotive designs is the tradeoffs required to provide adequate range for this equipment to provide effective passenger service. Zero-emission locomotives currently have a relatively short range, approximately 200 miles, before needing to be recharged or refueled. Due to the large amount of energy required to power a locomotive, fueling or charging requires over an hour, which is impractical in many passenger service operations. The addition of power storage in sufficient quantities to provide additional range has a considerable impact on the locomotive weight and may require the addition of power tenders, which increases the overall length of the train. For this reason, it is unlikely that zero-emission locomotives can be implemented in passenger service in the near future without requiring some compromises in overall train capacity.

11.1.2 Multiple-Unit Trainsets

A typical MU trainset will consist of at least two, but as many as five or six, permanently coupled sections or rail cars that form a single operating unit with no separate locomotive required to move the trainset. MU trainsets are capable of bi-directional travel and have full operator cabs at each end of the train. Since the individual rail cars that make up a trainset cannot be operated as independent units, some systems, like air compressors, auxiliary electrical equipment, and propulsion inverters, may be shared by two or more cars in the consist. They can also be powered via diesel engine, overhead catenary, or a zero-emission onboard energy source, such as hydrogen fuel cells or batteries. An example of a typical Multiple-Unit Trainset — on TEXRail at Fort Worth, Texas — is presented in Figure 11.2 below.

Figure 11.2 Typical Multiple-Unit Trainset on TEXRail



Source: HDR

MUs feature propulsion equipment distributed throughout the trainset. Unlike a traditional locomotive, which typically has four, or sometimes six powered axles, MU equipment might have eight or more axles that are available to drive the train. This can yield improved acceleration and deceleration performance for the MUs over that of traditional locomotive-hauled trains if the vehicle is optimized for line performance, which can reduce travel times between closely spaced stations or if multiple speed changes are required during a trip. Another advantage of this approach is a reduction in train weight, and thus its energy consumption, as locomotives are heavier than the distributed propulsion equipment on a MU. Thanks to multiple propulsion units on a MU, the availability of a trainset is also improved as the failure of one propulsion unit will not prevent the train from completing its run, albeit with possibly reduced performance. Redundancy of other critical systems, such as auxiliary electric and air, is also a feature of most MU designs.

Many MU operators couple two or more multicar units to form longer trains during peak demand times and run shorter consists during off-hours. Most modern MUs feature automated couplers at the ends of each MU. These allow trains to be coupled and uncoupled in seconds without assistance from personnel outside of the train. Some operators use multi-MU consists and divide them at some point on their route to serve different end destinations along branch lines that connect to the mainline.

In general, MU trainsets tend to be used in applications with lower to medium ridership over short to moderate distance routes. Locomotive-hauled trains become more efficient than MUs if more than approximately 400 passengers will need to be accommodated in a single trainset. The reason for this is two-fold. First, longer consists require more power to move and, at that threshold, a single large prime mover begins to burn less fuel per trailing ton than multiple smaller distributed engines. Also, with the addition of more propulsion equipment to the longer consist, the cost to maintain and reliability of the equipment is better for a single locomotive. The addition of amenities, such as a lounge car or additional lavatory compartments that would be necessary to support longer routes would also negatively impact the power consumption of an MU as the weight of the MU would increase and passenger seats would be lost.

There has been considerable growth in the zero-emission MU market over the last five years with all major MU suppliers in the U.S. and European market now offering some type of zero-emission MU solution. Because of their overall lower energy requirements than locomotive-hauled trains, MUs require considerably less onboard energy to provide the desired range for most passenger operators. A zero-emission MU, whether battery or hydrogen powered, can offer several hundred miles of range without the need to recharge or refuel. Hydrogen powered trains typically have longer unrefueled range than battery trains but, due to their lower power needs, battery powered MUs can receive a short top-off charge during end-of-line dwells, which would permit full-day operation without needing extended battery charging.

11.1.3 Light Rail Vehicles

LRVs have been widely used in urban environments for decades. Modern vehicles offer aesthetically attractive design combined with operational flexibility that permits the construction of vehicles in many different lengths, from 80 feet to 250 feet or more, to meet service capacity requirements.

In the vast majority of applications, LRVs serve short routes with a typical length of 20 miles or less and with frequent stations along the line. Many LRVs can reach a top speed of approximately 60 miles per hour, but few systems can support these speeds for long periods of time due to the relatively short distances between stations that do not permit such speeds to be achieved.

Most LRVs are designed with maximum passenger density in mind, which favors increased floor space for standees at the cost of passenger seats. In most cases, passengers travel only a few stops along the service line and typically do not require a seat for their journey as they do not spend a long period of time aboard the train. LRVs also feature multiple doorways on each side of the train, often closely spaced together, to facilitate efficient boarding and disembarking of passengers. An example of a typical Light Rail Vehicle — on TriMet at Portland, Oregon — is presented in Figure 11.3 below.

Figure 11.3 Typical Light Rail Vehicle at TriMet



Source: Wikimedia Commons

To permit operation in street and cityscape environments, LRVs utilize lightweight construction, which reduces the load bearing requirements for track and structures along LRV lines. The structural design of LRVs ensures passenger safety only in low-speed collisions with road traffic or with similar vehicles. They are not designed to operate in a mainline environment where freight or heavy rail traffic might operate.

There are several disadvantages to the LRV design that would be particularly impactful in their potential application on the SCBRL for the ZEPRT service, and principally, the requirement for overhead catenary along the majority of the route. Many LRV designs today are capable of off-wire operation with batteries. However, due to weight and space limitations, these vehicles can typically only travel a few miles off-wire before needing to return to an electrified section of track to get traction power and to recharge their batteries. This could be feasible in the downtown area of Santa Cruz, for example, but would not be feasible along the majority of SCBRL corridor between Pajaro and Santa Cruz. Overhead catenary is expensive to construct and maintain and requires power distribution infrastructure along the right-of-way to supply power to the train. It is highly likely that the infrastructure required for overhead catenary could not be placed outside of the required railroad clearance envelope and would therefore preclude the operation of freight rail traffic on the SCBRL corridor.

The route profile of the SCBRL corridor also does not favor an LRV application. The 22-mile length of the proposed line is at the upper limit of what LRV vehicles typically serve. The main reason for this is passenger comfort. As discussed previously, a typical LRV layout minimizes the number of seats available in favor of floor area for standees. While the interior design could be optimized to provide maximum seating



space, the small physical size of the LRV vehicles, combined with many doorway and articulation areas in the vehicle where seats could not be placed, would diminish the number of seats that could effectively be fitted inside an LRV. The somewhat-cramped environment in a maximum seating configuration, combined with a general vehicle design that does not prioritize noise attenuation, would not create a comfortable environment for travelers who would ride this train for an extended period.

From a regulatory perspective, LRVs also pose a considerable challenge. The FRA currently does not permit mixing (comingling) traffic that meets FRA crashworthiness requirements with traffic that does not. Locomotive-hauled trains and most modern MUs do meet those requirements and can operate without restrictions on lines shared with other passenger train equipment types and freight rail traffic. LRVs do not meet those requirements and cannot be modified to do so. As a result, any operation of LRVs on the SCBRL corridor would require strict physical separation from other rail traffic. Temporal separation of traffic would be possible, but that would restrict the operation of these trains and freight traffic to certain well predefined and fixed windows of operation. This would also severely restrict the ability to expand ZEPRT service beyond the current alignment or to use station platforms that are shared with other passenger traffic.

From a statewide transportation planning perspective, the 2024 *California State Rail Plan* envisions intercity passenger rail to Santa Cruz in the future, which would require interlining over the SCBRL corridor hosting the ZEPRT service between Pajaro and Santa Cruz and the operation of FRA-compliant passenger rail equipment that is capable of operating in the shared-use environment. Therefore, any passenger rail equipment operated for the ZEPRT service would also need to be FRA compliant to comeingle with the planned intercity passenger rail trains.

Furthermore, the SCCRTC Commission decided on March 20, 2025, that the ZEPRT Project should align with the planned passenger rail service vision identified in the 2024 *California State Rail Plan* by pursuing intercity passenger rail on the SCBRL as part of the ZEPRT Project in order to maximize future opportunities for federal and state funding and technical support.

Therefore, the disadvantages of LRV design and the regulatory challenges associated with LRV operations in a comingled, shared-use environment are significant when considering their use on the SCBRL corridor. For this reason, LRVs will not be considered as a viable option for the ZEPRT service on the SCBRL corridor between Pajaro and Santa Cruz.

11.2 Rolling Stock Design Attributes

11.2.1 Vehicle Strength

One of the main differentiators between different rolling stock types is the structural requirements that govern each vehicle classification. In the U.S., heavy rail mainline trains must meet FRA requirements for 49 CFR Part 238, while subway trains must meet less stringent RT-2 requirements and light rail vehicles even less stringent RT-1 requirements. The difference in crashworthiness requirements is mainly due to the mass of the vehicles that could be involved in an accident. Larger and heavier rail vehicles need a stronger car shell structure and more robust crashworthiness elements to protect occupants in the event of a crash than lighter trains. For this reason, lighter trains like LRVs are physically incompatible with heavier mainline passenger and freight rail traffic. In the event of a crash between an LRV and a mainline train, the LRV simply could not withstand the impact forces that would result from a collision with a much heavier mainline train.

For most of the 20th century, FRA crashworthiness requirements mandated a single path to achieving compliant crashworthy train design. These requirements excluded many European MU mainline trains from being able to achieve compliant crashworthy design. In 2019 the FRA amended its regulations to allow an alternative approach to meeting crashworthiness standards, which now mirrors the approach used in Europe to design mainline trains. This change, and related adaptations to European compliant trains to make them meet U.S. crashworthiness standards, has opened the U.S. market to many more modern and more efficient train designs that were not permitted under the legacy regulations. Through the alternative crashworthiness design, the modern MU train can absorb the energy produced in a collision with a legacy mainline train or another modern MU train.

11.2.2 Vehicle Amenities

Modern trains offer extensive options for customization of vehicle systems and other equipment to provide tailored customer experience. Most rail vehicle manufacturers have migrated to a highly customizable vehicle platform design approach, where they are able to offer the same basic vehicle design to multiple clients to serve varied client needs. As a result, many different amenities can be built into any given vehicles design based on customer requirements. A good example of this approach is the Stadler FLIRT platform that has been sold to several clients in the U.S. The basic FLIRT design can be built as a diesel-powered MU, a battery powered MU, or a Hydrogen powered MU. In Europe, FLIRT vehicles also operate as EMUs using overhead electric catenary. In the U.S. market, the TEXRail, DART Silver Line and San Bernardino County Transportation Authority (SBCTA) FLIRTs were built as higher density commuter rail trains, offering more seating space for shorter journeys. The Caltrans FLIRTs will be built for longer journeys and will feature more comfortable seats with a larger seat pitch at the cost of passenger capacity. Those trains will also feature onboard ADA accessible washroom facilities and limited food service facilities.

Other amenities that can be offered in most train designs include advanced passenger information systems with infotainment options and passenger counting systems. Other increasingly popular features are a wide variety of bicycle storage designs to accommodate varying number of bicycle users for each application. In applications that serve major transportation hubs, such as airports or intercity train stations, luggage racks are another popular feature.

11.3 Rolling Stock Relative Advantages and Disadvantages

The relative advantages and disadvantages of Locomotive-Hauled Trains, Multiple-Unit Trains, and Light Rail Vehicles, and are summarized in Table 11.1 below.

Table 11.1 Relative Advantages and Disadvantages by Rolling Stock Type

	Locomotive-Hauled (LH) Trains	Multiple-Unit (MU) Trains	Light Rail Vehicles (LRV)
Advantages	Long Range	Lighter weight/axle loads	Light axle loads
	High load/passenger capacity	Higher braking and acceleration performance	High braking and acceleration performance
	Ease of reconfigurability (add/remove coaches)	Better passenger space efficiency; lower operating costs	Can negotiate tighter turns
	Robust second-hand market	Ease of conversion to zero emissions	Multiple supplier options available
Disadvantages	High fuel/energy consumption	Lower passenger capacity	Not interoperable with freight traffic, unless there is some form of positive separation
	High weight/axle loads	More limited consist flexibility than LH trains	Limited off-wire range, passenger capacity
	Poor acceleration/deceleration performance		Limited power options (catenary)
	Limited zero-emission conversion options		High cost per seat

In addition to the attributes of each type of rolling stock, several other factors significantly influence vehicle design decisions, including line length, station stop profiles (such as number and distance between stops), top speed, travel times, passenger capacity, track class/type, interoperability with FRA traffic including freight rail and other passenger rail operations (i.e., conventional intercity trains), bridge/civil loading limits, as well as vehicle clearance restrictions.

Moreover, essential inputs for vehicle design decisions encompass anticipated ridership, expected service frequency, trip time, the number of stations and station spacing, corridor type (whether dedicated or shared), civil track limits (i.e., axle load, curvature, train length, clearance), track type/class, emission requirements, and preferred platform type and height.

11.4 Rolling Stock Market Analysis

To support the rail vehicle type selection for the ZEPRT service proposed to operate on the SCBRL, a market survey of the major rail transit vehicle providers was performed to identify what type of rolling stock was currently available on the market and to identify the base characteristics of each. This section summarizes the major rail transit vehicle manufacturers and their product most applicable to the ZEPRT service envisioned.

11.4.1 Locomotive-Hauled Trains

The shrinking locomotive-hauled train market has reduced manufacturer investment in these products in recent years. Of the global brands, Siemens has the largest footprint with its Charger locomotive line and Venture passenger coaches. Several operators in the U.S. have procured this locomotive and coach combination in recent years, including Caltrans in California, Brightline in Florida, and Illinois Department of Transportation in Illinois. All of these operations feature conventional longer-range intercity service as opposed to shorter-range commuter rail service, however.

Other manufacturers also build both locomotives and rail coaches in the U.S. market. Wabtec and Progress Rail have delivered passenger locomotives in recent years while Alstom has supplied double-deck coaches for commuter rail operations. Due to the design of this equipment, which focuses primarily on high-capacity commuter traffic, these options were removed from further consideration for the ZEPRT Project, as the equipment does not fit the application on the SCBRL alignment.

11.4.2 Multiple-Unit Trains

MU Trains have become the dominant rolling stock in the global market, mainly due to their efficiency. Because many operators are migrating towards more frequent service, the capacity of the MU train is very suitable to meet these service requirements.

The U.S. is behind in this trend. The main reason for that is legacy crashworthiness regulations, which made it difficult to build an efficient MU train. That, combined with the incompatibility of these requirements with many of the major suppliers' existing products, has resulted in few multiple units being delivered in the U.S. market. A change in the crashworthiness regulations in 2019 has brought U.S. crashworthiness requirements much closer to those currently used in Europe. As a result, European rail vehicles can now be deployed in the U.S. market with only modest modifications to their existing design, in many instances.

To date, only Stadler has brought their multiple-unit products to the U.S. market. Other suppliers have indicated that they could also bring their European multiple units to the U.S. market but have not done so as of early 2025.

All of the major manufacturers use a platform approach for the multiple-unit product, where the same vehicle design can be built in many different lengths to accommodate passenger capacity needs. These vehicles can also be fitted with different propulsion systems, from diesel, through electric catenary power, to zero-emission onboard propulsion via battery or hydrogen power. The basic train design remains the same regardless of the power system employed.

11.4.3 Product Lines and Vehicle Characteristics for Major Rolling Stock Suppliers

The product lines and vehicle characteristics for the major rolling stock suppliers in the U.S. passenger rail equipment market as of early 2025 are summarized in Table 11.2 below.

Table 11.2 Vehicle Characteristics for Major Rolling Stock Suppliers in U.S. Market

	Multiple-Unit Trains					Locomotives
Make	Alstom	Alstom	Siemens	Stadler	Stadler	Siemens
Model	iLint	Coradia Continental	Mireo Plus H, Mireo Plus B	SBTA FLIRT H2, BATTERY	Caltrans KISS Battery	Charger
Propulsion Technology	Hydrogen Fuel Cell	Battery	Hydrogen Fuel Cell or Battery	Hydrogen Fuel Cell or Battery	Battery	Battery
Length over Couplers for 2-Car MU	177 feet-10 inches	183 feet-8 inches	152 feet-9 inches	168 feet-11 inches	348 feet-4 inches (4 car)	71 feet-10 inches (1 loco)
Width over Bodyside	9 feet	9 feet-7 inches	9 feet-2.6 inches – 9 feet-10.1 inches	9 feet-5 inches	9 feet-10 inches	10 feet-2 inches
Height	14 feet-1 inch	14 feet	13 feet-10 inches	14 feet	15 feet- 10.5 inches	14 feet-7 inches
Passenger Capacity, Seated (including tip-ups)	150	150	120	116 79 mph Yes Yes (alternative compliance, Appendix G)	403	N/A (54-74 per Venture Coach)
Maximum Speed	87 mph	100 mph	87 mph		110 mph	125 mph
Current U.S. Projects	No	No	No		Yes	N/A
FRA 49 CFR 238 Tier 1 Structural Compliance	No - (EN-15227)	No - (EN-15227)	No - (EN-15227)		Yes (alternative compliance, Appendix G)	Yes
Current Procurement	Frankfurt RMV (Germany)	Verkehrsverbund Mittelsachsen (Germany)	Stuttgart SFBW (Germany), Berlin NEB, Hessische Landesbahn (Germany)	SBCTA, Caltrans, University of Utah	Caltrain	None
Production Location	Germany	Germany	Germany	U.S. (Utah)	U.S. (Utah)	U.S. (California)

11.5 Planning Level ZEPRT Vehicle Type and Standard Consist

The following criteria were considered during a conceptual assessment conducted to identify a potential vehicle type and standard train consist to support on-going planning for the ZEPRT passenger rail service between Pajaro and Santa Cruz:

- Best option for a safe, reliable, and time-competitive passenger rail service.
- Ability to accommodate forecasted ridership demand for a daily passenger service operating on 30-minute headways between 6 a.m. and 10 p.m. over a 22-mile, single-track segment of the SCBRL with nine stations.
- Applicability of the equipment to the characteristics of the proposed ZEPRT rail alignment and vertical and horizontal profile within or immediately adjacent to the SCBRL right-of-way.
- Interface with the multimodal transportation network and the potential need to comingle with freight rail operations, if those are not temporally separated.
- Industry best practices and regulations for implementation of a new passenger rail service in the U.S. and California.
- Availability of rolling stock types available in the U.S. market, as of early 2025.
- Input from stakeholders and the public during advancement of the ZEPRT Project related to mobility, accessibility, connectivity, functionality, and amenities needs for a zero-emission passenger rail service in Santa Cruz County.

Based on this conceptual assessment, the zero-emissions multiple-unit (ZEMU) Stadler FLIRT H2 hydrogen/battery powered trainset that complies with FRA vehicle strength requirements was selected for further analysis. An example Stadler FLIRT trainset — used on SBCTA Arrow service in San Bernardino, California — is shown in Figure 11.4 below.

Figure 11.4 Example Stadler FLIRT ZEMU Trainset



Source: SCCRTC

The general physical, technical, and operating characteristics of the Stadler FLIRT developed for the North American market, and assumed to be identical to the Stadler FLIRT H2 trainsets procured by SBCTA, were used in the planning for the ZEPRT Project includes the following¹⁰:

- **Standard Consist:** Stadler FLIRT H2 hydrogen/battery powered trainset with two passenger cars and a power unit (note that there is the potential to couple two of these trainsets together to operate longer trains to accommodate additional passenger demand for a total length of 338 feet)
- **Length:** 168 feet, 11 inches
- **Horsepower:** 938
- **Maximum Operating Speed:** 79 miles per hour
- **Range:** At least 286 miles
- **Refueling Time:** Up to 30 minutes
- **Passenger Capacity:** 116 seated plus 12 folding seats and 120 standing
- **Floor Height at Car Entrances:** 24 inches above top of rail
- **Station Platform Interface:** Level-boarding and fully ADA compliant

The actual passenger rail equipment type, number and configuration of cars, and means of propulsion will be confirmed through stakeholder coordination and operations planning during advancement of the ZEPRT Project.

12.0 Conceptual Passenger and Freight Rail Interface Assessment

The approximately 22 miles of the SCBRL between Pajaro and Natural Bridges Drive in Santa Cruz is currently operated as a shared-use freight and passenger railroad. Portions of the SCBRL in Pajaro and Watsonville see regular freight service, while a short segment in Santa Cruz sees regular recreational passenger rail service to the Beach Boardwalk. The SCBRL is a federally designated common carrier rail line, a classification which offers both rights and obligations, and a designation which cannot be unilaterally changed by the owner of the rail line, SCCRTC. Beyond the common carrier obligation, there are other regulatory implications of a mixed freight and passenger operation which affect design choices for development of the ZEPRT Project. This chapter describes the regulatory background and highlights several of the key requirements which the SCCRTC would need to comply with to develop and implement the ZEPRT Project.

12.1 Background

SCCRTC acquired the SCBRL from UP in 2012. At that time and continuing to the present, most of the line, except for a short section in central Santa Cruz used by the SCBG, had been used only for freight service. The last regularly scheduled passenger trains to operate on the SCBRL were in 1959. Freight trains continued to operate regularly to serve local customers and the cement plant at Davenport. Upon closure of the cement plant in 2009, freight customers along the western portion of the SCBRL were served on an as-needed basis.

Today, SPP is the designated operator of the SCBRL for the SCCRTC, and SCBG provides freight service to local customers in the area around Pajaro and Watsonville (from approximately SCBRL Milepost 0.4 to Milepost 3.0) under a third-party agreement with SPP. SCBG's current recreational passenger service, the Beach Train, has since 1987 connected the Santa Cruz Beach Boardwalk and Felton using a short section of the SCBRL main track from the Santa Cruz Boardwalk (approximately SCBRL Milepost 19.5), along Beach Street, to the Santa Cruz Wye (approximately SCBRL Milepost 20.4), where SCBG's rail line diverges north towards Felton.

In addition, there have been limited instances of short-duration demonstration passenger service along SCBRL. For example, in 1996 there were several round trips of Amtrak or Caltrain passenger trains to demonstrate the concept of returning passenger service to Santa Cruz via the SCBRL. In the 2012 timeframe, Iowa Pacific Railroad (IP) operated an occasional recreational rail service, such as its Train to Christmas Town. SCCRTC hosted a demonstration of the Futura trolley service in 2021 over a short section of the SCBRL in Santa Cruz. Each of these examples operated for only a few days or weeks.

More recently, the 2024 *California State Rail Plan* identifies a proposed passenger service along the SCBRL to be integrated with hourly service connecting Salinas, San Francisco Bay Area, Sacramento, and Roseville. This would be accomplished by a cross-platform connection for a planned multimodal station at Pajaro.

In addition, the 2024 *California State Rail Plan* long-term vision identifies hourly intraregional passenger service between Santa Cruz and Monterey via Pajaro and Castroville. This service would be an interline

service, one that allows passengers to remain on the same train for their entire trip over multiple rail lines, including the SCBRL, UP, and TAMC-owned Monterey Branch. Such a service would operate over the UP Coast Subdivision main line between Pajaro and Castroville to connect passenger service on the Santa Cruz and Monterey branch lines. Operation over the UP would necessitate vehicles that comply with federal and UP requirements for operation in the mixed freight and passenger environment.

With this background, the ZEPRT Project made the baseline assumption that improvements to the SCBRL would need to accommodate both regular passenger operations as well as freight operations. Thus, the infrastructure proposed for the ZEPRT Project will need to accommodate both freight and passenger equipment.

12.2 Regulatory and Design Framework

Multiple entities have promulgated regulations and design codes that affect freight and passenger railroads and that inform the proposed ZEPRT Project infrastructure. Examples of several key regulations and codes include:

- Surface Transportation Board's (STB) common carrier obligation
- Title 49 of the Code of Federal Regulations (49 CFR) Subtitle A, Office of the Secretary of Transportation, and Subtitle B, FRA
- GOs promulgated by the CPUC
- ADA
- California Title 24 Building Standard Code
- Federal, state, and local regulations and codes relating to roadway and pathway design, such as the CA MUTCD as adopted by the State of California
- The American Railway Engineering and Maintenance of Way Association (AREMA) Manual of Railway Engineering (MRE), while not having regulatory effect, does guide the design of railroads used for both freight and passenger operation
- Caltrans, county, and city roadway standards

These regulations and codes are a baseline that shapes the ZEPRT Project infrastructure, and they have been supplemented with standard plans and practices from other agencies across California, as well as recent rail project experience in California. For example, several agencies in California operate passenger rail service on lines shared with freight trains and have made their standards available, including Caltrain, the Southern California Regional Rail Association (SCRRA) and North County Transit District (NCTD), which have been used as a reference for the ZEPRT Project. Note that many of these regulations would apply regardless of whether freight trains operate on the full extent of the SCBRL or only portions of the SCBRL. These regulations would be effective because the passenger trains on the SCBRL comply with FRA requirements for vehicle strength.

Also note that the existing freight service and existing SCBG passenger service operating on the SCBRL would both be reasons for adhering to the standards applicable to the general rail system of transportation (as described by the FRA) and also to CPUC requirements applicable to railroads. Moreover, many regulations would still be applicable, such as the ADA, the related CFRs, and AREMA's recommended practices, so the infrastructure in a scenario with no freight trains would be largely the same as the

scenario contemplated for the ZEPRT Project, where freight trains and FRA-compliant passenger trains operate.

Many of the aforementioned regulations and codes relate to clearances between the track and fixed objects. For example, the AREMA MRE identifies minimum clearances for railroad structures, while CPUC GO 26-D identifies minimum clearances established by the State of California for most situations found along the right-of-way. There are three situations that arise frequently: clearances on tangent (straight), curved track, and at passenger station platforms.

12.2.1 Surface Transportation Board

The SCBRL was originally, and remains, a common carrier railroad engaged in interstate commerce. In general terms, a common carrier provides transportation under commercially reasonable terms to an entity making a reasonable request for transportation. The STB is the final arbiter of what terms are reasonable.

The STB was originally established by the Interstate Commerce Commission Termination Act of 1995. Unlike the FRA and CPUC, both discussed below, the STB's enabling legislation does not directly affect railroad infrastructure in the form of prescriptive regulations. However, the STB's procedural framework and statutory authority to regulate commercial matters, including the durability of the obligations and rights of common carriers, do affect the SCBRL.

There is a complex legal framework that describes common carrier rights and obligations, though the legal details are beyond the scope of this conceptual passenger and freight rail interface assessment for the ZEPRT Project. However, if a railroad desired to terminate the common carrier obligation, the railroad must make a formal request and receive permission from the STB. Abandoning a common carrier obligation also generally requires agreement from the entity holding that obligation. In this case it is understood that the common carrier obligation is currently held by the SPP. In other words, the railroad cannot simply be removed without permission from STB. Thus, it was assumed that freight service would be preserved and the ZEPRT Project would be implemented in a way that accommodates both freight and passenger operations.

12.2.2 Federal Railroad Administration

At the federal level, the FRA has promulgated safety standards covering a wide range of rail topics that are applicable to what the FRA describes as the general railroad system of transportation. While FRA has the authority to regulate any transportation system operating on rails, in practice, FRA applies its authority to any railroad that is or could readily be connected to the national network, as well as those railroads that operate trains that comply with the FRA's vehicle strength requirements. In general, these federal regulations supersede conflicting state and local regulations. The FRA's regulations are described in Title 49 CFR Subtitle B Chapter II. Of the over 50 parts within Chapter II, here are a few examples of those that affect the proposed ZEPRT Project infrastructure:

- Part 37 Transportation Services for Individuals with Disabilities, which establishes requirements for accessibility at stations and in vehicle design.

- Part 38 Americans with Disabilities Act Accessibility Specifications for Transportation Vehicles, which identifies vehicle criteria related to accessibility.
- Part 213 Track Safety Standards, which among other parameters, defines the manner in which train speeds are established.
- Part 236 Rules, Standard, and Instructions Governing the Installation, Inspection, Maintenance, and Repair of Signal and Train Control Systems, Devices, and Appliances which informs the design of train control systems and outlines the requirements for PTC.
- Part 238 Passenger Equipment Safety Standards, which informs the design of passenger equipment and identifies the circumstances under which the FRA may consider waivers from this part, which further informs the potential for temporal separation.

Most FRA regulations are not prescriptive in nature; rather, infrastructure designs typically must be developed in a way that the performance criteria can be achieved and maintained. For example, in the case of the Passenger Equipment Safety Standards, for example, the possibility of temporal separation waivers implies different track configurations may be necessary to achieve the separation of qualified and non-qualified equipment. Similarly, the requirements for PTC provide the option for multiple different technical systems, but nonetheless guide the operation of a railway which, in turn, informs the infrastructure. Brief summaries of these regulations are included in the following sections.

Americans with Disabilities Act (49 CFR Parts 37 and 38)

The Americans with Disabilities Act regulates, among other accessibility issues, the maximum gap between a station platform and the door threshold on a passenger car. The 49 CFR Part 38 Articles 93(d)(1) and 113(d)(1), related to commuter rail systems and intercity passenger rail systems, respectively, state that: "... the horizontal gap between a car at rest and the platform shall be no greater than 3 inches and the height of the car floor shall be within plus or minus 5/8 inch of the platform height." This is also identified in 49 CFR Part 37.42. There are exceptions, however, and these must be handled on a case-by-case basis and typically require the use of car-born or platform-mounted ramps, lifts, or bridge plates. In general, access must be provided in the most integrated manner possible, and for a new facility constructed within right-of-way owned by a public agency, the expectation would be for the platform surface to be coordinated to match the height of the vehicles.

Track Safety Standards (49 CFR Part 213)

The FRA's track safety standards identify the minimum safe geometric tolerances for constructing and maintaining railroad track. In particular, 49 CFR Part 213 sets out the approach to determining the maximum allowable speed on curves. This information was used during development of the ZEPRT Project to both assess track geometry during the conceptual design work and to establish travel times for the rail operational modeling associated with the ZEPRT service. Part 213 also identifies the minimum inspection requirements and limits when the SCBRL is in operation, including requirements for regular inspections, geometry testing, and rail testing.

Positive Train Control (49 CFR Part 236)

One of the key provisions of 49 CFR Part 236 is the requirement for PTC. The requirements for PTC are extensive, but in summary, PTC is a system that enforces compliance with wayside signals and speed restrictions. For example, PTC would both prevent a train from passing a stop signal and would also

enforce speed reductions where track geometry (or other conditions) required a train to slow down. PTC systems are complex, comprising wayside infrastructure, equipment on the railcars themselves, and associated data links. Data transmission between field assets usually relies on dedicated fiber optic links, with the most obvious effect on the physical footprint being the additional space required for a duct bank or buried cables, and associated access points, extending the length of the right-of-way.

Passenger Equipment Safety Standards (19 CFR Part 238)

The passenger equipment safety standards establish design criteria and strength requirements for passenger rail equipment operating in a mixed freight and passenger environment. Details of these standards and implications for railcar design are addressed in Section 11.2.1, Vehicle Strength.

12.2.3 California Public Utilities Commission

The CPUC is a state regulatory agency that not only promulgates its own regulations affecting public utilities, including railroads, but also has the ability to enforce regulations promulgated by the FRA. The CPUC's regulations are called GOs. While the GOs are targets at all types of public utilities, including public transit operators, gas utilities, and electric utilities, there are several that are targeted specifically at railroads. A few examples of those that affect the proposed ZEPRT Project infrastructure include:

- GO26-D, which establishes minimum clearances.
- GO75-D, which governs warning devices at grade crossings.
- GO88-B, which governs altering public highway-rail crossings.
- GO118-A, which establishes the requirements for walkways adjacent to the track.

GO 26-D Clearances

CPUC GO26-D is the most applicable and may have the widest reaching implications for the ZEPRT Project. GO26-D establishes minimum horizontal and vertical clearances for railroads in a wide range of situations. It was originally adopted in 1948, when railcars and locomotives were substantially smaller than modern railcars and locomotives, and it has been revised several times since then, most recently in 1981, though references to 1940s and 1950s vintage rail facilities remain.

GO26-D identifies 8 feet-6 inches as the minimum clearance to most obstructions on tangent (straight) track, measured perpendicularly from the centerline of the track to the obstruction. There are several exceptions for specific types of structures or obstructions, which are discussed below. To put that distance in context, CPUC GO26-D limits the width of railcars (unless they are specially placarded) to 10 feet-10 inches, meaning that such a railcar would extend 5 feet-5 inches to each side of the track centerline. However, subtracting the maximum railcar width from the minimum clearance leaves 3 feet-1 inch of clearance between the railcar and an obstruction. Modern railcars generally comply with these dimensions, and many passenger railcars are indeed narrower, often on the order of approximately 10 feet-4 inches wide overall. A passenger railcar 10 feet-4 inches wide would leave 3 feet-4 inches of clearance between the railcar and the obstruction.

CPUC does not provide an official or formal discussion of the origin of the 8 feet-6 inches clearance. While not explained in GO26-D, people in the industry have sometimes referred to this as the clearance needed

for a railroad employee to walk beside a railcar, or to ride on the ladders mounted on the sides of railcar during switching operations.

For curved track, GO26-D requires minimum clearances be increased by 1 foot, to 9 feet-6 inches from centerline of track to an obstruction, to allow for overhang of railcars to the inside and outside of curves. While traversing a curve, the body of a railcar follows a chord on the inside of the track between their truck centers, while the ends of a railcar project out beyond the track, on the outside of curves.

GO26-D also affects the design of passenger rail station platforms. Specifically, the CPUC minimum clearance for a station platform whose top surface is 8 inches or less above the top of rail is 4 feet-8 inches from the centerline of the track. In practice, the CPUC minimum does not provide sufficient clearance for locomotives, which often have steps that project outward farther than 4 feet-8 inches and so many railroads have adopted a somewhat more restrictive minimum clearance, typically 5 feet-4 inches, from centerline of track to edge of platform. However, any platform that is higher than 8 inches above top of rail must comply with the 8 feet-6 inches minimum clearance.

12.2.3.2 Standards for Warning Devices for At-Grade Highway-Rail Crossings (GO75-D) and Rules for Altering Public Highway-Rail Crossings (GO88-B)

GO75-D identifies the types and applications of warning devices at highway-rail grade crossings. Given the relatively frequent rail traffic anticipated on the SCBRL as part of the ZEPRT Project, it is assumed that highway-rail grade crossings will require active warning devices including flashing light signals and gate arms that activate in advance of train arrival. And as prescribed GO75-D and where required by the CA MUTCD, traffic signals would be interconnected with the railroad warning devices (although, at this conceptual level, such interconnections have not yet been defined for the ZEPRT Project).

In conjunction with GO26-D, GO75-D establishes the type, basic geometry, and layout of warning devices and signage at the grade crossings along the SCBRL. GO88-B outlines the process for identifying those modifications and upgrades at each crossing and receiving CPUC approval prior to implementing the changes.

12.2.4 American Railway Engineering and Maintenance of Way Association's Manual for Railway Engineering

The AREMA MRE, while not a regulation, identifies recommended practices to “guide railways ... in establishing their individual policies and practices...” While the AREMA manual is not a set of standards for use by railroads, it does establish basic criteria which have been incorporated into conceptual design for the ZEPRT Project. The MRE covers a wide range of topics, from track geometry to roadbed to structures to passenger facilities. A few examples of the recommended practices that have been included are the approach to track geometry design, analysis of railroad structures, and selection of structure types and conceptual structural design where new structures are anticipated.

12.3 Regulatory Effects on SCBRL Infrastructure

As noted, the SCBRL is under the jurisdiction of multiple agencies, and their respective regulations shape the proposed infrastructure for the ZEPRT Project. A few key examples are presented in the sections that follow.

12.3.1 Station Platforms

The SCBRL presents a situation where platform height could be coordinated with the vehicles to be used solely on the SCBRL. However, in the event that intercity passenger rail vehicles from an interline service operate on the SCBRL in the future, such as the proposed regional passenger rail service between Santa Cruz and Monterey or the proposed intercity passenger rail service between Santa Cruz and the San Francisco Bay Area, those vehicles may have a different boarding height than the vehicles dedicated to the SCBRL for the ZEPRT service. In that case, the platform height would be set to match the height of the vehicle with the lowest floor, and ramps or lifts would be used to provide access to the railcars with higher floors.

Using current equipment as a guideline, the likely lowest vehicle floor height, based on the current multiple unit and intercity passenger rail fleet in California, would be approximately 15 inches above top of rail. Thus, the platform surface would also be located 15 inches above top of rail. At this elevation, and in fact at any elevation higher than 8 inches above top of rail, a passenger platform would encroach on the 8 feet-6 inches clearance required by CPUC GO26-D. To resolve the conflict in regulatory requirements, transit agencies have typically used a configuration known as a gauntlet track to allow freight trains to pass the passenger platform while still maintaining the minimum 8 feet-6 inches clearance. Gauntlet tracks are a second set of tracks, offset by slightly more than 3 feet from the tracks nearest the platform. Passenger trains operate on the track nearest to the platform, in order to bring the door thresholds close to the platform in compliance with ADA requirements, while freight trains operate on the track farther from the platform to achieve the minimum 8 feet-6 inches clearance required by CPUC. An example gauntlet track at a passenger station with level-boarding platform on a shared-use corridor is shown in Figure 12.1 below.

Figure 12.1 Example Gauntlet Track at a Passenger Station on a Shared-Use Corridor



Source: Google Maps

There have been examples of CPUC allowing waivers for passenger platforms as high as 23.5 inches above top of rail at less than 8 feet-6 inches from the track centerline, though these waivers are considered on a case-by-case basis and are not guaranteed for any specific project. At this conceptual stage of the ZEPRT Project, it has been assumed that waivers may not be available and that gauntlet tracks would be required.

Note that the relatively tight vertical tolerance may limit the amount of wheel wear that could be allowed; while 1 inch of wheel tread wear may be acceptable from a mechanical perspective, this much wheel wear would also lower the elevation of the car floor by 1 inch, which is more than would be acceptable from the perspective of level boarding.

12.3.2 Clearance to Fixed Objects

Clearances to fixed objects, other than station platforms, are also governed by CPUC GO26-D. While station platforms are a special subset covered by GO26-D, the 8 feet-6 inches minimum horizontal clearance is applicable to nearly all other structures. As discussed, the 8 feet-6 inch clearance is a minimum clearance but may not be sufficient clearance in all situations. Freight railroads have generally adopted a 15-foot minimum clearance from the centerline of the track to fixed objects. Passenger rail agencies across California have adopted clearances typically ranging from 12 feet to 12 feet-6 inches. For example, Caltrain has adopted a minimum clearance of 12 feet-6 inches for new structures on their rail line between San Francisco and San Jose, which is used primarily by passenger trains but also hosts freight trains. Conversely, for work on the joint passenger and freight rail lines owed by North County Transit District, the San Diego Association of Governments has adopted a minimum clearance of 12 feet for new construction or design.

At the May 2, 2024, Commission meeting, the SCCRTC adopted 12 feet as the standard minimum clearance from the centerline of the track to a fixed object. When only used for short distances, the SCCRTC adopted an 11-foot variance as the minimum clearance.

Given CPUC's maximum allowable width of 10 feet-10 inches for passenger and freight cars (without special placarding), on tangent track with a railcar at-rest, a 12-foot minimum horizontal clearance would provide approximately 6 feet-7 inches between the side of a railcar to a fixed object. Note that the 6 foot-7 inch space does not account for additional space needed for variations in track geometry, railcar suspension, or the dynamic envelope that is typically added to account for the deflection of railcar suspensions when railcars are in motion.

Examples of fixed objects include structures, such as bridges, retaining walls, and fences; signal equipment, such as wayside and grade crossing signal equipment; poles and signs, elements such as roadway light poles or signage (as at grade crossings); and the rail trail.

12.3.3 Vehicles and Train Operations

The regulatory effects of combined freight and passenger operations on the SCBRL affect vehicle type selection as well as the railroad operating plan. As presented in Section 11, Conceptual Rail Vehicle Technology and Performance Requirements, the regulatory framework established by the FRA sets minimum vehicle strength requirements. So long as passenger vehicles meet the FRA minimum strength requirements (known as FRA-compliant vehicles), no special measures are required, and passenger and

freight operations can comeingle as needed to support the operating plan. If the passenger vehicles do not fully meet the FRA requirements (known as noncompliant vehicles), FRA may consider allowing operation of noncompliant vehicles under a vehicle-specific and location-specific waiver. In such cases, FRA has often conditioned the waiver upon a system of temporal separation whereby noncompliant passenger equipment operates in absolute time blocks during which no other equipment may operate.

An example of a temporal separation scenario for the ZEPRT Project would be for the SCBRL to be used exclusively for noncompliant passenger equipment between the hours of, say, 5 a.m. and 11 p.m. (this includes scheduled revenue passenger train operations between 6 a.m. and 10 p.m. and one-hour blocks before and after these scheduled operations to facilitate the non-revenue deadheading of passenger rail vehicles from terminal stations at Pajaro and Natural Bridges Drive in Santa Cruz from/to a layover and maintenance facility at Watsonville). Only at other times — from 11 p.m. to 5 a.m. — could compliant equipment, including both freight trains as well as the current SCBG recreational trains operate. This could present a challenge for freight customers in the Watsonville area if, for example, a customer needs rail access inside their facilities and a staff member must be present to open security gates, or to direct trains inside the facility. Similarly, this may be challenging for the SCBG recreational Beach Train rail service to the Santa Cruz Beach Boardwalk, which currently operates seasonally and on select days of the week during morning and afternoon hours.

Because each FRA waiver is case-specific, it may be possible to develop specific infrastructure and operating plans to suit the SCBG passenger operations. Although, at this early stage, the SCCRTC has not coordinated with the FRA about potential waivers as part of the ZEPRT Project.

Freight operations in the Pajaro and Watsonville area present different challenges from the temporal separation perspective. Due to the geographically scattered nature of the various rail customers, a freight train would need to traverse long sections of the SCBRL to be used by the ZEPRT service, requiring large blocks of time. It may not be possible to provide physical blocks to such a long segment of track while maintaining passenger schedules. At this early stage, the ZEPRT Project assumed that, even if passenger trains consist of FRA-compliant equipment, freight trains would only have sufficient time to operate in the evening hours, this would in many ways be a de facto temporal separation approach that could be used in the event that a noncompliant vehicle were selected.

12.4 Examples of Systems Operating both Passenger and Freight Trains

There are many passenger rail systems around the U.S. where both freight and passenger trains operate. Indeed, nearly the entire Amtrak route network, consisting largely of rail lines owned and operated by freight railroads, is shared with freight trains. However, the most relevant examples are those where a public agency owns the railroad and operates shorter passenger trains or multiple unit trains. A few examples of these systems follow, with emphasis on features and approaches to infrastructure development that might be similar to the proposed ZEPRT Project.

12.4.1 SPRINTER

NCTD operates the SPRINTER system on a former freight rail branch line between Oceanside and Escondido, California. At Oceanside, the SPRINTER system offers a cross-platform transfer to the COASTER commuter rail trains serving San Diego, the Metrolink commuter rail trains serving the Los Angeles Basin, and the Amtrak Pacific Surfliner trains serving the San Diego-Los Angeles-San Luis Obispo corridor. The SPRINTER line is nominally 20 miles in length, which is of similar length to the SCBRL between Pajaro and Natural Bridges Drive in Santa Cruz. This system uses diesel multiple unit (DMU) vehicles and temporal separation to allow freight trains to operate at night in order to serve several freight customers along the line. This system also includes a bike path for a significant distance along the right-of-way, as well as section of elevated track which leaves the right-of-way to access a station near the California State University campus, located a distance from the freight railroad right-of-way.

Accessibility at passenger stations was achieved using retractable platform extensions (which lower on hinges) arranged along the platform to correspond with the vehicle door locations. These retractable extensions must be lifted in order to provide additional clearance before freight trains can operate, adding a level of complexity and additional maintenance. These retractable extensions are hinged on the platform edge; their locations must match the vehicle door locations closely, with only small longitudinal tolerances. Vehicles must consistently stop in the same place at each platform in order to ensure the doors align with the retractable platform extensions. As a result, it would be difficult for NCTD to operate new or different vehicle types with different door spacing since the retractable extensions would also have to be relocated to match the new door locations.

12.4.2 Arrow

SBCTA operates the approximately 9-mile-long Arrow service between Downtown San Bernardino and Redlands, California, on a former freight branch line that still has freight customers. The Arrow line received a waiver from the CPUC for their passenger platforms, which are located at approximately 23.5 inches above top of rail. The Arrow line offers a cross-platform connection to the Metrolink commuter rail service, as well as to Amtrak long-distance passenger trains in San Bernardino. While the Arrow initiated passenger service with DMU cars, it recently received new hydrogen fuel cell, ZEMU cars that meet FRA vehicle strength requirements.

12.4.3 SMART

The Sonoma-Marin Area Rail Transit District (SMART) operates an approximately 48-mile-long service between Larkspur and Windsor, California. Much of the line is shared with freight trains, which operate in a comingled fashion throughout the day with passenger service, which is provided by FRA-compliant DMU cars. The floors of these DMU cars are approximately 48 inches above top of rail and thus are too high to reliably clear freight trains. The minimum horizontal clearances for mixed freight and passenger operations at station platforms are facilitated by gauntlet tracks at each station. The SMART system also includes a bike path for a significant distance along the corridor right-of-way. In constrained areas, the bike path has been narrowed to as narrow as 11 feet wide (between fences on either side of the bike path) to allow space for both the railroad facilities and bicycle facilities.

12.5 Summary

The regulatory environment that influences the infrastructure on the SCBRL required to support implementation of the ZEPRT Project will be affected by the ongoing operation of freight trains in Pajaro and Watsonville, by the operation of the SCBG's Beach Train in Santa Cruz, and by the use of FRA-compliant vehicles. Several significant implications relate to:

- Clearances between the track and station platforms and other fixed objects along the right-of-way, with minimum clearances prescribed by the CPUC.
- The interplay between the ADA, station platforms, and railroad clearances.
- A railroad signaling system that incorporates the FRA's PTC requirements.

13.0 Conceptual Rail Transit and Trail Alignment

13.1 Introduction

A key activity of the ZEPRT Project is to identify a preferred conceptual alignment within the approximately 22 miles of the existing SCBRL corridor right-of-way between Pajaro and Santa Cruz that accommodates a rail transit line over which the ZEPRT service would operate, and the adjacent Coastal Rail Trail, for one preferred rail transit build alternative. Definition of the preferred alignment supports, and is informed by the following:

- Characteristics of the existing SCBRL alignment and right-of-way, with an emphasis on overall right-of-way width and potentially constrained areas where the rail and trail alignments may not both fit, owing to the need to meet regulatory guidance, standards, and requirements of the FRA and CPUC related to clearances for rail operations and for separation between rail and trail facilities.
- Conceptual analysis of passenger rail vehicle technologies and equipment and performance requirements for the ZEPRT service.
- Rail operations modeling and analysis for the desired ZEPRT operations plan for a daily service operating on 30-minute headways from 6 a.m. to 10 p.m.
- Identification of proposed ZEPRT rail transit station and layover and maintenance facility locations.
- Consideration of interface of the ZEPRT service and the Coastal Rail Trail with the multimodal transportation network, adjacent land use, and potentially environmentally sensitive areas.
- Interface with the conceptual Coastal Rail Trail alignment, including segments of which are currently in design or have already been constructed.

This activity also included preliminary evaluation of potential modifications to the conceptual rail alignment which would allow an increase in design speed for ZEPRT passenger trains, address coastal resiliency, and modify alignment at various constrained interface locations on the SCBRL corridor.

13.2 Conceptual Rail Transit and Trail Alignment Development Approach

The approach to developing the conceptual ZEPRT rail transit and trail alignments was driven by safety standards and appropriate design guidelines, while attempting to mitigate or avoid the corridor's unique constraints and engaging stakeholders and the community during development. Throughout the process of identifying the proposed conceptual rail and trail alignment for the SCBRL corridor, the following benefits were contemplated:

- Utilizing the entire length of the SCBRL corridor right-of-way between Pajaro and Natural Bridges Drive in Santa Cruz.
- Assuring a continuous corridor for rail and transit operations.
- Serving a high percentage of disadvantaged populations in Santa Cruz County.
- Providing an effective transportation system that can be implemented in the shortest possible amount of time.

- Avoiding the potential to impede existing or potential future freight or recreational rail from using the corridor.

In general, as much as feasible, the design sought to have the proposed ZEPRT rail alignment follow the existing SCBRL rail alignment, with the trail alignment adjacent to the corridor and avoiding instances of multimodal conflict. Further, while attempting to remain in the SCBRL right-of-way and not create impacts to bordering properties, the design also sought to maximize operating speeds by modifying track geometry, including flattening of curve alignments, to reduce ZEPRT passenger train travel times.

In west Santa Cruz, with the trail segment between Bay Street and Natural Bridges Drive already constructed, the design adjusted rail designs to mitigate potential conflicts. Within the Beach Boardwalk area between the San Lorenzo River and along Beach Street, the ultimate design aims to minimize impacts to vehicular, bicycle, and pedestrian traffic while not inhibiting mobility or the functionality of the area attractions to visitors.

Between Pajaro, Watsonville, La Selva Beach, and Capitola, the track design generally maintains the existing alignment, confined within the SCBRL right-of-way. The design includes locations of passing sidings and implements minor modifications to make improvements to track geometry that would be better suited for passenger rail operation. The SCBRL right-of-way traverses a floodplain for a portion of its eastern segment between Pajaro and the Harkins Slough near Watsonville. Between Watsonville and Buena Vista Drive the trail alignment diverts from this right-of-way for safety and environmental considerations as well as to allow for a route more conducive to pedestrian circulation addressing comments from Santa Cruz County and the City of Watsonville to improve non-vehicular access to the Pajaro Dunes.

13.3 Conceptual Rail Transit and Trail Alignment Development Assumptions and Coordination

While defining the conceptual alignments and various components of the ZEPRT Project, collaboration and cooperation were foundational pillars of Project development. The Project team has incorporated, and will continue to incorporate, stakeholder and community input related to infrastructural and operational elements for the Project. This input will specifically be used during development of concepts and refinement of the alignment and related design as the Project advances beyond the current phase.

The Project has also received approvals and direction from the SCCRTC at several stages of project development. Between April 2024 and March 2025, SCCRTC actions and decisions included adoption of typical design cross sections for rail and trail facilities, adoption of recommended horizontal setback guidelines for new structures from the SCBRL right-of-way, analysis of conceptual rail transit vehicle types, design proximity to Watsonville and Santa Cruz downtown districts and Santa Cruz County beaches, station locations and amenities, ridership approach, and others.

In addition to SCCRTC, the following list identifies key Project stakeholders:

- Santa Cruz, Big Trees and Pacific Railway (SCBG), a short line providing local passenger excursion and freight train operations
- Santa Cruz Seaside Company, which owns and operates the Santa Cruz Beach Boardwalk

- Cities: including Watsonville, Aptos, Capitola, and Santa Cruz
- Counties: Santa Cruz and Monterey
- Transportation Agencies: TAMC
- Public: Open Houses, etc. (see Chapter 4 of this *Project Concept Report* for more details on the outreach process conducted)

Assumptions that were used to inform development of the conceptual rail transit and trail alignments for the ZEPRT Project, while also accounting for standard industry practices and guidelines, include the following key considerations:

- Rail track bed width to be 24 feet (12 feet either side of track centerline, although in some scenarios it may be possible for 11 feet either side of track centerline).
- Maximum track superelevation on curves to be 4 inches.
- Horizontal clearance to an adjacent vertical object, fence, or edge of trail to be 12 feet minimum from track centerline.
- Trail width to be 12 feet.
- Permanent stations should coincide with siding locations where meet-pass events occur between passenger trains, whenever feasible.
- Station platform lengths to be 350 feet along tangent track and widths to be a minimum of 16 feet (along one track) and 20 feet (along two tracks).
 - The Aptos Station is located on the inside of a curve which is superelevated, so special precautions will be required to comply with ADA level-boarding requirements and visibility along the platform for train operations.
 - The Beach Street / Downtown Station platform is only 200 feet long due to geometric constraints and the historic Cliff Drive overpass to the west of Pacific Avenue. As a result, only some of the doors on the ZEPRT passenger trains will be able to open, reducing passenger flow.
- Relocating the track along Walker Street in Watsonville and Beach Street in Santa Cruz to be separated from traffic.
- Maintain or reduce passenger train operating speeds in the highly congested Santa Cruz area, and particularly in the vicinity of the Beach Boardwalk.
- Highway-rail and pedestrian-rail grade crossing safety measures, with primary measures including:
 - Installing four-quadrant crossing gate system.
 - Installing crossing gates along with medians or channelization device.
 - Redirecting the street traffic to be one-way with crossing gates.
 - Permanent closure of the grade crossing.
 - Eliminating on-street parking adjacent to the crossing to improve sight distance for users.

13.4 Conceptual Rail Transit and Trail Alignment and Potential Modifications

A conceptual horizontal and vertical alignment for one main track, within the existing SCBRL right-of-way, as well as a parallel trail between Pajaro and Santa Cruz has been developed for the ZEPRT Project. The

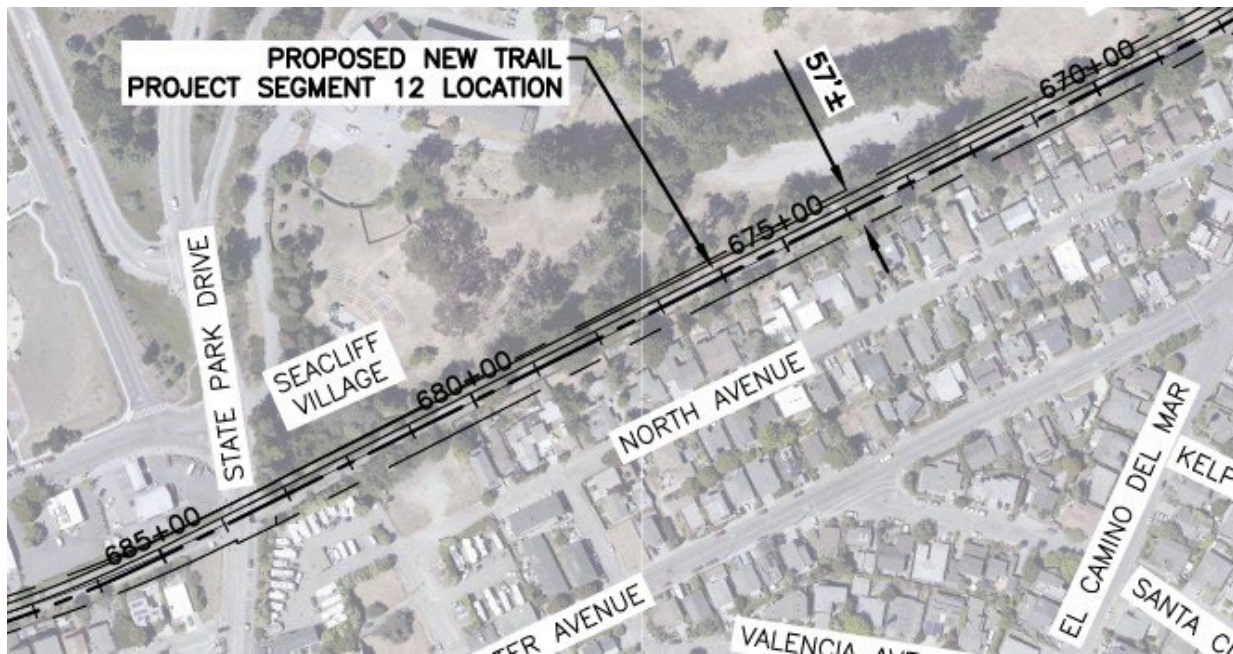
track alignment is also comprised of proposed siding tracks to allow for passenger trains on the single-track SCBRL main track to meet and pass each other, and it adheres to applicable regulations and guidance related to railroad safety and operating practices for a shared-use passenger and freight rail corridor.

The conceptual rail alignment is largely consistent with the existing at-grade rail alignment; only minor modifications have been proposed to account for standardization of design and shifts to adapt to various physical constraints along the SCBRL corridor. The right-of-way along the SCBRL is comparatively narrow relative to the width of the proposed improvements; in some areas the right-of-way is less than 35 feet, and in many areas, it is less than 50 feet wide. Comparing the minimum 24 foot wide track section (see Figure 13-1, below) to a 50 foot wide right-of-way, illustrates that there would be only 26 feet remaining, 13 feet on each side of the track (assuming the track would be centered in the right-of-way), for drainage channels, slope grading, fencing, retaining walls, the trail, and other features. The narrow right-of-way is a key driver of the infrastructure configuration for the ZEPRT Project. The proposed ZEPRT rail alignment is intended to not preclude future passenger and freight operations on the SCBRL. The trail alignment is commonly situated directly adjacent to the rail alignment or within the SCBRL right-of-way, except for a segment in the eastern portion of the SCBRL corridor.

Due to various constraints, as described later in this section as well as elsewhere in this *Project Concept Report*, for the conceptual rail alignment through Walker Street in Watsonville, along Park Avenue and through New Brighton State Beach in Capitola, and along Beach Street in Santa Cruz, several preliminary alternatives were considered. At Walker Street in Watsonville, shifting the rail alignment to one side of the street and adjusting the location of the Downtown Watsonville Station were considered. In the area around the Capitola Station along Park Avenue as well as near the Cabrillo Station along New Brighton Road, shifting the main track alignment as well as adjusting the station platform and siding trackage were considered, among other options, to accommodate the Coastal Rail Trail alignment through these areas and accounting for right-of-way considerations. In Santa Cruz, along Beach Street and in western Santa Cruz, alternatives (including an elevated option by the Boardwalk, and an end-of-line station at Depot Park instead of at Natural Bridges Drive) were considered to address the various constraints identified. A final rail alignment that meets the objectives of the ZEPRT Project will be defined through future analysis and stakeholder coordination as the ZEPRT Project advances.

An example of the typical conceptual rail and trail alignments for the ZEPRT Project is shown at Seacliff Village in Figure 13.1 below.

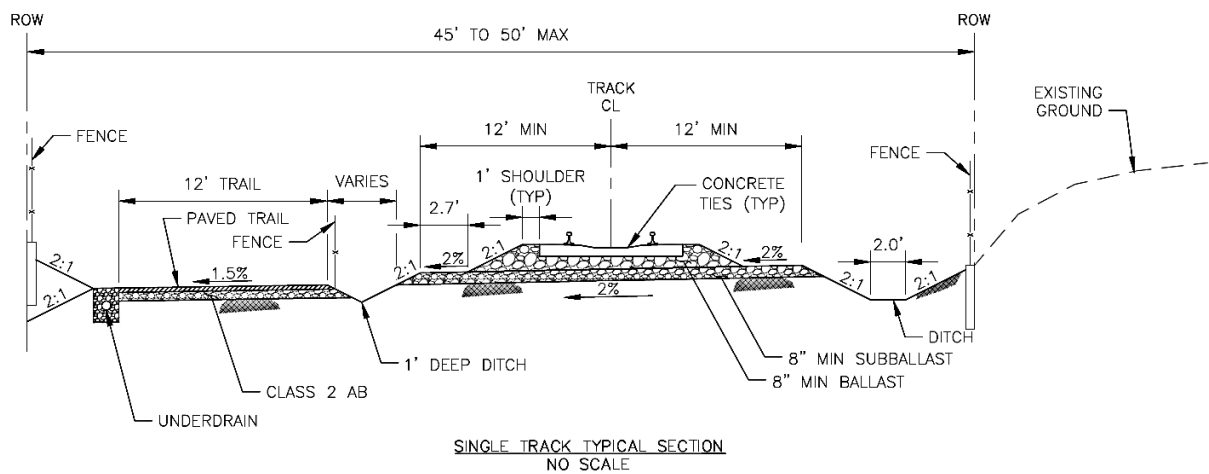
Figure 13.1 Example of Typical Alignment for Rail and Trail Alignments



Source: HDR

An example of the typical section for rail and trail alignments for the ZEPRT Project is shown in Figure 13.2 below.

Figure 13.2 Example of Typical Section for Rail and Trail Alignment



Source: HDR

While the final rail and trail alignments will be confirmed as the ZEPRT Project advances, the proposed conceptual rail transit and trail alignment for the full Pajaro-Santa Cruz SCBRL corridor are presented in Appendix A at the end of this *Project Concept Report*.

A few key locations on the SCBRL corridor and supporting context for the development of the conceptual rail and trail alignments for the ZEPRT Project are identified and described in the sections that follow.

13.4.1 Watsonville Area Rail and Trail Alignment

The existing SCBRL alignment is located within Walker Street through central Watsonville. Due largely to vehicle movement, intersection conflicts, limited street right-of-way constraints and challenges associated with providing for sufficient tangent track to support a new platform at the historic Downtown Watsonville Depot location, several alternatives were considered preliminarily for the conceptual rail alignment through Walker Street. At this stage of the ZEPRT Project, the conceptual rail alignment includes a slight shift of the SCBRL to the east side of the Walker Street footprint, which helps to resolve some of these constraints. A final rail alignment through Watsonville that meets the objectives of the ZEPRT Project will be defined through future analysis and stakeholder coordination as the ZEPRT Project advances.

Between the Pajaro River and Buena Vista Drive in Watsonville, the trail alignment diverts from the SCBRL right-of-way hosting the ZEPRT rail alignment. For almost 7 miles, the trail follows San Andreas Road, Beach Street, and Rodriguez Street with a separated Class I or Class IV bikeway, largely as a result of public input as well as to avoid potential environmental impacts and conflicts with roadway users along Walker Street and train movements along the industrial freight tracks of western Watsonville. Within this segment of its course, the trail alignment shifts on either side of these streets, depending on design considerations such as safety, traffic, and land use. For example, in Watsonville, the trail alignment is proposed along Rodriguez Street rather than Walker Street or the SCBRL right-of-way, due to Rodriguez Street being a safer route and exhibiting land use more compatible with pedestrian circulation (i.e., residential and commercial land uses as opposed to industrial) and the ability to additionally accommodate parking on one side of the street. This adjustment of the trail alignment has the added benefit of being closer to the central core of Downtown Watsonville and of directly connecting several community activity centers, such as Muzzio Park and community center in Watsonville as well as Pajaro Park and Cayetano Park in the community of Pajaro.

13.4.2 Pajaro and Watsonville Floodplain Rail Alignment

East of the Harkins Slough, the majority of the ZEPRT Project is located within a Federal Emergency Management Agency (FEMA) designated floodplain. As such, a slightly raised track alternative for the rail alignment is proposed at select locations, including near the Pajaro River, Harkins Slough, and Buena Vista Drive.

An operations and maintenance facility used for storing and maintaining passenger rail and track equipment for the ZEPRT service is proposed west of State Route 1 and just outside the limits of the City of Watsonville. This facility is proposed on the south side of the track alignment to avoid impacts to the Watsonville Slough and for improved accessibility.

13.4.3 Capitola Station Rail and Trail Alignment

In the area around the proposed ZEPRT Capitola Station, the rail track alignment has been shifted inland towards Park Avenue, to allow for the trail alignment to be positioned towards the Pacific Coast, accounting for right-of-way considerations. With this design, retaining wall structures will be required to address the significant elevation differences between the trail and residential areas on the coastal side of the alignments and the rail network and Park Avenue on the inland side of the alignments. A shortened passing siding is proposed coincident with the station to minimize consequential right-of-way impacts from the adjacent trail alignment. Also, a gauntlet track will be added to accommodate clearances for

freight operations occurring at a safe and offset distance from the passenger station. The conceptual rail and trail alignments in the vicinity of Capitola Station are shown in Figure 13.3 below.

Figure 13.3 Conceptual Rail and Trail Alignments at Capitola Station



Source: HDR

13.4.4 Beach Flats Area Rail and Trail Alignment in Santa Cruz

From the San Lorenzo River to the traffic roundabout at Pacific Avenue, the current SCBRL alignment passes in front of the Boardwalk and through the center of Beach Street. The current alignment carries significant complexities due to conflicting priorities, such as visitor access and safety, parking, circulation, railroad operations, adjacent property use, physical topography, and coastal constraints. Various alternatives were considered preliminarily for the conceptual rail and trail alignments through this area, including shifting the rail alignment farther north as well as on an elevated guideway. This *Project Concept Report* identifies alternatives for the rail and trail alignments through this area, and cost estimates (described later in this document) assume an at-grade alignment for the ZEPRT baseline concept, but additional study and stakeholder coordination will be required in future project phases as the ZEPRT Project advances.

13.4.5 West Santa Cruz Rail and Trail Alignment

At the western limit of the ZEPRT Project corridor, the trail has already been constructed between Bay Street and Natural Bridges Drive in west Santa Cruz. The base rail alignment remains within the SCBRL corridor right-of-way with instances of minor geometric realignments, as shown in Figure 13.4 below.

Figure 13.4 Conceptual Rail and Trail Alignment in West Santa Cruz



Source: HDR

The Santa Cruz Wye was adjusted slightly to allow for through movements to operate on the SCBRL main track comprising the south leg of the wye, thus resulting in the proposed design of a retaining wall structure along a portion of the eastern border of the Santa Cruz Wastewater Treatment Facility, and the eastern leg of the Wye being minimally shifted to provide adequate clearance from existing stormwater infrastructure.

This vicinity also includes modifications or options for consideration as the Project advances. One option includes the implementation of an additional station along Bay Street if it should be desired in a future phase, which would require alterations to the existing trail and likely necessitate a supporting retaining structure to mitigate the vertical design constraints between La Barranca Park and the potential station.

Various alternatives were considered preliminarily for the end-of-line station in Santa Cruz, including the potential for a station at Depot Park instead of Natural Bridges Drive in west Santa Cruz, in an effort to address considerations for ridership and more direct connectivity to Downtown Santa Cruz. A final end-of-line station and related rail alignment that meets the objectives of the ZEPRT Project will be defined through future analysis and stakeholder coordination as the ZEPRT Project advances.

14.0 Conceptual Network Infrastructure Improvements

This chapter conceptually describes rail network infrastructure initially identified during the ZEPRT Project to accommodate implementation of ZEPRT passenger rail service and to maintain the provision for freight rail service on the SCBRL between Pajaro and Natural Bridges Drive in Santa Cruz. Infrastructure to support development of, and interface with, the Coastal Rail Trail adjacent to the ZEPRT rail alignment is also conceptually identified. These infrastructure improvements include the following categories:

- Track and Track Structure
- Existing Railroad Bridges
- Public Highway-Rail and Pedestrian-Rail Grade Crossing Signals and Surfaces
- Wayside Signal and Positive Train Control Systems
- Communications Systems
- Trail Infrastructure and Interface with Rail Network Infrastructure
- New Passenger Rail Facilities

The analysis for this activity was based on the conceptual existing infrastructure evaluation, rail corridor safety assessment, preliminary environmental screening, rail vehicle technology and performance requirements assessment, passenger and freight rail interface assessment, the conceptual rail transit and trail alignment developed for the ZEPRT Project, as well as practices typical in the passenger and freight rail industry.

The final types, characteristics, locations, and scope of conceptual network infrastructure improvements on the SCBRL will be confirmed through design and coordination with project stakeholders as the ZEPRT Project advances.

14.1 Track and Track Structure

The ZEPRT Project developed a concept for the track structure (i.e., rail, ties, ballast, sub-ballast, and subgrade) on the SCBRL main track, proposed sidings to accommodate meet-pass events between passenger trains on the single-track SCBRL, and connections between SCBRL and other rail lines to facilitate ease of maintenance and low maintenance cost. While detailed engineering design and geotechnical explorations and analyses were not available in July 2025 for the current conceptual phase of the ZEPRT Project, best practices from the passenger rail industry, AREMA recommended practices, and observations of existing conditions on the SCBRL corridor between Pajaro and Natural Bridges Drive in Santa Cruz guided development of the track structure.

Track Structure Background

Railroad track is a structure that distributes the highly concentrated loads from the rail vehicle wheels, which can be on the order of 8 to 18 tons per wheel for passenger and freight equipment, respectively, to the ground. At the interface between the wheel and rail, contact pressures for passenger railcars could be on the order of approximately 50,000 psi (depending factors such as car design, passenger load, etc.). A key role for the track structure is to reduce this pressure by orders of magnitude, to a value less than

approximately 25 psi at the bottom of the sub-ballast layer, such that the underlying subgrade soils can support the imposed loads, including impact loading. To accomplish this, the track structure is designed as a system; each component distributes the loads, reducing the pressures imposed on the underlying components: the rails distribute loads to the ties, the ties distribute loads to the crushed rock ballast, the ballast distributes loads to the finer crushed rock sub-ballast, and the sub-ballast distributes loads to the existing subgrade soils. The ZEPRT Project leveraged past experiences on other passenger railways to guide development of design concepts.

Assumptions for ZEPRT Track Structure

The ZEPRT Project proposes a trail within much of the SCBRL right-of-way between Pajaro and Natural Bridges Drive in Santa Cruz, which would require the future main track that will be used by ZEPRT passenger trains and freight trains to be relocated in some areas, away from the SCBRL main track's existing location. Although it is possible to shift existing railroad track small distances (several feet) laterally by pushing the track sideways with heavy machinery, the shifts necessary to avoid the trail may be so large as to be potentially impractical. Based on rail industry experience and best practices, shifting track requires first strengthening it with new materials (e.g., new ties) to ensure the track can withstand the forces involved in the shifting operation. The shifted track would also need a strong soil foundation upon which to rest, implying new grading, sub-ballast, ballast, and new drainage features. The extent to which the SCBRL main track alignment may be shifted to interface with the proposed trail within the existing SCBRL right-of-way will be confirmed through design and coordination with project stakeholders as the ZEPRT Project advances.

In many areas, the existing ballast is contaminated with fine soil particles or vegetation. These contaminants compromise the ballast's ability to support loads from the rail and ties, meaning the track would deflect more when rail vehicles pass. The FRA places limits on the allowable amount of deflection; even small amounts of contaminants in the ballast can weaken the track structure to the point where deflections exceed the allowable limits.

The existing timber ties are typically at least 20 years old. Wood ties in tangent (straight) track may have a useful service lifespan of 25 to 30 years in the relatively damp Santa Cruz County climate, assuming frequent passenger service. However, in curves subject to regular train operations, wood ties may have a useful life of approximately 10 years. Thus, many of the existing wood ties are at or near the end of their useful life and could not continue to function if regular passenger operations were implemented.

To be serviceable for regular passenger service, most of the existing jointed rail, much of it over 100 years old, manufactured before modern metallurgical practices improved rail strength and reliability, would need to be replaced with modern, continuously welded rail.

Regardless of whether the track would be shifted, effectively, the track would need to be completely rehabilitated with new ties, new rail, a new rail fastening system, and new ballast.

There is a trade-off insofar as capital costs for new track tend to be higher than for rehabilitated track, but maintenance requirements and costs for new track are substantially lower than those for rehabilitated track. Instead of attempting to shift and rehabilitate the track, at this conceptual stage the ZEPRT Project assessed that the overall life cycle costs would be lower if the railroad were reconstructed with new track

on new ballast, sub-ballast, subgrade, and drainage. Complete reconstruction also offers the opportunity to resolve drainage issues that have developed over time by cleaning existing drainage channels or establishing new drainage channels.

The reduced maintenance requirements offered by the new track would be important from an operational perspective, since frequent passenger service throughout the day would make it difficult to simultaneously conduct track maintenance. This is because track maintenance activities often require specialized maintenance equipment to operate on the track, which would block the track and impact passenger train schedules. Instead, in order to allow uninterrupted passenger operations, track maintenance would be relegated to the evening hours when passenger trains were infrequent or not operating. Having only a few hours to conduct track maintenance favors a low-maintenance track structure.

A track structure that has worked well for other passenger agencies was selected for the ZEPRT Project: continuously welded rail (CWR) weighing 115 pounds per yard on concrete ties supported by crushed rock ballast (typically two-inch sized rock) resting on compacted, crushed rock sub-ballast (typically sized less than 1 inch). It was assumed that this track structure would provide adequate strength for the underlying subgrade soils.

CWR eliminates maintenance-intensive rail joints and reduces noise and is the standard for passenger rail operations in the U.S.

Concrete ties mitigate the tendency for wood ties to deteriorate due to environmental factors, such as rot, or mechanical factors, such as lateral forces in curves. The many curves on the SCBRL suggest that, if wood ties were used, they would require frequent replacement. Conversely, passenger operators around the U.S. have adopted concrete ties due to their longer lifespan (and thus less frequent replacement intervals) and overall lower life-cycle costs. For example, concrete ties that were installed in the Caltrain system in the San Francisco Bay Area 25 years ago are still serviceable today.

Another reason the ZEPRT Project assumed use of concrete ties is the limited clearance between the track and many fixed objects along the right-of-way. SCCRTC adopted a 12-foot minimum clearance between the track centerline and fixed objects, although there may be potential to achieve 11 feet in select areas. The 12-foot minimum clearance constrains the ability to replace ties in the track. If, for example, a long section of retaining wall were installed exactly 12 feet from the track centerline, the distance from the outside of the rail nearest the wall and the wall itself would be approximately 9 feet-4 inches.

Wood ties are typically 8 feet-6 inches long and are conventionally replaced by extracting them sideways from the track, which requires sufficient space for the length of the tie to be extracted. The 9 foot-4 inch clearance from the base of the rail to the retaining wall in this hypothetical example would leave only 10 inches of clearance in which to replace the tie (though in practice the tie can often be angled slightly to gain a few additional inches clearance). Since railroad ties are replaced with mechanical equipment operating with relatively large tolerances, the 10-inch clearance would pose a constraint on the tie replacement operation, slowing it, making it more expensive and, in the process, subjecting any fixed objects (the retaining wall, in this example) to the potential for damage.

By comparison, concrete ties require much less frequent replacement (as noted, their anticipated lifespan for the relatively light traffic on the SCBRL would likely be in excess of 25 to 30 years). Thus, tie replacement

and therefore the clearance to fixed objects would be less of a consideration. That concrete ties typically used for passenger railroads are slightly shorter, at 8 feet-3 inches long as opposed to the 8 foot-6 inch length of wood ties) provide a few extra inches of clearance in the event a concrete tie does need to be replaced (e.g., due to isolated damage to a specific tie, etc.).

The proposed concrete tie track structure comprising new rail, ties, ballast, sub-ballast, and drainage should offer relatively low maintenance costs, facilitate minimal interruptions to passenger service, and provide many years, possibly decades, of reliable service before significant rehabilitation is needed.

The final types and characteristics of the track and track structure on the SCBRL will be confirmed through design and coordination with project stakeholders as the ZEPRT Project advances.

14.2 Existing Railroad Bridge Replacements

This section summarizes the initial conceptual improvements for existing railroad bridges on the SCBRL between Pajaro and Natural Bridges Drive in Santa Cruz identified for potential replacement as part of the development of the ZEPRT Project. The conceptual bridge evaluation and design effort being conducted for the ZEPRT Project is ongoing during 2025.

As a result of a sales agreement between UP and SCCRTC from 2010 for the SCBRL that a retained right, by UP, is reserved for freight railroad purposes (ostensibly by a “Short Line Rail Operator”) typical UP standards for bridges, as well as typical freight rail industry bridge replacement construction approaches, were used to determine the replacement structures for the ZEPRT Project.

The draft conceptual ZEPRT rail alignment and profile developed for the ZEPRT Project are being used to develop replacement bridge drawing layouts as of July 2025. A geotechnical desktop study, using publicly available information to develop conceptual foundation type recommendations for supporting new railroad bridges for the ZEPRT Project has not begun as of July 2025. As a result, reasonable assumptions regarding the foundation type for each railroad bridge replacement using heavy haul freight railroad experience are incorporated in the concept approach for the ZEPRT Project. At this time, the intent for larger bridge foundations will be to use larger diameter cast-in-drilled-hole (CIDH) piles, while smaller bridges will utilize smaller diameter CIDH piles or driven steel piling. Since noise and vibration limitations are anticipated in residential and urban areas, the appropriate foundation type will be assumed based on these potential constraints.

Hydrology and Hydraulics (H&H) analyses of new railroad bridges were not developed for this conceptual phase of the ZEPRT Project. The bridge hydraulic opening is compared with the existing along with incorporating historical information concerning flooding for an initial check on the opening or bridge height.

A draft conceptual design criteria for the ZEPRT Project was developed for addressing existing railroad bridge conditions and rated capacity, as well as the design of new railroad bridges that would accommodate ZEPRT passenger and potential future freight rail operations. In general, new railroad bridges will be designed in accordance with the current AREMA Manual for Railway Engineering and rail industry standards using Cooper E80 design live loading per direction from the SCCRTC in April 2024. In

addition, new railroad bridges will include the following overall features, consistent with U.S. freight rail industry practice:

- Simply supported spans
- Prefabricated spans
- Redundant spans
- Non-redundant spans (i.e., steel through-plate girders [TPG], steel truss) not preferred, but may be considered in special circumstances
- Ballast deck

The span length and type along with the recommended substructure are based on typical railroad replacement bridge structure type approaches which provide for economical spans based on overall bridge length ranges for those spans, feature being crossed, consideration for depth of structure and hydraulic opening and typical foundation used for the proposed span length and type.

The following existing timber bridges on the SCBRL are intended for replacement with modern freight railroad industry standard-type bridges, such as UP bridge standards, generally consisting of driven steel H-pile or pipe pile, precast concrete bent caps, and precast prestressed (PC/PS) concrete slab or double box beam spans with ballast decks. These bridges are not relatively close to commercial or residential neighborhoods and vibration/noise from pile driving are assumed not to be a factor.

- Bridge 4.45 over Watsonville Slough
- Bridge 4.87 over Harkins Slough
- Bridge 5.42 over drainage
- Bridge 5.54 over drainage
- Bridge 6.01 over drainage
- Bridge 6.14 over drainage
- Bridge 6.25 over drainage
- Bridge 8.32 over drainage

The following existing timber bridges on the SCBRL are intended for replacement with freight railroad industry standard-type bridges, such as UP bridge standards, generally consisting precast prestressed concrete slab or double box beam spans with ballast decks. However, due to nearby commercial and residential neighborhoods sensitive to vibration and noise, the substructure would tentatively consist of CIDH concrete pile foundations with cast-in-place (CIP) concrete columns and caps.

- Bridge 0.86 over drainage
- Bridge 1.06a/c over Pajaro River (approach spans); Combined with Bridge 1.06b for an overall SCBRL milepost location of 1.06
- Bridge 8.64b over drainage

The following existing bridges are intended for replacement with freight railroad industry accepted primary span type consisting of precast prestressed concrete I-girders with cast-in-place concrete ballast deck and approach spans consisting of industry standard precast prestressed concrete slab or double box beam spans. PC/PS concrete I-girder spans generally provide for a longer span length at an economical

cost. Due to nearby commercial and residential neighborhoods that would be sensitive to vibration and noise, as well as larger primary span length and weight, the substructure would tentatively consist of CIDH concrete pile foundations with CIP concrete columns and caps.

- Bridge 10.45 over Bush Gulch
- Bridge 11.16 over Dry Creek
- Bridge 19.43a over San Lorenzo River

The following existing bridges on the SCBRL are intended for replacement with freight railroad industry accepted primary span type consisting of steel TPGs with steel pan ballast deck — and, if applicable — approach spans consisting of industry standard precast prestressed concrete slab or double box beam spans. Steel TPG spans offer a minimized structure depth, measured from top of rail to span low chord, to maximize vertical clearance underneath. Due to nearby commercial and residential neighborhoods which would be sensitive to vibration and noise, as well as larger primary span length and weight, the substructure would tentatively consist of CIDH concrete pile foundations with CIP concrete columns and caps.

- Bridge 1.06b over Pajaro River; Combined with Bridge 1.06a/c for an overall SCBRL milepost location of 1.06
- Bridge 12.39 over Soquel Drive
- Bridge 12.71b over Soquel Drive
- Bridge 15.89e over Wharf Road

The following existing bridges on the SCBRL are intended for replacement with freight railroad industry accepted primary span type consisting of steel DPGs with concrete ballast deck and (if applicable) approach spans consisting of industry standard precast prestressed concrete slab or double box beam spans. Steel DPG spans offer a longer span length to minimize substructure support units providing an economical structure for longer length crossings. Due to nearby commercial and residential neighborhoods which would be sensitive to vibration and noise, as well as larger primary span length and weight, the substructure would tentatively consist of CIDH concrete pile foundations with CIP concrete columns and caps.

- Bridge 12.34 over Valencia Creek
- Bridge 12.71a over Aptos Creek
- Bridge 15.89a over Capitola Avenue
- Bridge 15.89b over Riverview Avenue and Soquel Creek

The existing truss span on the SCBRL at Bridge 15.89c over Soquel Creek will be replaced with a modern steel deck truss span with cast-in-place concrete ballast deck to maintain a similar viewshed and avoid placing new piers in the waterway. Steel truss spans provide a larger span length to minimize substructure support units over typical span lengths for DPG or TPG spans. Due to nearby commercial and residential neighborhoods sensitive to vibration and noise, as well as the longer primary span length and weight, the substructure would tentatively consist of CIDH concrete pile foundations with CIP concrete columns and caps. Due to relatively narrow SCBRL right-of-way width, the track will be shifted by about 8 feet to the

north along the entire Bridge 15.89 crossing so that new bridge foundations can be constructed and shared by both the railroad track superstructure and trail bridge superstructure.

The existing timber bridge span on the SCBRL at Bridge 15.89d over Soquel Creek will be replaced with a modern rolled steel beam span with cast-in-place concrete ballast deck to frame into the new truss span end at Bridge 15.89c.

The existing steel deck-plate girder span on the SCBRL at Bridge 19.43b over the Santa Cruz River Walk will be replaced with freight railroad industry standard-type bridges, such as UP bridge standards, generally consisting precast prestressed concrete double box beam spans with ballast decks. However, due to the nearby Boardwalk area sensitive to vibration and noise, the substructure would tentatively consist of CIDH concrete pile foundations with cast-in-place concrete columns and caps.

Table 14.1 below presents the overall length and component types for railroad bridges identified for replacement on the SCBRL as part of the development of the ZEPRT Project. Concept drawings for these structures, showing specific span lengths are approximate bridge height, are in progress as of July 2025 and are not included in this *Project Concept Report*.

Table 14.1 Conceptual Length and Component Types for Railroad Bridge Replacements

	Current SCBRL Milepost	Crossing Name and Type	Bridge Length (feet)	Primary Span Type	Approach Span Type	Deck Type	Foundation Type
1	0.86	Drainage	220	PC/PS Concrete Slab Beam	-	Ballast	CIDH Concrete Pile
2	1.06	Pajaro River	577	Steel Thru-Plate Girder	PC/PS Concrete Dbl Box Beam	Ballast	CIDH Concrete Pile
3	4.45	Watsonville Slough	110	PC/PS Concrete Slab Beam	-	Ballast	Driven Steel Pipe Pile
4	4.87	Harkins Slough	198	PC/PS Concrete Slab Beam	-	Ballast	Driven Steel Pipe Pile
5	5.42	Drainage	22	PC/PS Concrete Slab Beam	-	Ballast	Driven Steel H-Pile
6	5.54	Drainage	154	PC/PS Concrete Slab Beam	-	Ballast	Driven Steel H-Pile

	Current SCBRL Milepost	Crossing Name and Type	Bridge Length (feet)	Primary Span Type	Approach Span Type	Deck Type	Foundation Type
7	6.01	Drainage	110	PC/PS Concrete Slab Beam	-	Ballast	Driven Steel H-Pile
8	6.14	Drainage	35	PC/PS Concrete Dbl Box Beam	-	Ballast	Driven Steel H-Pile
9	6.25	Drainage	132	PC/PS Concrete Slab Beam	-	Ballast	Driven Steel H-Pile
10	8.32	Drainage	22	PC/PS Concrete Slab Beam	-	Ballast	Driven Steel H-Pile
11	8.64b	Drainage	115	PC/PS Concrete Slab Beam	-	Ballast	CIDH Concrete Pile
12	10.45	Drainage (Bush Gulch)	270	PC/PS Concrete I-Girder	PC/PS Concrete Dbl Box Beam	Ballast	CIDH Concrete Pile
13	11.16	Drainage (Dry Creek)	240	PC/PS Concrete I-Girder	PC/PS Concrete Dbl Box Beam	Ballast	CIDH Concrete Pile
14	12.34	Valencia Creek	199	Steel Deck Plate Girder	PC/PS Concrete Dbl Box Beam	Ballast	CIDH Concrete Pile
15	12.39	Soquel Drive Undercrossing	150	Steel Thru-Plate Girder	-	Ballast	CIDH Concrete Pile
16	12.71a	Aptos Creek	205	Steel Deck Plate Girder	PC/PS Concrete Dbl Box Beam	Ballast	CIDH Concrete Pile
17	12.71b	Soquel Drive Undercrossing	115	Steel Thru-Plate Girder	-	Ballast	CIDH Concrete Pile

	Current SCBRL Milepost	Crossing Name and Type	Bridge Length (feet)	Primary Span Type	Approach Span Type	Deck Type	Foundation Type
18	15.89a	Capitola Avenue	139	Steel Deck Plate Girder	PC/PS Concrete Slab Beam	Ballast	CIDH Concrete Pile
19	15.89b	Riverview Avenue and Soquel Creek	190	Steel Deck Plate Girder	-	Ballast	CIDH Concrete Pile
20	15.89c	Soquel Creek	170	Steel Deck Truss	-	Ballast	CIDH Concrete Pile
21	15.89d	Soquel Creek	22	Rolled Steel Beam Span	-	Ballast	CIDH Concrete Pile
22	15.89e	Wharf Road	107	Steel Thru-Plate Girder	-	Ballast	CIDH Concrete Pile
23	19.43a	San Lorenzo River	290	PC/PS Concrete I-Girder	PC/PS Concrete Dbl Box Beam	Ballast	CIDH Concrete Pile
24	19.43b	Santa Cruz Beach Boardwalk and Beach Street	2,500	PC/PS Concrete Dbl Box Beam	-	Ballast	CIDH Concrete Pile

Source: HDR

The final types, characteristics, and scope of replacement railroad bridges on the SCBRL will be confirmed through design and coordination with project stakeholders as the ZEPRT Project advances.

14.3 Public Highway-Rail and Pedestrian-Rail Grade Crossing Signals and Surfaces

Many at-grade crossings along the SCBRL corridor are reaching the end of their practical operational life. These crossings typically lack the infrastructure necessary to support the safety, reliability, and frequency of modern passenger rail service, like the implementation of the proposed new ZEPRT service. Conceptually, improvements developed for the ZEPRT Project will need to address both the physical condition of the crossings and their functional capabilities. This includes full replacement of worn track panels, resurfacing of roadway approaches, and installation of new crossing surfaces designed for higher-speed passenger trains.

Signal and warning systems at a majority of these crossings must be upgraded to meet current FRA and CPUC standards. This involves installing or replacing active warning devices such as flashing lights, gates, and bells, as well as implementing constant warning time circuitry to ensure consistent activation regardless of train speed. Where feasible, crossings should also be equipped with advanced preemption systems to coordinate with nearby traffic signals, reducing the risk of vehicle-train conflicts.

For the handful of crossings that have been recently upgraded, much of the existing hardware may be reused, provided it meets the design and operational requirements of passenger rail service. These crossings will still require evaluation for compatibility with increased train frequency, speed, and integration with centralized train control systems. Additional enhancements such as pedestrian gates, tactile warning surfaces, and fencing may be necessary to ensure compliance with accessibility and safety standards.

The final types, characteristics, locations, and scope of the signal and warning systems, crossing surfaces, and roadway approaches at highway-rail and pedestrian-rail grade crossings on the SCBRL will be confirmed through coordination with project stakeholders, local jurisdictions, and the CPUC as the ZEPRT Project advances.

14.4 Wayside Signal and Positive Train Control Systems

The existing SCBRL corridor currently lacks any active signaling or train control infrastructure, necessitating a full build-out of both wayside CTCS signal system and PTC overlay to support safe and efficient passenger rail operations for the ZEPRT Project. The new system must be designed to accommodate bi-directional train movements, variable headways, and integration with centralized train dispatching. This will require the installation of a complete network of signals, interlockings, and communication infrastructure along the entire SCBRL corridor between Pajaro and Natural Bridges Road in Santa Cruz.

Wayside signals will serve as the primary visual communication system for train crews, providing movement authority, speed restrictions, and route indications. Signal placement will be determined based on corridor block lengths, station spacing, and operational requirements. Interlockings will be installed at key junctions, crossovers, and terminal areas to manage train routing and protect conflicting movements. All signal hardware must be designed to interface with the selected PTC system, ensuring seamless coordination between physical signals and the train control system.

PTC is a federally mandated safety system required for most commuter rail operations in the United States under the Rail Safety Improvement Act of 2008. Its primary function is to prevent train-to-train collisions, overspeed derailments, unauthorized train movements in work zones, and movement through misaligned switches by continuously monitoring train location, speed, and authority limits, and automatically intervening if necessary. For a new passenger rail system being developed, implementing PTC is not only a regulatory requirement but also a foundational element of modern rail safety and operational reliability, regardless of the specific technology ultimately selected such as E-ATC, I-ETMS, or another FRA-approved system.

The SCBRL corridor will require installation of onboard equipment, wayside interface units, communication infrastructure, and a back-office server. These components must be designed to support real-time data exchange between trains, wayside equipment, and the central dispatching system, ensuring seamless coordination between physical infrastructure and digital train control. A robust fiber-optic or wireless communication backbone will be essential to support both signaling and PTC functions. This network will carry control signals, diagnostic data, and real-time train location information. Redundancy and cybersecurity measures must be incorporated into the design to ensure system reliability and protection against unauthorized access or failures.

In addition to physical infrastructure, a comprehensive systems integration effort will be required to ensure compatibility between the new signal and PTC systems, rolling stock, and dispatching software. This includes development of control logic, testing protocols, and safety certification in accordance with FRA regulations. Staff training and operational readiness testing will also be critical to ensure safe and effective use of the new systems from day one of service. Finally, the design and implementation of these systems should be scalable to accommodate future service expansions, increased train frequencies, and potential interoperability with other intercity and regional rail operators.

The final types, characteristics, locations, and scope of the wayside signal and PTC systems on the SCBRL will be confirmed through coordination with project stakeholders and federal and state regulatory authorities as the ZEPRT Project advances.

14.5 Communications Systems

A passenger rail system like the one being developed for the ZEPRT Project requires a robust and integrated communication infrastructure to support both operational safety and passenger-facing services. At the core of this system will be a high-capacity, resilient data network, typically fiber-optic or hybrid wireless/fiber that connects all stations, wayside equipment, and operational facilities. This network must support real-time data exchange for critical systems such as signaling, PTC, and indications from grade crossing warning devices. It will also serve as the backbone for non-safety systems including fare collection, passenger information displays, and CCTV used for security monitoring at stations and onboard trains.

To ensure operational continuity and system resilience, the network must connect to both a primary and a geographically separate backup control center. The primary control center will house a data room equipped with servers, network switches, and storage systems to manage train dispatching, system diagnostics, and data archiving. The backup facility will be capable of operating the system in the event the

primary system is unavailable. The backup systems may be at the same location as the backup control center or in an off-site cloud facility. These facilities must be designed with redundancy in power, cooling, and connectivity to maintain uninterrupted service during maintenance or emergencies. The control centers will also host voice radio systems to enable continuous communication between train crews, dispatchers, and field personnel, using either conventional radio frequencies or digital trunked radio systems. Considerations using any locally available radio system will be prioritized.

The communication infrastructure must also support a wide array of field devices. Wayside sensors for track condition monitoring, intrusion detection, and environmental data collection will feed into the central system for predictive maintenance and safety alerts. Passenger information systems, including digital signage, audio announcements, and mobile app integration will rely on real-time data feeds to provide accurate service updates. Fare collection systems, whether contactless card readers or mobile ticket validators, will require secure, low-latency connections to back-office systems for transaction processing and fare policy enforcement.

While the specific technologies and protocols for each subsystem, such as IP-based video, LTE/5G for mobile connectivity, or proprietary signaling interfaces, will be determined during the detailed design phase, the overall communication architecture must be flexible, scalable, and interoperable. Early definition of use cases and performance requirements will be critical to ensure that the selected technologies meet future service expansions. The system must also be designed with cybersecurity, data privacy, and regulatory compliance in mind, forming the digital foundation of a safe, efficient, and passenger-friendly commuter rail network.

The final types, characteristics, locations, and scope of the communications systems on the SCBRL will be confirmed through coordination with project stakeholders and federal and state regulatory authorities as the ZEPRT Project advances.

14.6 Trail Infrastructure and Interface with Rail Network Infrastructure

The final types and characteristics of interface between the trail infrastructure and rail network infrastructure on the SCBRL will be confirmed through coordination with project stakeholders and federal and state regulatory authorities as the ZEPRT Project advances.

14.7 New Passenger Rail Facilities

New facilities required to support the ZEPRT service, including conceptual rail transit stations and a layover and maintenance facility, are identified and described separately in Chapters 15 and 16, respectively.

15.0 Conceptual Rail Transit Stations

The ZEPRT Project has identified nine proposed passenger rail stations on the 22-mile SCBRL corridor between Pajaro and Natural Bridges Drive in Santa Cruz, based on conceptual ridership demand and the ability to provide transportation access and multimodal connectivity. The proposed station locations and design features are identified and described in this chapter.

15.1 Station Analysis Approach and Methodology

Throughout the ZEPRT Project conceptual planning process, several station locations were considered and evaluated to determine which would best serve the community and maximize ridership, using projections for each of the identified stations as well as considerations for railroad safety and operations, site access, transit connectivity, community connectivity and equity, engineering and environmental feasibility, and existing and known future adjacent land use. The potential need for additional right-of-way outside of the existing SCBRL corridor to accommodate station footprints was also assessed.

The general method for conceptually assessing the potential stations for the ZEPRT service included the following steps:

- Assessed past SCBRL corridor studies.
- Conducted station site visits and analyzed available Google Earth Pro imagery.
- Documented existing conditions on, and immediately adjacent to, the SCBRL corridor.
- Determined space needs based on ridership projections and typical industry requirements.
- Estimated parking requirements for each station.
- Compared existing conditions to the space and parking requirements to identify recommended improvements for the new service.
- Contemplated the rail and trail alignments in the SCBRL corridor right-of-way and interface with proposed zero-emission passenger rail equipment conceptually identified for further consideration for the ZEPRT service (which requires level-boarding at stations).
- Developed a conceptual station site plan and prepared a conceptual cost estimate.

15.2 Potential Design Concept and Features

The design, layout, and amenities at each proposed ZEPRT station are anticipated to vary based on the location and the way riders would access the station. The following elements were also considered during preliminary station concept development for the ZEPRT Project:

- User-centered design concept to represent the community and its people through the following design pillars:
 - Physical environment, community culture, and demographics
 - Cohesive systemwide identity with community pride, safety, and usability
 - User needs supporting the journey from origin to destination
- Security and safety
- Passenger experience

- Connectivity and multimodal travel (i.e., local transit and intercity buses, bicycles, etc.)
- Navigation and wayfinding
- Future climate sustainability conditions
- Maintainability

It is anticipated that design elements, basic features, and ADA-compliant level-boarding platforms will be consistent across stations; however, the following layout and additional features may vary:

- Parking
- Kiss-and-Ride
- Bicycle Parking
- Multimodal Connectivity (including with other transit modes and Coastal Rail Trail)
- Platform Shelter
- Seating
- Ticket Vending / Fare Collection System
- Wayfinding and Public Information

15.3 Potential Station Locations

Several station locations were evaluated by drawing from the previous SCCRTC Transit Corridor Alternatives Analysis and through stakeholder and community outreach. Based on this evaluation, nine potential station locations have been identified for ZEPRT on the SCBRL corridor from Pajaro to Santa Cruz, as identified in the sections that follow.

15.3.1 Pajaro

The proposed Pajaro Station is at the east end of the SCBRL corridor running along Lewis Road in Pajaro (and at SCBRL Milepost 0.0) and is the only station on the ZEPRT service located in Monterey County. It is in a low-density area surrounded by industrial and commercial buildings, agricultural fields, the UP Coast Subdivision corridor and the UP Watsonville Junction Yard. The proposed station is anticipated to provide direct future connections to planned commuter and intercity passenger rail services under development by the State of California and partner local agencies that would operate over the UP. This proposed station is also expected to include local and regional bus connections, pick-up / drop-off areas, and a parking lot.

15.3.2 Downtown Watsonville

The proposed Downtown Watsonville Station is between Second Street and Beach Street, west of the Historic Southern Pacific Railroad Depot in Watsonville (and at SCBRL Milepost 1.4). The site is adjacent to an area described as Workplace/Industrial with several opportunity sites indicated in the 2023 *Downtown Watsonville Specific Plan*.

15.3.3 Aptos

The proposed Aptos Station is near the corner of Trout Gulch Road, between Aptos Street and Soquel Drive in Aptos (and at SCBRL Milepost 12.3). The site is within the historic township of Aptos Village, and the platform area is surrounded by a mix of commercial and single-family buildings.

15.3.4 Cabrillo

The proposed Cabrillo Station is in the vicinity of McGregor Drive and New Brighton Road in unincorporated Santa Cruz County (and at SCBRL Milepost 14.2). It is north of New Brighton State Beach and Campground. The site is surrounded by single-family residential buildings and tall tree canopies.

15.3.5 Capitola

The proposed Capitola Station is at the southeast intersection of Park and Monterrey Avenues on the south side of Park Avenue in Capitola (and at SCBRL Milepost 15.5). The site is surrounded by low-rise single family residential housing and is adjacent to existing mature trees.

15.3.6 17th Avenue (Santa Cruz)

The proposed 17th Avenue Station is near 17th Avenue south of its intersection with Kinsley Street, in Santa Cruz (and at SCBRL Milepost 17.8). The site is close to the Simpkins Family Swim Center and is surrounded by single-family residential and commercial buildings.

15.3.7 Seabright (Santa Cruz)

Seabright Station is at the northeast corner of Seabright Avenue and Murray Street in Santa Cruz (and at SCBRL Milepost 18.9). The platform is between gently sloped terrain on the north and Murray Street on the south, and close to a mix of commercial and single-family residential buildings. The site is within the vicinity of Woods Lagoon and the Santa Cruz Small Craft Harbor.

15.3.8 Beach Street / Downtown

The proposed Beach Street / Downtown Station is at the northwest corner of Pacific Avenue and Beach Street, in front of the Monterey Bay National Marine Sanctuary Exploration Center, in Santa Cruz (and at SCBRL Milepost 20.0). This station is in a commercial and tourism area close to the Santa Cruz Wharf and Santa Cruz Beach Boardwalk. The platform is adjacent to the historic wooden Howe Truss Bridge carrying Cliff Drive above the SCBRL corridor.

15.3.9 Natural Bridges Drive (Santa Cruz)

The proposed Natural Bridges Drive Station runs along Monterey Bay Sanctuary Scenic Trail between Swift Street and Natural Bridges Drive in Santa Cruz (and at SCBRL Milepost 21.7). The site is within an area classified as general industrial/performance zone and is currently surrounded by industrial/storage buildings, commercial buildings, and undeveloped land.

15.4 Station Design Concepts and Features

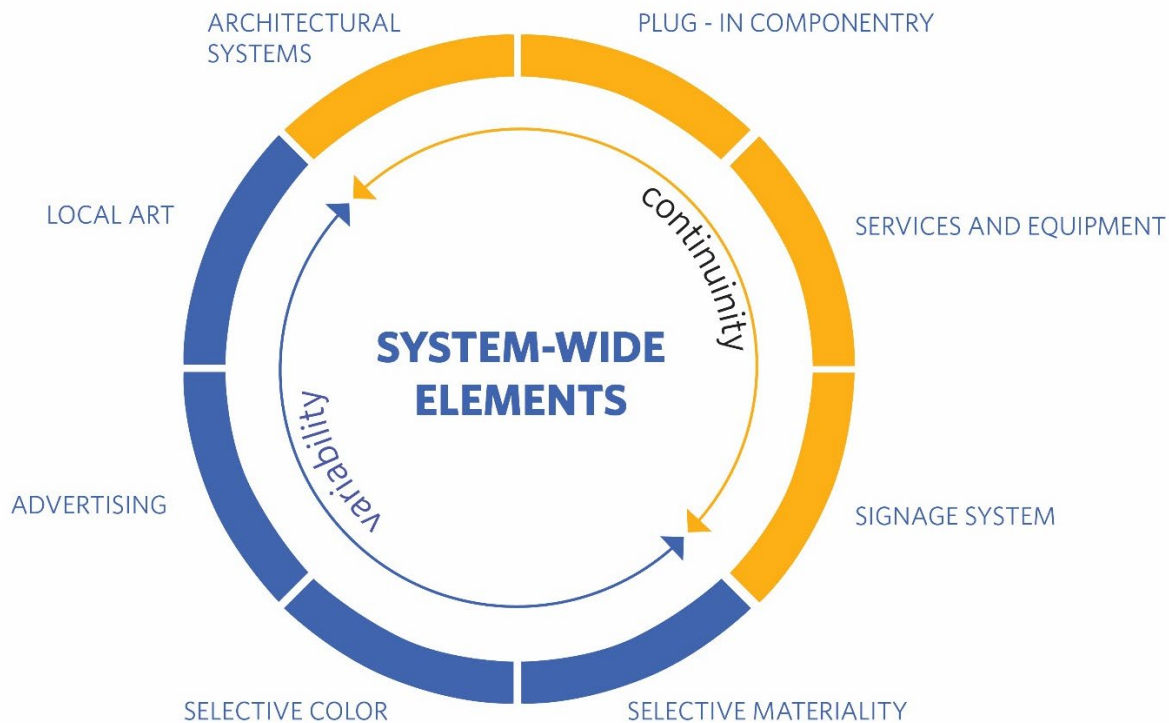
The proposed ZEPRT station concepts are guided by a deliberate balance between continuity and variability, establishing consistent elements across all stations while allowing flexibility for localized differentiation.

Establishing systemwide continuity fosters a clear, intuitive user experience that supports effortless navigation for users.

These inherently navigable spaces are further reinforced by a standardized approach to the placement of key station functions, such as information, ticketing, waiting, boarding, and alighting, alongside prescriptive signage applied consistently throughout the system.

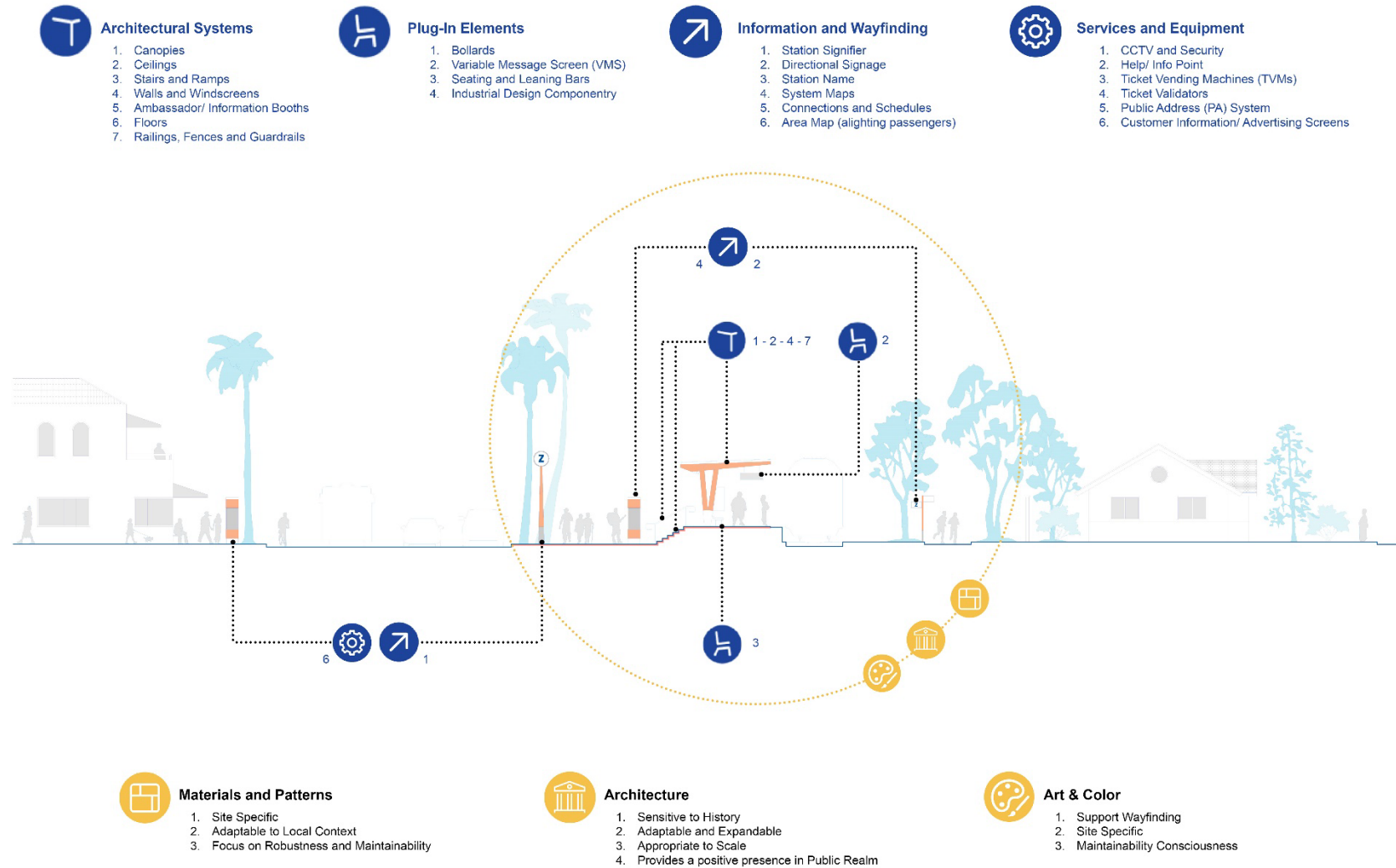
This systemwide experience will be further supported by a clearly defined “kit of parts,” a set of functional and architectural components that provide a common design language across a passenger rail corridor or network to establish experiential consistency. This approach ensures that once users understand how to navigate one station, they can intuitively navigate them all. Variable and consistent components of systemwide elements for passenger rail stations are presented in Figure 15.1 below and a systemwide approach for development of passenger rail stations is presented in Figure 15.2 below.

Figure 15.1 Systemwide Elements — Variable and Consistent Components



Source: HDR

Figure 15.2 Systemwide Approach



Source: HDR

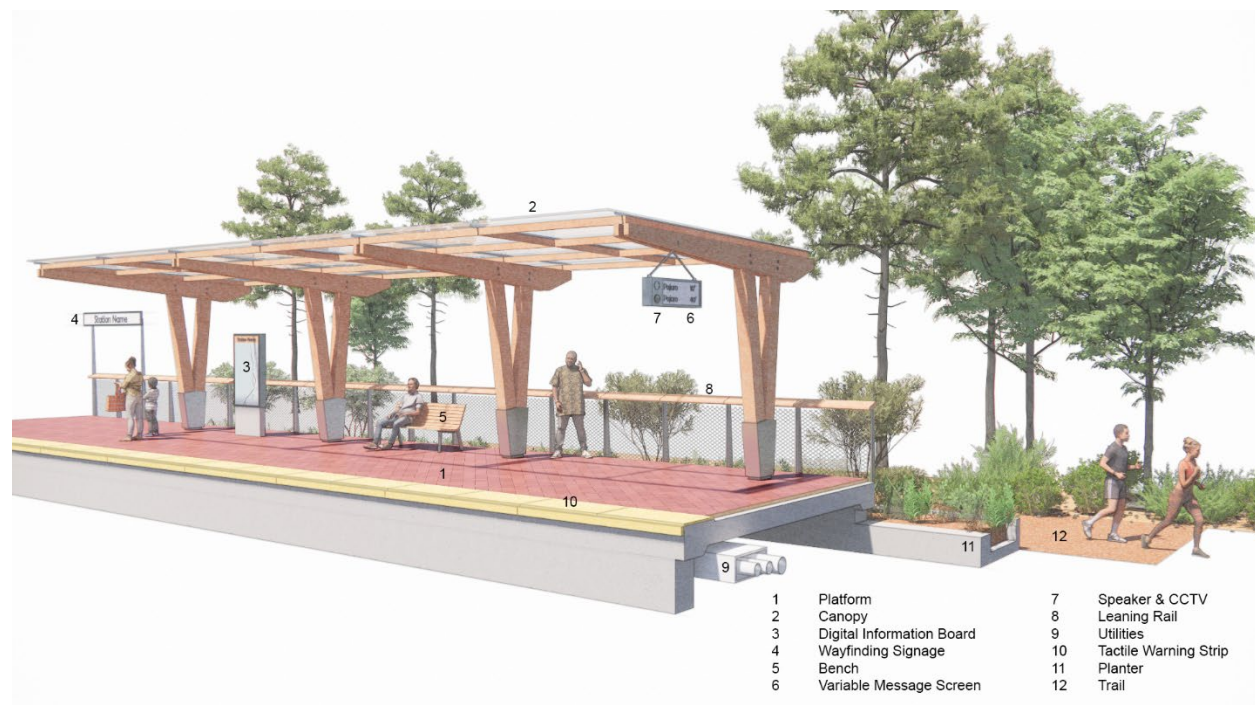
To achieve experiential consistency, a thoughtful balance between continuity and variability is essential. This allows the design to respond meaningfully to local context and evolving conditions, while also contributing to placemaking and enhancing the station's presence within the public realm. Select elements — such as architectural form, color, and materials (distinct from branding and maintenance protocols), public art, and integrated advertising — will offer opportunities for place-specific expression and placemaking, without compromising the overall coherence of the system.

15.4.1 Kit of Parts Componentry

The use of repeating elements across ZEPRT stations enables mass production and prefabrication, applying principles of product design — as opposed to site-built architecture — to enhance quality and optimize manufacturing and installation costs. Off-site fabrication and pre-assembly will significantly reduce on-site construction activities, helping to minimize risks related to cost overruns and schedule delays during implementation.

Standardizing components also improves maintainability and extends the service life of the system by promoting commonality in parts replacement, facilitating future technology upgrades, and supporting a consistent state of good repair. This approach streamlines maintenance operations and ensures long-term operational efficiency across the system. Common components for a station platform kit of parts are shown in Figure 15.3 below.

Figure 15.3 Station Platform Kit of Parts (Common Components)



Source: HDR

15.4.2 Customization Versus Off-the-Shelf Componentry

A cohesive family of components within the ZEPRT kit of parts can be achieved through a strategic combination of three distinct approaches to design and procurement related to the development of stations for the ZEPRT service:

- **Off-the-Shelf Products:** Standard components readily available from manufacturers that can be directly procured and installed by contractors.
- **Customized Off-the-Shelf Products:** Standard products that are modified in collaboration with manufacturers to meet specific design requirements before installation by contractors.
- **Fully Custom Products:** Unique components developed entirely by the design team, then fabricated and installed specifically for the project.

Each approach offers distinct advantages and trade-offs in terms of cost, lead time, design flexibility, and system integration. The most suitable option should be carefully evaluated for each component during subsequent design phases to ensure optimal performance, value, and consistency across the system. The benefits, trade-offs, and typical use cases for each approach by design and procurement approach are presented in Table 15.1 below.

Table 15.1 Benefits, Trade-Offs, and Typical Use Cases by Design and Procurement Approach

Approach	Benefits	Trade-Offs	Typical Use Cases
Off-the-Shelf Products	Lower cost, shorter lead times, proven reliability, and warranty	Limited design flexibility; may not fully meet project-specific needs	Standard equipment and fixtures, hardware, and finishes
Customized Off-the-Shelf Products	Balance between customization and efficiency, moderate cost, and lead time	Requires coordination with manufacturers; may involve additional cost and time	Modified signage, adapted enclosures, semi-custom furnishings, and finishes
Fully Custom Products	Maximum design flexibility, tailored performance, and aesthetics	Higher cost, longer lead times, increased complexity in design, fabrication and maintenance	Signature architectural elements, bespoke furniture, fully integrated systems

Source: HDR

A preliminary list of elements of continuity that are common to all stations:

- Platform Canopies
- Platform Geometry and Tactile Warning Strips
- Entry Plaza Canopies and Shading Devices
- Seating and Leaning Bars
- Ticket Vending Machines (TVMs)

- Ticket Validators
- Variable Message Screens (Countdown Clocks)
- Signage and Wayfinding Products
- Help Point Intercom
- Trash and Recyclables Receptacles
- Wind and Shade Screens
- Lighting Fixtures
- Fences and Balustrades
- Bollards
- Bike Storage and Parking
- CCTV and Audio Public Address Equipment (i.e., cameras, loudspeakers, etc.)

A preliminary list of elements of variability that are station specific:

- Public Art
- Selective Color and Materiality
- Landscaping

15.4.3 Civic Pride

By embracing a user-centered design philosophy, the proposed ZEPRT station design aims to foster a sense of community ownership and instill civic pride by creating a system that prioritizes usability, convenience, and exceptional customer service.

Placing passengers at the heart of the design process ensures that every station touchpoint is thoughtfully tailored to the needs of both the Santa Cruz County community and visitors, thus enhancing the user experience and encouraging greater ZEPRT ridership.

15.4.4 Design Pillars — Place, System, and People

To create a rail transit system that is truly responsive to user needs, the proposed ZEPRT design is guided by the three interdependent conceptual values identified below.

- **Place:** Station designs are rooted in, and responsive to, the natural and built environment, enhancing the character and identity of each location.
- **System:** The infrastructure delivers reliable, highly usable, and comfortable service that ensures convenience and accessibility for all users.
- **People:** The design reflects the needs, culture, and diversity of the community it serves, fostering inclusivity and a sense of belonging. The aim is to go beyond minimum ADA requirements and embrace the principles of Universal Design.

Together, these pillars — as presented in Figure 15.4 below — provide a holistic framework that ensures the ZEPRT system is not only functional, but also meaningful and resonant with the people and places it connects.

Figure 15.4 Design Pillars



Source: HDR

15.4.5 Design Drivers

Building upon the core design pillars of place, system, and people, a set of design drivers provides actionable guidance for developing station environments that are responsive to the user needs of the proposed ZEPRT service, including the elements described in the following sections.

Security and Safety

Station environments, and every stage of the passenger journey, must not only be safe but also feel safe. This is achieved through the application of CPTED (Crime Prevention Through Environmental Design) principles to ensure both actual and perceived security.

Passenger Experience and Comfort

Stations are designed with the users at the center, creating a seamless and frictionless journey. Key station zones will offer protection from the elements and prioritize comfort throughout the travel experience.

Connecting Destinations

Platforms, entry plazas, and vertical circulation elements (such as stairs and ramps) will be strategically located to maximize connectivity to key origins, destinations, and ridership generators.

Navigation and Wayfinding

Clear sightlines and intuitive spatial organization take precedence over excessive signage. A progressive disclosure strategy ensures that users receive the right information at the right place and time, supporting effortless navigation.

Multimodal Integration

Station design will anticipate and enable seamless connections with other transportation modes, including rail, bus, bicycle, and pedestrian networks, as well as accommodating park-and-ride and kiss-and-ride transfers.

Climate Future and Sustainability

The system should minimize resource consumption, demonstrate resilience to climate change impacts, and visibly promote the environmental benefits of public transportation.

Robustness and Maintainability

Stations and infrastructure must be designed to withstand wear and vandalism over the passage of time. This includes the use of durable, long-life materials and components that are easy to maintain and replace. Prioritizing resilience and serviceability ensures long-term performance, reduces operational disruptions, and supports a consistent state of good repair.

15.4.6 Conceptual Station Layouts

As described in the continuity and variability section of this chapter, certain design elements — such as level-boarding platforms and core continuity features — will remain consistent across the ZEPRT system. However, the spatial relationship between platforms and adjacent functional zones will be adaptable, responding to the unique context of each station site. These zones may include:

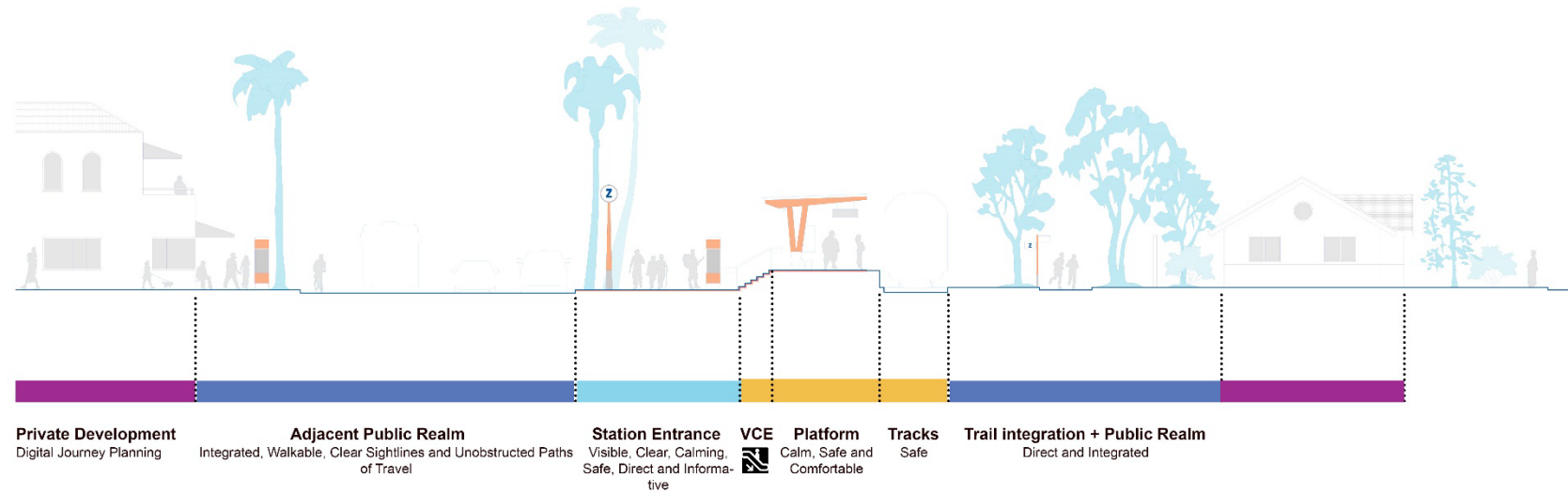
- Parking
- Kiss-and-Ride (Drop-off/Pick-up Areas)
- Bicycle Parking and Storage
- Multimodal Connectivity (including integration with other transit modes and the Coastal Rail Trail and other trails)
- Platform Shelter Location (targeting approximately 30% platform coverage)
- Waiting Areas (including seating and leaning bars)
- Ticket Vending Machines
- Station Signifiers and Information Dashboards

While the presence and function of these elements will remain consistent across stations, it is anticipated that their configuration and placement will be tailored to the context of each site, ensuring both functional efficiency and sensitivity to local conditions.

Figure 15.5 below presents, at a conceptual level, station functional zoning and potential layouts that could be considered contextually for development at stations for the ZEPRT Project.

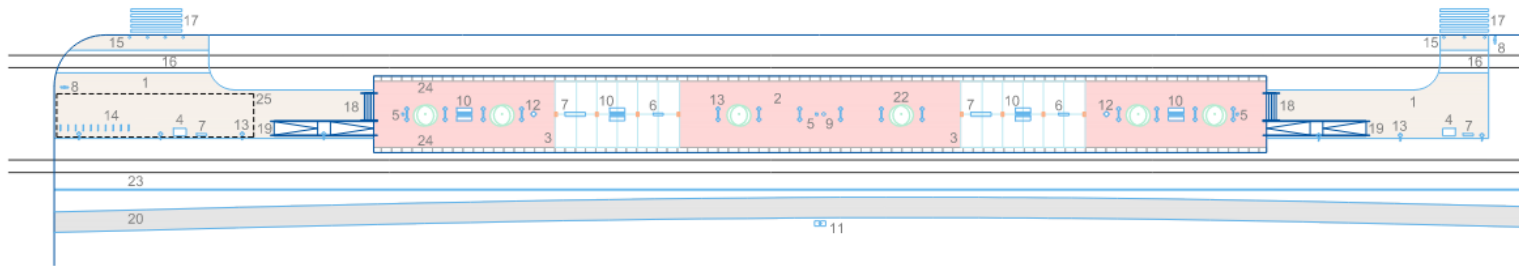
Station locations and conceptual layouts will continue to be refined and confirmed as the ZEPRT Project advances into future design phases.

Figure 15.5 Stations Functional Zoning and Potential Layouts

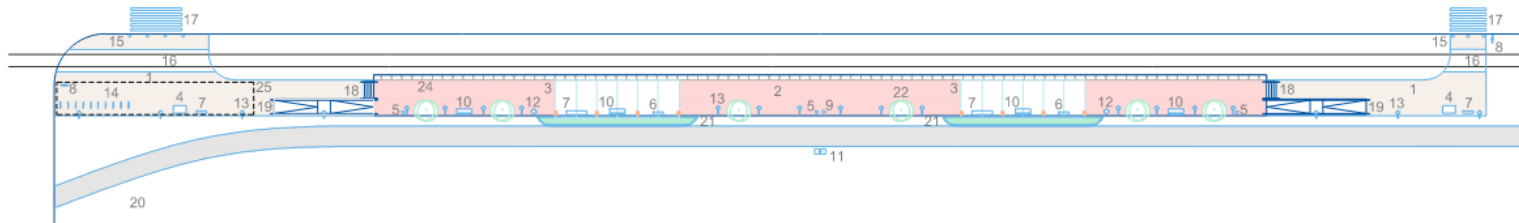


Source: HDR

Figure 15.6 Typical Platform Arrangement



Typical Island Platform Plan - 30'x350'



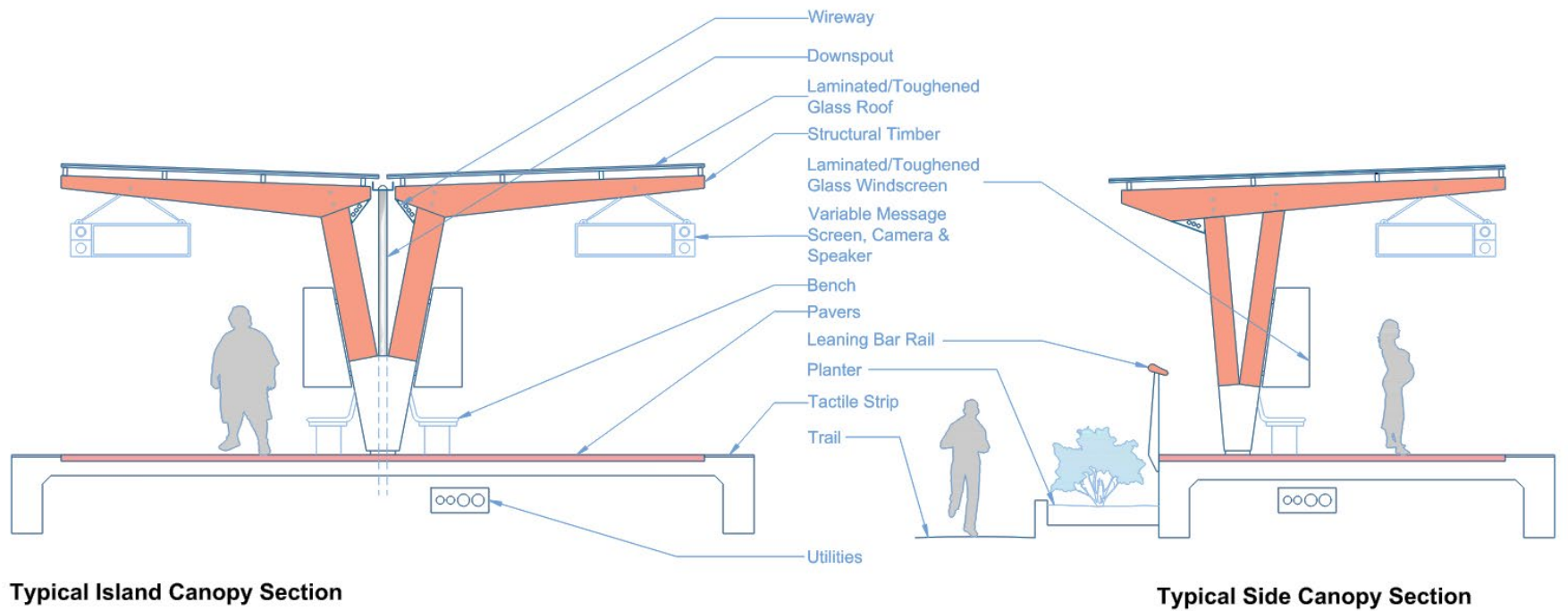
Typical Side Platform Plan - 16'x350'

1 Entrance / Plaza	14 Bike Rack
2 Platform	15 Bollard
3 Canopy	16 Track Crossing
4 Ticket Vending Machine	17 Pedestrian Crossing
5 Ticket Validator	18 Stair
6 Digital Information Board	19 Ramp
7 Wayfinding Signage	20 Trail
8 Signifier Totem	21 Planter
9 Help Point	22 Tree
10 Bench	23 Fence
11 Drinking Fountain	24 Tactile Warning Strip
12 Trash / Recycling Bin	25 Shading Trellis
13 Light Pole	

0 25 50 100'
DRAFT - CONCEPTUAL DIAGRAM

Source: HDR

Figure 15.7 Typical Canopy Section



0 1 2 5 10'
 DRAFT - CONCEPTUAL DIAGRAM

Source: HDR

16.0 Conceptual Rail Transit Layover and Maintenance Facility

A Layover and Maintenance Facility (LMF) where ZEPRT passenger rail trainsets and other rail-borne equipment associated with operations and maintenance can be stored during periods of non-operation and where routine cleaning, inspection, refueling/recharging, and maintenance would occur on service tracks and in a shop is anticipated for development of the ZEPRT Project. This chapter conceptually identifies and describes the facility requirements based on rail transit industry experience and best practices, potential facility design concept and features, and potential facility locations on and/or immediately adjacent to the SCBRL corridor between Pajaro and Santa Cruz. The specific location, requirements, and scope of the LMF will be confirmed through coordination with stakeholders and the manufacturer of the passenger rail trainset selected for the ZEPRT service and additional planning and design activities conducted during ongoing development of the ZEPRT Project.

The potential for developing an LMF for the ZEPRT Project on an alternative or phased basis — including the ability to accommodate select LMF functions off-site in the local area or also facilitate heavy maintenance activities (i.e., wheel truing, heavy body work, painting, fleet rehabilitation, and so on) at a nearby facility shared with other rail transit operators in the Northern California region or at a facility owned and operated by a third-party rail equipment manufacturer or vendor instead of including them in a complete and autonomous LMF on the ZEPRT network — will also be considered through stakeholder coordination and additional planning and design as the ZEPRT Project advances.

16.1 Layover and Maintenance Facility General Requirements

General requirements for the ZEPRT LMF are conceptually identified and described in the sections that follow.

16.1.1 Overall Site

It is anticipated that the overall LMF site to support the ZEPRT service will include the following support and infrastructure areas:

- **Storage Track:** the LMF will include exterior storage track for the storage of ZEPRT trainsets.
- **Track to LMF Repair Positions:** track will be provided that allows the trainsets drive-through access to the LMF repair positions and back out with access to the storage track.
- **Access Roadways:** will be provided off main ingress and egress paths to the site, as well as between the various facilities on site. Additionally, there will be a loop-road surrounding the LMF building to facilitate complete access and navigation to the key areas of the facility.
- **Wash Building:** the LMF site will include a freestanding, automated wash bay with an automated drive-through type wash system and an integrated water reclamation system. The wash system will be designed to specifically accommodate passenger rail cars. Wash equipment providing

water, power, and detergent to the automated wash bay system will be in a dedicated, enclosed equipment room adjacent to the wash lane.

- **Employee / Visitor Parking Lot:** the LMF will provide a dedicated parking lot for LMF staff working in the LMF facility, other employees engaged in the operations and maintenance of the ZEPRT service, and visitors.
- **Rail Bound Vehicle Storage:** the LMF will include dedicated storage areas for all rail-bound vehicles and equipment.
- **Track to Rail Bound Vehicle Maintenance Repair Positions:** track will be provided for full accessibility of rail-bound equipment to each of the repair positions located in the Maintenance-of-Way (MOW) facility.
- **MOW Storage Yard:** will include a dedicated MOW storage yard, with large vehicular access, to store spare replacement components and equipment used for maintenance of the system infrastructure (i.e., track, bridges, signals, stations, etc.). In addition to the MOW storage yard, covered storage areas will be required for the components that need ultraviolet (UV) protection and security. A storage track will be provided to allow for storage of MOW-specific rail vehicles and equipment.
- **MOW Vehicle Parking:** dedicated secure parking lots and areas will be provided for agency non-revenue vehicles and MOW maintenance vehicles.
- **MOW / Non-Revenue Vehicle (NRV) Maintenance Employee Visitor Parking:** the MOW facility will provide a dedicated parking lot for staff working in the facility and visitors.

16.1.2 Rail Administration

The Rail Administration section of the LMF will house rail-specific administrative staff to manage and support the operation of the ZEPRT system. The spaces associated with Rail Administration will include office areas, conference rooms, break rooms, and support spaces specific to the needs of the administrative staff.

16.1.3 Rail Operations Control Center

The Rail Operations Control Center (ROCC) of the LMF will provide oversight and management of ZEPRT operations on the SCBRL with direct train dispatching that controls the operators and movements of the ZEPRT trainsets. The ROCC will include a secure Control Room with workstations and a video wall, offices, a breakroom, restroom, an incident meeting room, an IT/Server Room, and an Equipment Room.

16.1.4 Rail Operations Support

The LMF will include rail operations spaces dedicated to the supervisory staff that oversee train operators. The support areas will provide spaces for dispatch, locker rooms, breakrooms, and restrooms.

16.1.5 Rail Maintenance

The Rail Maintenance department will be responsible for servicing, inspecting, performing preventative maintenance, and overall maintenance of the trainsets for the ZEPRT service. Rail Maintenance facilities at the LMF will include the following areas.

- Office and office support areas for the maintenance staff and technicians that will maintain the rail cars.
- Repair positions and shop areas sized and equipped to maintain the fleet of trainsets assigned to the ZEPRT service.
- Service and inspection and preventative maintenance positions which include:
 - The Lower-Work Area (LWA) will be utilized by the maintenance staff for access to the lower skirts and the underside of a trainset.
 - Interior access platforms will be utilized by maintenance and cleaning staff to access the interiors of the trainset.
 - Upper-Level Work Platforms (ULWP) will be provided to access the roof tops of the train cars to access and maintain rooftop mounted components, including Heating, Ventilation, and Air Conditioning (HVAC) systems.
- Vehicle lift positions, including trainset lifts which will allow for truck/bogie removal for maintenance or change out.
- Support shop and storage areas to support rail car maintenance functions.
 - The Train Car maintenance functions shall be directly supported by dedicated shop areas, including the Truck Shop and Common Work Area (CWA), Brake and Couple Shop, and other component shops will provide dedicated areas and equipment necessary for component repair and maintenance. Additionally, the shops and rail repair positions shall be supported by dedicated Portable Equipment Storage (PES) and Toolbox Storage Areas.
- **Parts Storage:** Spare parts required for routine maintenance, service, and repair of the rail cars will be stored in a dedicated, secure Parts Room. This Parts Room will include small parts storage areas utilizing both conventional shelving and high-density storage systems, and large (heavy) parts storage utilizing high density palletized rack storage systems, conventional pallet rack systems, and bulk storage shelving equipment. The Parts Room will include a dedicated shipping and receiving area with exterior access via an overhead door and dedicated delivery dock outside for delivery truck unloading. Parts will be issued through a dedicated Issue Window.
 - **Wheel Truing:** a dedicated area to facilitate the reshaping and smoothing of the train wheels will be included within LMF. The area will be located with easy access to the support areas of the LMF building.

- **Paint and Body:** a dedicated area will be included to facilitate the maintenance and repair of the trainset exteriors. This area will have easy access to specialty shops and support areas of the LMF building.

16.1.6 Cleaning

The LMF will have a dedicated interior cleaning platform that provides access to the interior of the trainsets for the service staff. The cleaning areas will be placed on the LMF site in a way that considers the efficiency of ZEPRT trainset movements between washing, fueling, and cleaning positions and trainset storage locations.

16.1.7 Maintenance-of-Way

The LMF will include a MOW building and yard that will provide the necessary storage, shops, and support spaces for MOW crews maintaining the ZEPRT network infrastructure.

16.1.8 NRV Maintenance

NRV maintenance will consist of an administration office, MOW crew support areas, crew tool and equipment storage areas, and specialty MOW shops. These shops will be used in maintaining all non-revenue vehicles, including rubber-tired and rail-bound equipment necessary to support ZEPRT.

16.2 Layover and Maintenance Facility Analysis Approach and Methodology

A conceptual space needs program was developed for the ZEPRT Project that includes a comprehensive list of proposed building and site areas for a complete and autonomous operation. The program is based upon the ZEPRT Project team's understanding of and best practices for passenger and commuter rail operations and maintenance facilities in the U.S., conceptual requirements to operate and maintain the daily ZEPRT service operating on 30-minute headways with ZEMU passenger trainsets (as identified in the Conceptual Passenger Rail Operations and Equipment Plans in Chapter 17), and preliminary coordination with SCCRTC and other stakeholders.

16.3 Potential Design Features and Concepts

This section identifies potential design features and concepts for the ZEPRT Project LMF.

16.3.1 Rail Administration

Rail Administration is typically a suite within LMF and could be located on an upper level of the building. The building should include a lobby to allow employees and visitors access to the space, and the staff assigned to Rail Administration. If required, the space for this department could also be located offsite. In that case, a smaller satellite presence would be located onsite and would include hoteling offices and workstations for Rail Administration staff.

16.3.2 Rail Operations Control Center

The ROCC suite will be secure with access only for authorized staff and could be located on an upper level of the LMF building. This space should be on backup power/generator to protect ZEPRT operations and maintenance activities during potential power outages. This space could be located offsite.

16.3.3 Rail Operations Support

The Rail Operations areas will be located within the main LMF building. Careful consideration for the safety and efficiency of the operators' daily movements between employee parking, building operators support areas, and ingress to the trainsets will be provided.

16.3.4 Rail Maintenance

The Rail Maintenance Office Areas shall be located on the main/ground level. In consideration of the safe and efficient movement of Rail Maintenance staff from the employee parking in the building (Rail Maintenance Support Areas), and out to the shop areas will be a determining factor for designing this space.

The Rails Maintenance repair positions need to be located on the site so that the track can efficiently access the LMF building and the repair positions. To minimize the building footprint consider locating shops on a second level which facilitates component change out of rooftop mounted equipment. The Truck Shop should be located adjacent to a repair position which includes a vehicle lift. To reduce the building footprint, the Truck Shop could be located off site at a separate facility. In this scenario, adequate storage for trucks and a loading and unloading area with access to a bridge crane should be planned onsite.

The Wheel Truing equipment should be located on the site so that the track can efficiently access the LMF building and the Wheel Truing Positions. The repair position should be sized so that no matter which truck/bogie is being maintained on the train car, the entire train car is located within the building. The staff that support Wheel Truing need access to the Rail Maintenance office and support areas, including break rooms, locker rooms, and restrooms. To increase space and staff efficiency, adding a Lower Work Area (LWA) for inspections on the same track as the wheel truing position should be considered. In addition, Wheel Truing requires adequate storage for trucks and a loading/unloading area with access to a bridge crane. To reduce the building footprint, Wheel Truing could be allocated to another facility with the capability of maintaining trucks/bogies. If the entire train set needs to be moved to another facility for Wheel Truing, then connecting trackwork between facilities will be necessary.

The Paint and Body should be located on the site so that the track can efficiently access the LMF building and the Paint and Body Repair positions. The staff that support Paint and Body Repair shall need access to the Rail Maintenance Office and support areas, including break rooms, locker rooms, and restrooms. Staff will need access to the Rail Maintenance Parts Storage for the components, materials and supplies needed for Paint and Body work. To reduce the building footprint, Paint and Body work could be supported at another facility. If the entire trainset needs to be moved to another facility, then the track needs to have connection to the track where the alternate facility is located.

16.3.5 Cleaning

The Wash Building should be located on track which can subsequently access the Service and Inspection (S&I) Bays inside the building. The S&I Bays are the proposed location for interior cleaning of the trainsets. The Train Wash building shall be based upon the requirements of the selected wash system for effective cleaning of the train cars. The Train Wash will be long enough so that there is sufficient dwell time (based on manufacturer recommendations) between the detergent (soap) arches and the brushes for optimal performance of the system. Blowers/dryers should be considered and used depending on the weather. The associated pumps, tanks, and reclaim system shall be in a separate room adjacent to the train wash. A covered Washing Building could be considered based on the climate. The Wash Equipment Room should remain inside an enclosed building.

16.3.6 Maintenance-of-Way

The MOW Office Areas shall be located on the main/ground level. Careful consideration of the safe and efficient movement of MOW staff from employee parking, into the building (MOW Office Locker/Break Rooms), and out to the MOW shop areas, will be a determining factor for designing this space.

The MOW Shop Areas shall be located with overhead-door access from the exterior to each shop and shall include a shared overhead bridge crane. A shared loading and unloading area shall be included inside the building to support the movement of large components and supplies to the individual shop areas. A wide central corridor will be maintained within the building to facilitate the movement of staff, materials, and supplies. Parking for rail-bound NRV and rubber-tired vehicles will be located near the MOW shop areas. A main storage yard of materials and supplies which do not need to be stored inside should be located on site, it should be accessible by both rubber-tired parking and rail-bound vehicles and equipment.

16.3.7 Non-Revenue Vehicle Maintenance

The Non-Revenue Vehicle Maintenance (NRV VM) Office will be located on the main/ground level with consideration for the safe and efficient movement of NRV VM staff from the employee parking, into the building (NRV VM Office Locker/Break Rooms), and out to the NRV VM Shop Areas.

The NRV VM shop will need to be located on the LMF site so that the track can efficiently access the NRV VM building and the Railed Vehicle Repair Positions. Rubber tire vehicle Repair Bays would be located adjacent to the Railed Vehicle Repair. The Shop Areas and Parts Storage would be located adjacent to the repair bays and positions.

NRV VM should be considered as part of the MOW Building. Support areas for MOW and VM staff could be consolidated within the building.

NRV VM could be supported by offsite Vehicle Maintenance Facilities. For railed VM, a PM Bay should be considered onsite at a minimum. If railed vehicles needed to be maintained offsite, then the track needs to have connection to the track where the alternate facility is located.

A Wash Building for rubber tire NRV vehicles in a central location would be considered. This would be shared by both ZEPRT rail and MOW operations.

16.4 Conceptual Space Needs Program Summary

A conceptual space needs program summary was developed for the ZEPRT Project that includes identification of proposed exterior and interior spaces for a complete and total facility need based upon the proposed number of trains which will be stored on the site. While the conceptual operating plan for the proposed ZEPRT service operating daily on 30-minute headways contemplated the need for five trainsets to support daily scheduled ZEPRT service, one spare trainset to accommodate maintenance cycles, and one hot spare trainset for a total of seven trainsets, the conceptual space needs program summary scenarios below was developed for the requirement to maintain a total of six trainsets and eight trainsets to establish a general range of probable LMF space needs. The two scenarios are summarized in Figures 16.1 and 16.2 below by department or function and include staffing, space quantity, and approximate overall square footage. The conceptual space needs summary for the ZEPRT layover and maintenance facility did not include infrastructure for storing hydrogen and for fueling the proposed vehicles at this time.

These requirements and the related types and scope of infrastructure will be identified and defined as the ZEPRT Project advances.

Figure 16.1 ZEPRT Conceptual LMF Space Needs Program Summary (Page 1 of 2)

Space Needs Program - Summary May 28, 2025			6 Total Trains			8 Total Trains			Remarks
			Qty.		Area	Qty.		Area	
			Staff	Space	(SF)	Staff	Space	(SF)	
RAIL VEHICLE FLEET YARD									
Rail Vehicle Storage Track				6	51,000		8	68,000	Train Storage Tacks
Miscellaneous Additional Tracks				2	8,875		2	8,875	Miscellaneous Trackwork
Maintenance of Way Track Work				8	12,000		8	12,000	Railbound MOW Vehicle Storage Track
Yard Buildings				1	100		1	100	
SUBTOTAL RAIL VEHICLE FLEET YARD				17	71,975		19	88,975	
Site Circulation					89,970			111,220	
TOTAL RAIL VEHICLE FLEET YARD				17	161,945		19	200,195	
BUILDING AREAS									
RAIL OPERATIONS ADMIN			10	32	5,908	10	32	5,908	Plan for a second floor Main Building Conditioned
OPERATIONS CONTROL CENTER			16	38	4,908	16	38	4,908	Plan for a second floor Main Building Conditioned
RAIL OPERATIONS			64	29	7,191	76	29	7,593	Plan for a second floor Main Building Conditioned
RAIL MAINTENANCE OFFICE AREAS			54	46	9,115	62	48	9,406	Main Building Conditioned
RAIL MAINTENANCE SHOP AREAS				39	49,483		42	50,243	Train Access Main Building Heated Only
RAIL MAINTENANCE PARTS STORAGE			10	27	10,886	10	27	13,271	Main Building Heated Only
RAIL MAINTENANCE WHEEL TRUING				5	13,500		5	13,500	Add Option Main Building Heated Only
RAIL MAINTENANCE PAINT AND BODY				14	13,750		14	13,750	Add Option Main Building Heated Only
CLEANING				6	9,865		6	9,865	Train Wash Separate Building Heated Only
MAINTENANCE OF WAY OFFICE AREAS			18	41	7,498	18	41	7,498	MOW Building Conditioned
MAINTENANCE OF WAY SHOP AREAS				36	14,713		36	14,713	MOW Building Heated Only
NRV VEHICLE MAINTENANCE			7	17	2,396	7	17	2,396	Train Access MOW Building Heated Only
NRV VEHICLE MAINTENANCE SHOP AREAS				14	8,680		14	8,680	MOW Building Heated Only
NON-REVENUE VEHICLE WASH				6	2,250		6	2,250	MOW Building Heated Only
TOTAL BUILDING AREAS			179	350	160,143	199	355	163,981	
Covered Areas									
RAIL MAINTENANCE				1.0	500.00		1.0	550.00	Patio
RAIL MAINTENANCE PARTS STORAGE				2.0	660.00		2.0	660.00	Loading Dock Canopy
TOTAL Covered Areas			0.0	3.0	1,160.00	0.0	3.0	1,210.00	

Source: HDR

Figure 16.2 ZEPRT Conceptual LMF Space Needs Program Summary (Page 2 of 2)

Space Needs Program - Summary May 28, 2025			6 Total Trains			8 Total Trains			Remarks
			Qty.		Area	Qty.		Area	
			Staff	Space	(SF)	Staff	Space	(SF)	
Exterior Areas									
RAIL MAINTENANCE				4.0	1,800.00		4.0	1,800.00	Dumpsters/Generators
RAIL MAINTENANCE PARTS STORAGE				3.0	6,200.00		3.0	6,200.00	Loading/Unloading Area for Semi Truck
MAINTENANCE OF WAY				9.0	27,800.00		9.0	27,800.00	Open Material Storage Yard
TOTAL Exterior Areas				16.0	35,800.00		16.0	35,800.00	
Covered Vehicle Parking									
RAIL OPERATIONS ADMIN				3.0	900.00		3.0	1,050.00	Canopy
OPERATIONS CONTROL CENTER				1.0	300.00		1.0	350.00	Canopy
RAIL MAINTENANCE				1.0	504.00		1.0	504.00	Canopy
RAIL MAINTENANCE PARTS STORAGE				1.0	300.00		1.0	300.00	Canopy
MAINTENANCE OF WAY				6.0	4,008.00		6.0	2,004.00	Canopy
NRV VEHICLE MAINTENANCE				1.0	504.00		1.0	504.00	Canopy
Subtotal Covered Vehicle Parking (Non Revenue Fleet)				13	6,516		13	4,712	
Site Circulation					4,512			4,712	
TOTAL Covered Vehicle Parking				13.0	17,544.00		13.0	14,136.00	
Employee/Visitor Parking									
RAIL OPERATIONS ADMIN				7.0	3,391.20		7.0	3,391.20	Canopy
OPERATIONS CONTROL CENTER				18.0	3,585.60		18.0	3,585.60	Canopy
RAIL OPERATIONS				30.0	5,918.40		38.0	7,473.60	Canopy
RAIL MAINTENANCE				28.0	5,529.60		32.0	6,307.20	Canopy
RAIL MAINTENANCE PARTS STORAGE				7.0	1,447.20		7.0	1,447.20	Canopy
MAINTENANCE OF WAY				24.0	4,752.00		24.0	4,752.00	Canopy
NRV VEHICLE MAINTENANCE				9.0	1,836.00		9.0	1,836.00	Canopy
Subtotal Covered Employee/Vistorage Parking				123	26,460		135	28,793	
Site Circulation					26,460			28,793	
Total Employee/Visitor Parking				123.0	52,920		135.0	57,586	
Site									
Subtotal Site and Building Areas					429,512			472,907	
Site Circulation, Setbacks, Landscaping, Site Access 125%					536,890			591,134	
Total Site Requirements					966,403			1,064,041	

Source: HDR

16.5 Potential Layover and Maintenance Facility Locations

During the development of the ZEPRT Project and based on the conceptual space needs program summary and rail industry experience and best practices, two locations for a potential LMF site were conceptually identified near the proposed ZEPRT terminal station in Pajaro on the east end of the SCBRL in the Pajaro / Watsonville area.

The primary LMF location identified during initial conceptual screening is an area situated in Santa Cruz County, west of the City of Watsonville and near the Watsonville Slough. The facility will be developed in a footprint immediately south of the existing SCBRL corridor. Two conceptual site diagrams to illustrate the potential arrangements of the West Watsonville site were developed for the ZEPRT Project.

Option 1 for the West Watsonville LMF, shown in Figure 16.2 below, explored the potential of an all-encompassing facility and vertically stacked drive-through track configuration. While being an ideal configuration for optimal site navigability, it will require the proposed right-of-way for the LMF to be moved further south of the SCBRL than initially proposed.

Option 2 for the West Watsonville LMF, shown in Figure 16.3 below, explored the viability of having two positions for each track line. This configuration allowed for a smaller vertical footprint and can be accommodated within the right-of-way footprint originally proposed.

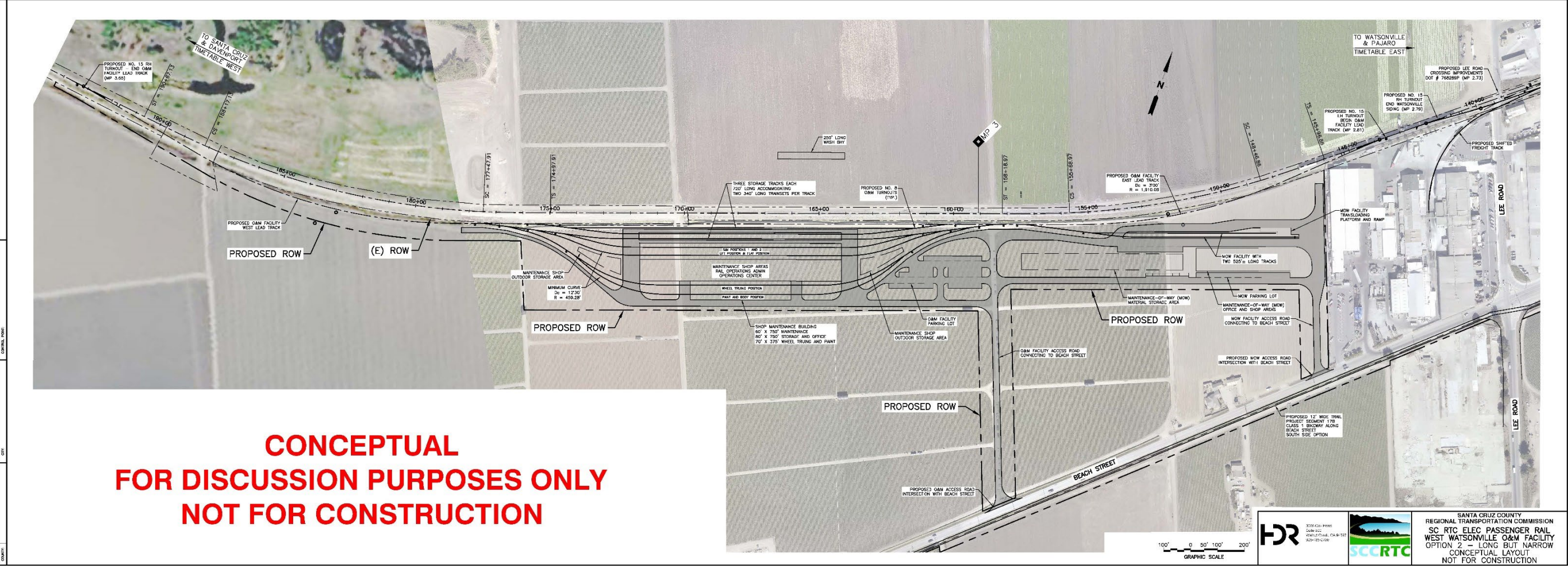
Additionally, conceptual screening identified a potential alternate site adjacent to the SCBRL in Pajaro, located in Monterey County. However, a cursory assessment of the site identified that it is situated in close proximity to a residential community and agricultural area and may not be conducive to the proposed functionality and operation of an LMF for the ZEPRT service.

The actual site location along the SCBRL corridor and specific configuration and requirements for the LMF will be confirmed through stakeholder coordination and additional planning and design activities as the ZEPRT Project advances.

[illegible]

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Figure 16.4 Potential ZEPRT West Watsonville LMF Site (Option 2)



Source: HDR

17.0 Conceptual Rail Transit Operations and Equipment Plans

The ZEPRT Project seeks to implement a new passenger rail service on the 22 miles of the single-track Santa Cruz County owned SCBRL between Pajaro and Natural Bridges Drive in Santa Cruz. The existing rail corridor would require various new and enhanced network infrastructure to host the ZEPRT passenger rail service while also accommodating freight rail service in a shared-use environment.

Development of initial conceptual rail operations modeling for the ZEPRT Project is required to identify and define the rail network and related infrastructure necessary to support the safe and efficient operation of passenger trains on the SCBRL corridor (identified and described in Chapter 14) and to validate the passenger train equipment type analyzed and an operating schedule and equipment plan that matches the demand for the service (identified in this chapter).

An iterative process leveraging the outputs from the rail transit operations modeling and informed by demand and ridership forecasting, confirmed conceptual rail transit alignment and track speeds, identification of proposed station locations, analysis of potential rail transit vehicle types, consideration of best practices, and coordination with project stakeholders and the community was used to develop an initial conceptual rail transit operations and equipment plan for the ZEPRT Project.

17.1 Conceptual Railroad Operations Modeling Approach and Methodology

This section describes the approach and methodology used in the initial conceptual rail operations modeling and analysis to establish a train operations baseline on the SCCRTC network between Pajaro and Natural Bridges Road in Santa Cruz, against which schedules for operation of the proposed new ZEPRT passenger rail service could be tested.

The Rail Traffic Controller™ (RTC) railroad operations simulation tool developed by Berkeley Simulation Software, LLC was used to support analysis undertaken for the project. The most recent version of RTC available at the time the simulation work was performed was production version 76Z, which was released on May 21, 2025. RTC is an operations simulation software used broadly by North American passenger and freight railroads; FRA; state and local public agencies; colleges and universities; and various research, engineering, and consulting companies. The RTC model uses empirically validated algorithms to operate trains through the infrastructure, so that trains perform in the model in a manner similar to how they would in the real world, with similar speed attainment and accelerations and decelerations, and using artificial intelligence algorithms to dispatch multiple trains in the model according to their priorities, railroad operating and safety rules, and as a human train dispatcher would. RTC is used to analyze and optimize rail operational and infrastructure plans; the effects of passenger train operations and schedules on shared-use and passenger-only rail corridors; and to quantify travel times, velocity, delay, and other measurements by simulating train operations over a specific network.

To develop analysis for the project, the RTC model was used to run a case that simulated a period of 10 days, with a two-day warmup and one-day cooldown period so that the model was in a steady state for

seven full days. Data was accumulated only from the seven-day capture period between warmup and cooldown days.

Outputs developed from the initial conceptual RTC modeling and used to support the analysis and the initial conceptual operations and equipment plans for the ZEPRT Project are identified and described in Chapter 17.5.

17.2 Key Assumptions for Modeling, Analysis, and Operating Plan Development

The key assumptions used to support development of the initial conceptual RTC model and the operational analysis and development of initial conceptual operations and equipment plans for the ZEPRT Project are identified and described in this section.

17.2.1 Operations Scenario Modeled

The operations scenario (case) modeled and analyzed for the ZEPRT Project included a scheduled zero-emission passenger rail service using a Stadler FLIRT H2 hydrogen/battery trainset between Pajaro and Natural Bridges Drive in Santa Cruz operating on 30-minute headways from approximately 6 a.m. to 10 p.m. daily.

The RTC model case included the SCBRL network and proposed network infrastructure improvements and ZEPRT passenger train operations that were depicted for a representative period in 2025. This case was developed and calibrated through SCCRTC inputs acquired via in-person and virtual coordination meetings and review and a site visit to the SCBRL corridor to optimize the model.

17.2.2 Operations Model Study Area

The RTC model requires input of a specific geographic territory, typically selected to include the area of analysis (model corridor Study Area) and connections to the contiguous rail network to allow trains to enter and exit the RTC model. The 22 miles of the single-track Santa Cruz County owned SCBRL used by the ZEPRT passenger rail service between Pajaro and Natural Bridges Drive in Santa Cruz and connections with and interface between the UP Coast Subdivision at Pajaro (Watsonville Junction) and the SCBG at Santa Cruz formed the general envelope of the model corridor Study Area. The route of the proposed ZEPRT passenger train is presented in Figure 17.1 below.

Figure 17.1 ZEPRT Passenger Rail Service Route



Source: HDR

17.2.3 ZEPRT Passenger Train Standard Consist

The planning-level standard train consist modeled for the ZEPRT passenger rail service between Pajaro and Natural Bridges Drive in Santa Cruz included a ZEMU Stadler FLIRT H2 hydrogen/battery powered trainset.

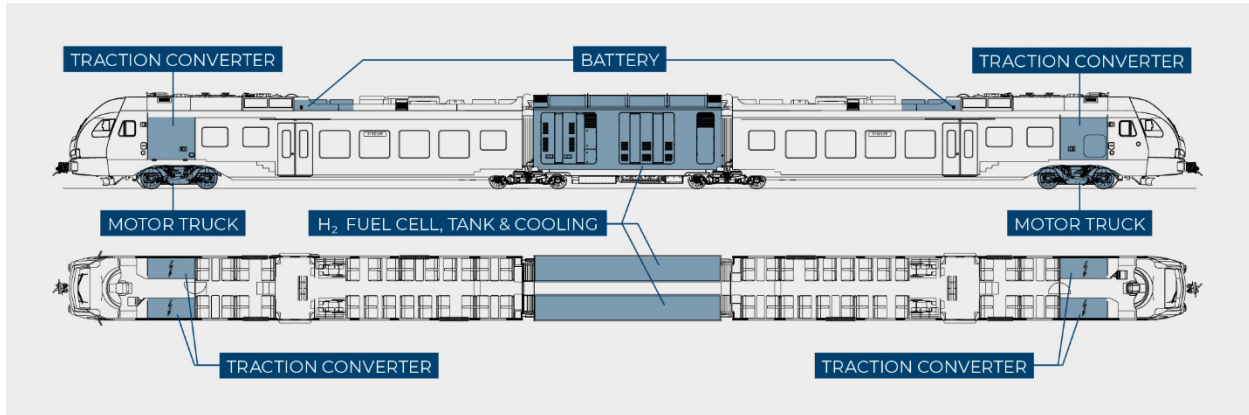
The general physical and operating characteristics of the planning-level standard trainset consist includes¹¹:

- **Standard Consist:** Stadler FLIRT H2 hydrogen/battery powered trainset with two passenger cars and a power unit (note that there is the potential to couple two of these trainsets together to operate longer trains to accommodate additional passenger demand for a total length of 338 feet).
- **Length:** 168 feet, 11 inches
- **Horsepower:** 938
- **Maximum Operating Speed:** 79 miles per hour

- **Station Platform Interface:** Level-boarding and fully ADA compliant with floor height of trainset at 24 inches above top of rail at the entrances
- **Passenger Capacity:** 116 seated plus 12 folding seats and 120 standing

A diagram of the planning-level standard trainset consist is shown in Figure 17.2 below.

Figure 17.2 Stadler FLIRT H2 Single-Unit Vehicle Diagram



Source: Stadler

The actual passenger rail equipment type, number, length, and configuration of cars, and means of propulsion will be confirmed through stakeholder coordination during development of the ZEPRT Project.

17.2.4 Station Locations

Proposed station locations served by the ZEPRT passenger rail service between Pajaro and Natural Bridges Drive in Santa Cruz were identified through an assessment of past studies for passenger rail service implementation on the SCBRL and through identification of a conceptual alignment for the ZEPRT service, development of a conceptual ridership forecast, and stakeholder and community outreach that occurred during development of the ZEPRT Project. These conceptual station locations and their general characteristics are identified by SCBRL milepost location and platform type in Table 17.1 below.

Table 17.1 Conceptual ZEPRT Station Locations on SCBRL

Station	SCBRL Corridor Location	Platform Type
Pajaro	Milepost 0.0	Single-faced level-boarding platform on SCBRL main track, shared with UP track pending further coordination with UP during development of ZEPRT Project
Downtown Watsonville	Milepost 1.34-1.39	Single-faced level-boarding platform on SCBRL main track
Aptos	Milepost 12.95-12.98	Single-faced level-boarding platform on SCBRL main track
Cabrillo	Milepost 14.13-14.20	Single-faced level-boarding platform on SCBRL main track
Capitola	Milepost 15.42-15.48	Double-faced level-boarding center platform between SCBRL main track and double-ended siding
17th Avenue (Santa Cruz)	Milepost 17.73-17.80	Single-faced level-boarding platform on SCBRL main track
Seabright (Santa Cruz)	Milepost 18.86-18.92	Double-faced level-boarding center platform between SCBRL main track and double-ended siding
Beach Street / Downtown	Milepost 19.97-20.01	Single-faced level-boarding platform on SCBRL main track
Natural Bridges Drive (Santa Cruz)	Milepost 21.71-21.78	Double-faced level-boarding center platform between SCBRL main track and stub-ended siding

Source: HDR

The location and potential configuration of these stations and level-boarding station platforms, as developed through conceptual network design undertaken for the ZEPRT Project, were included in the RTC model. Based on industry best practices, a one-minute dwell at each intermediate station on the SCBRL corridor for passenger boarding and alighting was assumed for the ZEPRT passenger trains. The end-of-line terminal stations at Pajaro and Natural Bridges Drive in Santa Cruz will also be used to accommodate “turning” of ZEPRT passenger trains between scheduled runs (i.e., sweeping train, changing ends, etc.). Final station locations and the potential for additional intermediate stations served on a seasonal basis will be confirmed during ongoing development of the ZEPRT Project.

17.2.5 Method of Operation

The Method of Operation anticipated for a shared-use passenger and freight railroad SCBRL corridor over which ZEPRT passenger trains would operate is CTCS, which is a wayside signal system that would allow a train dispatcher to remotely control movements on the main track and into and out of sidings and connections to the UP at Pajaro (Watsonville Junction) and SCBG at Santa Cruz. The CTCS would be further equipped with a PTC overlay to provide an additional measure of safety and to prevent the potential for overspeed train derailments, incursions into established work zones where maintenance and construction are occurring on the network, and movement of trains through turnouts to sidings and connection tracks left in the wrong position. The Method of Operation will be confirmed through coordination with FRA and potentially other regulatory stakeholders during ZEPRT Project development.

17.2.6 ZEPRT Passenger Train Operating Speed

Given the characteristics of the conceptual alignment and passenger train equipment type for the proposed ZEPRT service, location and proximity of potential stations, typical operating practices for a passenger service like that being studied for the ZEPRT Project, and other local safety and multimodal transportation and community interface considerations, maximum speeds for ZEPRT passenger trains on the SCBRL main track in the RTC model is 60 miles per hour.

Permanent speed restrictions owing to main track curvature and other track geometry considerations and operation within the roadway environment in Watsonville and Santa Cruz and operations on passing sidings, connection tracks, and through the diverging path of main track turnouts are more restrictive, and range between 15 and 55 miles per hour. Table 17.2 below conceptually identifies maximum passenger train speeds by milepost on the ZEPRT conceptual alignment within the SCBRL right-of-way.

Table 17.2 Maximum Passenger Speeds on ZEPRT Conceptual Alignment in SCBRL Right-of-Way

SCBRL Corridor East Milepost Location	SCBRL Corridor West Milepost Location	Maximum ZEPRT Passenger Train Speed (Miles per Hour)
MP 0.00	MP 0.23	15
MP 0.23	MP 0.43	20
MP 0.43	MP 0.74	30
MP 0.74	MP 1.08	35
MP 1.08	MP 1.42	25
MP 1.42	MP 1.63	20
MP 1.63	MP 1.88	45
MP 1.88	MP 3.70	60
MP 3.70	MP 4.25	50

SCBRL Corridor East Milepost Location	SCBRL Corridor West Milepost Location	Maximum ZEPRT Passenger Train Speed (Miles per Hour)
MP 4.25	MP 4.46	40
MP 4.66	MP 4.78	35
MP 4.78	MP 5.83	30
MP 5.83	MP 6.03	25
MP 6.03	MP 6.27	20
MP 6.27	MP 6.72	30
MP 6.72	MP 6.83	45
MP 6.83	MP 7.77	40
MP 7.77	MP 7.90	50
MP 7.90	MP 8.06	40
MP 8.06	MP 8.30	55
MP 8.30	MP 8.53	45
MP 8.53	MP 8.77	40
MP 8.77	MP 9.06	30
MP 9.06	MP 9.31	50
MP 9.31	MP 11.73	60
MP 11.73	MP 12.03	30
MP 12.03	MP 12.54	20
MP 12.54	MP 13.58	30
MP 13.58	MP 14.20	25
MP 14.20	MP 14.34	20
MP 14.34	MP 14.79	15
MP 14.79	MP 15.73	25
MP 15.73	MP 15.87	20
MP 15.87	MP 18.75	30

SCBRL Corridor East Milepost Location	SCBRL Corridor West Milepost Location	Maximum ZEPRT Passenger Train Speed (Miles per Hour)
MP 18.75	MP 19.22	25
MP 19.22	MP 19.49	10
MP 19.49	MP 20.63	15
MP 20.63	MP 21.04	20
MP 21.04	MP 21.38	35
MP 21.38	MP 22.50	25

Source: HDR

Operating speeds within sidings where meet-pass events occur between passenger trains are designed for 25 mph including turnouts and operating speeds on connection tracks to other railroads and all other tracks are 10 to 15 mph.

Final passenger rail operating speeds over the SCBRL and the potential for speed increases above those shown in Table 17.2 above will be confirmed during ongoing development of the ZEPRT Project.

17.2.7 Siding Locations

Siding locations where meet-pass events between opposing ZEPRT passenger trains might occur on the single-track SCBRL between Pajaro and Natural Bridges Drive in Santa Cruz were identified through an assessment of past studies for passenger rail service implementation on the SCBRL and through identification of a conceptual alignment for the ZEPRT service, development of a conceptual ridership forecast, and stakeholder and community outreach that occurred during development of the ZEPRT Project. The RTC model was employed to validate siding locations and lengths and associated power-operated main track turnouts at the ends of each siding identified during development of the conceptual rail alignment to provide the capacity required to operate scheduled ZEPRT passenger trains.

These conceptual siding locations and related characteristics are identified by SCBRL milepost in Table 17.3 below.

Table 17.3 Conceptual ZEPRT Siding Locations on SCBRL

Siding Name	Siding Clear Length	Siding East Switch Turnout Type and SCBRL Location	Siding West Switch Turnout Type and SCBRL Location
Pajaro	1,300 feet	No. 15 (Milepost 0.49)	No. 15 (Milepost 0.81)
West Watsonville	1,750 feet	No. 20 (Milepost 2.29)	No. 15 (Milepost 2.70)
Renaissance	750 feet	No. 11 (Milepost 7.58)	No. 11 (Milepost 7.81)
Seascape	750 feet	No. 11 (Milepost 11.45)	No. 11 (Milepost 11.67)
Capitola	870 feet	No. 15 (Milepost 15.24)	No. 11 (Milepost 15.58)
Seabright	700 feet	No. 11 (Milepost 18.77)	No. 11 (Milepost 18.99)
Natural Bridges	1,050 feet	No. 15 (Milepost 21.59)	No. 15 (Milepost 22.38)

Source: HDR

The final locations and characteristics of sidings on the SCBRL and the potential for additional sidings necessary to provide supplemental redundant network capacity to accommodate delayed (out-of-slot) passenger trains, outages during routine maintenance events or response to an emergency scenario, or extra passenger trains operated seasonally or for a special event will be confirmed during ongoing development of the ZEPRT Project.

17.2.8 Layover and Maintenance Facility

A facility where ZEPRT trainsets can be stored on yard tracks during periods of non-operation (layover) and where routine maintenance would occur on service tracks and in a shop is anticipated for development on the east end of the SCBRL in Pajaro near Milepost 0.5 or west of Watsonville area near SCBRL Milepost 3.0. While the RTC model included a maintenance facility at West Watsonville (accessed by a double-ended lead at SCBRL Milepost 2.7 and 3.6) for the purposes of conceptual operations analysis for the ZEPRT service, the actual location of the facility is subject to further study and stakeholder coordination during the ZEPRT Project. Whether heavy maintenance or reconditioning or rebuilding of the passenger trainsets would be accommodated at the ZEPRT layover and maintenance facility or by a third-party contractor at an off-site location will also be confirmed later in the ZEPRT Project. Terminal train operations within the layover yard and maintenance facility were not included in the RTC model.

17.2.9 Existing SCBG Beach Passenger Trains in Santa Cruz

The existing SCBG Beach Trains that operate seasonally as an excursion service between Felton and Santa Cruz, and which currently involve operation on approximately 0.9 mile of the SCBRL main track between a point immediately west of the Santa Cruz Wye and the Beach Boardwalk in Santa Cruz, typically with two round trips per day on a seasonal basis, differs from the proposed operating plan, equipment type, and network capacity needs of the frequent daily and scheduled ZEPRT service. An approach to modify SCBG passenger train operations in central Santa Cruz will be further developed during ongoing ZEPRT Project

development activities and through coordination with stakeholders. Therefore, the initial conceptual operations modeling developed for the ZEPRT Project did not include the Beach Trains.

17.2.10 Planned Intercity and Regional Passenger Trains on SCBRL

Caltrans, SCCRTC, and other transportation agencies are studying the potential for expansion of passenger rail service in the California Central Coast region that aligns with California's statewide vision for passenger rail and the 2024 *California State Rail Plan*. This includes a new San Jose–Santa Cruz intercity passenger rail service via the SCBRL between Pajaro and Santa Cruz and a new regional passenger service between Monterey, Castroville, Watsonville, and Santa Cruz via the SCBRL between Pajaro and Santa Cruz. No operating and equipment plans have been identified for those services yet, so the initial conceptual RTC model and related operations planning developed for the ZEPRT Project does not include these trains. Further operations modeling and analysis of the SCBRL will be required in a future phase to identify what additional network infrastructure may be needed to support the interlining of these additional trains between Pajaro and Santa Cruz while also providing ample capacity to support preliminary and potential future expansion of ZEPRT services.

17.2.11 Freight Trains on SCBRL Corridor

While it is understood that the SCBRL would initially be a shared-use passenger and freight rail corridor after implementation of the ZEPRT Project, the initial conceptual operations modeling assumed that freight rail operations between the UP yard and interchange at Pajaro (Watsonville Junction) and customers in Watsonville as is currently provided by SPP and its third party contractor SCBG, and any future freight rail operations over other segments of the SCBRL as required in the future, would likely be temporally separated from ZEPRT passenger train operations. Freight operations with exclusive occupancy on the SCBRL would likely occur during late evening and early morning periods when no scheduled passenger trains would be operating. Therefore, existing and potential future freight operations on the SCBRL were not modeled and the feasibility of this approach will be confirmed through coordination with SPP and SCBG as the ZEPRT Project advances. In addition, there may be potential interface between UP local freight trains accessing the UP Watsonville Yard and ZEPRT trains accessing the Pajaro Station on secondary tracks currently owned and maintained by UP, which will be coordinated with UP and other stakeholders as the ZEPRT Project advances (note that the ZEPRT service would not affect operations on the UP Coast Subdivision main track).

17.2.12 Model Randomization Factors

Randomization factors that account for the typical variability of passenger railroad operations and programmed railroad maintenance activities — based on typical industry practice — include the following factors:

- Late departure from originating station
- Passenger train dwell times at initial and intermediate stations
- Train operator handling
- Network outages to account for maintenance activities or emergency response scenarios (e.g., accident or incident at a highway-rail grade crossing or an intermediate corridor location)

As the initial conceptual RTC operations modeling was leveraged only to determine a potential base line scenario, none of these factors were included in the analysis. In order to understand the impacts of the factors listed above and any additional network infrastructure needed for mitigations, additional RTC modeling will be conducted during a future phase of the ZEPRT Project.

17.2.13 Project Coordination and Inputs for Model Development

No coordination occurred with SPP or SCBG providing freight rail service on the SCBRL; UP connecting with the SCBRL at Pajaro (Watsonville Junction); federal, state, or local public agencies (other than SCCRTC); or other public or private parties to acquire data, inputs, or resources related to the development of railroad operations modeling and analysis undertaken for the ZEPRT Project.

Data, inputs, and resources necessary to support development of the initial conceptual RTC modeling were provided by SCCRTC or developed during ZEPRT Project activities, as identified below:

- Track Chart and Google Earth Pro KMZ File identifying and describing existing physical characteristics of the rail line segments in the RTC model corridor Study Area, including conceptual SCBRL main track alignment, vertical and horizontal alignments, track arrangement, and the locations of bridges, public highway-rail grade crossings, and potential ZEPRT Project passing siding and stations.
- Existing SCBRL Informational Right-of-Way Maps created by SCCRTC in November 2005 showing the property limits overlaid on aerial images and historic railroad valuation maps.
- UP Employee Timetable for the Santa Cruz Branch describing the Method of Operation, maximum speeds for trains, and other operating rules that affect train operations for historical context (UP was previously the owner and operator of SCBRL until it sold the line to SCCRTC).
- Speed Table developed for ZEPRT Project identifying anticipated maximum passenger train operating speeds over the conceptual ZEPRT alignment within the SCBRL right-of-way by milepost between Pajaro and Natural Bridges Drive in Santa Cruz.
- Information about SCCRTC capital projects recently completed, soon to be completed, or planned on the SCBRL that would potentially impact the configuration and operation of the SCBRL.

The following additional information was used to enhance understanding of the SCBRL network and potential ZEPRT passenger train operations over the SCBRL and to inform development of the RTC model:

- Inputs from ongoing in-person and virtual ZEPRT Project coordination meetings with SCCRTC, other local agency stakeholders, and the community during 2023-2025.
- Inputs from HDR site visits to the SCBRL during 2023-2025 to observe existing conditions with SCCRTC staff and to independently observe operation of the SCBG Beach Train between Felton and Santa Cruz in 2025.

17.3 Outputs of the Initial Conceptual Railroad Operations Modeling

Outputs from the initial conceptual RTC modeling developed for the ZEPRT Project include:

- Initial Train Performance Calculator (TPC) Diagrams for the proposed ZEPRT passenger trains on the SCBRL corridor for unimpeded end-to-end runs for 60 mph maximum track speeds, including operating characteristics of the planning-level rail vehicle (Stadler FLIRT H2) and initial proposed station stops and operating speeds and restrictions imposed by horizontal and vertical track characteristics of the conceptual rail alignment identified for the ZEPRT Project to establish a range of general performance.
- Initial Stringline Time/Distance Diagrams for the proposed initial ZEPRT passenger train operating scenario at the determined maximum speed and conceptual operating plan, which is a temporal output that shows the interaction of passenger train operations (including meet-pass events) and station dwells by location over the course of one operating day.

Train Performance Calculator Diagrams

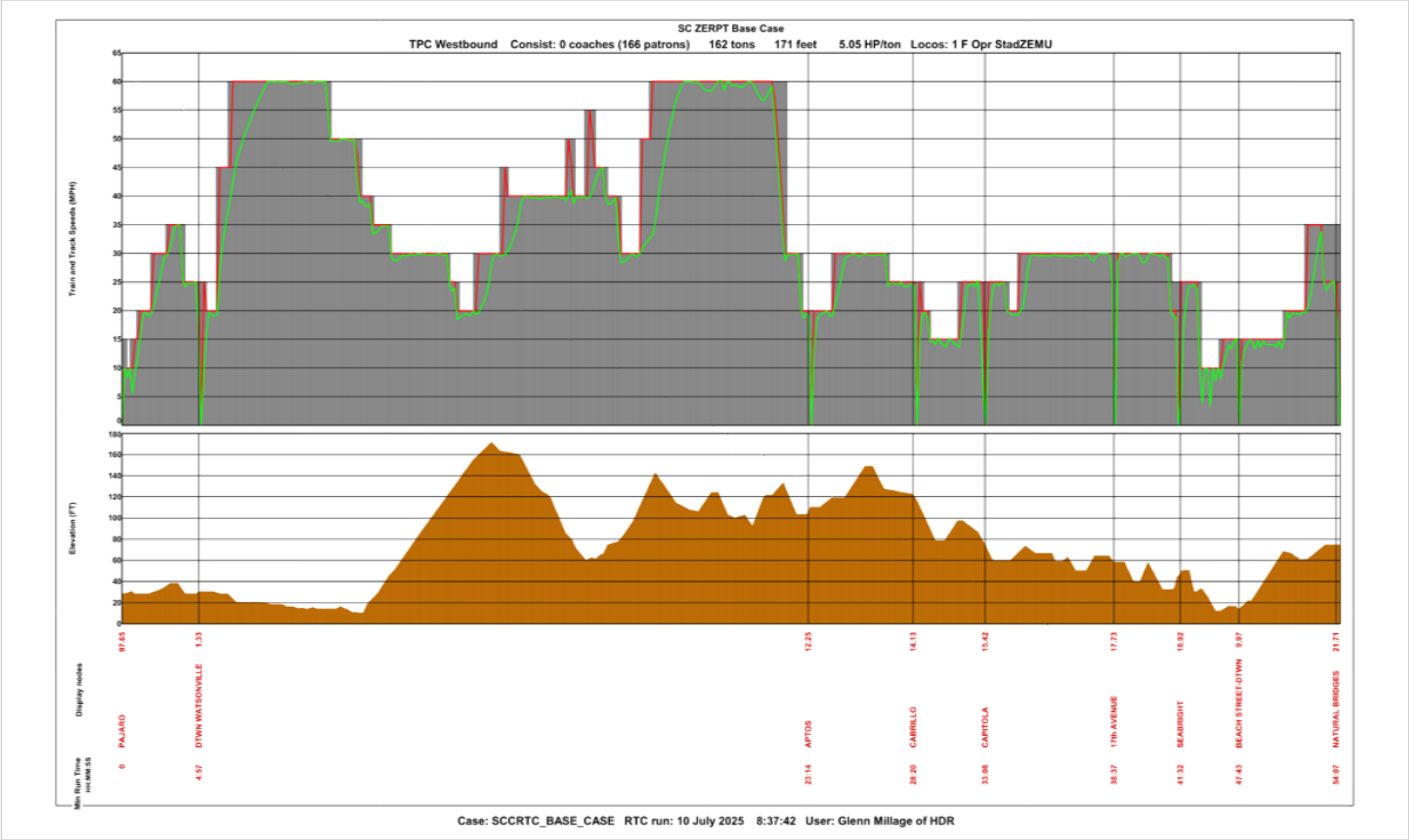
A representative TPC shown in Figure 17.3 below indicates an unimpeded run time of 54 minutes for a westbound ZEPRT passenger train between Pajaro and Natural Bridges Drive in Santa Cruz.

A representative TPC shown in Figure 17.4 below indicates an unimpeded run time of 53 minutes for an eastbound ZEPRT passenger train between Natural Bridges Drive in Santa Cruz and Pajaro.

Stringline Diagram

A stringline diagram for a representative ZEPRT operating day is shown in Figure 17.5.

Figure 17.3 Representative TPC for Westbound ZEPRT Passenger Train (Pajaro–Santa Cruz)



Source: HDR

Figure 17.4 Representative TPC for Eastbound ZEPRT Passenger Train (Santa Cruz–Pajaro)

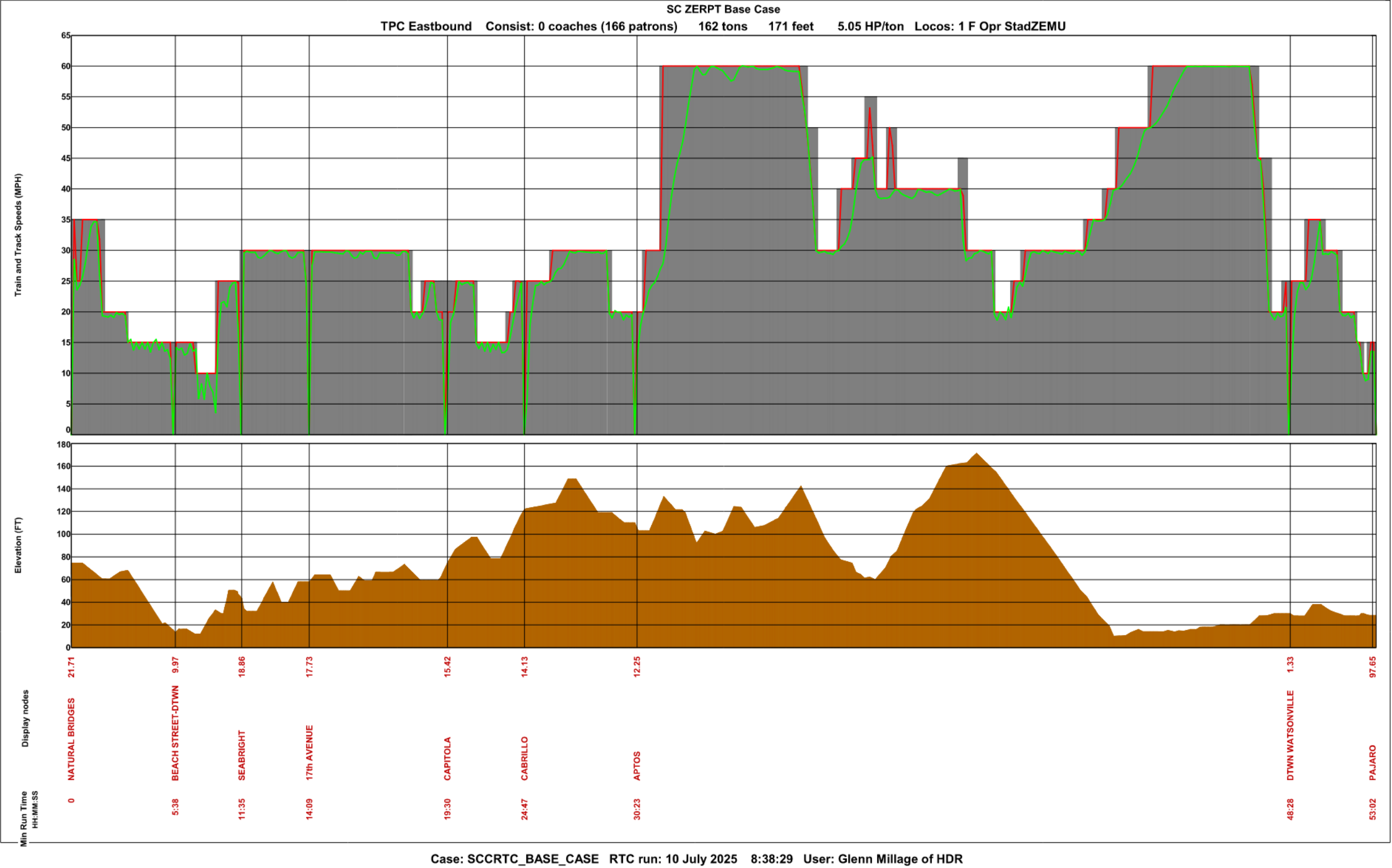
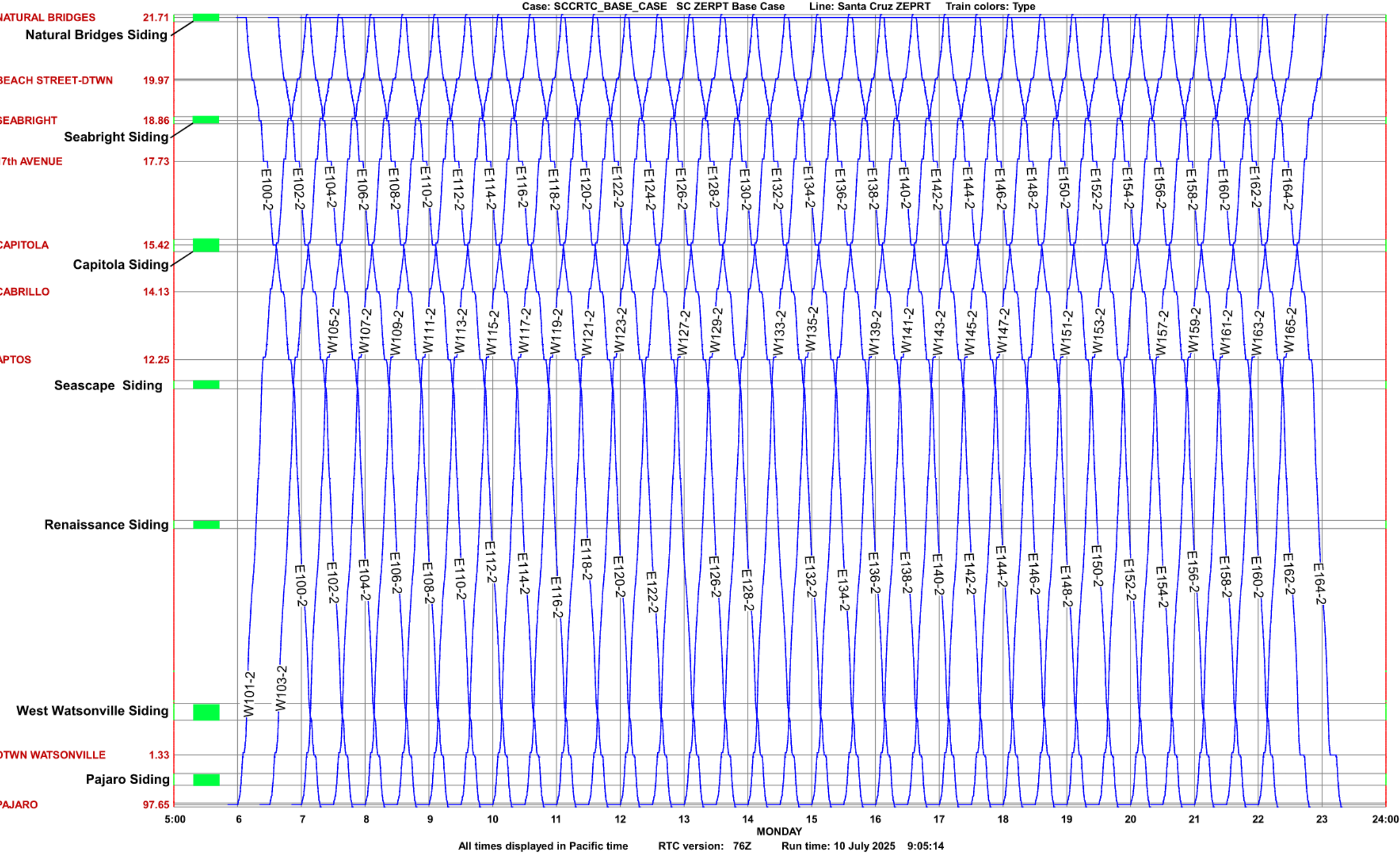


Figure 17.5 Stringline Diagram for Representative Day of ZEPRT Operations



17.4 Initial Conceptual ZEPRT Operations Plan

An initial conceptual operations plan was developed for the ZEPRT service between Pajaro and Natural Bridges Road in Santa Cruz, based on the outcomes of railroad operations modeling and analysis and related inputs and ongoing stakeholder coordination undertaken during the ZEPRT Project. This initial conceptual operations plan presented below illustrates what a potential 30-minute headway service on the SCBRL may include.

- **Service Operating Times:** Daily from approximately 6:00 a.m. to 10:00 p.m.
- **Initial Conceptual Scheduled End-to-End Run Time with Dwells for Station Stops and Meet-Pass Events Between Opposing Passenger Trains on the Single-Track SCBRL Corridor:**
Approximately 1 hour and 8 minutes one-way westbound between Pajaro and Natural Bridges Drive in Santa Cruz and 1 hour and 13 minutes one-way eastbound between Natural Bridges Drive in Santa Cruz and Pajaro.
- **Standard Trainset Consist:** Depending upon passenger demand at any given time, either a single-unit trainset or two-unit trainset (with two single-unit trainsets coupled together) could be used. A single-unit Stadler FLIRT H2 trainset is assumed for the initial conceptual ZEPRT operations plan.
- **Layover and Maintenance Facility:** Assumed to be located at West Watsonville at approximately SCBRL Milepost 3.0.

Tables 17.4 and 17.5 below illustrate an initial conceptual daily operating schedule for the westbound and eastbound ZEPRT service, respectively, that aligns with the above assumptions.

The conceptual schedule provides for a first departure from either end of the line at 6 a.m. and a last departure at 10:08 p.m. The first arrival at either end of the line is at 7:08 a.m. and the final arrival is at 11:21 p.m. Also, non-revenue movements of trainsets from the West Watsonville layover and maintenance facility to Pajaro and Natural Bridges Road in Santa Cruz are required to get equipment in place to start the daily scheduled service from terminal points in the morning hours, and the reverse occurs in evening periods after the last scheduled trains operate so that trainsets can return to the layover and maintenance facility in West Watsonville during periods of non-operation. Additional movements to and from the layover and maintenance facility may also be necessary to refuel trainsets at various intervals. None of these non-revenue movements are included in the initial conceptual RTC modeling or conceptual schedule below and would be defined during development of the ZEPRT Project.

Table 17.4 Conceptual Daily ZEPRT Westbound Passenger Service Schedule (Pajaro–Santa Cruz)

	Westbound Train Schedule																																
	101	103	105	107	109	111	113	115	117	119	121	123	125	127	129	131	133	135	137	139	141	143	145	147	149	151	153	155	157	159	161	163	165
Pajaro - AR	06:00	06:30	07:00	07:30	08:00	08:30	09:00	09:30	10:00	10:30	11:00	11:30	12:00	12:30	13:00	13:30	14:00	14:30	15:00	15:30	16:00	16:30	17:00	17:30	18:00	18:30	19:00	19:30	20:00	20:30	21:00	21:30	22:00
Watsonville -DP	06:06	06:36	07:06	07:36	08:06	08:36	09:06	09:36	10:06	10:36	11:06	11:36	12:06	12:36	13:06	13:36	14:06	14:36	15:06	15:36	16:06	16:36	17:06	17:36	18:06	18:36	19:06	19:36	20:06	20:36	21:06	21:36	22:06
Aptos - DP	06:26	06:56	07:26	07:56	08:26	08:56	09:26	09:56	10:26	10:56	11:26	11:56	12:26	12:56	13:26	13:56	14:26	14:56	15:26	15:56	16:26	16:56	17:26	17:56	18:26	18:56	19:26	19:56	20:26	20:56	21:26	21:56	22:26
Cabrillo - DP	06:32	07:02	07:32	08:02	08:32	09:02	09:32	10:02	10:32	11:02	11:32	12:02	12:32	13:02	13:32	14:02	14:32	15:02	15:32	16:02	16:32	17:02	17:32	18:02	18:32	19:02	19:32	20:02	20:32	21:02	21:32	22:02	22:32
Capitola - DP	06:38	07:08	07:38	08:08	08:38	09:08	09:38	10:08	10:38	11:08	11:38	12:08	12:38	13:08	13:38	14:08	14:38	15:08	15:38	16:08	16:38	17:08	17:38	18:08	18:38	19:08	19:38	20:08	20:38	21:08	21:38	22:08	22:38
17th Avenue - DP	06:45	07:15	07:45	08:15	08:45	09:15	09:45	10:15	10:45	11:15	11:45	12:15	12:45	13:15	13:45	14:15	14:45	15:15	15:45	16:15	16:45	17:15	17:45	18:15	18:45	19:15	19:45	20:15	20:45	21:15	21:45	22:15	22:45
Seabright Avenue - DP	06:50	07:20	07:50	08:20	08:50	09:20	09:50	10:20	10:50	11:20	11:50	12:20	12:50	13:20	13:50	14:20	14:50	15:20	15:50	16:20	16:50	17:20	17:50	18:20	18:50	19:20	19:50	20:20	20:50	21:20	21:50	22:20	22:50
Beach Street/Dtwn - DP	06:58	07:28	07:58	08:28	08:58	09:28	09:58	10:28	10:58	11:28	11:58	12:28	12:58	13:28	13:58	14:28	14:58	15:28	15:58	16:28	16:58	17:28	17:58	18:28	18:58	19:28	19:58	20:28	20:58	21:28	21:58	22:28	22:58
Natural Bridges - AR	07:08	07:38	08:08	08:38	09:08	09:38	10:08	10:38	11:08	11:38	12:08	12:38	13:08	13:38	14:08	14:38	15:08	15:38	16:08	16:38	17:08	17:38	18:08	18:38	19:08	19:38	20:08	20:38	21:08	21:38	22:08	22:38	23:08

Source: HDR

Table 17.5 Conceptual Daily ZEPRT Eastbound Passenger Service Schedule (Santa Cruz–Pajaro)

Eastbound Train Schedule																																	
	100	102	104	106	108	110	112	114	116	118	120	122	124	126	128	130	132	134	136	138	140	142	144	146	148	150	152	154	156	158	160	162	164
Natural Bridges - DP	06:08	06:38	07:08	07:38	08:08	08:38	09:08	09:38	10:08	10:38	11:08	11:38	12:08	12:38	13:08	13:38	14:08	14:38	15:08	15:38	16:08	16:38	17:08	17:38	18:08	18:38	19:08	19:38	20:08	20:38	21:08	21:38	22:08
Beach Street/Dtwn - DP	06:15	06:45	07:15	07:45	08:15	08:45	09:15	09:45	10:15	10:45	11:15	11:45	12:15	12:45	13:15	13:45	14:15	14:45	15:15	15:45	16:15	16:45	17:15	17:45	18:15	18:45	19:15	19:45	20:15	20:45	21:15	21:45	22:15
Seabright Avenue - DP	06:22	06:52	07:22	07:52	08:22	08:52	09:22	09:52	10:22	10:52	11:22	11:52	12:22	12:52	13:22	13:52	14:22	14:52	15:22	15:52	16:22	16:52	17:22	17:52	18:22	18:52	19:22	19:52	20:22	20:52	21:22	21:52	22:22
17th Avenue - DP	06:28	06:58	07:28	07:58	08:28	08:58	09:28	09:58	10:28	10:58	11:28	11:58	12:28	12:58	13:28	13:58	14:28	14:58	15:28	15:58	16:28	16:58	17:28	17:58	18:28	18:58	19:28	19:58	20:28	20:58	21:28	21:58	22:28
Capitola - DP	06:36	07:06	07:36	08:06	08:36	09:06	09:36	10:06	10:36	11:06	11:36	12:06	12:36	13:06	13:36	14:06	14:36	15:06	15:36	16:06	16:36	17:06	17:36	18:06	18:36	19:06	19:36	20:06	20:36	21:06	21:36	22:06	22:36
Cabrillo - DP	06:43	07:13	07:43	08:13	08:43	09:13	09:43	10:13	10:43	11:13	11:43	12:13	12:43	13:13	13:43	14:13	14:43	15:13	15:43	16:13	16:43	17:13	17:43	18:13	18:43	19:13	19:43	20:13	20:43	21:13	21:43	22:13	22:43
Aptos - DP	06:50	07:20	07:50	08:20	08:50	09:20	09:50	10:20	10:50	11:20	11:50	12:20	12:50	13:20	13:50	14:20	14:50	15:20	15:50	16:20	16:50	17:20	17:50	18:20	18:50	19:20	19:50	20:20	20:50	21:20	21:50	22:20	22:50
Watsonville -DP	07:13	07:43	08:13	08:43	09:13	09:43	10:13	10:43	11:13	11:43	12:13	12:43	13:13	13:43	14:13	14:43	15:13	15:43	16:13	16:43	17:13	17:43	18:13	18:43	19:13	19:43	20:13	20:43	21:13	21:43	22:13	22:43	23:13
Pajaro - AR	07:21	07:51	08:21	08:51	09:21	09:51	10:21	10:51	11:21	11:51	12:21	12:51	13:21	13:51	14:21	14:51	15:21	15:51	16:21	16:51	17:21	17:51	18:21	18:51	19:21	19:51	20:21	20:51	21:21	21:51	22:21	22:51	23:21

Source: HDR

The final operations plan and the potential for development of main track speed increases and additional sidings and network infrastructure necessary to provide supplemental redundant network capacity to address operational variability and improve overall ZEPRT operating efficiency and end-to-end run times between Pajaro and Santa Cruz will be confirmed through ongoing stakeholder coordination and engineering and service design for the ZEPRT Project.

17.5 Initial Conceptual ZEPRT Equipment Plan

Based on the initial conceptual operations plan, vehicle requirements were identified for the ZEPRT service including the number of in-service Stadler FLIRT H2 trainsets required to protect the daily operating schedule and spare Stadler FLIRT H2 trainsets required to support anticipated routine maintenance cycles over the lifecycle of the trainsets.

In addition to the five in-service trainsets required for daily revenue service, one additional spare train would be required to allow for routine maintenance of vehicles. This factor was calculated using a spare equipment ratio, which is an industry standard of 20% spare fleet, rounded up to the next whole number. Further, one hot spare trainset was added to accommodate any emergent need for an operating trainset to be substituted to maintain the service schedule. Therefore, the total fleet requirement for an initial daily service of 30-minute headways is seven single-unit Stadler FLIRT H2 trainsets. Additional trainsets would be required to accommodate potential extra or seasonal services.

The layover and maintenance facility at West Watsonville is where daily cleaning, light maintenance, and storage of trains during periods of nonoperation would occur. Whether heavy maintenance or reconditioning or rebuilding of the passenger trainsets would be accommodated at the ZEPRT layover and maintenance facility or by a third-party contractor at an off-site location will be confirmed later in the ZEPRT Project.

17.6 Integration of ZEPRT with Existing and Planned Transit Services

This section identifies connectivity, integration, and interaction of the SCBRL corridor and proposed ZEPRT service and stations with existing and known planned future bus, rail, and other transit services in Santa Cruz and Monterey counties. Note that the routes of some existing rail transit and intercity buses do not currently intersect with the SCBRL corridor but could be modified in the future to more directly provide connectivity to the ZEPRT service at any number of proposed stations. This potential will be explored during future study and coordination with transit and bus operators, local jurisdictions, and the community.

Pajaro Station (Monterey County)

- Monterey–Salinas Transit (MST)
 - Existing bus routes serving Pajaro, Watsonville, Moss Landing, Castroville, Prunedale, and Salinas
 - Route 29
 - Approximate distance of route from proposed station – 200 feet (0.03 mile)

- Proposed transit improvements: timed transfers to the 28/29 would improve the headway from 55 minutes to 25 minutes
 - Approximate distance of route from proposed station – 300 feet (0.05 mile)
- Amtrak
 - Existing Coast Starlight long-distance passenger trains between Los Angeles, California, and Seattle, Washington, via Pajaro that may potentially stop at Pajaro in the future.
 - Approximate distance of route from proposed station – 100 feet (0.01 mile)
- Caltrain
 - Planned expansion of existing Caltrain commuter rail service from the San Francisco Bay Area and Gilroy to Pajaro and Salinas, along with planned development of a rail passenger station in Pajaro.
 - Potential expanded Central Coast intercity passenger rail service from the San Francisco Bay Area to Santa Cruz via Pajaro from the San Francisco Bay Area as well as rail service to Salinas and San Luis Obispo via Pajaro, as envisioned by the 2024 *California State Rail Plan* and the federal Corridor ID program.
 - Approximate distance from proposed station – 100 feet (0.01 mile)

Downtown Watsonville Station

- Monterey-Salinas Transit (MST)
 - Existing bus routes serving Pajaro, Watsonville, Moss Landing, Castroville, Prunedale, and Salinas
 - Proposed routes: 28/29 (timed transfers would lessen headway from 55 minutes to 25 minutes)
 - Approximate distance of route from proposed station – 800 feet (0.15 mile)
 - Santa Cruz Metropolitan Transit District (METRO)
 - Existing – Routes 1, 2, 79, 72, 73, 75, 78, and 745
 - Approximate distance from routes to proposed station – 800 feet (0.15 mile)
- Amtrak
 - Existing Coast Starlight long-distance passenger trains between Los Angeles, California, and Seattle, Washington, via Pajaro, that may potentially stop at Pajaro in the future.
 - Approximate distance from proposed station – 1 mile
 - Caltrain
 - Planned expansion of existing Caltrain commuter rail service from the San Francisco Bay Area and Gilroy to Pajaro and Salinas.
 - Approximate distance from proposed station – 1 mile

Aptos Station

- Santa Cruz Metropolitan Transit District (METRO)
 - Existing – Routes 1, 2, 73, and 55
 - Approximate distance of routes from proposed station – 300 feet (0.05 mile)
 - Proposed: Route 55, new routing and service increase in Aptos/Seacliff/Rio Del Mar

Cabrillo Station

- Santa Cruz Metropolitan Transit District (METRO)
 - Existing routes serving Cabrillo College – 73, 2, and 1
 - Closest Route is 73
 - Approximate distance of routes from station – 2,000 feet (0.37 mile)

Capitola Station

- Santa Cruz Metropolitan Transit District (METRO)
 - Capitola Mall Transit Center
 - Existing – Routes 2, 3, 73, and 55
 - Approximate distance from proposed station – 300 feet (0.05 mile)
 - Closest Route is 71
 - Approximate distance from station – 100 feet (0.01 mile)
 - Proposed routes – Route 73 will now serve Capitola Village in both directions between Capitola Mall and Watsonville every hour, seven days a week, following the former 55 routing

17th Avenue Station (Santa Cruz)

- Santa Cruz Metropolitan Transit District (METRO)
 - Existing – Route 3B
 - Approximate distance from station – 300 feet (0.05 mile)

Seabright Station (Santa Cruz)

- Santa Cruz Metropolitan Transit District (METRO)
 - Existing routes – none
 - Closest is Route 3 which is over 1 mile away

Beach Street / Downtown Station (Santa Cruz)

- Santa Cruz Metropolitan Transit District (METRO)
 - Existing – closest routes are 19, 20
 - Approximate distance from station – 300 feet (0.05 mile)
 - River Front Transit Center – Routes 1, 18, 19, 2, 3, 11, 35, 4, 17, 20, 40, and 41
 - Approximate distance from station – 4,000 feet (0.75 mile)
 - Proposed – Route 16 will be reintroduced, providing service every 30 minutes from Downtown Santa Cruz to UC Santa Cruz via Laurel and Bay streets.
 - Amtrak Thruway Bus
 - Downtown Santa Cruz Bus Stop – 700 Front Street, Santa Cruz
 - Approximate distance from proposed station – 1 mile
 - Greyhound Intercity Bus
 - Downtown Santa Cruz Bus Stop – 700 Front Street, Santa Cruz
 - Approximate distance from proposed station – 1 mile



Natural Bridges Road Station (Santa Cruz)

- Santa Cruz Metropolitan Transit District (METRO)
 - Existing – Routes 18, 20, and 40
 - Approximate distance from station – 500 feet/0.09 mile

18.0 Initial Opinion of Probable Conceptual Capital and Operations and Maintenance Costs

An initial opinion of probable capital cost to construct the ZEPRT Project and a companion initial opinion of probable annual operations and maintenance cost for the ZEPRT Project post-implementation is presented in this chapter.

18.1 Cost Approach and Methodology

Industry standard methodologies and tools were used to develop an initial opinion of probable capital cost and initial opinion of probable annual operations and maintenance costs for the ZEPRT service. While these costs will be refined and finalized as the ZEPRT Project advances, preliminary conceptual estimates and the assumptions for their development are presented in the sections that follow.

18.2 Cost Assumptions and Inputs

The initial opinion of probable capital cost estimate to design, construct, and implement ZEPRT service between Pajaro and Natural Bridges Drive in Santa Cruz was based on initial conceptual level engineering design developed for the ZEPRT Project to date, with contingency applied. It includes all network and infrastructure elements (i.e., track and track structure, bridges, wayside signal system, grade crossing signals, stations, layover and maintenance facility, vehicle procurement, etc.) on the at-grade ZEPRT alignment.

While both at-grade and elevated alternatives were considered for the conceptual ZEPRT rail alignment through Beach Street and along the Santa Cruz Beach Boardwalk, and their related costs and community impacts were qualitatively assessed, the cost estimate prepared for the ZEPRT baseline concept assumed an at-grade alignment. The Santa Cruz Beach Flats area of the ZEPRT Project requires additional refinements and coordination with stakeholders, including the Seaside Company, SCBG, City of Santa Cruz, and other Beach Flats area stakeholders to address pedestrian access, safety, operations, and local roadway network changes, the cost of which is not included in the ZEPRT baseline concept Project cost estimate. A final rail alignment through Beach Flats area that meets the objectives of the ZEPRT Project will be defined through future analysis and stakeholder coordination as the ZEPRT Project advances.

The estimated cost presented also includes certain grading and construction costs for segments of the Coastal Rail Trail where the trail is within the SCBRL corridor right-of-way but excludes costs for major trail bridges and structures and costs for the construction of the trail where it is located outside of the SCBRL right-of-way.

The opinion of probable annual operations and maintenance cost estimate to operate and maintain the ZEPRT service between Pajaro and Natural Bridges Drive in Santa Cruz was based on transit industry averages for peer U.S. operations in the Federal Transit Administration (FTA) National Transit Database and

conceptual level engineering design and operations planning developed for the ZEPRT Project to date. It assumes a service operating on 30-minute headways with 45 minutes of end-to-end runtime (6 a.m. to 10 p.m. daily). It includes typical operations and maintenance elements (i.e., infrastructure maintenance, vehicle operations and maintenance, labor, general administration, etc.).

18.3 Capital Cost Estimate Steps

In general, development of the initial opinion of probable capital cost consisted of the following steps, which are described in the sections that follow:

- Establish Project Segmentation
- Identify Project Elements and Measure Quantities
- Develop Cost Library
- Compile Cost Estimate

18.3.1 Establish Project Segmentation

The SCBRL corridor between Pajaro and Natural Bridges Drive in Santa Cruz over which the ZEPRT Project will be developed was divided into six distinct segments based on track stationing for Segments 1 through 4 and the Vehicles and Maintenance Facility as Segments 5 and 6, respectively. Table 18.1 below provides a summary of the six segments. Included in the summary are the rail corridor stationing, total route feet, and route miles of SCBRL, as applicable for network segments.

Table 18.1 ZEPRT Project Segment Summary

Segment	Segment Start	Segment End	Route Feet	Route Miles
Segment 1 – Network	1014+92	1204+55	18,963	3.59
Segment 2 – Network	616+92	1014+92	39,800	7.54
Segment 3 – Network	356+67	616+92	26,025	4.93
Segment 4 – Network	0+00	356+67	35,667	6.76
Segment 5 – Vehicles	N/A	N/A	N/A	N/A
Segment 6 – Maintenance Facility	N/A	N/A	N/A	N/A

Source: HDR

18.3.2 Identify Project Elements and Measure Quantities

A list of ZEPRT Project elements was developed to adequately define aspects of Project construction while reflecting the level of design development and quantities that could be readily measured from existing design data. These elements were developed in large part through quantity takeoffs, a process of measuring and listing all materials, equipment, and labor needed for a construction project. Additional items not shown in the initial conceptual design were developed from other existing ZEPRT Project documentation and from estimator and project team experience with other similar rail transit projects.

18.3.3 Develop Cost Library

The cost library is a compilation of all construction and non-construction items contained within the cost estimate, with the items presented in 2025 dollars. Various strategies were utilized in developing both the quantification and pricing of each scope item, and these can be categorized as bid item, composite item, parametric item, allowance, and percentage item. Based on general industry experience, the greater the percentage of items that are built up as Bid or Composite items, the greater confidence in both the quantification and pricing can be inferred.

18.3.3.1 Bid Items

Bid items represent basic construction elements such as excavation, pavement, curb and gutter, and ballasted track, which are typically bid by a contractor on a given project. Due to the level of detail available from the initial conceptual design for the ZEPRT Project at this stage, these have been priced based on average unit prices for recent bid tabs for similar types of work.

18.3.3.2 Allowances and Percentage Items

Allowances and percent-based items are intended to capture elements known to be a part of this type of project but not known and/or defined at the time the opinion of probable capital cost was prepared. Examples of allowances include scope for hazardous and contaminated soils remediation, vehicle costs, and various professional services costs such as Owner Controlled Insurance Program (OCIP) and Quality Control (QC) Testing and Inspection. Pricing for these elements is based on estimator experience with similar scope or input from recent rail transit projects.

18.3.3.3 Composite Items

Composite items are built up from a known combination of bid items and/or other cost elements and are quantified at a summary level unit of measure to be carried in the estimate as a single line item. Examples of this type of item include the Guideway for the At-Grade Exclusive Right-Of-Way and Ballasted Track.

18.3.3.4 Parametric Items

Parametric items represent a combination of bid items or other cost elements and are quantified at a summary level unit of measure to be carried in the estimate as a single line item. Unit pricing is built up through comparison of similar cost elements to other projects of similar scope and included in the opinion of probable capital cost based on a comparable parametric unit of measure such as cost per route meter. Examples of parametric items include Bridges, Communications, and Signals.

18.3.4 Compile Cost Estimate

A Microsoft Excel workbook was developed to compile the various components of the opinion of probable capital cost. Individual tables were created to hold specific information such as the cost library, segmentation, quantity takeoff, work categorization, Standard Cost Categories (SCC) coding, and other elements. These tables are compiled in the Base Cost Estimate worksheet via look-up or other formulaic methodology. This approach provides consistency for elements that are distributed in a variety of locations throughout the estimate. In addition, it provides a single database from which various summaries can be easily generated to provide responses to a wide variety of potential information requests.

18.3.5 Assumptions

The following is a list of major assumptions used while developing the opinion of probable capital cost. Other assumptions have been made as part of the quantification and pricing of the ZEPRT Project and are included in other sections of this report.

- Market Adjustment Factor: the estimate is assumed to include typical market conditions that exist at the time the estimate was created. Any additional adjustments to anticipate changes in the future are excluded from this OPCC. These adjustments may include potential influence of an abnormal bidding environment such as a lack of competition among contractors (contractors being busy or selectively bidding jobs), competition for construction personnel that requires contractors to pay wage premiums to retain key workers and management staff, and abnormal increases or decrease in fuel and material costs.
- Imported construction materials, such as fill and concrete, are available in sufficient quantities from local suppliers, and that waste material can be disposed of within a reasonable haul distance from the Project location.
 - All material will be new.
 - Buy America requirements are included.
 - Assumed imported and exported aggregates and other fill materials are available within a reasonable haul distance.
- Assumes labor force is available and no consideration for work stoppage due to labor strikes or other negotiations affects the completion of the project.
- Base Cost developed in 2025 dollars.

18.4 Major Items of Work

The following section is intended to describe the major category elements of work that may be part of the ZEPRT Project. It is not intended to describe all category elements. Rather, it is intended to capture the key cost drivers associated with the ZEPRT Project as currently described in the Project documentation.

18.4.1 Guideway and Track Elements

10.01 Guideway: At-Grade Exclusive Right-Of-Way

This category includes elements necessary to build at-grade guideway within an exclusive right-of-way for the ZEPRT alignment. Scope items are composite costs and include cut and fill of existing ground to make way for the new track section, and place and compact sub-ballast. Quantities are based on alignment stationing as provided in the initial conceptual design information.

10.02 Guideway: At-Grade Semi-Exclusive

This category is not applicable.

10.03 Guideway: At-Grade in Mixed Traffic

This category is not applicable.

10.04 Guideway: Aerial Structure

This category includes elements necessary to provide 26 aerial crossings and two pedestrian crossings. Pricing is based on a parametric cost per lineal foot and square foot of bridge.

10.05 Guideway: Built-Up Fill

This category is not applicable.

10.06 Guideway: Underground Cut and Cover

This category is not applicable.

10.07 Guideway: Underground Tunnel

This category is not applicable.

10.08 Guideway: Retained Cut or Fill

This category includes elements required to construct retaining walls and other guideway elements within sections of the ZEPRT alignment where retaining walls are required to support the guideway.

10.09 Track: Direct Fixation

This category is not applicable.

10.10 Track: Embedded

This category is not applicable.

10.11 Track: Ballasted

This category includes elements necessary to remove, shift, and resurface existing ballasted track, and furnish and install new ballasted track for the alignment. Scope items are based on a composite cost and include ballast, 115 or 136 RE rail, ties, Other Track Materials (OTM), welding, grinding, and testing.

10.12 Track: Special (Switches, Turnouts)

Special track work includes the installation of 22 new turnouts (TO).

10.13 Track: Vibration and Noise Dampening

This category is not applicable.

10.14 Special Structures

This category is not applicable.

18.4.2 Stations, Stops, Terminal, and Intermodal Elements

20.01 At-Grade Station, Stop, Shelter, Mall, Terminal, Platform

This category includes costs to construct five new side platforms, one new side short platform, and three island platforms. Pricing is based on a parametric square foot costs per station platform.

20.02 Aerial Station, Stop, Shelter, Mall, Terminal, Platform

This category is not applicable.

20.03 Underground Station, Stop, Shelter, Mall, Terminal, Platform

This category is not applicable.

20.04 Major Stations, Landings, Terminals: Intermodal, Ferry, Trolley, Etc.

This category is not applicable.

20.05 Joint Development

This category is not applicable.

20.06 Automobile Parking Multi-Story Structure

This category is not applicable.

20.07 Elevators, Escalators

This category is not applicable.

20.08 Passenger Overpass

This category is not applicable.

20.09 Underground Interconnecting Tunnel

This category is not applicable.

20.10 Signage and Graphics

This category is not applicable.

18.4.3 Support Facility Elements: Yards, Shops, Administrative Buildings

30.01 Administration Building: Office, Sales, Storage

This section includes the costs of constructing a new administration building. The facility includes various dedicated spaces such as office areas.

30.02 Light Maintenance Facility

This category is not applicable.

30.03 Heavy Maintenance Facility

This section includes the costs of constructing a new heavy maintenance facility. The facility includes various dedicated spaces such as office areas, maintenance positions, and specialized shops, train wash unit, generator building, and a substation.

30.04 Storage or Maintenance-Of-Way Building

This section includes the costs of constructing a new maintenance-of-way building. The facility includes spaces for non-revenue vehicles and storage for vehicles.

30.05 Yard and Yard Track

This category includes scope associated with building elements within the maintenance facility yard area. This includes site improvements such as parking, access roads, site lighting, and yard track.

18.4.4 Sitework and Special Conditions Elements

40.01 Demolition, Clearing, Earthwork

This category includes costs for demolition, clear and grub, roadway excavation, and embankment. Demolition is made up primarily from removals of elements at roadway crossings such as removal of existing fencing, pavement, curbs, sidewalks, and driveways. Clear and grub includes costs to remove light and heavily vegetated areas along the corridor. Roadway excavation and embankment provides scope to raise or lower the existing grade to subgrade level.

40.02 Site Utilities, Utility Relocation

This category includes an allowance for unquantified utilities as well as costs for two drainage culverts.

40.03 Hazardous Materials, Contaminated Soil, Ground Water

This category includes an allowance for unquantified hazardous materials.

40.04 Environmental Mitigations, Wetlands, Historic, Parks

This category includes a percentage allowance for unquantified environmental mitigation based on the total construction base cost of SCC 10-50.

40.05 Site Structures Including Retaining Walls, Sound Walls

This category is not applicable.

40.06 Pedestrian/Bike Access, Landscaping

This category includes costs to construct at grade pedestrian crossings as well as an allowance for unquantified landscaping.

40.07 Automobile, Bus, Van Accessways, Roads, Parking Lots

This category includes construction of concrete items such as curb and gutter, cross gutter, and driveway, asphalt and concrete pavement elements associated with roadway crossings, parking lots or other access ways, pavement markings, and roadway signage.

40.08 Temporary Facilities and Other Indirect Costs During Construction

This category includes costs associated with Mobilization, General Conditions, Traffic Control, Temporary Erosion Control, Project Survey, and Flagging.

Mobilization costs are the cost to bring equipment and subcontractors to and from the site.

General Conditions are made up of fixed and time related indirect costs, bonding and insurance, and markup. Fixed indirect costs include setup and teardown of project offices and yards, corridor access requirements, staging areas, haul roads, safety and railroad training, joint venture fees, and temporary designs. Time related indirect costs include project supervision and management staff, office and yard maintenance costs, and project support. Bonding and insurance rates are included to cover performance and payment, warranty and subcontractors, along with professional and general liability.

18.4.5 Systems Elements

50.01 Train Control and Signals

This category covers all components related to the installation of train control and signal systems.

50.02 Traffic Signals and Crossing Protection

This category includes elements associated with the construction of new traffic signals and gated vehicular crossings.

50.03 Traction Power Supply: Substations

This category is not applicable.

50.04 Traction Power Distribution: Catenary, Third Rail

This category is not applicable.

50.05 Communications

This category includes improvements required to build communication systems across the Project alignment, at each existing station location, at each rail system installation (interlocking, automatic signal location), and at each park and ride location. Systemwide elements include fiber optic cabling and duct bank installed across the alignment. Allowances for spare parts, manuals, and training are also accounted for.

50.06 Fare Collection System and Equipment

This category is not applicable.

50.07 Central Control System

This category includes costs for a control center and backup control center.

18.4.6 Right-of-Way Elements

60.01 Purchase or Lease of Real Estate

Right-of-way (ROW) includes anticipated costs to acquire property necessary to construct the Project, as well as the legal and professional services that support the ROW effort.

60.02 Relocation

This category is not applicable.

18.4.7 Vehicles Elements

70.01 Light Rail

This category is not applicable.

70.02 Heavy Rail

This category is not applicable.

70.03 Commuter Rail

This category includes costs to purchase seven new rail vehicles. The quantity required was based on a daily ZEPRT service operating on a 30-minute headway.

70.04 Bus

This category is not applicable.

70.05 Other Vehicles

This category is not applicable.

70.06 Non-Revenue Vehicles

This category includes an allowance for five maintenance-of-way trucks.

70.07 Spare Parts / Rotable Components

This category is not applicable.

70.08 Intercity Passenger Rail

This category is not applicable.

18.4.8 Professional Services Elements for Cost Categories 10-50

SCC 80 includes all professional, technical, and management services related to the design and construction of fixed infrastructure during the project development and construction phases of the ZEPRT Project. This includes environmental work, design, engineering, and architectural services; specialty services such as safety or security analyses; value engineering; risk assessment; cost estimating; scheduling; ridership modeling and analyses; auditing; legal services; administration and management; etc. by agency staff or outside consultants.

80.00 Planning and Concept Design

This includes initial planning and preliminary design.

80.01 Preliminary Engineering

This category includes preconstruction efforts and preliminary environmental contracts.

80.02 Final Design

Engineering includes final design, and independent cost estimating.

80.03 Project Management for Design and Construction

This category includes project staff time and project management activities.

80.04 Construction Administration and Management

This category includes an allowance for QC, testing, and inspection along with Construction Management (CM) and additional Quality Assurance (QA) testing at the maintenance facility.

80.05 Professional Liability and Other Non-Construction Insurance

This category costs for Owner Controlled Insurance Program (OCIP).

80.06 Legal; Permits; Review Fees by Other Agencies, Cities, Etc.

This category includes contract values for known and allowances for unknown third-party review fees.

80.07 Surveys, Testing, Investigation, Inspection

This category includes an allowance for additional testing and investigation.

80.08 Start Up

This category includes costs for training and start-up.

80.09 Other

This category is not applicable.

18.5 Results of Initial Opinion of Probable Capital Cost Estimate

The following section summarizes the results of the initial opinion of probable capital cost estimate developed for the ZEPRT Project. It is presented in two main sections: base cost and contingency.

18.5.1 Base Cost

Base cost is considered as the cost in Year 2025 dollars, excluding cost risk. The base cost estimate is summarized by major SCC category in Table 18.2 below.

Table 18.2 Base Year Initial Opinion of Probable Capital Cost Estimate by Major SCC Category

SCC Category		Base Cost
10	GUIDEWAY AND TRACK ELEMENTS (route miles)	\$729,252,512
20	STATIONS, STOPS, TERMINALS, INTERMODAL (number)	\$80,318,546
30	SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	\$253,599,991
40	SITEWORK AND SPECIAL CONDITIONS	\$740,177,746
50	SYSTEMS	\$152,518,075
60	ROW, LAND, EXISTING IMPROVEMENTS	\$215,686,271
70	VEHICLES	\$145,400,000
80	PROFESSIONAL SERVICES	\$684,553,405
Total Base Cost		\$3,001,506,547

Source: HDR

18.5.2 Contingency

The initial opinion of probable capital cost estimate follows the Federal Transit Administration (FTA) approach and naming conventions for risk identification. Thus, the overall value of contingency has been

assigned to two categories — Allocated Contingency and Unallocated Contingency. As the names suggest, contingency included within the allocated category is assigned to particular scope elements, whereas contingency included within the unallocated category is not assigned to any particular scope elements but rather applied across the project as a whole. Table 18.3 below provides a summary of base year contingency by major SCC Category. Note that as ZEPRT advances into environmental in a future project phase, the California Coastal Commission may require mitigations as part of its approval process and that these mitigations would increase the total cost of the Project.

Table 18.3 Base Year Initial Opinion of Probable Capital Cost Estimate Contingency by Major SCC Category

SCC Category		Allocated Contingency		Unallocated Contingency		Total Contingency	
		\$	%	\$	%	\$	%
10	GUIDEWAY AND TRACK ELEMENTS	\$177,408,553	24%	\$72,925,251	10%	\$250,333,804	34%
20	STATIONS, STOPS, TERMINALS, INTERMODAL	\$28,111,491	35%	\$8,031,855	10%	\$36,143,346	45%
30	SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	\$88,759,997	35%	\$25,359,999	10%	\$114,119,996	45%
40	SITework AND SPECIAL CONDITIONS	\$258,693,953	35%	\$74,017,775	10%	\$332,711,728	45%
50	SYSTEMS	\$53,381,326	35%	\$15,251,807	10%	\$68,633,134	45%
60	ROW, LAND, EXISTING IMPROVEMENTS	\$86,274,509	40%	\$21,568,627	10%	\$107,843,136	50%
70	VEHICLES	\$50,890,000	35%	\$14,540,000	10%	\$65,430,000	45%
80	PROFESSIONAL SERVICES	\$239,593,692	35%	\$68,455,340	10%	\$308,049,032	45%
Total Contingency		\$983,113,521	32.8%	\$300,150,654	10.0%	\$1,283,264,176	42.8%

Source: HDR

18.5.3 Initial Opinion of Probable Capital Cost to Construct ZEPRT Project

Table 18.4 below provides a Total Base Year 2025 program level summary of the Base Cost, Allocated Contingency, and Unallocated Contingency.

Table 18.4 Summary of Opinion of Probable Capital Cost to Construct ZEPRT Project (Base Year 2025 Cost)

Major SCC		Base Cost	Allocated Contingency	Unallocated Contingency	Total Base Year Cost
10	GUIDEWAY AND TRACK ELEMENTS	\$729,252,512	\$177,408,553	\$72,925,251	\$979,586,316
20	STATIONS, STOPS, TERMINALS, INTERMODAL	\$80,318,546	\$28,111,491	\$8,031,855	\$116,461,892
30	SUPPORT FACILITIES: YARDS, SHOPS, ADMIN. BLDGS	\$253,599,991	\$88,759,997	\$25,359,999	\$367,719,987
40	SITework AND SPECIAL CONDITIONS	\$740,177,746	\$258,693,953	\$74,017,775	\$1,072,889,474
50	SYSTEMS	\$152,518,075	\$53,381,326	\$15,251,807	\$221,151,208
60	ROW, LAND, EXISTING IMPROVEMENTS	\$215,686,271	\$86,274,509	\$21,568,627	\$323,529,407
70	VEHICLES	\$145,400,000	\$50,890,000	\$14,540,000	\$210,830,000
80	PROFESSIONAL SERVICES	\$684,553,405	\$239,593,692	\$68,455,340	\$992,602,437
Grand Total		\$3,001,506,546	\$983,113,521	\$300,150,654	\$4,284,770,721

Source: HDR

The initial opinion of probable capital cost estimate resulted in a Base Year cost of \$4.3 billion. Based on the current initial conceptual level of design, this estimate would rank as a Class 4 estimate according to the Association for the Advancement of Cost Engineering (AACE) International Cost Estimate Classification System with an expected accuracy range of -30% and +50%. With this resulting range applied to the initial opinion of probable capital cost estimate Base Year cost, the expected accuracy range can be seen in Table 18.5 below.

Table 18.5 Expected Accuracy Range of Initial Opinion of Probable Capital Cost Estimate for Base Year

Summary of Initial Opinion of Probable Capital Cost Estimate — Base Cost (Billions of Dollars)			
	Low Range (-30%)	Initial Opinion of Probable Capital Cost Estimate	High Range (+50%)
Total Project	\$3.0 B	\$4.3 B	\$6.4 B

Source: HDR

The initial opinion of probable capital cost presented above will be refined during ongoing development of the ZEPRT Project to better understand the cost to construct and implement the ZEPRT service between Pajaro and Natural Bridges Road in Santa Cruz.

18.6 Initial Opinion of Probable Annual Operations and Maintenance Cost

This section presents an initial opinion of probable annual operations and maintenance cost estimate for the ZEPRT passenger rail service. This estimate excludes any major maintenance or rehabilitation of structures and represents a typical year of maintenance and operations.

The reasonable assumptions presented in Table 18.6 below were made regarding the operations of the ZEPRT service to develop the estimate.

Table 18.6 Conceptual Operating Assumptions for ZEPRT Passenger Rail Service

Category	Assumption
Service Pattern	All-day end-to-end service with a one-way trip of 22 miles
Operating Hours	Daily from 6 a.m. to 10 p.m.
Operating Days	365 days per year
End-to-End Run Time	45 minutes
Headway	Every 30 minutes

Source: HDR

18.6.1 Methodology

A benchmark operations and maintenance cost estimate for a proposed passenger rail transit service typically compares similar transit service operating costs to estimate a reasonable range of operating costs that are comparable to industry standards and best practices.

The method of estimating operations and maintenance costs consisted of the steps identified below.

1. Determine transit services of a similar nature in both operating characteristics and regulatory environment to be used as benchmarks.

2. Obtain data on operations and operating expenses for each of the above properties.
3. Calculate the operating cost per train revenue mile (TRM) for each of the above properties.
4. Calculate the expected TRM for future ZEPRT passenger rail service on the SCRBL based on the assumed headway of 30 minutes.
5. Apply the results of Step 3 to the results of Step 4 to determine an average Rough Order of Magnitude (ROM) cost estimate for operations and maintenance.
6. (Optional) Escalate the cost estimate from Step 5 to the appropriate year of estimate, as required.

More information on each step, data source, and calculation are provided in the sections that follow.

Step 1

The following six transit services were selected as representative benchmarks. Each operates electric or diesel multiple-unit trains on a single line.

- California
 - San Francisco Bay Area Rapid Transit (BART): eBART from Pittsburg/Bay Point to Antioch
 - North County Transit District: SPRINTER from Oceanside to Escondido
 - Sonoma-Marín Area Rapid Transit: SMART from Larkspur to Sonoma County Airport in Santa Rosa
- Texas
 - CapMetro Austin: Red Line from Downtown Austin to Leander
 - Trinity Metro: TEXRail from Fort Worth to Dallas-Fort Worth Airport
 - Denton County Transportation Authority: A-train from Denton to Trinity Mills

Step 2

Operations and operating expense data for each service identified in Step 1 was obtained from the FTA National Transit Database (NTD) for the latest reporting year available, 2023. The following key data points were included:

- Total Annual Operating Expense for the selected mode
- Total Train Revenue Miles for the selected mode

The Total Annual Operating Expense includes the following: “vehicle operations, vehicle maintenance, non-vehicle maintenance, general administration object classes include labor, fringe benefits, services, materials and supplies, utilities, casualty and liability costs, taxes, purchased transportation expenses, miscellaneous, salaries, wages, cost, fuel costs, tires and tubes, vehicle upkeep, agency operations.” It excludes major maintenance or rehabilitation of structures.

It is anticipated that revenue from fares and other sources would be used to offset some of the cost associated with operations and maintenance of the ZEPRT service. A preliminary conceptual ZEPRT fare revenue forecast was developed for the ZEPRT Project and is presented in Section 10.14 of this report. Fares, and other revenue sources once confirmed and quantified for ZEPRT, will be presented as the ZEPRT Project advances.

Step 3

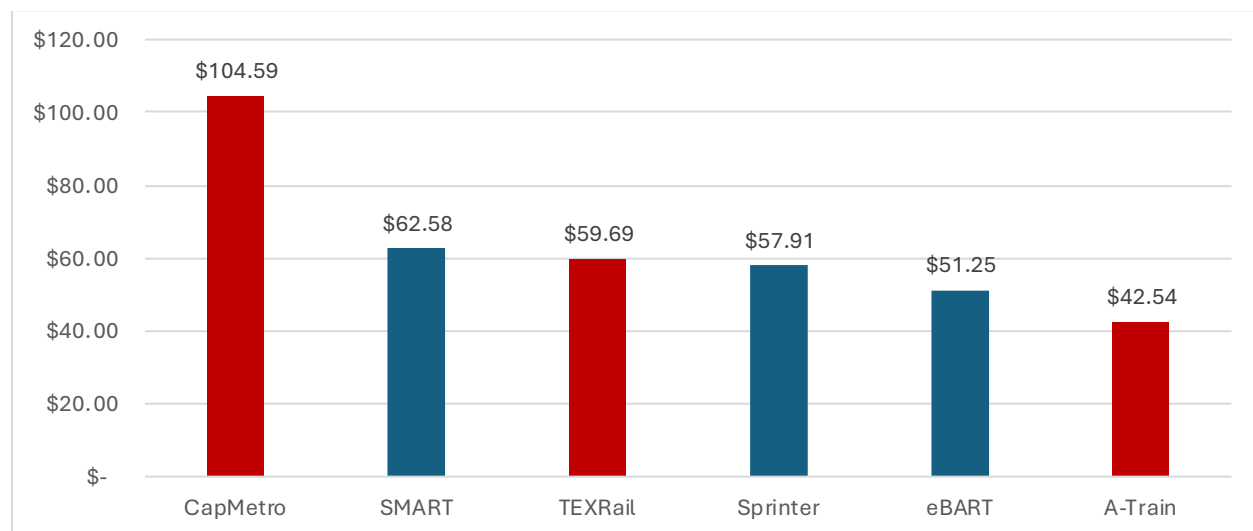
The total annual operating expense was divided by the total train revenue miles to determine each transit service's average annual operating expense per train revenue mile. These figures were then averaged to create a basis of cost estimate. Table 18.7 below presents selected NTD operations figures and calculations for 2023, Figure 18.1 below shows annual operating expense per TRM (2023), and Figure 18.2 below indicates average annual operating expense per TRM by type of service.

Table 18.7 Selected National Transit Database Operations Figures and Calculations (2023 Dollars)

Transit Service	Service Operations	Total Annual Operating Expense	Total Train Revenue Miles	Annual Operating Expense per Train Revenue Mile
eBART	Directly Operated	\$19,617,059	382,785	\$51.25
SPRINTER	Directly Operated	\$29,883,425	516,006	\$57.91
SMART	Directly Operated	\$30,585,066	488,765	\$62.58
CapMetro	Purchased Transportation	\$34,842,819	333,124	\$104.59
TEXRail	Purchased Transportation	\$36,897,485	618,139	\$59.69
A-train	Purchased Transportation	\$16,322,003	383,720	\$42.54

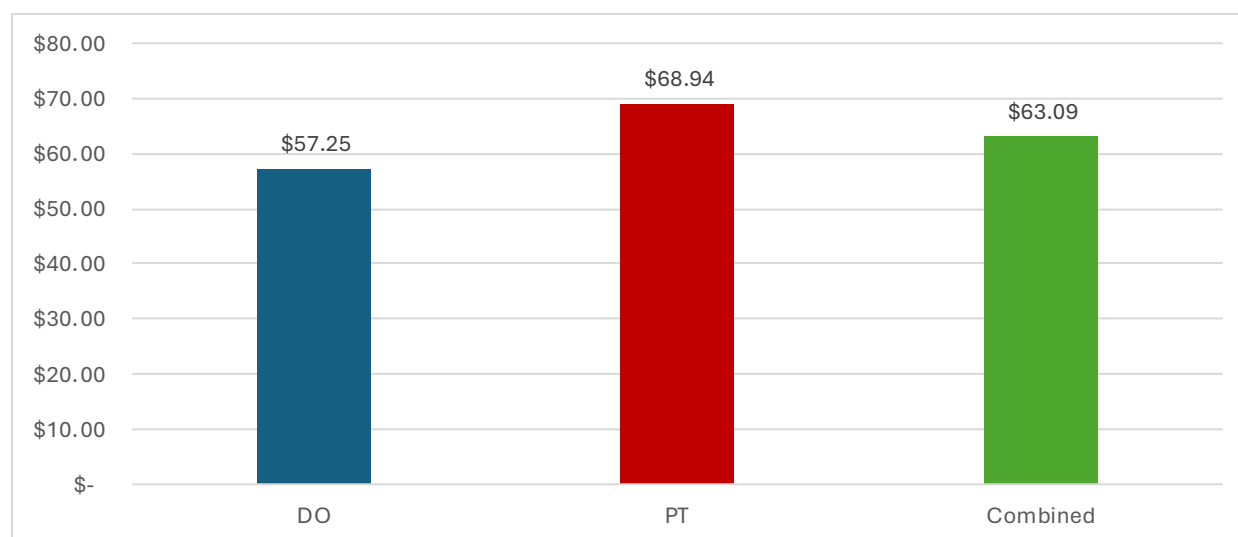
Source: FTA National Transit Database

Figure 18.1 Annual Operating Expense per Train Revenue Mile (2023)



Source: FTA National Transit Database

Figure 18.2 Average Annual Operating Expense per Train Revenue Mile by Type of Service



Source: FTA National Transit Database and HDR Analysis

Step 4

To calculate the expected TRM for future ZEPRT passenger service on SCRBL, the assumptions in the above section were applied and a conceptual operating schedule was developed for service with 30-minute headways. The total annual TRM for ZEPRT was calculated to be 513,920.

Step 5

The basis of cost estimate from Step 3 was applied to the TRM for 30-minute headways determined in Step 4. Annual operating expenses may be higher due to the historical experience of Santa Cruz METRO labor agreements and the uncertainty around hydrogen-fueled passenger train operations, a technology which is undergoing rapid development and change. To account for these variables, a contingency of +20% has been applied to the average estimate.

Step 6

To escalate the costs to the year of estimate (2025), the U.S. Bureau of Labor and Statistics' CPI (Consumer Price Index) Inflation Calculator was used. The total inflation rate of the previous 10 years (2013-2023) was used to determine an average annual inflation rate. This annual rate (3.0%) is then applied to the figures from Step 5 to create a cost estimate for 2025. This process can be repeated to determine operations and maintenance cost estimates for the first year of operation when that date is determined and as the ZEPRT Project advances.

18.6.2 Initial Opinion of Probable Annual Operations and Maintenance Cost Estimate

The initial opinion of probable annual operations and maintenance cost for the proposed ZEPRT passenger rail service is expressed as an estimated average ROM operating cost range in 2025 dollars in Table 18.8 below.

Table 18.8 ROM Estimate of ZEPRT Annual Operating Expense on SCRBL (2025 Dollars)

ZEPRT Operating Headway	Average Annual Operating Expense Without Contingency	Average Annual Operating Expense Including Contingency
30 Minutes	\$34 Million	\$41 Million

Source: HDR

The initial opinion of probable annual operations and maintenance cost presented above will be refined during ongoing development of the ZEPRT Project to better understand the cost to operate and maintain the ZEPRT service on the SCRBL between Pajaro and Natural Bridges Road in Santa Cruz.

19.0 Conceptual Initial Risk Analysis and Risk Register

The Conceptual Initial Risk Analysis and Risk Register for the ZEPRT Project will be developed at a future date to be determined by SCCRTC.

20.0 Potential ZEPRT Project Next Steps

The Final *Project Concept Report* documents the key understandings and outcomes of the analysis, study, and outreach conducted during the current phase of the ZEPRT Project. With the SCCRTC Commission's approval, and subject to available funding, the ZEPRT Project would continue to advance preliminary engineering and environmental review in future phases including standalone projects of independent utility.

Potential steps that SCCRTC and stakeholders can consider for strategic advancement of ZEPRT as presented in this Final *Project Concept Report* would help to inform and progress future project activities (e.g., confirming ridership forecasts, additional conceptual engineering and operations planning to refine rail network infrastructure improvements and to improve ZEPRT end-to-end travel times, etc.). These potential steps will not only help inform the environmental process by providing more clarity as to how the project can serve Santa Cruz County but would also serve to benefit the Commission in making future decisions on funding and a specific approach to implementation.

20.1 Potential Next Steps

20.1.1 Perpetuate Broad Stakeholder Engagement and Coordination to Catalyze Consensus and Maintain Momentum for the ZEPRT Project

SCCRTC can leverage momentum from the current phase of the ZEPRT Project to cooperatively identify and define needs, issues, challenges, and opportunities related to ZEPRT passenger rail implementation and collect further inputs to define next steps and confirm the scope and schedule of the Project. Key stakeholders include state agencies such as California Department of Transportation (Caltrans), California State Transportation Agency (CalSTA), CCC, and California Public Utilities Commission (CPUC); local agencies such as Santa Cruz METRO, Transportation Agency for Monterey County (TAMC), and other local jurisdictions (e.g., cities of Watsonville, Capitola, and Santa Cruz); local universities and colleges (e.g., UC Santa Cruz and Cabrillo College); railroads that operate in or connect to the SCBRL corridor (i.e., St. Paul and Pacific Railroad [SPP], Santa Cruz, Big Trees, and Pacific Railway [SCBG, the operator of Beach Train], and Union Pacific Railroad [UP]); adjacent landowners; significant employment centers; local communities and the public in Santa Cruz County and Pajaro in Monterey County. This may include requesting acceptance of the ZEPRT Project Concept by affected local jurisdictions and the transit district.

20.1.2 Confirm End-to-End ZEPRT Travel Time and Network Infrastructure Required to Support a Reliable and Competitive Transportation Option

Initial operations modeling conceptually identified end-to-end travel time for a daily passenger ZEPRT rail service operating on 30-minute headways over the 22-mile SCBRL corridor between Pajaro Station and Natural Bridges Drive (Santa Cruz) Station. End-to-end travel times for operation over the single-track network including up to five meet-pass events between passenger trains at sidings and stops at seven intermediate stations en route can range from approximately 45 to 70 minutes in each direction, based on the outputs of the initial rail operations modeling. This travel time is affected by the ZEPRT rail alignment (including track geometry in and on approach to curves, which is a determining factor for maximum operating speeds) and the number and locations of proposed network infrastructure improvements, including sidings that accommodate meet-pass events between trains and stations.

An important next step is to confirm end-to-end ZEPRT travel time through additional engineering and rail operations analysis and stakeholder coordination — and the network infrastructure required to support a reliable and competitive transportation option — as the Project advances. Ultimately, the confirmed end-to-end ZEPRT travel time will be influenced by and fully dependent upon the characteristics of the final ZEPRT rail alignment and adjacent trail alignment; locations of sidings, terminal tracks, and stations; passenger vehicle operating characteristics; safety and multimodal interface at highway-rail grade crossings and at locations where the SCBRL interfaces with roadway alignments; adjacent land use; and other considerations. The potential for increasing passenger train operating speeds over the SCBRL corridor, development of an additional station track at the east terminus of the ZEPRT service in Pajaro to reduce train turnaround times, and shifting of the west terminus of the ZEPRT service in Santa Cruz to Beach Street / Downtown instead of Natural Bridges Drive — and the resulting changes in network infrastructure requirements, operating plan, end-to-end travel times, and capital costs — will also be considered.

20.1.3 Develop an Optimized Travel Demand Forecast Benefitting from Opportunities for Transit-Oriented Development and Intensifications of Uses Along the Corridor

An optimized ZEPRT ridership scenario would involve updating the Santa Cruz County Model and Direct Ridership Model to account for high level land use changes necessary for desired transit-oriented development (TOD) results. The model results would be iteratively refined to achieve maximum ridership outcomes and other project benefits like greenhouse gas emissions reduction and new housing.

This new ridership scenario would be focused on achieving higher ridership levels that could incorporate potential land use and surface transit/bike/pedestrian service changes around ZEPRT stations, maximizing TOD, implementing park-and-ride facilities, reconfiguring Santa Cruz METRO feeder routes, and improving bicycle and pedestrian infrastructure around stations.

20.1.4 Develop a Detailed Alternative for Meeting Long-Term Objectives of Stakeholders in the Beach Flats Area of the City of Santa Cruz

A critical next step is to develop a more detailed alternative for the ZEPRT rail alignment through the Beach Flats area of Downtown Santa Cruz. The alignment running along Beach Street from the San Lorenzo River to the traffic roundabout at Pacific Avenue carries significant complexities due to overlapping issues: rail alternatives, visitor-serving uses, parking, circulation, and coastal constraints. This *Project Concept Report* identifies alternatives for the alignment along Beach Street but will require further study to resolve land use, circulation, and regulatory trade-offs along this corridor. Additional study and stakeholder coordination in the environmental phase will mitigate the risk of potential prolonged disputes, permitting delays, and funding challenges.

As part of the environmental review process, SCCRTC can work with local stakeholders to conduct a focused study of the corridor and traffic circulation network to evaluate land use, safety, transportation, and operational considerations. The study will consolidate critical issues such as pedestrian and vehicular circulation, emergency access to the Boardwalk, the Boardwalk's operations and functionality, long-term recreational access, parking requirements, the location of the ZEPRT station, and the future modifications of the recreational Beach Train operations into a coordinated framework, providing clarity on benefits and trade-offs. This framework will help guide the selection of a preferred alignment that is consistent with the community and City of Santa Cruz's vision for the future of the Beach Flats area and that builds consensus among stakeholders.

20.1.5 Continue Coordination with Stakeholders in the Walker Street and Downtown Areas of Watsonville

The existing SCBRL is located within Walker Street and roadway and railway traffic coming through parts of Watsonville. This alignment presents constraints related to vehicle movement, intersection conflicts, limited right-of-way to accommodate street, rail, and bicycle and pedestrian use, and challenges with providing for sufficient tangent track to support a new platform at the historic Downtown Watsonville Depot location. Various alternatives were considered preliminarily for the conceptual ZEPRT rail and trail alignment through Walker Street and Downtown Watsonville. A final rail alignment that meets the objectives of the ZEPRT Project will be defined through future analysis and stakeholder coordination as the ZEPRT Project advances.

20.1.6 Begin Early Environmental Activities to Advance Towards NEPA/CEQA

Early coordination with the federal lead agency on appropriate level of NEPA documentation will be critical. As design refinements continue to be made, environmental input will be considered. The design team will look for engineering/design solutions to avoid highly sensitive resources. Identification of the proposed project (including options) for analysis in the environmental document, and the reasons for rejecting an alternative or options, will be clearly defined.

20.1.7 Continue Resiliency Planning for Both Rail and Trail Along the SCBRL

SCCRTC was awarded a FY23-24 Caltrans Sustainable Transportation Planning Grant to develop a plan for climate resilience of the ZEPRT corridor, focusing on four specific locations that have been identified as vulnerable to climate change impacts. Technical analysis of existing conditions and climate hazards will further inform the project concept and resiliency at the four most vulnerable locations along the ZEPRT corridor — Pajaro River Rail Bridge, Harkins Slough Rail Crossing, La Selva/Manresa coastal bluffs, and Capitola coastal bluffs. The project concepts will be developed for short-term (2030), medium-term (2050) and long-term (2100) climate projections that consider protection, accommodation, and/or retreat strategies from climate hazards at these vulnerable locations.

Ongoing coordination with the CCC will be critical as this work continues. The CCC has been involved throughout the development of the Project's Transit Corridor Alternatives Analysis (2022) and *Project Concept Report*. Most recently, RTC staff have met with CCC staff through each of the *Project Concept Report* milestones to provide updates and seek guidance and feedback on the project approach. Key discussion topics have included public access to the coastline, the use of seasonal stations to provide new access to coastal areas, whether the project is considered a new or existing facility and if it can be considered a coastal-dependent use, what design approaches are permissible to address anticipated bluff retreat. Development of climate resilience measures and alternatives analyses will be used to ultimately seek CCC approval of a required Coastal Development Permit.

20.1.8 Identify Potential Federal, State, and Local Funding Sources and Other Options for Phased Advancement of ZEPRT Project that Aligns with Federal, State, and Local Priorities and Programs

The phasing of the ZEPRT Project could be advanced to meet both local demand for passenger and freight rail services while also maximizing public benefits and funding competitiveness by aligning with federal and state visions for intercity and regional passenger rail inclusive of the ZEPRT corridor as identified in the 2024 *California State Rail Plan* and in the federal Corridor Identification and Development (Corridor ID) program launched in 2024.

Given the substantial capital investment required for full-service implementation, the ZEPRT Project may be advanced through a series of prioritized, high-value investments, each representing an individual project or a set of interoperable improvements with independent utility. Collectively, these projects would build toward the full system vision by improving infrastructure and capacity along the SCBRL. Phasing would likely, at least initially, proceed geographically, beginning at the eastern connection to the state rail network in Pajaro and progressing generally westward toward Santa Cruz. However, project phasing needs to be considered realistically and within the context of available funding sources, a description of which follows later in this chapter. The current availability of funding sources, both discretionary and by formula, will constrain near-term progress. Most formula-based funds are already programmed, leaving limited opportunity for large-scale capital commitments, and discretionary grant programs vary in terms of the available award sizes and eligibility criteria.

Additionally, discretionary grant programs prioritize different benefits that projects can deliver. These programs are highly competitive, and rigorous and detailed benefit analyses, which can be costly to prepare, are often required. As such, a phased delivery strategy is suggested as a practical means to advance Project elements that are most likely to be reasonably competitive for funding within a given program, while maintaining momentum towards the long-term delivery of the full-build vision.

The suggested phasing strategy aligns with both federal and state goals and objectives, while also considering the competitiveness of currently available funding programs and the limited likelihood of securing sufficient grant funds to construct the entire ZEPRT Project in a single phase.

To remain competitive in future funding cycles, ZEPRT will require a detailed Benefit-Cost Analysis (BCA) to monetize and quantify project benefits across different evaluation frameworks. This economic analysis and forecast are essential to meet federal expectations, particularly under USDOT and FRA programs that require justification of potential public benefits through monetized outcomes such as travel time savings, reduced collisions, and operational efficiency. While used for the Federal Transit Administration (FTA) National Transit Database (NTD) as a measure of transit service performance, revenue miles and revenue hours are not quantified or evaluated in a benefit cost analysis required by discretionary grant programs. FTA is explicit that “all agencies must report accurate and truthful service data” rather than any potential forecasts. Further, the methods for monetizing anticipated benefits, particularly GHG reductions, vary between federal and state programs with their own annually updated evaluation guidelines.

Federal programs such as FRA CRISI will place stronger weight on rail safety improvements, while state programs such as TIRCP will more heavily value accessibility, mode shift, and equitable access to clean transportation. Within the September 2025 NOFO release for the Federal-State Partnership for Intercity Passenger Rail Program For Projects Not Located on the Northeast Corridor (FSP-National), FRA notes that a project’s economic benefits are ranked “high” if it reports a benefit cost ratio of 2.0. A benefit cost ratio evaluates the cost of a project against future economic benefits. Under this specific FRA benefit criteria, in order to compete for federal investments, ZEPRT would need to demonstrate that for every dollar spent on the project nearly 2 dollars in economic benefits will be realized. While previous funding cycles for California discretionary programs do not have an explicit metric on economic benefits, ZEPRT related projects must also complete a specific California economic effort using the latest California Benefit Cost-Analysis (CalBCA) tool and metrics. As such, future funding pursuits will require carefully tailored applications that frame the ZEPRT Project’s benefits in ways that align with each program’s stated goals.

While a benefit-cost analysis requires monetization of specific benefits from infrastructure investment, federal and state funding applications must highlight intangible social benefits for communities. CalSTA’s Transit Transformation Task Force (TTTF) is currently developing a statewide report with policy recommendations towards funding the future of public transportation, including best practices on growing transit ridership, improving the transit experience for all users of those services as well as agency performance metrics. Current discussions at the Task Force’s public meetings indicate an interest in further discussion with the Legislature about performance measures, such as cost per rider or cost per passenger mile. At the project’s current stage, ZEPRT should continue highlighting federal and state direction on potential benefits, both monetized or qualitative, rather than an unusable potential comparative forecast of variables such as cost per rider or cost per passenger mile.

20.2 Develop Funding and Financing Strategy

Owing to the complexity of the ZEPRT Project in terms of the size of capital funds required, and the time it takes to secure funding and financing sources, any funding and financing strategy for ZEPRT should be developed by taking into account any phased implementation strategies that arise out of the Corridor ID program as well as any improvements that emerge as a series of targeted capital projects with independent utility.

Investments along the SCBRL corridor used by ZEPRT will need to compete with other transportation projects for finite transportation funding resources at federal, state, and local levels. This underscores the importance of a funding and financing strategy to be considered early on in project implementation so that SCCRTC investments in ZEPRT can be integrated with federal formula and competitive programs, state programs including State Transit Assistance (STA) and State Rail Assistance (SRA) funds, both formulaic and competitive SB 1 related programs, discretionary programs associated with the Regional Transportation Improvement Program, potential future sales tax measures, and other improvement and funding plans for the governmental agencies involved with this Project.

As the ZEPRT Project's capital fund requirements are unlikely to be provided for by only one funding source, there is the need to identify a mix of funding and financing sources. The funding and financing strategy could also consider an alignment of interests between freight, interstate passenger, and intercity passenger rail needs. Under an incremental approach, the completion of targeted capital projects may potentially provide a benefit to existing corridor use (freight) prior to implementation of intercity passenger rail service but would likely be limited to the southernmost 3 miles in Watsonville where active freight exists. If such a benefit is identified and mutually recognized by the SCCRTC, it should be defined and memorialized in any shared-use agreements developed for the Project.

The funding and financing strategy would further address the questions relative to the difficulty of securing the funding required, and the degree to which specific Project elements would qualify (and compete well) for funding. A BCA will be needed for most grant programs, and emissions quantification will be required for state programs relying on SB 1 dollars.

20.3 Funding Sources

Given the early stage of the ZEPRT Project development that currently exists, the following description of funding programs for the Project discusses potential sources available in today's funding climate for the capital and operational funding required to implement the project and initiate service.

20.3.1 Corridor ID

Passenger rail projects seeking federal funding need to coordinate with the FRA and be consistent with its Corridor Identification and Development (Corridor ID) program goals and objectives. The overarching goal of Corridor ID is to develop a "pipeline of projects" which have been vetted through the development of a Service Development Plan (SDP) covering the rail corridor in which a project proponent is seeking to implement or expand passenger rail service. The FRA has prepared a "template-based approach" which covers all elements needed to obtain an FRA approved SDP. In this case, a funding strategy will be critical to the development of the project's required financial plan and the SDP's discussion of "investment

packages” needed to implement the service. Furthermore, an SDP will need to examine equipment costs as well as operations and maintenance costs to present a holistic picture of the financial investment required. As such, a robust project cost estimate will underpin the funding strategies needed for the investment packages. Completing the SDP makes projects eligible for future rounds of Federal-State Partnership for State of Good Repair Program (FSP) funds. Caltrans Department of Rail (DOR) is the grantee recipient of the Corridor ID award for the Central Coast Corridor and has prepared the required Step 1 deliverables which are awaiting FRA approval. Once approved, DOR will follow the FRA guidance that will advance the corridor into Step 2 of the program which will be the preparation of the Service Development Plan for the entire Central Coast Corridor.

Beyond the requirements of Corridor ID, these steps will also serve to align ZEPRT to State of California goals and objectives identified in the *California State Rail Plan* as well as those articulated by Caltrans DOR, and those identified in the State of California’s discretionary grant programs. The project team recommends aligning ZEPRT with the FRA Corridor ID program and associated processes, but acceptance into the program and allocation of funds for project development activities, including SDP preparation, is subject to FRA approval and is not guaranteed.

20.3.2 Discretionary Federal Sources

Federal Railroad Administration

The Federal Railroad Administration (FRA) is mainly in charge of creating and enforcing safety regulations for the national railroad network and administering federal rail funding. It offers the following programs to fund rail projects:

- **Corridor Identification Program (Corridor ID):** To implement passenger rail corridor planning and ultimately develop an FRA-approved pipeline of projects.
- **Federal-State Partnership for State of Good Repair Program (FSP):** To fund capital projects that reduce the state of good repair backlog, improve performance, or expand or establish new intercity passenger rail service, including privately operated intercity passenger rail service if an eligible applicant is involved.
- **Consolidated Rail Infrastructure and Safety Improvements Program (CRISI):** To improve the safety, efficiency, and reliability of passenger and freight rail systems.
- **Railroad Crossing Elimination Program (RCE):** Provides funding to promote highway rail or pathway-rail grade crossing improvement projects that focus on improving the safety and mobility of people and goods.

Federal Highway Administration

The Federal Highway Administration (FHWA) is mainly in charge of the construction, maintenance, and preservation of the nation’s highways, bridges, and tunnels. It offers the following programs that intersect rail projects:

- **Railway-Highway Crossings (Section 130) Program:** This program provides annual funding of about \$220 million to fund the elimination of hazards at railway-highway crossings to reduce the number of fatalities, injuries, and crashes. Funding is distributed to the states based on a formula that accounts for the number of public railway-highway crossings in the state. A state’s

apportionment of Section 130 funds may be used to improve safety at-grade crossings along the corridors.

- **Transportation Enhancements Program (TEP):** This program supports nontraditional transportation-related improvements. For rail, program funds can be used to support the rehabilitation and operation of historic transportation buildings and other structures, as well as the acquisition of abandoned railroad corridors.

Combined/Multimodal Programs

- **Multimodal Project Discretionary Grant (MPDG):** This program is a USDOT umbrella initiative that combines the MEGA program packaged with the Infrastructure for Rebuilding America (INFRA) program and a Rural Surface Transportation Grant (Rural) program component into one funding opportunity. MPDG was created to fund major projects that are too large and complex for traditional funding programs. It provides competitive grants for highway, bridge, freight, passenger rail, and public transit projects of national and regional significance, helping to better leverage federal resources in order to advance transformational infrastructure improvements across the country.

Federal Loan Programs

Limited discretionary federal funding for major transportation projects has led to increased reliance on federal loans, notably through the following and programs:

- **FRA Railroad Rehabilitation and Improvement Financing Loans — Railroad Rehabilitation and Improvement Financing (RRIF):** Created in 1998 to help railroad operators finance improvements to infrastructure and equipment. Eligible borrowers include railroad operators, state and local governments, government-sponsored authorities, and joint ventures that include at least one railroad. The program was designed to operate at no cost to the government, and therefore, it charges the credit risk premium to the borrower based on the borrower's financial health.
- **FHWA Transportation Infrastructure Finance and Innovation Act (TIFIA):** Created in 1998 to provide loans and loan guarantees for highway, transit, railroad, intermodal freight, and port access projects. According to the program guide, rail projects "involving the design and construction of intercity passenger rail facilities or the procurement of intercity passenger rail vehicles" are eligible for Transportation Infrastructure Finance and Innovation Act assistance. Interest rates are determined by the TIFIA committee based on a variety of factors as well as the specific qualification of each project.

20.3.3 Discretionary State Sources

The 2018 *California State Rail Plan* offers an investment strategy that allows the state to focus on corridor-level rail investments to achieve service goals that will help in closing capacity gaps, improving corridor safety, and increasing the frequency and reliability of intercity passenger rail. This plan identifies short-, medium-, and long-term investments and costs, including on the SCBRL Corridor. Between Pajaro and Santa Cruz. Potential discretionary sources derived from state programs include the following:

- **Transit and Intercity Rail Capital Program (TIRCP):** Created by SB 862 (Chapter 36, Statutes of 2014) and modified by SB 9 (Chapter 710, Statutes of 2015), to provide grants from the

Greenhouse Gas Reduction Fund to fund transformative capital improvements that will modernize California's intercity, commuter, and urban rail systems, and bus and ferry transit systems to significantly reduce emissions of greenhouse gases, vehicle miles traveled (VMT), and congestion.

- **State Rail Assistance (SRA):** Primarily formula-based funding derived from a sales tax share of diesel fuel specifically to commuter rail and intercity rail, but it also includes a 25% set aside of the intercity funds for California State Transportation Agency (CalSTA) to award discretionary grants for eligible projects.
- **Low Carbon Transportation Operations Program (LCTOP):** Created to provide operating and capital assistance for transit agencies to reduce greenhouse gas emission and improve mobility, with a stated priority on serving disadvantaged communities. Approved projects in the Low Carbon Transportation Operations Program will support new or expanded bus or rail services, expand intermodal transit facilities, and may include equipment acquisition, fueling, maintenance, and other costs to operate those services or facilities, with each project reducing greenhouse gas emissions. For agencies whose service area includes disadvantaged communities, at least 50% of the total monies received will be expended on projects that will benefit disadvantaged communities.
- **Road Repair and Accountability Act of 2017, SB 1 (Chapter 5, Statutes of 2017):** Includes a program that will provide additional revenues for transit infrastructure repair and service improvements. This investment in public transit is referred to as the State of Good Repair Program. This program receives funding of approximately \$105 million annually. State of Good Repair funds are to be made available for eligible transit maintenance, rehabilitation, and capital projects. Also included are State Rail Assistance funds for expanded service, outreach, increased customer amenities, and discounted tickets with the purpose of increasing ridership. This category can also be utilized for capital investments, such as new and cleaner emissions rolling stock (to increase capacity and reduce emissions), as well as track and station investments (which will reduce travel times and delays, improve accessibility, and enhance customer experience).
- **SB 1 Local Partnership Program (LPP):** Intended to provide local and regional transportation agencies that have passed sales tax measures, developer fees, or other imposed transportation fees with a continuous appropriation of \$200 million annually from the Road Maintenance and Rehabilitation Account to fund road maintenance and rehabilitation, sound walls, and other transportation improvement projects. This program is meant to balance the need to direct increased revenue to the state's highest transportation needs while fairly distributing the economic impact of increased funding.
- **SB 1 Solutions for Congested Corridors Program (SCCP):** This statewide, competitive program makes \$250 million available annually for projects that implement specific transportation performance improvements and are part of a comprehensive corridor plan by providing more transportation choices while preserving the character of local communities and creating opportunities for neighborhood enhancement.

- **Caltrans Section 190 Grade Separation Program:** A competitive grant program that provides \$15 million each year to local agencies for the construction of grade separation projects. This program is jointly administered by the California Public Utilities Commission (CPUC) and Caltrans. Local agencies submit project applications to CPUC, which develops a list of projects. Caltrans enters into funding agreements with local agencies for the reimbursement of the cost to construct the grade separation.
- **Trade Corridor Enhancement Funds (TCEP):** Created to provide funding for infrastructure improvements on federally designated Trade Corridors of National and Regional Significance, on California's portion of the National Highway Freight Network, as identified in the *California Freight Mobility Plan*, and on other corridors that have a high volume of freight movement. This statewide, competitive program will provide approximately \$300 million per year in state funding and approximately \$515 million in National Highway Freight Program funds, if the federal program continues under the next federal transportation act. Eligible applicants apply for program funds through the nomination of projects. All projects nominated must be identified in a currently adopted regional transportation plan.
- Other state funding sources that complement SB 1 goals for sustainable transportation, housing, and disadvantaged communities may also be potentially leveraged for the construction of rail stations and station-level improvements. One such program is the Affordable Housing and Sustainable Communities (AHSC) Program, which funds projects that implement land-use, housing, transportation, and agricultural land preservation practices to reduce greenhouse gas (GHG) emissions. Funding for the AHSC Program is provided by the Greenhouse Gas Reduction Fund (GGRF), an account established to receive Cap-and-Trade auction proceeds. The AHSC Program provides grants and/or loans, or any combination thereof, to projects that seek to integrate low-carbon transportation and affordable housing, with an emphasis on providing benefits to Disadvantaged and Low-Income Communities. The AHSC Program identifies three eligible Project Types:
 - Transit-Oriented Development (TOD) Project Areas
 - Integrated Connectivity Project (ICP) Areas
 - Rural Innovation Project Areas (RIPA)

20.3.4 Federal Formula Funding

Each year, the U.S. Congress passes legislation which, when signed by the President, appropriates funds for the U.S. Department of Transportation and related agencies. After that legislation is enacted, Federal Transit Administration (FTA) publishes a notice in the Federal Register that provides an overview of the apportionments and allocations based on these funds for the various FTA programs as well as statements of policy and guidance on public transit administration. Every state, territory, and urban area benefits from the federal transit funding. These formula grant programs allocate funding to states, urbanized areas, and transit agencies based on formulas set by Congress, and state governments and urbanized areas decide how much to provide to specific transit agencies and other providers. The following two links identify current apportionments:

[FTA | FY 2025 Full Year Apportionments State Totals](#)¹³

[FTA | FY 2025 Full Year Apportionments State Totals](#)¹⁴

20.3.5 State Formula Funding

- **California SB 125 (Chapter 54, Statutes of 2023):** Guides the distribution of \$4 billion through [TIRCP](#)¹⁵ on a population-based formula to regional transportation planning agencies, which will have the flexibility to use the money to fund transit operations or capital improvements.
- **State Transit Assistance Funds (STA):** Generated by a sales tax on gasoline and diesel. These funds are apportioned by formula by the State Controller's office with 50% allocated to Regional Transportation Planning Agencies and 50% allocated to eligible transit operators based on revenue.
- **Transportation Development Act Funds (TDA):** Provide funding for various transportation projects and services. TDA includes two funding streams, Local Transportation Funds (LTF) and State Transit Assistance. LTF is derived from a ¼-cent general sales tax while the STA is generated from the statewide sales tax on diesel fuel.
- **State Rail Assistance Funds (SRA):** As mentioned above with respect to the discretionary element of the program, SRA funds are derived from a sales tax on diesel fuel. These are formula based funds and are divided between intercity rail and commuter rail operators.

20.4 Funding and Implementation: Potential Next Steps to Advance the ZEPRT Project

Formula funding on federal and state levels is currently rather stable with the discretionary programs cited above in somewhat of a state of flux. Having a clear vision for the pursuit of State funding is a necessity as it provides important local match contribution and can be utilized as leverage when competing for federal funding where program priorities are changing and funding cycles uncertain. The change in administration has resulted in a change of federal policies tied to the discretionary programs. These programs were under the IIJA and are rather cyclical in nature with the current suite of federal programs in a state of schedule uncertainty. Specifically for USDOT, policies now prioritize the safety of the railroad network including railroad grade crossings and bridge safety.

This change in priorities if managed correctly, can require both a strategic and flexible approach to advance the ZEPRT Project in a way that shows progress, achieves both short and long-term goals, and demonstrates to stakeholders and constituents that the project is viable and that there is a path to project implementation.

¹³ Federal Transit Administration, Funding FY 2025 Full Year Apportionments State Totals.

<https://www.transit.dot.gov/funding/apportionments/fy-2025-full-year-apportionments-state-totals>

¹⁴ Federal Transit Administration, Funding FY 2025 Full Year Apportionments State Totals. Updated May 5, 2025.

<https://www.transit.dot.gov/funding/apportionments/fy-2025-full-year-apportionments-state-totals>

¹⁵ CalSTA, Transit Intercity Rail Capital Program (TIRCP). <https://calsta.ca.gov/subject-areas/transit-intercity-rail-capital-prog>.

- **Corridor ID:** This was intended to be the bellwether program of the FRA to address passenger rail planning and the programming of funds. Cooperation with Caltrans Division of Rail (DOR) has placed the project into the Central Coast corridor and is currently under consideration at the FRA. However, the viability of Corridor ID along with DOR priorities (as stated in the *California State Rail Plan*) to advance projects on the Central Coast mainline leaves ZEPRT in a position of having to wait its turn for project advancement. The *California State Rail Plan* puts the ZEPRT in the strategic long-range planning category, which equates to a 25-year implementation horizon. This horizon represents a substantial time frame, however, as mentioned above, flexibility and the ability to advance individual projects through the use of State funds can demonstrate project viability and short-term success. State funds can demonstrate project viability and short-term success.
- **State of California Programs:** These programs are cyclical in nature and, as in the case of SB 125, while substantially funded, sometimes comprise one-time advancement of funds. Specifically, with the TIRCP program and the grant currently in hand, it is important for the ZEPRT Project to show advancement and deliver actual benefit to CalSTA in order to remain eligible for future funding.

Taking the above into account, the path forward would appear to align with advancing two concurrent strategies for further project development. The first is to continue to work with DOR and advance ZEPRT with the larger corridor planning effort for the Central Coast Corridor ID planning process. Doing so, while taking time, also helps to ensure that the project is seen as a partner to the larger Central Coast Corridor planning effort, supports the corridor planning process central to the goals and objectives of the Corridor ID program while also remaining committed to the goals and objectives identified in the *California State Rail Plan*. These activities can be complemented by the suggested phasing strategy of investing in infrastructure and capacity improvement projects of independent utility along the SCBRL, which may create opportunities of eligibility for funding sources outside of the Corridor ID program. Together, these activities would protect funding eligibility with the State for rail corridors identified in the *California State Rail Plan* while also positioning SCCRTC for potential opportunities for funds from other sources to advance critical bridge and other infrastructure projects that would eventually be needed to support the larger, full-build project but that would also provide near-term benefits.