

Monterey Bay Area Network Integration Study

Future Service Vision

September 2020

Future Service Vision

Summary

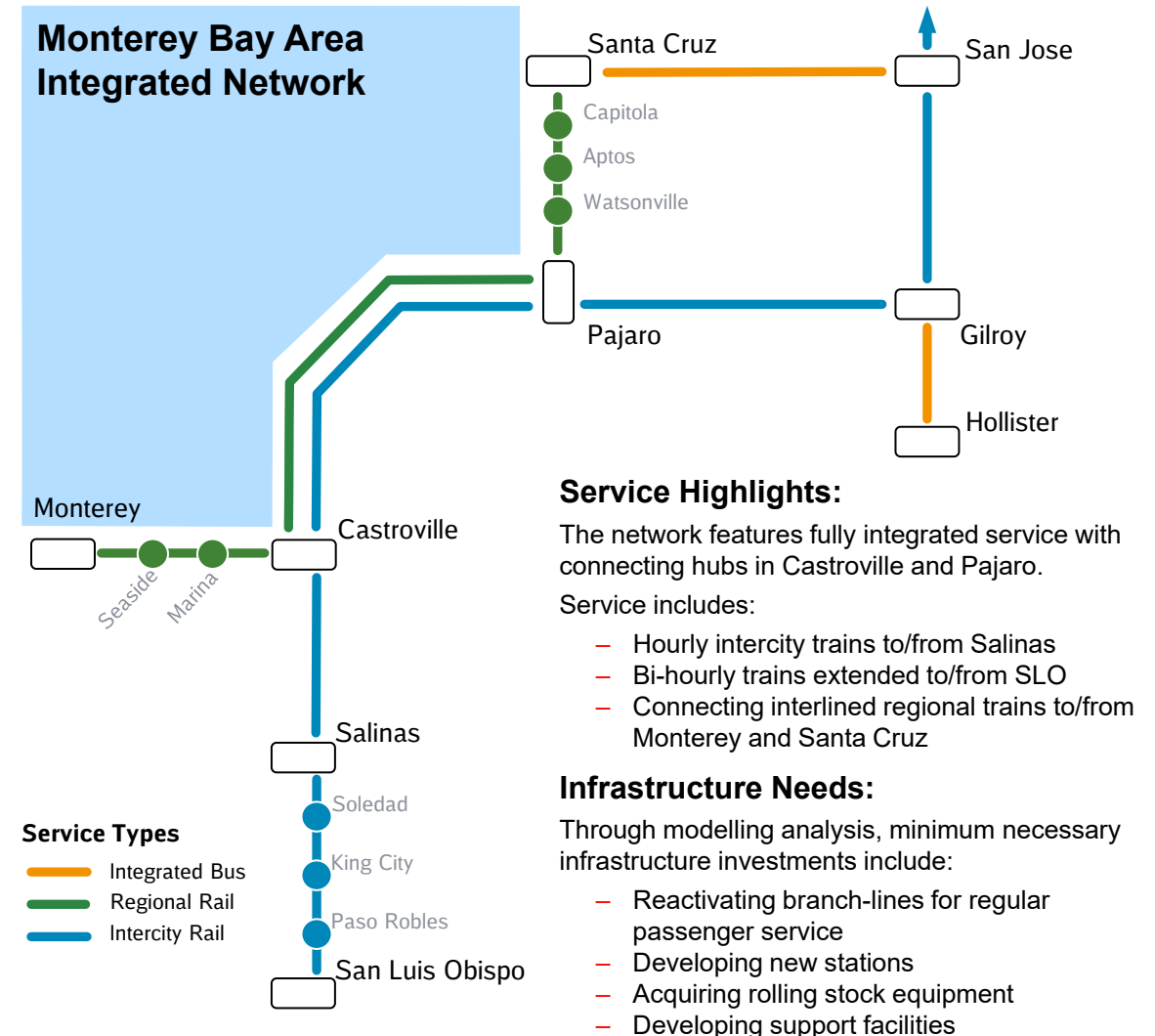
Future Service Vision

Building on long-standing efforts to re-establish regular passenger rail service to Monterey Bay and the Central Coast, the Monterey Bay Area Network Integration Study has developed a detailed Service Vision to guide the establishment and expansion of the future regional rail network. Aligned with the 2018 California State Rail Plan, the Service Vision describes a network that connects regional communities to the San Francisco Bay Area and broader statewide rail network.

The network has been designed through strategic analysis and operations modelling using clear guidelines and goals set by TAMC and regional stakeholders. The Service Vision seeks to maximize rider benefit, minimize capital and operations costs, shorten implementation timelines, minimize risk, and create a scalable service network. The design prioritizes service goals, customer experience, intuitive operations, direct connections, minimized travel time, and hub stations to allow for pulsed-style scheduling and timed transfers.

The Service Vision considers needs and constraints along the different corridors to arrive at an implementable integrated network through a strategic program of phased implementation as the network and rail ridership market scale together.

This document describes the Service Vision, network design, phased implementation, and methodology.



Future Service Vision

Study Background

Monterey Bay Area Network Integration Study

The Service Vision, and corresponding network design, lays out a guide map for a future integrated intercity and regional rail network that connects communities in Monterey Bay to the Central Coast and the San Francisco Bay megaregion. The Service Vision has been designed according to the statewide strategy, policies, and priorities set forth in the 2018 California State Rail Plan (Figure 1). The State Rail Plan provides a blueprint for regions across the state to align investments and rail service improvements toward a fully integrated statewide network.

The Service Vision recognizes that both the Coast Subdivision and the Monterey and Santa Cruz branch lines are largely single-tracked corridors often running through environmentally sensitive areas, particularly Elkhorn Slough. Use of the Coast Subdivision, owned by Union Pacific, must defer to and respect the freight service.

As such, this Service Vision and its operating concepts were designed to be operable on a largely single-track network with minimal investment in additional tracking or need for additional right-of-way.

Service Vision Goals

In developing the Service Vision, TAMC and local stakeholders set out clear guidelines and goals to design a robust passenger rail service connecting Monterey Bay communities and the Central Coast to the San Francisco Bay Area. TAMC has designed an implementable, technically sound Service Vision for a future Monterey Bay Area regional rail network that accomplishes regional service goals and provides technical inputs for implementation planning. While the design process is open and transparent, it has been developed through a strict methodology that prioritizes better service and minimizes infrastructure investment.



Figure 1 – 2018 State Rail Plan Statewide Vision

Future Service Vision

Background

Design Principles

The Service Vision is guided by several design principles, carried from the State Rail Plan and international best practice in modern rail network design. These design principles balance maximum rider benefit for minimum capital investment, shorten implementation timelines, minimize development risk, and provide the basis for a stable service network that can be scaled with market growth over time.

- **Service-led design** means putting service goals and customer experience first, designing a network to support service goals, and only identifying infrastructure needed to support the network.
- **An intuitive network** means simplifying and standardizing service patterns, schedules, connections, operations, and ticketing. This reduces the logistical burden and cost placed on customers to understand and utilize the service.
- **Direct connections** means minimizing physical and temporal distance so passengers can transfer trains across a platform or to a bus bay. This reduces travel time, allows more efficient operations, and reduces the physical footprint and related capital cost of infrastructure at stations.
- **Hub stations** means service is organized to meet at stations at regular intervals. This ensures connectivity throughout the network, minimizes capital investment, and increases accessibility throughout the region. Hub stations allow for repeating pulsed schedules and timed transfers.
 - **Pulsed scheduling** means a repeating schedule at regular intervals (hourly, half-hourly, etc.) throughout the day. This ensures easy understanding for customers, regular connections at hubs, simplified operations, and minimized infrastructure.
 - **Timed transfers** means quick connections for passengers at hub stations, reducing travel time and expanding network connectivity.



Figure 2 – Hub station with direct connections, making timed transfers between bus and rail services at a quarter after the hour

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Planning Parameters – Service Goals

State Rail Plan Vision and the Monterey Bay Region

The 2018 California State Rail Plan articulates a clear vision for rail service throughout the State of California and provides specific service goals for regional service in the Monterey Bay Region and on the Central Coast. The State Rail Plan identifies the need for and prioritizes the establishment of a regional network connecting Monterey and Santa Cruz, integrated with intercity service between the Central Coast and San Francisco Bay.

Coast Corridor Opportunities and Constraints

The Coast Corridor presents both opportunities and constraints for regional service in Monterey Bay. The existence of an established rail line with passenger service, the Coast Subdivision, provides a head start on the infrastructure and markets needed for future expansion of a rail network. However, the corridor is privately owned by Union Pacific and primarily used for freight service. Future passenger service expansion will need to be carefully coordinated with and ultimately supported by Union Pacific, meaning it cannot jeopardize freight service.

Caltrain Business Plan

The Caltrain Business Plan sets out a long-term strategy for the expansion and electrification of passenger service between Tamien and San Francisco. This presents an opportunity for Monterey Bay service as it builds out a broader megaregional network but also presents constraints as future service from the Central Coast north of Gilroy will have to integrate with Caltrain’s future service plans.

San Jose – Gilroy Alignment

The California High Speed Rail Authority has prioritized establishing a new, electrified passenger alignment between San Jose and Gilroy, allowing speeds of up to 110 mph. This is an opportunity for expanded Monterey Bay service, opening additional capacity and reducing travel time to San Jose. However, again it means future service development in Monterey Bay will have to integrate with service planning done to the north.

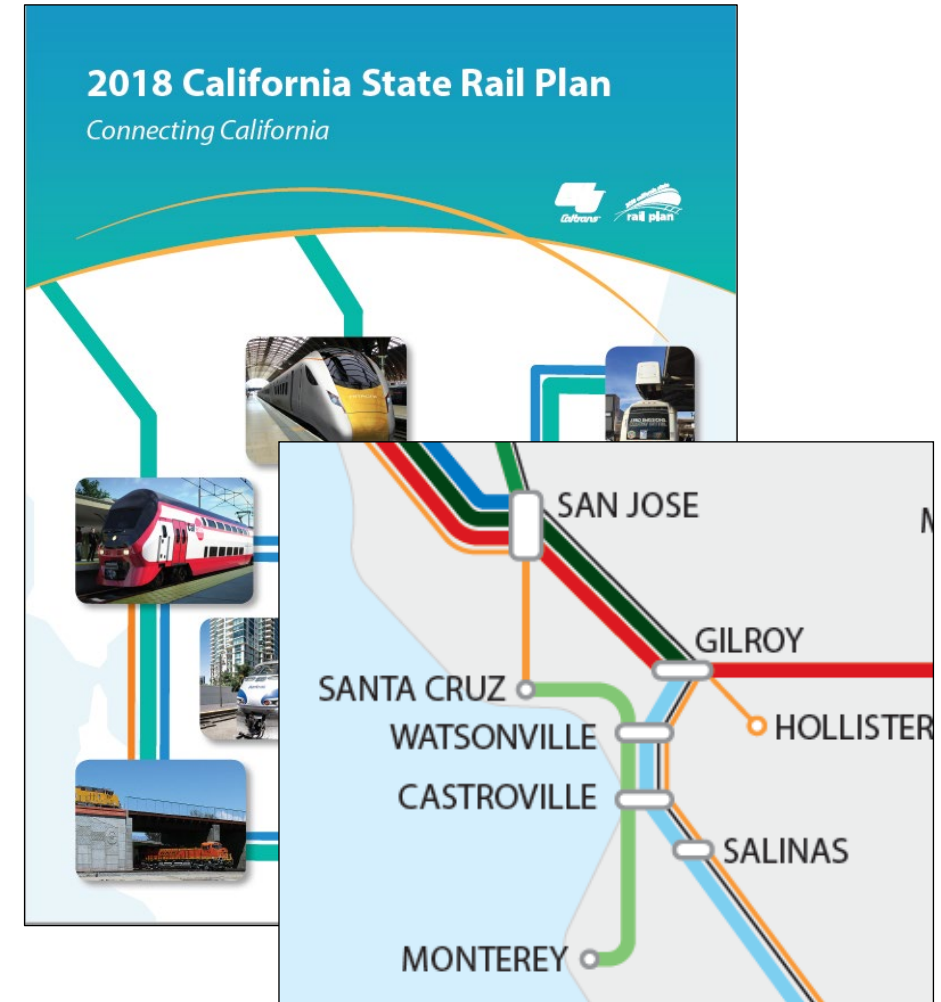


Figure 3 – 2018 California State Rail Plan & the Monterey Bay Region

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Planning Parameters – Rolling Stock

Rolling Stock

Rolling stock refers to the type of equipment used to provide service. Different rolling stock types (locomotive hauled, multiple unit) and different power sources (diesel, electric) have different performance characteristics (top speed, acceleration) in different operating environments. The network design process develops assumptions and analyzes tradeoffs of different rolling stock types to potentially be used to provide the service.

- **Conventional Diesel-Hauled**

- Diesel-hauled locomotive with passenger cars
- Examples: Coast Starlight (Amtrak), existing Caltrain (Peninsula)

- **Bi-Mode / Hybrid**

- Bi-mode, or hybrid, trains draw power from a diesel engine and/or overhead catenary to a locomotive pulling passenger cars
- Examples: British Rail Class 800 (UK), Renfe Class 130 (Spain)

- **Diesel Multiple Unit (DMU)**

- Diesel-powered trains with self-propelled passenger cars (no locomotive)
- Examples: SMART (Sonoma, Marin), Sprinter (San Diego), eBart (Contra Costa County)

- **Electric Multiple Unit (EMU)**

- Electric-powered trains with self-propelled passenger cars (no locomotive)
- Examples: future Caltrain (Peninsula)

Conventional Diesel-Hauled



Bi-mode / Hybrid



Diesel Multiple Unit (DMU)



Electric Multiple Unit (EMU)



Future Service Vision

Planning Parameters – Service Concepts

Service Concepts Overview

The following section details service concepts designed for initial, phased, and vision planning horizons that scale over time as the network is developed and service is expanded. Each balances specific service goals with appropriate constraints and levels of detail given development timelines and anticipated funding.

Focus Points

Network integration demands special attention to organize service in a way that provides seamless connectivity at regional hubs (Castroville and Pajaro). These hubs are not necessarily the biggest cities or biggest stations; more importantly to operations, they are the nodes in the network where different services come together to provide connectivity and regional accessibility.

Initial Service

The initial service concept is intended as a start-up to re-establish regular passenger service to Salinas. The concept involves extending existing peak-hour Caltrain service from Gilroy to Salinas.

Phased Service

The phased service concept scales the initial peak-hour service to an all day, bi-directional service with through trains to San Luis Obispo. The concept involves taking advantage of planned improvements to infrastructure north of Gilroy.

Vision Service

The vision service concept represents the full build-out of the regional network, with direct regional service between Monterey and Santa Cruz, interlining with intercity service between San Luis Obispo and San Jose / San Francisco. The concept involves reestablishing passenger service on the publicly owned Monterey and Santa Cruz branch lines.

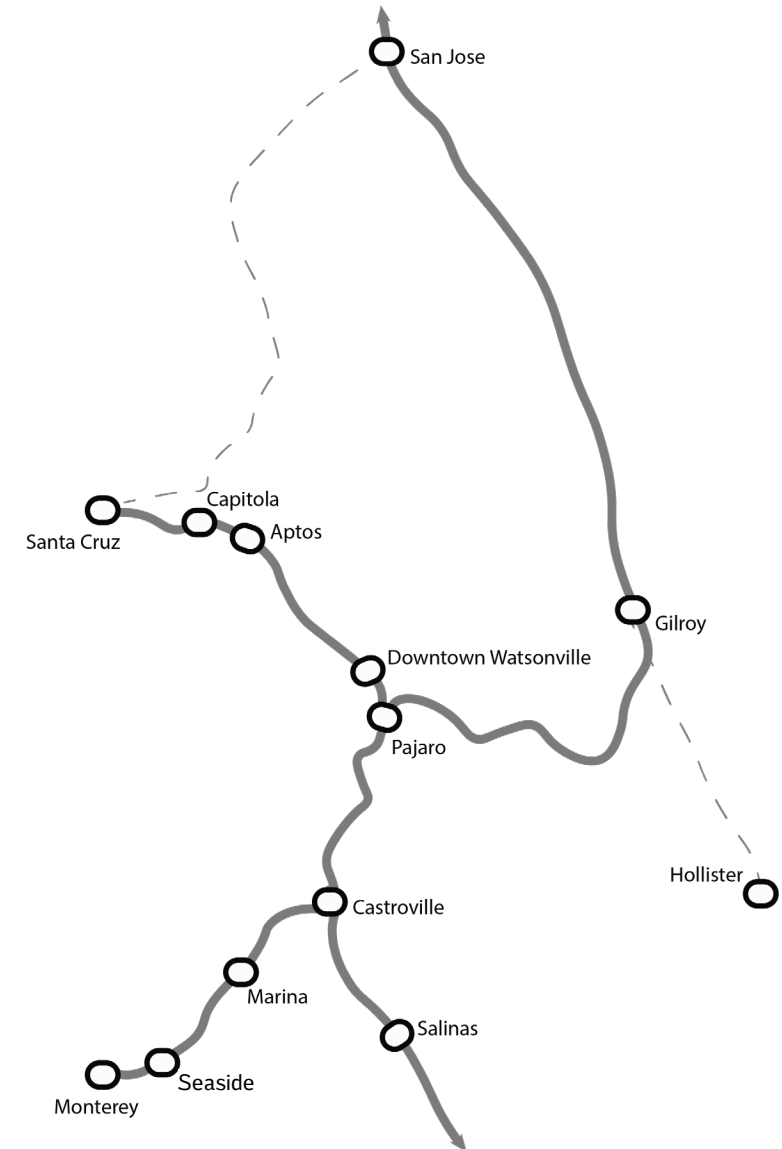


Figure 4 – Monterey Bay Area Network Integration Study Area

Future Service Vision

Initial Service Concept

Initial Service Concept

The initial service concept is an extension of existing Caltrain service from Gilroy to San Francisco. Under this concept, trains to and from Gilroy would be extended to Salinas. The goal for the initial service concept is to establish regular passenger rail service to/from Monterey Bay and provide a basis for future expansion. This service concept is supported by the 2018 State Rail Plan's goal for 'two intercity trains per day connecting the San Francisco Bay Area to Salinas'.

Any additional service south of Gilroy of course depends on close coordination and approval from Union Pacific to allow for increased traffic on the freight corridor.

Markets Served

- Commute-oriented service from Salinas to San Jose / San Francisco via Pajaro and Gilroy
- Integrated hourly bus service making regional connections

Service Frequency:

■ Intercity service:

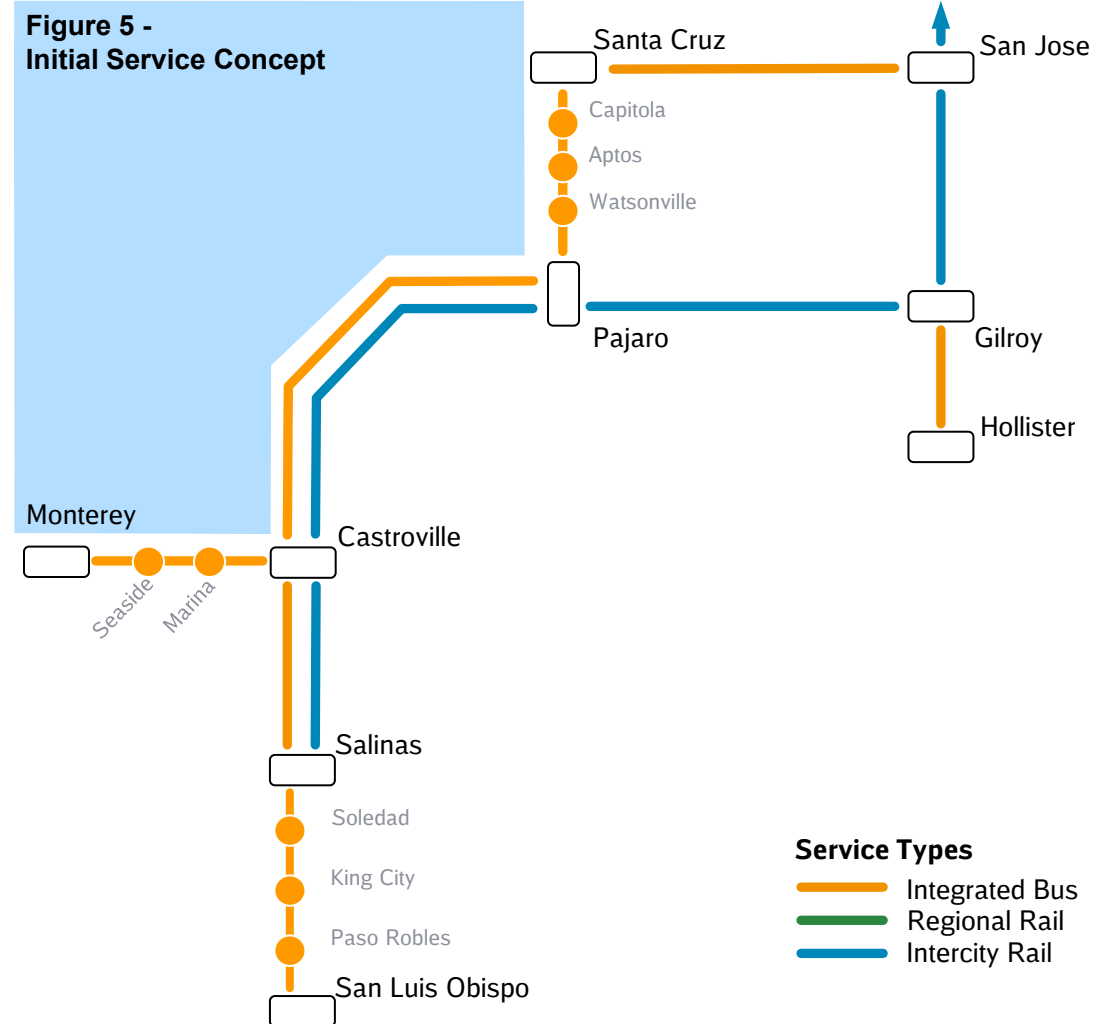
- Peak hour, peak direction commute-oriented service northbound in the AM and southbound in the PM from Salinas to San Jose / San Francisco
- Three daily round trips, maximum authorized speed 79 mph

■ Regional service:

- Integrated bus service providing connections to/from intercity rail at hub stations in Castroville and Pajaro
- Initial regional service (Monterey to Santa Cruz) provided by integrated bus connections

■ Rolling Stock

- Conventional diesel-hauled rolling stock



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Phased Service Concept

Phased Service Concept

As the market scales up from the initial service and investments are made in providing additional service, the Phased Service concept plans for all day hourly, bi-directional service between Salinas and San Jose / San Francisco.

The Phased Service concept introduces regular, bi-directional service to the corridor, provides better connections to integrated buses, and prepares the network for fully integrated regional service in the Vision Concept.

The Phased Service concept offers high levels of frequency and lower travel times that depend on access to new high-speed infrastructure planned between Gilroy and San Jose. Without access to that infrastructure, service frequency will be much more constrained, with higher travel times.

Markets Served

- Regular intercity service from Salinas to San Jose / San Francisco
- Minimum every-four-hour intercity service extensions to/from San Luis Obispo
- Integrated hourly bus service making regional connections

Service Frequency:

■ Intercity service:

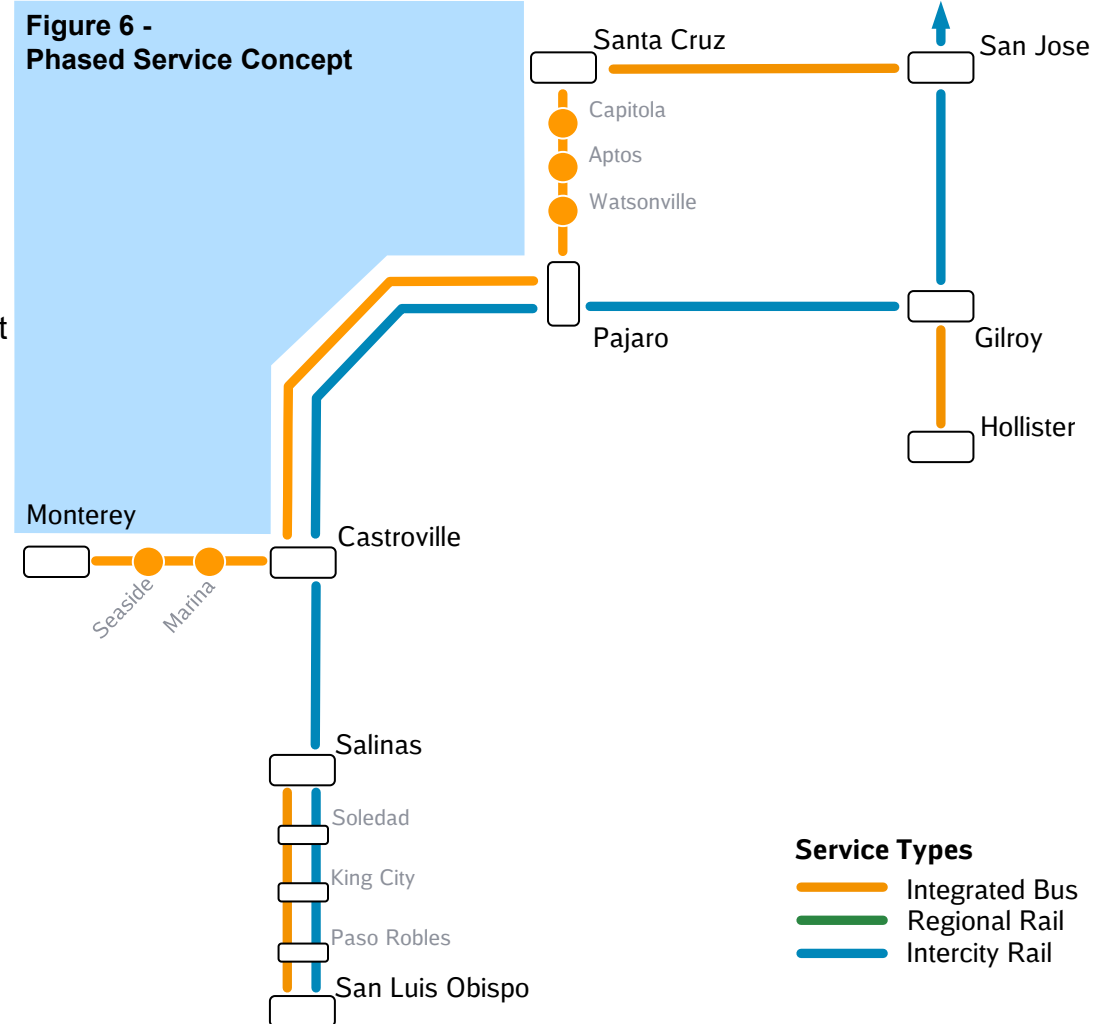
- Hourly, bi-directional service between Salinas to San Jose / San Francisco, with minimum every-four-hour through service to San Luis Obispo.

■ Regional service:

- Integrated bus service providing connections to/from intercity rail at hub stations in Castroville and Pajaro.
- Phased regional service (Monterey to Santa Cruz) provided by integrated bus connections.

■ Rolling Stock

- Bi-modal, hybrid rolling stock able to maintain technical slots north of Gilroy



Future Service Vision

Vision Service Concept

Vision Service Concept

The Vision Service Concept represents the fully built-out and integrated regional rail network for Monterey Bay with regularized, hourly intercity service between Salinas and San Jose / San Francisco. Intercity service offers timed connections to hourly regional service between Monterey and Santa Cruz. Connections between services would be cross-platform and timed for minimal transfer times.

The Vision Service Concept offers maximum accessibility and mobility in the regional network.

Markets Served

- Regular intercity service from Salinas to San Jose / San Francisco via Pajaro and Gilroy
- Bi-hourly intercity service extensions to/from San Luis Obispo
- Integrated regional service making local connections

Service Frequency:

■ Intercity service:

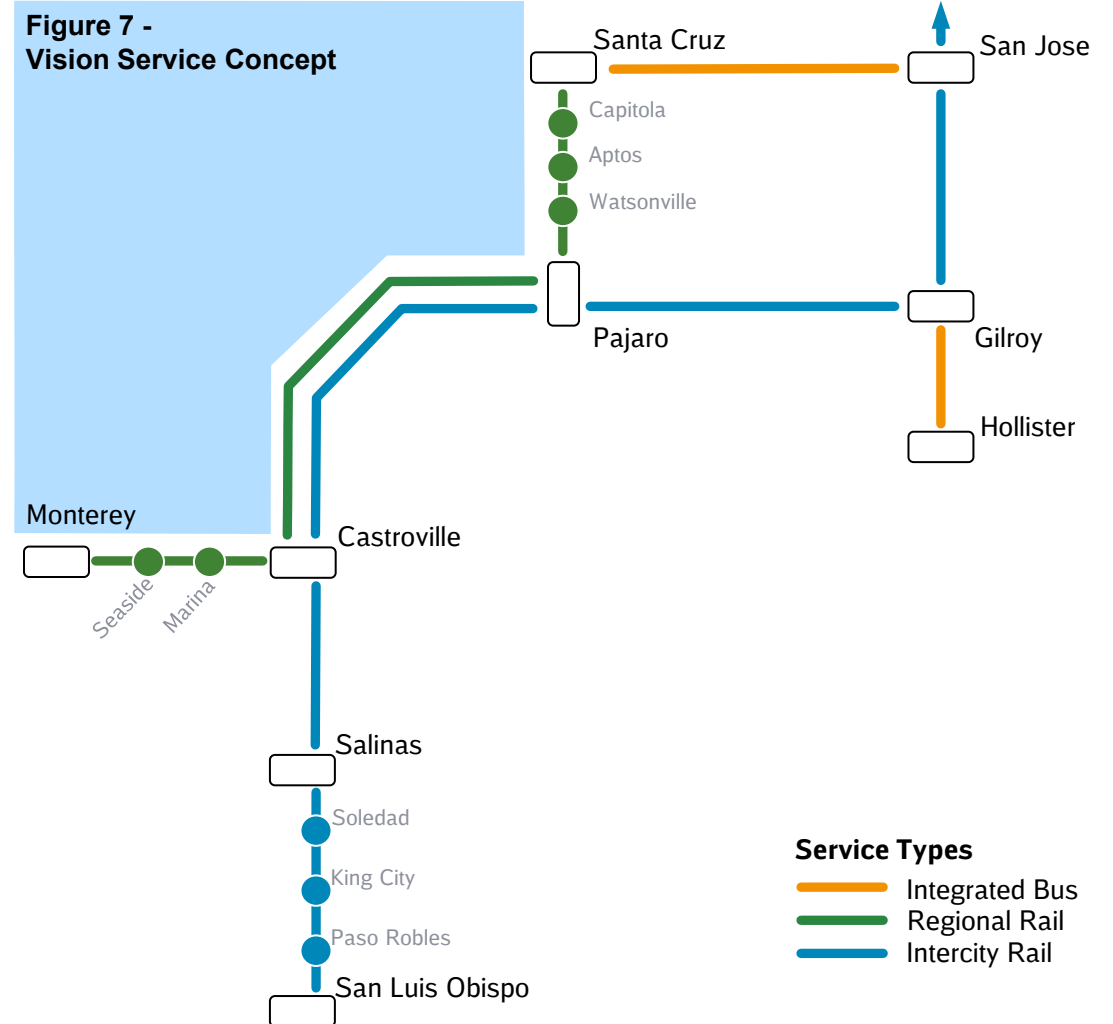
- Hourly, bi-directional intercity service between Salinas to San Jose / San Francisco, with bi-hourly through service to San Luis Obispo

■ Regional service:

- Hourly, bi-directional regional service between Monterey and Santa Cruz, with timed connections to/from intercity rail service at hub stations in Castroville and Pajaro
- Regional rail service does not preclude additional local transit service

■ Rolling Stock

- Bi-modal, hybrid trains able to maintain slots north of Gilroy (intercity service)
- DMU (regional service)



Future Service Vision

Hub Stations

Hub Stations

The Vision Service Concept organizes schedules around hub stations in Castroville and Pajaro. This allows trains to meet and pass each other at station platforms, potentially eliminating the need for any additional double-tracking or siding projects along the corridor.

Timed Connections

Timed connections at hub stations minimize travel time and maximize convenience for riders. For northbound connections from Monterey to San Jose / San Francisco, riders would have cross-platform transfers available from regional to intercity trains available at both Castroville and Pajaro/Watsonville with a minimal wait (Figure 8).

At Castroville, trains from Monterey arrive at :11 after the hour. Passengers can disembark and connect to a San Jose bound train that departs at :16 after the hour from the same platform.

Pulsed Service

Hub stations facilitate regular, bi-directional pulse service where trains arrive at the same interval and make the same connections all day, in both directions. This minimizes risk and complexity for customers, maximizes utilization of investments, and provides robust accessibility and mobility all day throughout the region.

The trains repeat their service patterns on the same schedule every hour meaning the same trips, same connections, and same travel times are available throughout the day at the same interval.

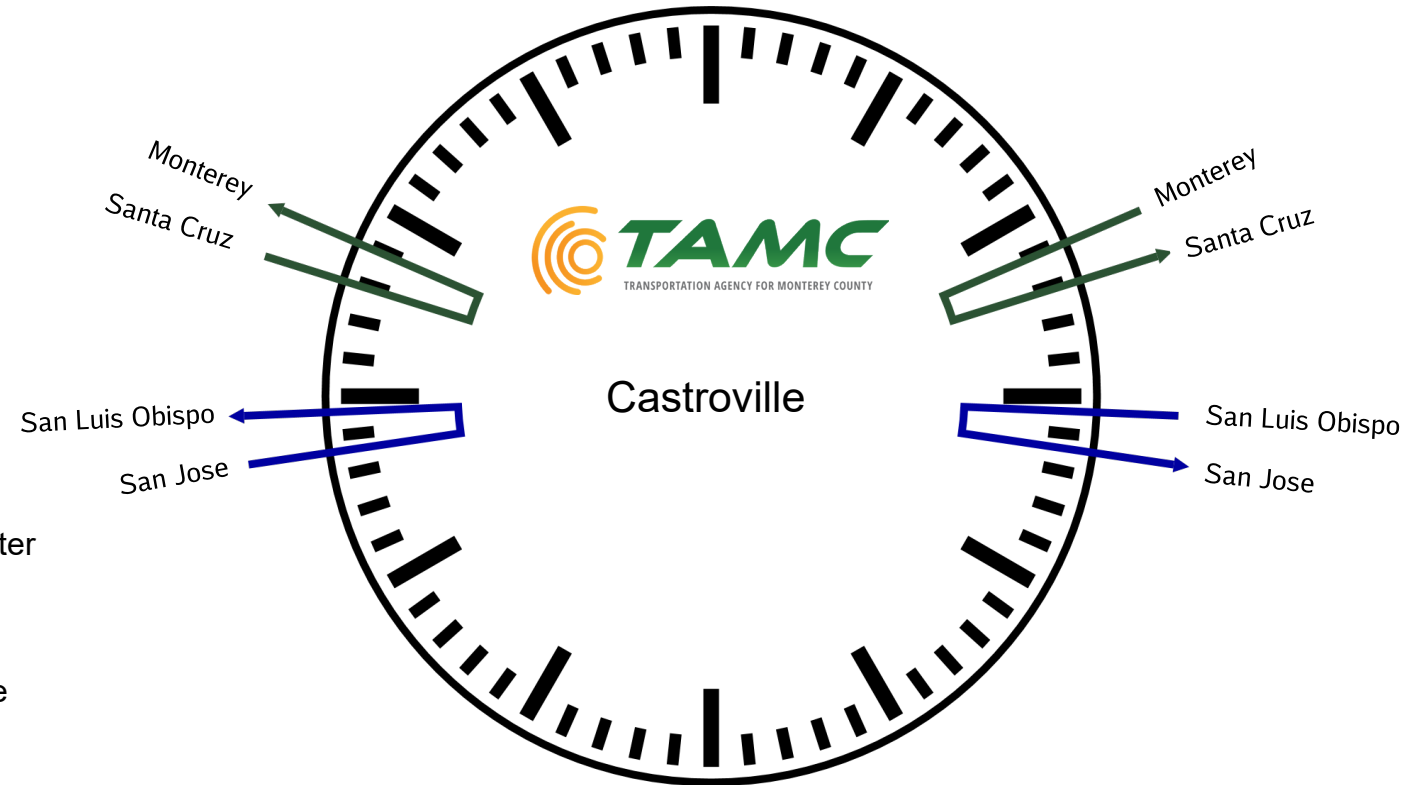


Figure 8 – Castroville Station Clock showing connections between regional and intercity trains as they subsequently arrive, dwell for one minute, and depart from the station

At Castroville, the service plan is optimized to prioritize transfers to/from Monterey and San Jose / San Francisco.

Future Service Vision

Pulsed Service

Conceptual Schedule

Utilizing pulse-style service, the Vision Service Concept has a fully developed conceptual schedule to illustrate the future regional operations. The schedule shows full connectivity and services available both northbound and southbound on the regional and intercity service lines. The schedule illustrates the connections available at Pajaro and Castroville as connections are available with timed connections. Passengers can transfer from regional to intercity trains with minimal wait time and same or cross platform access at hub stations.

Service Hierarchy

The Vision Service creates a hierarchy between regional and intercity service to differentiate the type of service being offered based on the travel demand being served in local markets.

■ Regional Service

Regional service operates between Monterey and Santa Cruz with smaller DMU equipment sets making more frequent stops to provide regional accessibility and connections to intercity hubs in Castroville and Pajaro.

■ Intercity Service

Intercity service operates between San Luis Obispo and San Jose / San Francisco with higher capacity bi-modal equipment capable of carrying more passengers at higher speeds. The intercity service provides faster regional mobility and connections across the region from the Central Coast to San Francisco Bay.

Northbound	REG	IC	REG	IC	REG	IC	REG	IC
San Luis Obispo	-	-	-	4:06	-	-	-	6:06
Paso Robles	-	-	-	5:14	-	-	-	7:14
King City	-	-	-	6:16	-	-	-	8:16
Soledad	-	-	-	6:41	-	-	-	8:41
Salinas	-	6:07	-	7:07	-	8:07	-	9:07
Monterey	5:42	-	6:42	-	7:42	-	8:42	-
Seaside	5:49	-	6:49	-	7:49	-	8:49	-
Marina	5:59	-	6:59	-	7:59	-	8:59	-
Castroville	6:12	6:16	7:12	7:16	8:12	8:16	9:12	9:16
Pajaro	6:30	6:30	7:30	7:30	8:30	8:30	9:30	9:30
Watsonville	6:34	-	7:34	-	8:34	-	9:34	-
Aptos	6:54	-	7:54	-	8:54	-	9:54	-
Capitola	7:01	-	8:01	-	9:01	-	10:01	-
Santa Cruz	7:07	-	8:07	-	9:07	-	10:07	-
Gilroy	-	7:10	-	8:10	-	9:10	-	10:10
San Jose	-	7:40	-	8:40	-	9:40	-	10:40
San Francisco**	-	8:41	-	9:41	-	10:41	-	11:41

Figure 9 – Conceptual schedule, portion of the service day

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Integration with *Coast Starlight* Service

Technical Service Slots

Pulse schedules work by identifying technical service slots in a repeating hourly pattern throughout the network. Once those patterns are identified, different operators or different services can fill those slots to support the overall network.

Coast Starlight Integration

The existing *Coast Starlight* (or a future *Coast Daylight*) could be integrated directly into the service plan by assigning northbound and southbound slots to the long-distance service (Figure 10). Long-distance trains could provide connectivity to/from regional trains and continue providing one seat rides to Seattle via Sacramento and Los Angeles.

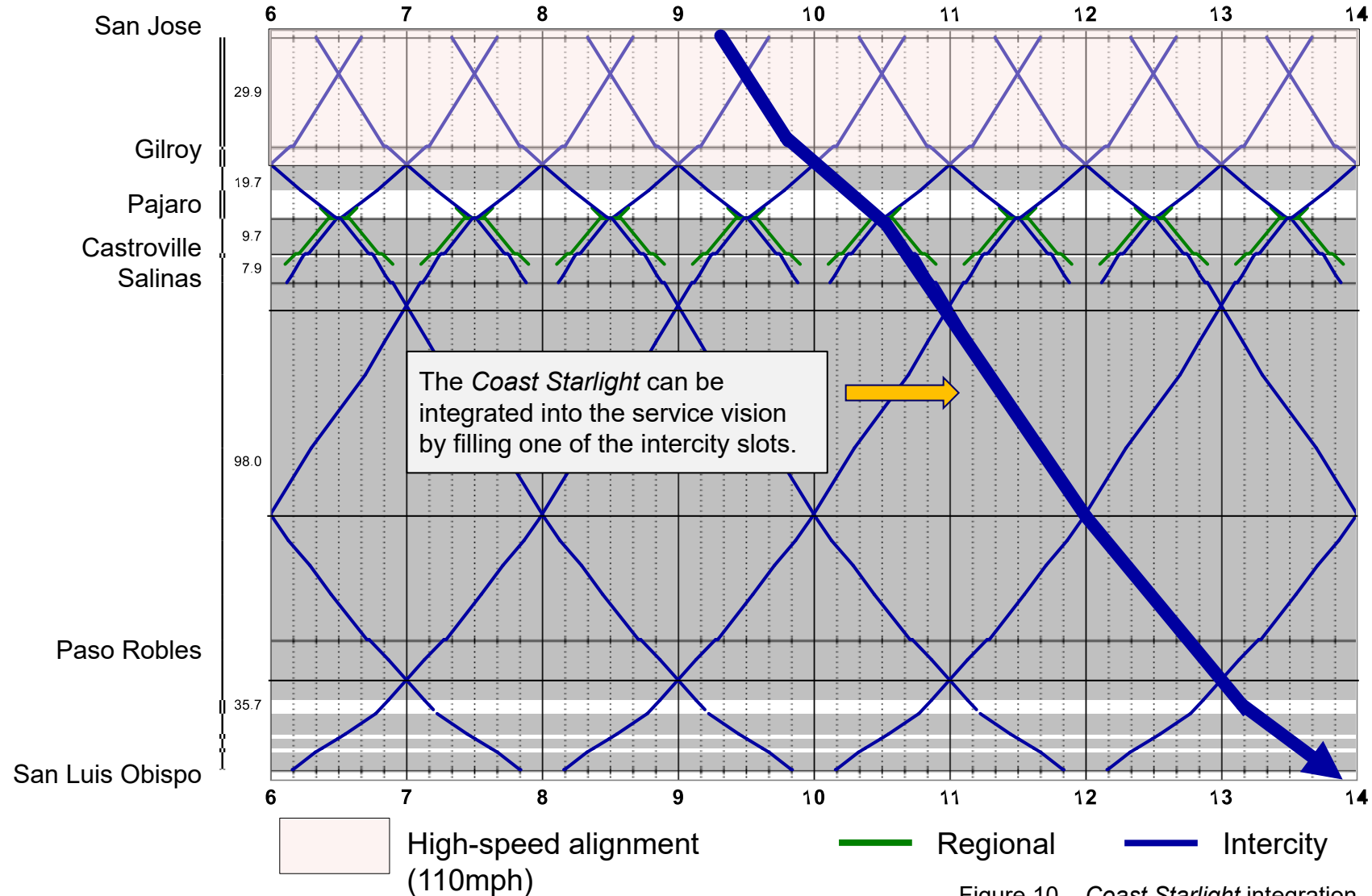


Figure 10 – *Coast Starlight* integration

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Freight Coordination

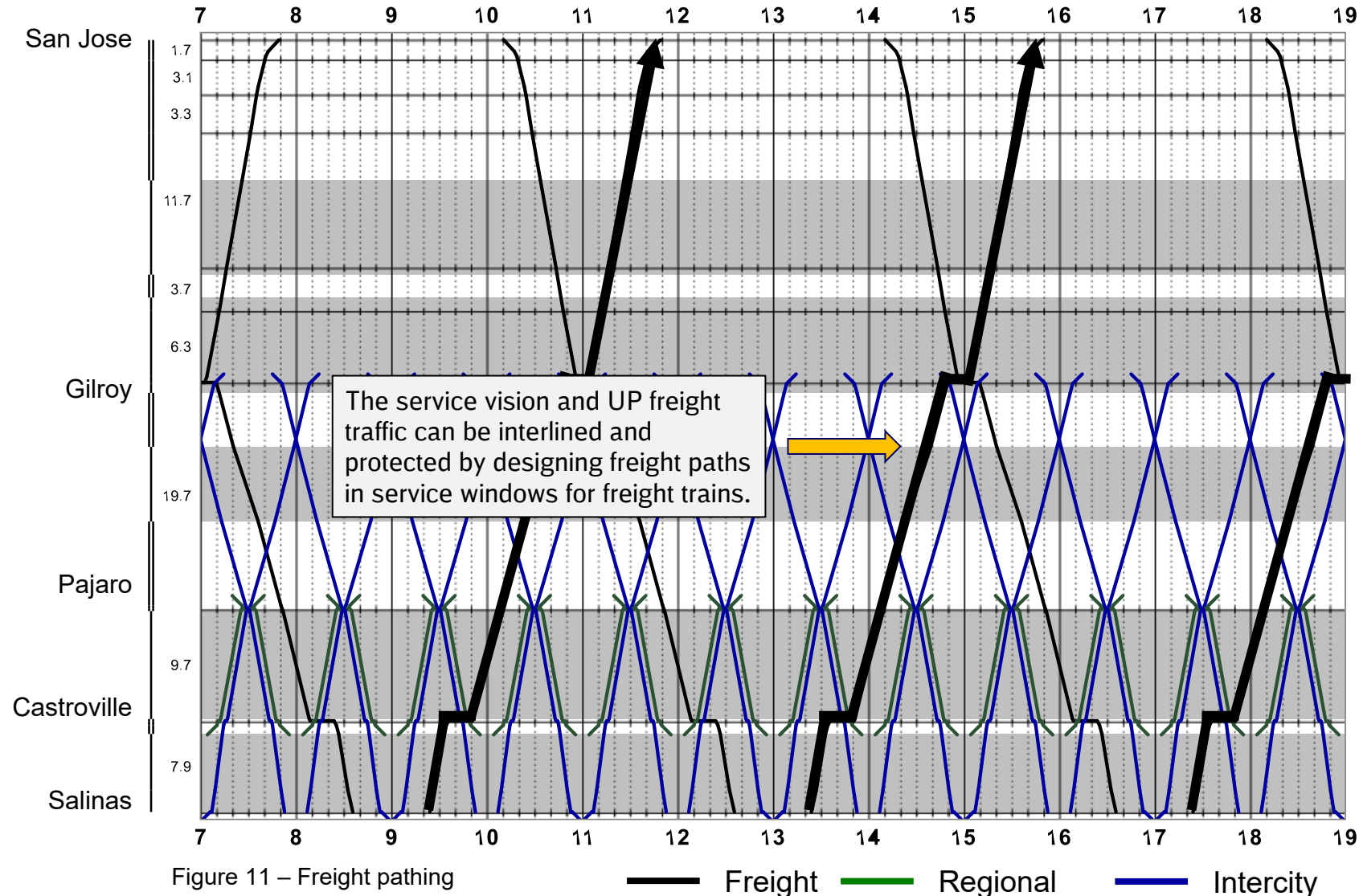
Freight Windows

As of 2020, the main line for intercity service—the Coast Subdivision from south of Oakland through San Luis Obispo—is owned and operated primarily for the freight service of the Union Pacific (UP). UP owns the right of way and will shape any potential future passenger service on its corridor. However, in designing the service concepts and Vision Service operating plan, great care was taken to identify paths and service windows in the network so as **not to preclude freight service**.

Efficient Mixed Corridor Operations

While complexity in the network increases as service increases, the service plan preserves overnight hours and every-four-hour freight windows. Utilizing the paths identified in Figure 11, freight trains could be able to move through the network every four hours without disrupting or being disrupted by the passenger schedule.

Effective freight coordination and protecting the freight franchise is critical to successful implementation planning and project delivery.



Future Service Vision

Network Integration

Infrastructure Requirements

The Service Vision and network design were developed with guidance from TAMC to limit capital cost and utilize existing infrastructure wherever possible. This means designing service patterns utilizing the largely single-track corridors and managing passing at existing sidings or planned stations.

Investments required to double track long corridors or build sidings can be constrained to limited investments in and around stations and the rolling stock and signal systems necessary to operate service. Planning service by investing in efficient operations and equipment can be orders of magnitude cheaper than the cost and environmental impacts of solving problems with large infrastructure projects.

Corridor Investments:

- The Vision Service is planned on single track corridors and no additional double tracking or sidings, outside of station areas, would be needed to operate the passenger service plan north of Salinas
- Investments needed to re-activate branch lines, improve signal systems, and ensure safety for modern passenger service

Station Investments:

- New stations would need to be built throughout the network. Most stations could be minimalist, with a single track and single platform. Passing stations would require double tracking and either two platforms or island platforms. Pajaro would require four tracks and two double-loading island platforms to facilitate transfers.

Rolling Stock Investments:

- The Vision Service requires modern, bi-modal intercity rolling stock capable of maintaining technical slots north of Gilroy that interline with Caltrain and high-speed service and modern DMU or EMU rolling stock capable of providing efficient acceleration and braking on the regional branch lines.

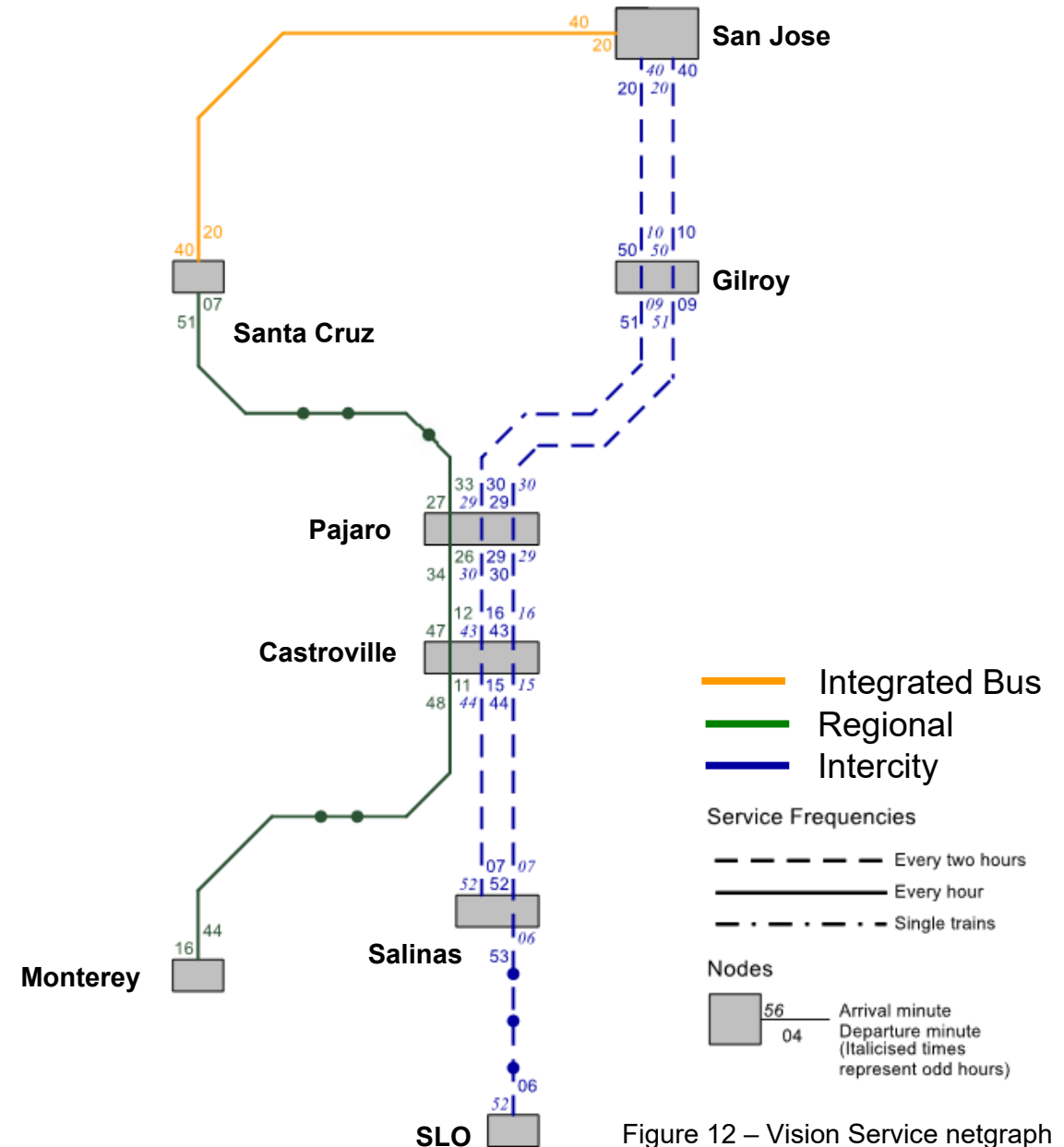


Figure 12 – Vision Service netgraph

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Equipment Needs

Intercity Service

Intercity service was modelled with bi-modal trains able to utilize both the electrified corridor north of Gilroy and the conventional corridor between Gilroy and Salinas. In order not to preclude through service to San Francisco, trains must be able maintain technical slots planned on the Peninsula. At minimum, bi-modal, or hybrid, trains that can draw power from electric catenary wire and generate their own power from onboard diesel engines are required. Such trains are in use today on similar corridors in the United Kingdom and Spain.

Regional Service

Regional service was modelled with diesel multiple unit (DMU) trains, as are currently in use throughout California in Sonoma, Marin, and San Diego Counties, and soon to be in use in San Bernardino County. DMUs are lighter than conventional diesel hauled locomotive trainsets, with more efficient acceleration and braking performance.

Bi-mode / Hybrid



Diesel Multiple Unit (DMU)



Service	Initial Service	Phased Service	Vision Service
Intercity Service Equipment Requirements	3 sets (conventional)	6 sets (hybrid / bi-mode)	7 sets (hybrid / bi-mode)
Regional Service Equipment Requirements	NA	NA	4 sets (DMU)

Figure 13 – Minimum equipment needs to serve operations, not including reserve equipment

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Infrastructure Needs – Connectivity

Hub Stations: Pajaro

At :30 after the hour, every hour of the service day, both northbound and southbound regional trains and northbound and southbound intercity trains stop at the Pajaro Station. This allows full connectivity throughout the network and minimizes infrastructure needs elsewhere in the corridor. To accommodate all four trains at once and to facilitate cross-platform transfers, the station requires four tracks, two center island platforms, and an additional crossover for the southbound regional train.

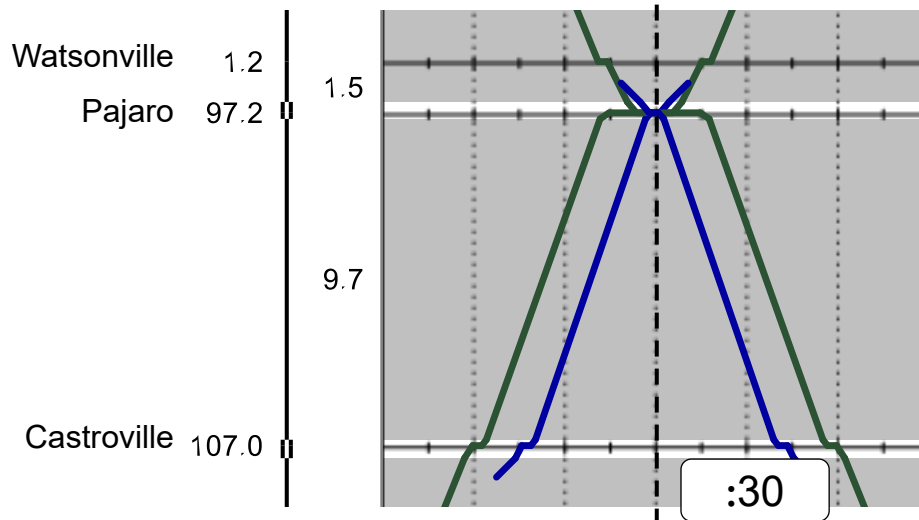


Figure 13 – Pajaro Service Connections

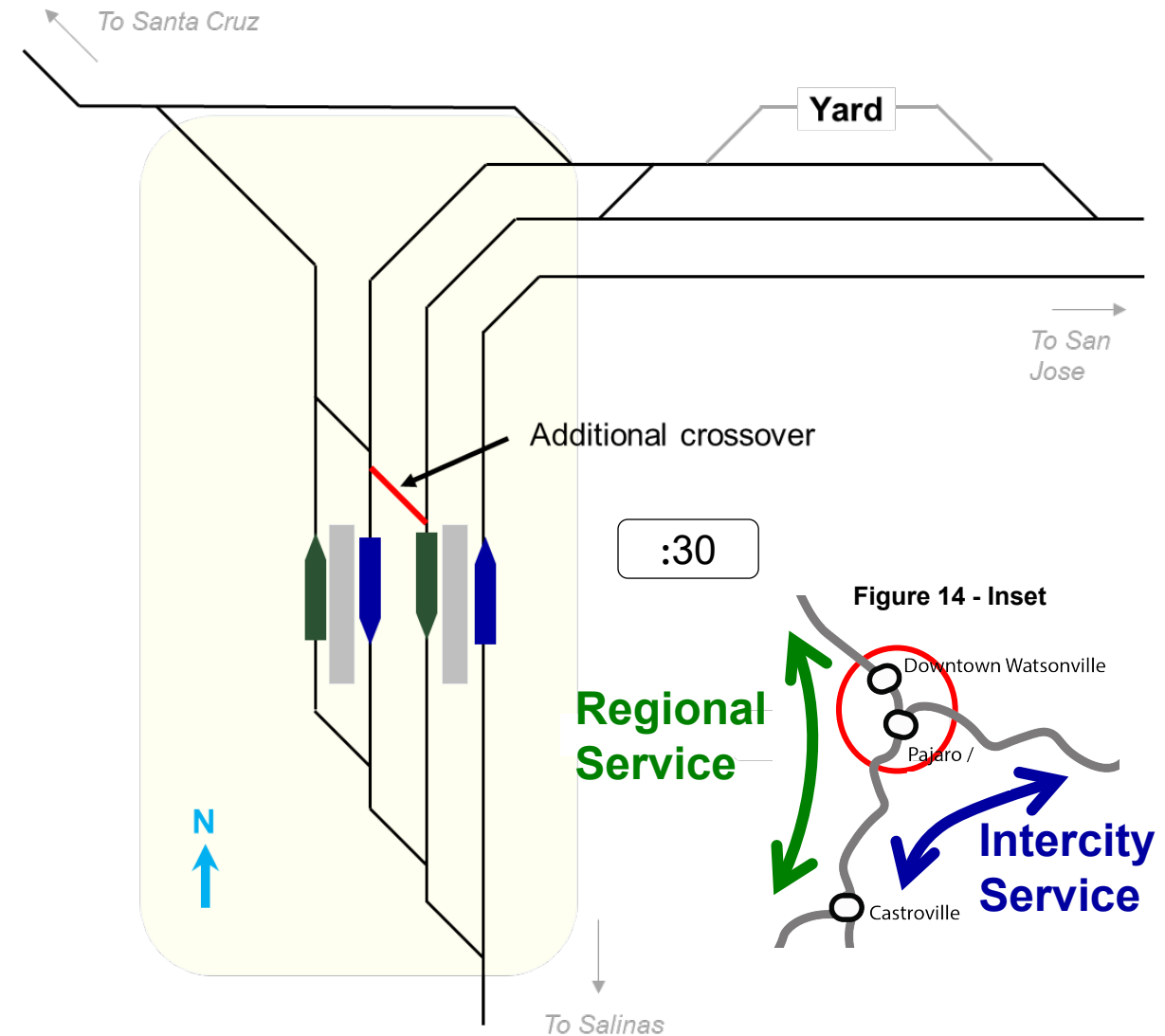


Figure 14 – Pajaro Station Diagram

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Infrastructure Needs – Connectivity

Passing Stations: Marina and Capitola

At the top of every hour, northbound and southbound regional trains pass each other along their journeys. This pass is designed to happen at a station, to minimize infrastructure investments in the corridor. Both Marina and Capitola stations are designed with single track approaches and with double tracking and center island platforms. This design allows for a minimalist footprint and capital investment while providing robust regional service.

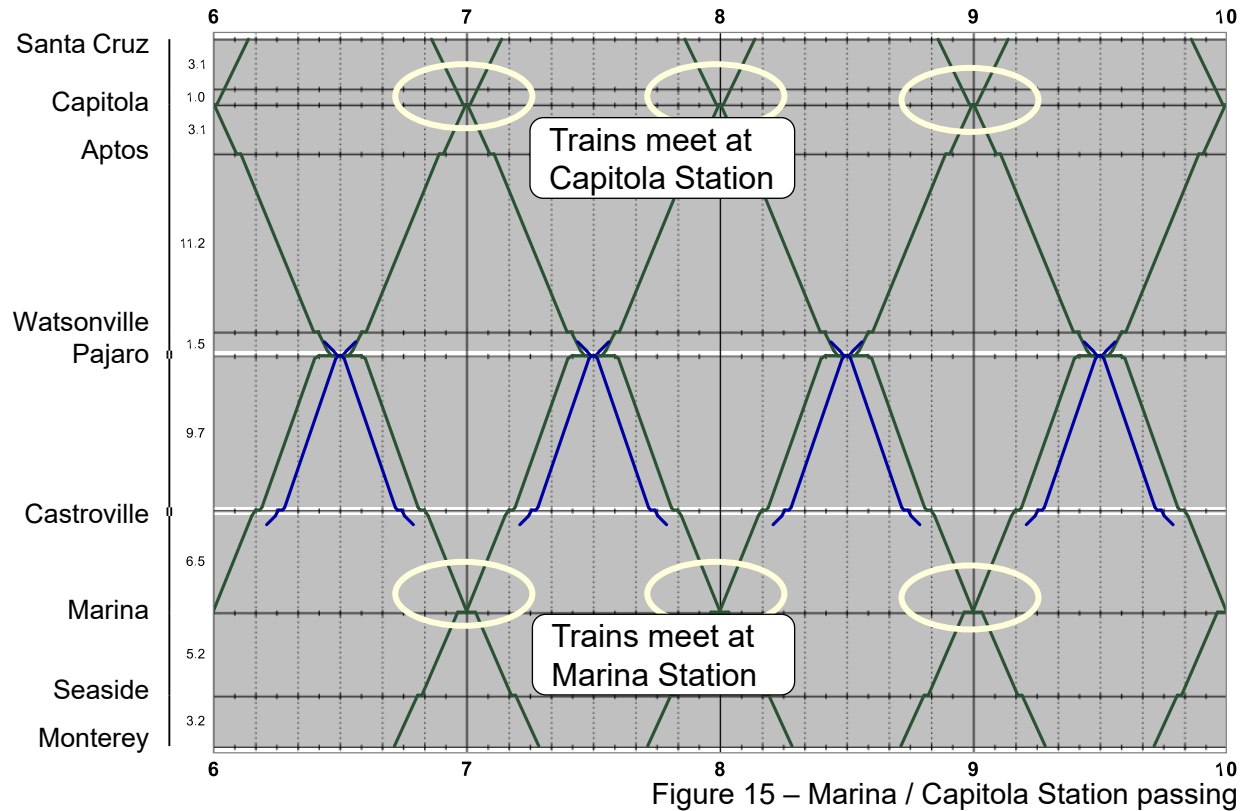


Figure 15 – Marina / Capitola Station passing

Passing Station:
Regional trains pass safely in the station

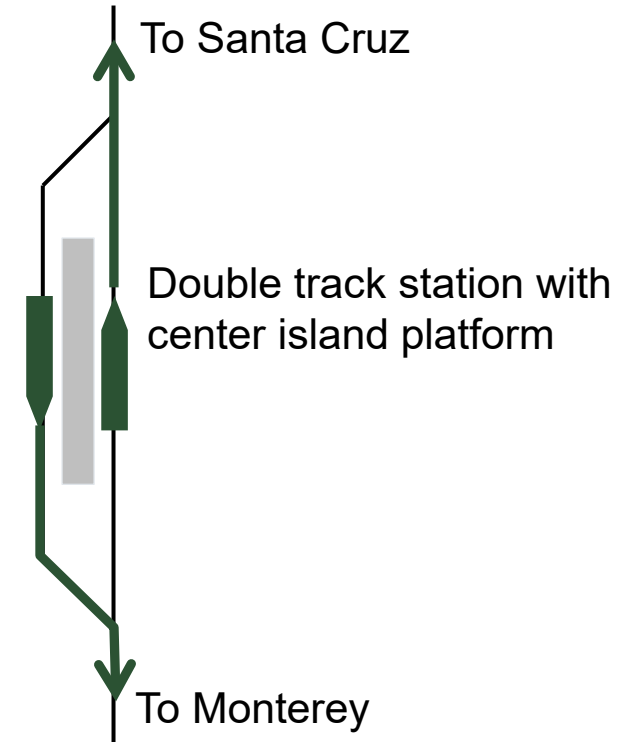


Figure 16 – Marina and Capitola Station Diagram

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Infrastructure Needs – Travel Time

Infrastructure Top Speed & Travel Time Impact

The maximum authorized speed of a rail line is set by several factors ranging from the physical limitations of the geography and topography to the operational limitations of mixed corridors, signal systems, and stopping patterns. The network design process allows for analysis of raising maximum authorized speeds on existing or planned infrastructure to estimate the benefit to travel times on the corridor.

Today, the maximum authorized speed is 79 mph on the Coast Sub. Topography, sidings, control points, bridges, schedules, and other constraints often mean trains travel more slowly under current conditions. In future, maximum authorized speeds are expected to be 110 mph on new passenger-only infrastructure north of Gilroy.

Maximum authorized speed is only a small component of determining travel times. Average speed is the more important variable. Raising top speeds on small segments of long corridors have a limited or even negligible effect, especially in proportion to potential capital costs, particularly in challenging topography (high grades and curvature) and in corridors with frequent stopping.

Results of raising top speeds from 79 mph to 110 mph:

- Travel time benefit (31 minutes saved) from upgrading San Jose – Gilroy alignment with new passenger-only electrified right of way offering express service
- Minimal to no travel time benefit for speed improvements south of Gilroy

This analysis found marginal to zero travel time benefit to investing in increasing top speeds on the existing corridor south of Gilroy. Curves, grades, and frequent stops limit the ability of trains to take advantage of higher speed limits. However, there would be significant travel time benefit (31 minutes) to new infrastructure north of Gilroy.

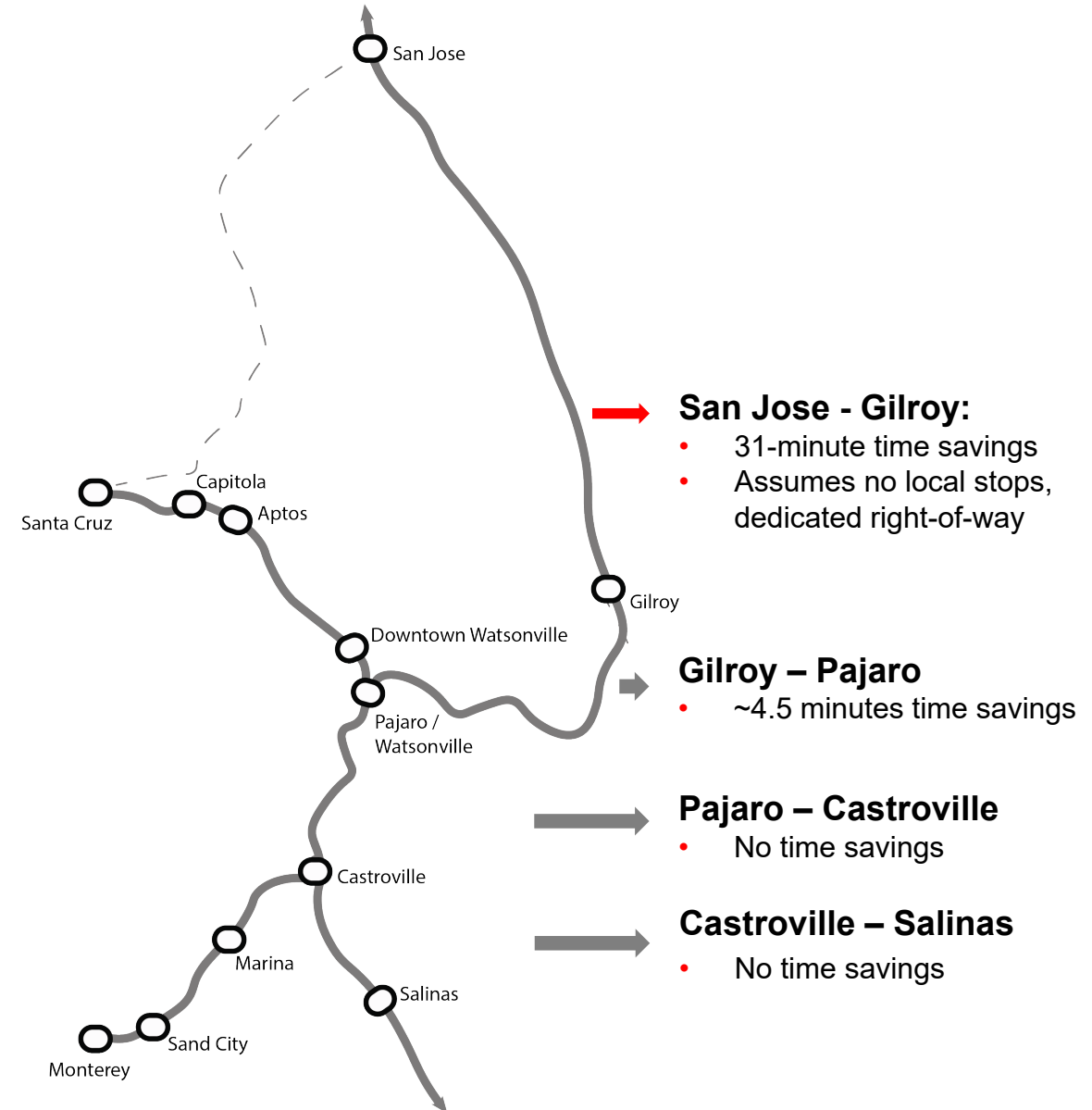


Figure 17 – Top speed analysis

Future Service Vision

Infrastructure Needs – Summary

Infrastructure Needs

This Service Vision was designed to minimize infrastructure, capital, equipment, and operational costs as much as possible while maximizing regional connectivity and rider benefit. As such, the corridors are planned as almost entirely single track, as they are today, with trains passing at stations instead of between stations where more track infrastructure and signaling would be needed.

Nevertheless, as the Monterey Bay region would be establishing a new service network, new infrastructure will be needed to support the service running the spectrum from revitalized tracks, powered switches, modern signaling systems, rolling stock, and stations. Tracks would have to be re-established for the branch line to Monterey. Subsequently, support facilities would be needed for train storage, maintenance, and other functions.

The adjacent list provides a summary of the broad categories of infrastructure needed to be analyzed and planned for through the implementation planning and capital costing portions of this study.

Planning Horizon:

■ Initial Service

- Pajaro station
 - island platform
- Castroville station
- Salinas station
 - storage tracks for 3 equipment sets

■ Phased Service

- Soledad station
- King City station
- Siding between King City and Paso Robles

■ Vision

- Santa Cruz station
- Capitola station
 - Double-tracked for train passing
- Aptos station
- Watsonville station
- Pajaro station expansion
 - station tracks, second platform, and crossover
- Castroville station
- Marina station
 - double-tracked for train passing
- Seaside station
- Monterey station
 - storage tracks (three trains)
- Two additional sidings (just south of Salinas, south of Paso Robles)