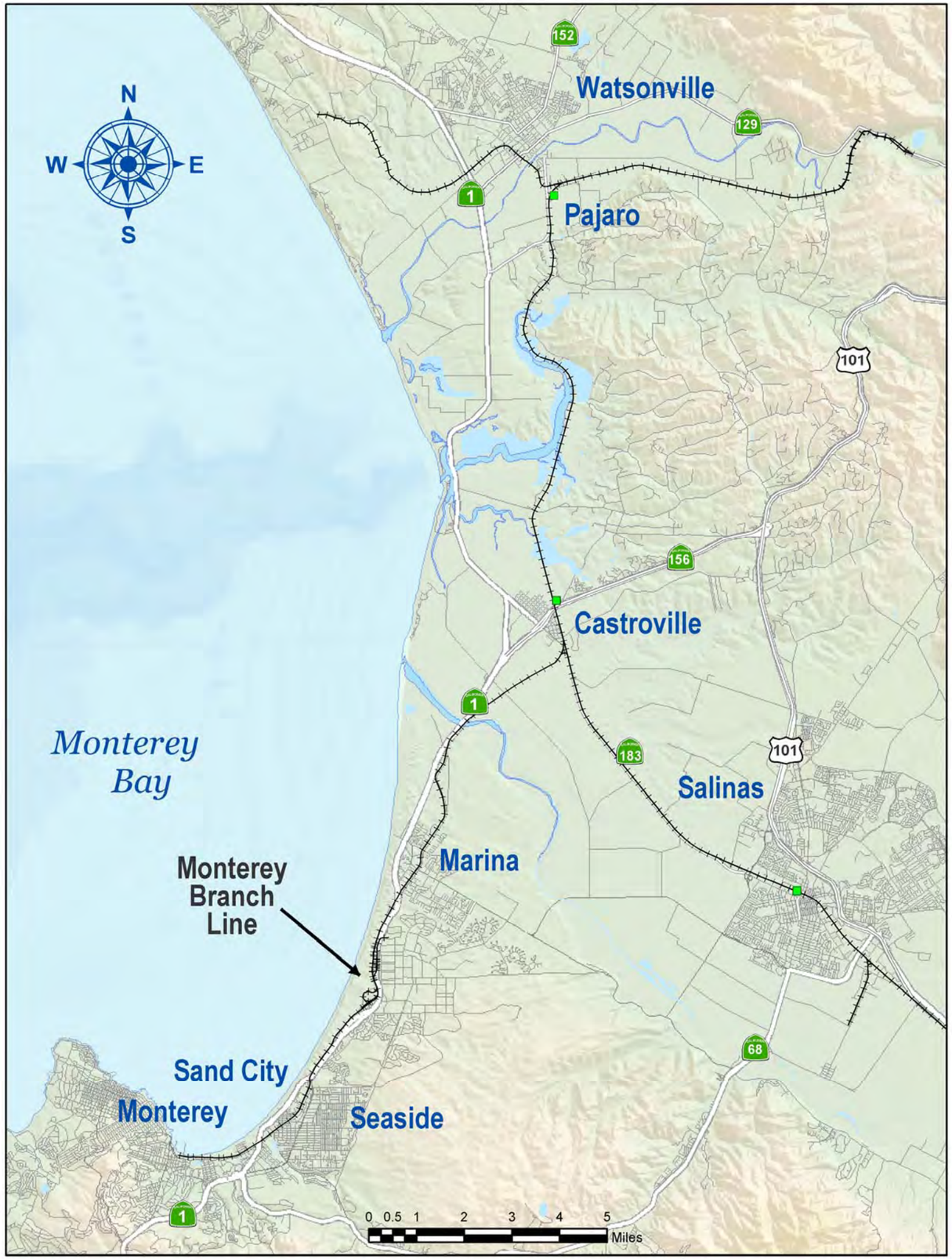


TRANSPORTATION AGENCY FOR MONTEREY COUNTY

CONCEPTUAL PLANS
FOR
TRACK RESTORATION

IN MONTEREY COUNTY, CALIFORNIA ON MONTEREY BRANCH LINE

FROM MP EE-110.4 IN CASTROVILLE TO MP EE-125.85 IN MONTEREY

NOVEMBER 2004
FEBRUARY 2005
REVISED MARCH 2006
REVISED OCTOBER 2006
REVISED NOVEMBER 2008
REVISED NOVEMBER 2009
REVISED JANUARY 2010
REVISED OCTOBER 2010

CONTENTS

1 Introduction

1. Introduction

The project is intended to offer a high-quality transit service that will be sufficiently attractive such that a viable alternative to automobile use along the Monterey Peninsula is provided. To attract the so-called "choice" riders, the project must also provide a product service that is permanent, safe, clean, comfortable, fast, frequent, and clearly superior to local bus and other transportation options. Once established, the service would provide an alternative to the continued and virtual sole reliance on the automobile, reduce congestion on the Highway 1/Del Monte corridor, accommodate growth from entitled land development projects, encourage higher density and in-fill development, and reduce greenhouse gas emissions.

A number of studies have been undertaken to define fixed guideway service in the Monterey Peninsula Corridor. These include but are not limited to:

- The Caltrans-sponsored "Passenger Rail Feasibility Study" was completed in September 1993 by Wilbur Smith & Associates in response to a state legislative requirement.
- The "San Francisco–Monterey Intercity Rail Service Implementation Plan" was completed in January 1998 by De Leuw, Cather & Company for TAMC.
- The "Around the Bay Rail Study" was completed in July 1998 by LS Transit Systems for TAMC and the Santa Cruz County Regional Transportation Commission.
- In 1999, STV Incorporated was contracted by TAMC to prepare environmental reports and a preliminary design of improvements necessary to accommodate intercity passenger rail service between Monterey and San Francisco on the Monterey branch line.
- To address concerns regarding noise impacts associated with intercity train service, and to potentially qualify the Monterey Peninsula service for Federal Transportation Authority "Small Starts" discretionary funding, TAMC contracted with Parsons Transportation Group Inc. in June 2004 to undertake a Monterey Peninsula Fixed Guideway [Alternatives Analysis] Study.

Alternatives Considered

As part of the Monterey Fixed Guideway Alternatives Analysis Study, a candidate pool of initial conceptual alternatives was developed to address mobility problems and other concerns in the study area. An initial set of conceptual alternatives were structured to provide a range of multi-modal transportation infrastructure and service improvements. The transportation alternatives emphasized candidate alignments and levels of investment and thus addressed different aspects of the study purpose and need. Included in the initial set of alternatives were baseline alternatives which assumed there was no new major transit capital investment, and various build alternatives which may include major investments in bus and/or rail transit technologies. The conceptual alternatives considered included:

- No Build Rail Service
- Caltrain to Salinas Rail Service
- Monterey Peninsula to San Francisco Intercity Rail Service
- Monterey Peninsula to San Francisco Intercity Rail Service plus Caltrain to Salinas and Monterey Peninsula
- Monterey Peninsula Passenger Rail Shuttle to Castroville Caltrain Service
- Local Monterey Peninsula LRT (light rail transit) or BRT (bus rapid transit) Service
- Salinas to Monterey Local Rail Service
- Monterey Peninsula to San Francisco Intercity Rail plus Salinas to Monterey Local Rail Service
- Enhanced Local Bus plus Monterey County to San Francisco Peninsula Express Bus Service (transportation system management (TSM)

These eight alternatives were defined for capital cost estimating purposes, mode technology information, right-of-way utilization and potential station renderings, and public involvement findings. A qualitative evaluation of alternative performance was presented to the Rail Policy Committee (RPC) in June 2005, along with a Project Development Team recommendation of shortlisted alternatives showing strong potential for implementation.

During the remainder of 2005 and early 2006, a process of careful policy review, quantitative and qualitative analysis, and extensive public involvement opportunities for local residents and stakeholders was begun and subsequently conducted over the course of the following two years. In late 2007, three basic transit alternatives were selected. One involved fixed guideway bus rapid transit (BRT) service, established in two phases—between Monterey and Marina and, as demand warranted, between Marina and Castroville. A second alternative involved light rail transit (LRT) service, also established in two phases—between Monterey and Marina and, as demand warranted, between Marina and Castroville, Finally, a third alternative involved a hybrid/combo alternative which ultimately entailed the construction of a BRT guideway alongside a parallel rail guideway within the same right-of-way. All three alternatives included BRT, LRT, or enhanced bus service between the Monterey Branch Line and the intercity rail station in Salinas.

Upon the completion of preliminary capital cost estimates for the three alternatives, it was determined that the "hybrid/combo" option was not a feasible alternative due to cost and funding considerations. The projected total cost for the alternative was greater than the $250 million threshold for FTA Small Starts Projects and thereby disqualified the hybrid/combo item from funding consideration under that federal program. Because the project was not deemed to be a good candidate for the larger New Starts funds (which are geared more towards densely populated areas with heavy rail or significant new construction), it was decided that any alternative forwarded for detailed definition and analysis must have a cost estimate below the $250 million threshold. Additionally, and common to all Build Alternatives, is the extension of Caltrain service to Monterey County. This commonality reflected the continued and conscious decision on the part of the Rail Policy Committee (RPC) to exclude from further consideration any build alternative which did not assume the extension of Caltrain service to Salinas as a complementary investment.

As such, four alternatives ultimately emerged as candidates for further refinement and testing. These four build alternatives, and an enhanced bus alternative, were defined to address the intra-county travel market along the Monterey Peninsula as follows.

- **BRT-1:** Bus Rapid Transit (BRT) service would be operated along a fixed guideway, mostly along the Monterey Branch Line, from downtown Monterey to northern Marina.
- **BRT-2:** Bus Rapid Transit (BRT) service would be extended on the Monterey Branch Line between Marina and the intercity rail station at Castroville.
- **LRT-1:** Light Rail Transit (LRT) service would be operated along a fixed guideway, mostly along the Monterey Branch Line, from downtown Monterey to northern Marina.
- **LRT-2:** Light Rail Transit (LRT) service would be extended on the Monterey Branch Line between Marina and the intercity rail station at Castroville.

These alternatives are described in further detail in the *Monterey Peninsula Fixed Guideway: "Alternatives Analysis."*

Following the narrowing of mode choices (either BRT or LRT) and an assessment of alignment and operational characteristic tradeoffs, the BRT and LRT alternatives were considered in terms of implementation phasing, such that a portion of the project could be initially built, with later additions implemented as funding and demand warrant.

Table 1-1 provides the final set of candidate alternatives which were subjected to very rigorous assessment as part of the Alternatives Analysis process. During this analytical phase, many technical studies and numerous

qualitative and quantitative analyses were performed on the final set of alternatives. The purpose of these studies was to elicit and evaluate information on the alternatives as well as provide a higher level of definition of their respective operational and physical characteristics. In addition, the information gathered facilitated the assessment of individual alternatives on a comparative basis as part of the alternatives analysis process. These studies included:

- Detailed definition of conceptual, final alternatives, and conceptual engineering
- Existing and future demographic conditions within the study area
- Existing study area land use and transit-supported land use regulations near proposed stations
- Environmental, noise and vibration, and traffic impact analysis
- Travel demand in the corridor and transit ridership forecasts
- Estimation of capital, operating and maintenance costs
- Financial capacity analysis

Table 1-1
SUMMARY OF ALTERNATIVE DESCRIPTIONS

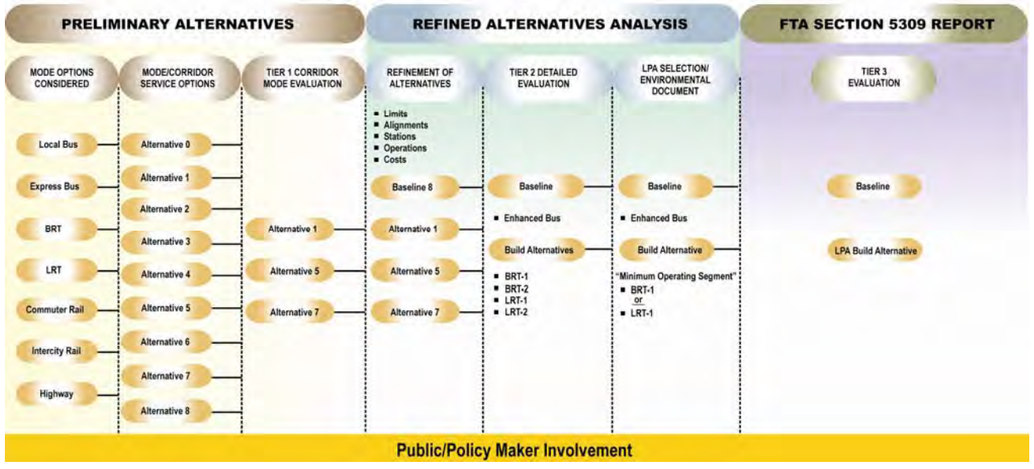
Alternative	Description	Mode	Location
BRT-1 (Phase 1)	Bus rapid transit service between Downtown Monterey and Northern Marina on MLB fixed-guideway	Bus rapid transit vehicles	Downtown Monterey to Northern Marina
	BRT service on local roadways between Northern Marina and Castroville.	Bus rapid transit vehicles	Northern Marina to Castroville
BRT-2 (Phase 1 + Phase 2)	Extend bus rapid transit service on MBL fixed-guideway from Northern Marina to Castroville	Bus rapid transit vehicles	Downtown Monterey to Castroville
LRT-1 (Phase 1)	Light rail transit service between Downtown Monterey and Northern Marina on MBL fixed-guideway.	Non-FRA compliant light rail vehicles	Downtown Monterey to Northern Marina
	Local bus service on local roadways between Northern Marina and Castroville.	Local bus vehicles	Northern Marina to Castroville
LRT-2 (Phase 1 + Phase 2)	Extend light rail service on MBL fixed-guideway from Northern Marina to Castroville	Non-FRA compliant light rail vehicles	Downtown Monterey to Castroville
Enhanced Bus	Local bus service from Monterey to Castroville	Articulated low-floor buses	Downtown Monterey to Castroville

With the supporting studies complete, the results were used to assess the travel benefits, costs, and impacts of the proposed alternatives. Key trade-offs among the alternatives were evaluated and discussed. Each of the alternatives underwent successive testing, refinement and shortlisting, all directed toward the selection of the locally preferred alternative. This general process is illustrated in Figure 1-1.

Selection of the Locally Preferred Alternative

Based on the array of technical information, evaluation findings, and public input, a Locally Preferred Alternative from among those exhaustively examined was selected and approved by TAMC October 28, 2009. The LPA carried forward for final design and approval is the Light Rail Transit mode, initially constructed between downtown Monterey and northern Marina, with a later extension to Castroville as demand warrants and funding availability allows. A detailed description of the Locally Preferred Alternative, is the subject of the following chapters of the report.

Figure 1-1
Alternatives Evaluation Process



2 Description of the Locally Preferred Alternative

2. Locally Preferred Alternative

Background—Screening of Conceptual Alternatives

Eight alternatives were originally defined for capital cost estimating purposes and further qualitative analysis as part of the Monterey County Fixed Guideway Study. Capital cost information, together with mode technology information, right-of-way utilization and potential station renderings, public involvement findings, and a qualitative evaluation of alternative performance were assembled and assessed. Following a short-listing of the conceptual alternatives for further refinement and evaluation, four alternatives emerged as candidates for further refinement and testing as subjects of an alternative analysis process. Preferred build alternatives and an enhanced bus alternative were then further defined to address the intra-county travel market along the Monterey Peninsula as addressed in the Monterey Peninsula Fixed Guideway Study. The examination and analysis of these build alternatives form the basis upon which the selection of a locally preferred alternative (LPA) was chosen. The LPA will be the project carried forth for further, detailed design and for assessments leading to an application for Federal Transit Administration Small Starts program funding support.

This chapter begins with summary descriptions of the LPA selection process and the LPA definition, with respect to service characteristics, station location, facilities, and operations. The chapter concludes with a discussion of Monterey Branch Line Corridor right-of-way location issues, facilities improvements, land uses, general conditions within close proximity to the proposed rail line, and detail regarding all improvements and modifications to existing facilities necessary to restore rail passenger service along the Monterey Branch Line Corridor.

Locally Preferred Alternative Selection

The Monterey Peninsula Fixed Guideway Project was established to restore fixed guideway service along the existing Monterey Branch Line rail right-of-way from Castroville to downtown Monterey. After careful study and deliberation, light rail transit (LRT) was selected by the Transportation Agency for Monterey County board as the locally preferred transit mode. The results of subsequent study efforts are contained within reports developed for the Monterey Peninsula Light Rail Project. As part of the overall design, new station platforms would be constructed in the cities of Monterey, Seaside, Sand City and Marina, and at the intercity rail station in Castroville. The LPA consists of two build segments, occurring in separate phases:

- **LRT-1:** Light rail transit service would be operated along a fixed guideway, mostly along the Monterey Branch Line, from downtown Monterey to northern Marina. Standard bus service would connect with the light rail transit, and would run on surface roadways between Marina and the intercity rail stations at Castroville and Salinas.
- **LRT-2:** Light rail transit service would be extended on the Monterey Branch Line between Marina and the intercity rail station at Castroville. Standard bus service would connect with the light rail transit, and would run on surface roadways between Marina and the intercity rail station at Salinas. Additionally, and commonly assumed in all Build alternatives, is the completion of an extension of commuter rail service to Monterey County.

A detailed definition of the LPA and restoration of the branch line to active service was conducted as part of the Alternatives Analysis Study, which preceded this conceptual design effort. It also identified impact areas which could affect implementation of the LPA. Areas of potential or significant impact are briefly summarized below.

Trackwork

Most all of the trackwork required between downtown Monterey and Castroville will take place on existing railroad right-of-way, which is owned by the Transportation Agency for Monterey County and the cities of Seaside and Monterey. As such, construction will occur in a relatively defined area with an existing construction base.

Street/Grade Crossings

There are no grade separations proposed as part of this project. All points where local roadways intersect the rail line will be at-grade. At-grade intersections are subject to rigorous safety, warning, and operational requirements to ensure smooth and safe operations. The selected LPA, as a regulated rail option, requires a prescribed set of requirements due to the nature, size, and stopping distances required by rail vehicles. It should be noted that, while at least partially significant, these issues can be fully mitigated, subject to California Public Utilities Commission concurrence.

Structures

The placement and construction of structures required for the LPA is not deemed to be significant for the first phase of construction between northern Marina and downtown Monterey. In the case of LRT-2, more significant restoration must be completed on a number of small structures, with extensive construction needed to replace or repair the Salinas River Bridge.

Systems

There are no foreseen problems insofar as systems characteristics are concerned. A layover facility for inspection and maintenance will be constructed east of Highway 1 on Transportation Agency for Monterey County/Monterey-Salinas Transit lands formerly used for Fort Ord quartermaster warehousing.

Detailed LPA Definition

Light Rail Transit Service

The **Locally Preferred Alternative (LPA) includes** two **separate phases of light rail transit (LRT) service implementation. During** the first phase, the Monterey Branch Line **(MBL)** railroad track will be restored or constructed between downtown Monterey and north Marina, with bus service continuing to Castroville on local roadways (Figure 2-1). The second phase will extend the guideway restoration to Castroville, at the intercity rail station north of Blackie Road (Figure 2-2). All bridges would be replaced with exception of the

Figure 2-1
Light Rail Transit—Phase I *(LRT-1)*

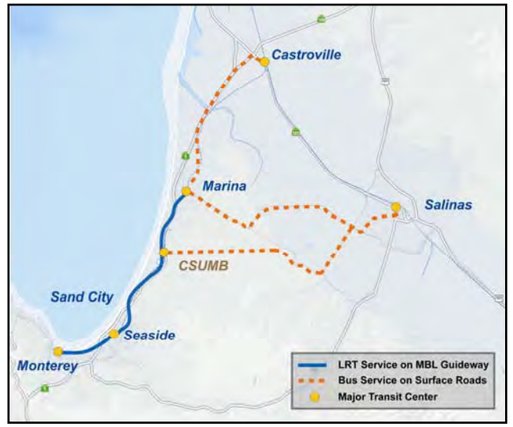
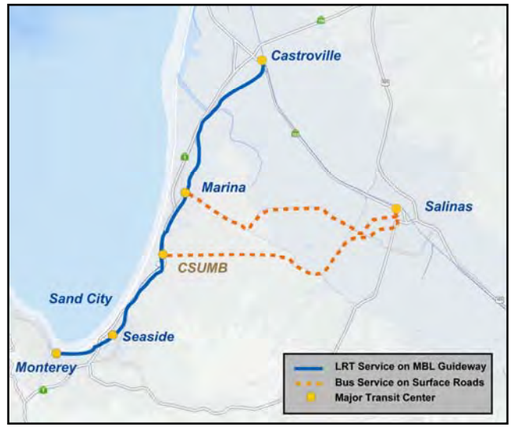


Figure 2-2
Light Rail Transit—Phase II *(LRT-2)*



span crossing Roberts Lake in Seaside. The 715-foot-long Salinas River Bridge **will** be repaired. A single-track line with new ties, ballast and grade crossing protection **will** be constructed for a distance of 10.0 miles in the first phase and extend another 5.2 miles to the Castroville intercity rail station during the second project phase. Existing track within the Fort Ord area will be reused. Passing sidings will be constructed where needed to allow for two-way train operations.

This project will also require the addition of an LRT station platform at the Castroville intercity rail station during Phase II in order to accommodate non-Federal Railroad Administration-compliant vehicles. Local bus service from Salinas **to downtown Marina and** to the California State University at Monterey Bay (CSUMB) will complement local rail service.

Stations/Stops

Local light rail transit service on the Monterey Branch Line will be coupled with stations serving all existing and projected population, employment, and educational concentrations along the Peninsula. **Five** stops will serve Marina at Marina Green Drive, Beach Road, Reservation Road, Palm Avenue, **and** Eighth Street (CSUMB). **Three** will serve Seaside and Sand City **at First Street**, Playa Avenue, and Contra Costa Street. In Monterey, **three** stops will be located at Casa Verde Way, the U.S. Naval Postgraduate School **(at Sloat Avenue)**, and Figueroa Street or **Custom House Plaza**. Light rail transit service will also serve the Castroville station at Blackie Road. Peninsula travelers could then transfer to commuter rail service to the San Francisco Bay area at this location.

Operations

Light rail transit service will operate between Monterey and Marina initially, with connecting bus service to Castroville **and Salinas**. Initially, 15- to 30-minute headways will be offered from 5:00 a.m. to 7:00 p.m., with less frequent service running to midnight. Headways will be decreased to 10 or 12 minutes during later years of operation as demand warrants. All train equipment will be interchangeable, thereby minimizing requirements for spare vehicles. The fleet will be stored at the former Fort Ord military reservation on lands owned by the Transportation Agency for Monterey County and**/or** Monterey–Salinas Transit.

Intercity service will be provided via light rail transit trains or bus connections between Monterey and Castroville, with transfers to commuter rail and Amtrak trains at the Castroville Station.

Right-of-Way Location, Facilities Improvements, and Land Uses

The Monterey Branch Line originally extended from Del Monte Junction (Castroville) to Lake Majella in Pacific Grove, a distance of approximately 20 miles. The track that remains is generally in unusable condition. The following provides a general description of the track restoration from Castroville to Monterey with respect to its reconstruction for Monterey Peninsula passenger rail service.

The original branch line connected to the Coast Main Line in Castroville (Coast Mainline milepost 106.65). The right-of-way in this area is flanked on either side by commercial and agricultural warehouses. From its junction with the mainline right-of-way, the track runs in a southwesterly direction toward Monterey. The location of the proposed LPA service begins with a Castroville station located just north of Blackie Road. The Coast Mainline milepost at Blackie Road is MP 107.30. The equivalent milepost on the Monterey Branch Line is 110.60, as the branch line was not re-stationed following the merger of the Southern Pacific and Union Pacific railroads in 1996. The grade crossing at Blackie Road is in good condition**, but will be reconstructed for the commuter rail project. A new track crossing and repositioning of gate crossing protection equipment will be required to implement the LPA**.

Blackie Road—North Limit of LPA Service

Track Condition and Land Use South of Blackie Road

The first portion of the rail line (MP 110.06 to MP 114.3) will pass through a mostly agricultural area of artichoke and strawberry fields. A grade crossing intersects the rail line at SR 183 (MP 110.8). State Route 183 is a two-lane highway running from SR 1 in Castroville to Salinas. Except as noted, all of the existing crossing surfaces are in poor condition and need to be replaced; and all of the grade crossing warning devices are obsolete, in disrepair, or non-functioning, and need to be replaced with new equipment.

The first structure along the rail line is found at the Trembladero Slough (MP 111.05)—a 150-foot, 10-span timber trestle bridge. This structure may be repaired or replaced, pending further study. Just south of this section, a short pass track would be constructed (MP 111.35) in the event that 10-minute headway service was provided between north Marina and Castroville.

Within a mile of the bridge crossing Trembladero Slough is another trestle bridge crossing the Alisal Slough (MP 111.93). This relatively short, 45-foot-long bridge was recently replaced by an earth embankment and culvert undercrossing to address mosquito abatement/West Nile virus concerns. It should be noted that all timber trestle bridges, the Salinas River Bridge, and Roberts Lake concrete trestles, as mentioned later in this chapter, are described in detail within the report entitled *Bridge Strategy Report for the Monterey Branch Line* dated July 2005, **and have been** reassessed as part of current study efforts (see **the May 2010 update)**.

Typical Agricultural Land Use

Southwesterly View of Trembladero Slough Bridge (MP 111.05)

Alisal Slough Bridge prior to Reconstruction (MP 111.93)

The next grade crossing along the rail line is at Nashua Road (MP 112.5). Surrounding land uses are strictly agricultural. Due to the poor existing condition of both the grade crossing and trackwork, improvements and replacement are necessary at this location.

Nashua Road Grade Crossing (MP 112.50)

Condition of Trackwork near Nashua Road (MP 112.50)

Just south of Nashua Road, there are three timber trestle bridge structures. These structures consist of a 120-foot, 8-span timber trestle drainage channel bridge (MP 112.54), a 225-foot, 15-span timber trestle floodplain equalizer bridge (MP 112.80) and a 90-foot, 6-span timber trestle floodplain equalizer bridge (MP 113.04). These structures and adjacent trackwork are in generally poor condition and agricultural uses have encroached very near the rail track base. All three structures have been recommended for replacement by earth embankment and culvert undercrossings as part of the LPA.

Drainage Channel Bridge Trestles (MP 112.54)

Drainage Channel Bridge Trackwork and Structure (MP 112.54)

Floodplain Equalizer Trestle Bridge (MP 112.8)

Example of Agricultural Land Use Proximity (MP 112.8)

Floodplain Equalizer Bridge Foundation (MP 112.8)

Floodplain Equalizer Timber Trestle Bridge Foundation (MP 113.04)

Trackwork near Agricultural Land Uses (MP 113.04)

The rail continues south through predominantly undeveloped land with some residential and light commercial use. The Salinas River Bridge (MP 113.50) is the next significant feature along the corridor. The adjacent highway bridge is utilized mostly by local residents and agricultural vehicles. This Monte Road Bridge is also heavily used as part of the recreational trail by walkers and bicyclists.

The former, closed rail bridge is located just east of the existing roadway bridge. The restoration issues associated with the existing bridge are detailed in the *Bridge Strategy Report for the Monterey Branch Line*, dated July 2005, **updated** as of **May 2010**. The bridge may be repaired or replaced on its current alignment, or a parallel alignment, subject to further assessment. **Bridge repair has been recommended based on the May 2010 study update.**

Typical Land Uses North of Salinas River Bridge (SR 1 in background)

Salinas River Bridge Roadway

Existing and Closed Salinas River Bridges (MP 113.50)

Closed Salinas River Bridge and Track (MP 113.50)

Just south of the Salinas River, the track passes by the Dole refrigeration plant located on the east side. The surrounding terrain begins to change just past this area from flat agricultural fields to rolling sand dunes populated by vegetative succulents and scrub. There are two grade crossings serving the Dole plant, north and south, (MP 113.80 and 114.07, respectively). Heavy vehicles utilize both grade crossings, particularly the south crossing.

North Dole Grade Crossing (MP 113.80)

South Dole/Ranch Grade Crossing (MP 114.07)

Major Heavy Vehicle Access (MP 114.07)

Beyond the Dole operations, the rail line once again experiences a highway at-grade crossing at Del Monte Boulevard. The existing track is in total disrepair and controls at this location are non-functional.

Grade Crossing at Del Monte Boulevard (MP 114.30)

Track Condition at Del Monte Boulevard (MP 114.30)

Non-Functional Controls at Del Monte Boulevard (MP 114.30)

Just past its intersection with Del Monte Boulevard (MP 114.3), the track angles to the southwest and follows the southern edge of the Lapis Sand Plant on Lapis Road. The existing rail spur turnout (switch) to the Lapis Sand Plant would be removed by the LPA. Adjacent land uses largely consist of an undeveloped dunes area. One private grade crossing (MP 114.64) **would be closed** and another at the Cemex plant (MP 115.04) will be replaced or repaired. Just south of the sand plant access road, a short pass track would be constructed to accommodate two-directional service. This pass track would allow for 10-, 12-, 15-, 20-, or 30-minute service headways between Castroville and north Marina.

Private Grade Crossing Off of Lapis Road (MP 114.64)—to be Closed

Typical Land Use at Lapis Road (MP 114.64)

Cemex Grade Crossing off Lapis Road (MP 115.04)

South of the Cemex plant, Lapis Road continues to again intersect with Del Monte Boulevard. At this junction, the rail line roughly parallels Del Monte Boulevard as both facilities approach the city of Marina. In addition, the recreational trail located adjacent to the rail line becomes increasingly more heavily used as one moves south.

Rail Line and Recreational Trail South of Lapis Road/Del Monte Boulevard

Recreational Trail Access Control South of Lapis Road/Del Monte Boulevard

The rail line continues, traveling mostly through undeveloped land as it enters the city of Marina. The segment through the currently populated portion of Marina is slightly less than two miles long. The segment begins with a station at Marina Green Drive, and ends at the Highway 1 overcrossing. Del Monte Boulevard abuts the right-of-way on the south (east). The rest of the segment is abutted by undeveloped land. Marina Green Drive generally has residences on its north side. A future, large, entitled residential and mixed-use development surrounds the station site.

Four light rail stops will serve the city of Marina at Marina Green Drive (MP 116.00), Beach Road (MP 116.50), Reservation Road (116.90), and Palm Avenue (MP 117.30). Two additional stations are located within the boundaries of the former Fort Ord military reservation at Eighth Street (CSUMB) and First Street. **Both stations are located within the jurisdiction of Monterey County, with Eighth Street serving Marina residents and businesses and First Street similarly serving Seaside.**

Light rail station platforms will be constructed at all station locations. Grade crossings associated with roadways intersecting the rail line near all stations will be rebuilt, in addition to grade crossings with the recreational trail (MP 119.50) and at Monterey Road (MP 122.20).

Northerly View at Marina Green Drive Grade Crossing (MP 116.00)

There are three significant structures along this segment. Included are two concrete-reinforced freeway overcrossings at SR 1 (MP 117.17 and 122.15), a two-lane pre-stressed concrete overcrossing at Eighth Street (MP 119.00) and a two-lane pre-stressed concrete undercrossing at First Street.

Between just north of Marina Green Drive to just north of Beach Road, the LPA is configured to allow for a double-track section, with two outboard platforms at both the Marina Green and Beach Road stations. Single track and single platform stations will be constructed to initiate the LRT-1 phase of service.

Southerly View at Marina Green Drive Grade Crossing (MP 116.0)

Northerly View at Beach Road Grade Crossing (MP 116.50)

Easterly View at Beach Road Grade Crossing (MP 116.50)

Between just south of Reservation Road and just south of Palm Avenue, the LPA will construct two tracks and double outboard platforms at the Reservation Road and Palm Avenue stations. The existing, southbound Monterey–Salinas Transit bus stop along Del Monte Avenue at **Palm Avenue** would be expanded to create a "super stop" or Transit Exchange to accommodate a local bus/LRT interface at this station.

Easterly View at Reservation Road Grade Crossing (MP 119.50)

Northeasterly View at Reservation Road Grade Crossing (MP 119.50)

Northerly View at Palm Avenue Grade Crossing (MP 117.30)

Westerly View at Palm Avenue Grade Crossing (MP 117.30)

A **park-**and-ride lot would be constructed **at the Marina Station LRT stop in conjunction with the entitled land development project at this location.**

Small kiss-and-ride parking areas would be constructed adjacent to the **Beach and Reservation Road** and Palm Avenue **stations**. Safety fencing would be installed along the LRT line between Marina Green Drive and the Highway 1 overcrossing to channelize pedestrian crossings of the light rail tracks and Del Monte Boulevard to signalized intersections.

South of the Highway 1 overcrossing, the rail line passes through the former Fort Ord area, which has now been designated as Fort Ord Dunes State Park. The terrain is generally rolling through this section. The existing length of double track will be extended to the north to permit two-way LRT operations. A two-platform station will be constructed at Eighth Street, and a single-platform station at First Street. **(The First Street station would be constructed in a later phase of development.)** Both stations would include elevator and stair access to the adjoining bridge and tunnel grade-separated crossings of the railroad track and Highway 1 to the east. At Eighth Street, a transit center will be constructed as part of the LPA. The transit center will include a park-and-ride lot.

Southerly View at Monterey Road (MP 122.20)

Just north of the First Street station, the railroad spur track connection to the Fort Ord quartermaster warehouses at Fifth Street will be restored **pending the ultimate site selection for the light rail maintenance facility, as discussed below.** The asphalt overlay to the rail track would be removed and the pedestrian/bicycle trail relocated to First Street and Eighth Street via the Highway 1 undercrossing and bridge structures, respectively.

East of Highway 1, a light rail transit maintenance and operations center will be constructed on three to five acres of land owned by the Transportation Agency for Monterey County and/or Monterey–Salinas Transit. The maintenance facility and light rail vehicle layover yard would be largely enclosed to minimize visual impacts. The maintenance building will be set back 100 feet or more from the Highway 1 right-of-way and would be 45 feet or less in height.

Alternatively, the light rail transit maintenance facility may be constructed west of Highway 1, on lands owned by the Transportation Agency for Monterey County, adjacent to the "balloon-spur" track. These lands were formerly used as a trailer/tank on flatcar loading ramp facility.

First Street, in the Fort Ord area, is the northern city limit of Seaside **to the east of Highway 1**. Just south of First Street, the existing track turnouts to the Fort Ord balloon spur tracks will be replaced. No operation along the balloon spur **track** is currently contemplated by the LPA; however, such use is not precluded and these lands may be utilized **as an alternative site for the LRT maintenance facility and** for the storage of maintenance of way materials.

South of the balloon spur at approximately MP 120.15, a short pass track will be constructed to permit 12-minute headway operations. **(This passing track is not required for the initial Phase I service deployment.)** To the north of Monterey Road and the Highway 1 overcrossing, a longer pass track will be constructed to accommodate 10-, 15-, and 30-minute headways. This double-track section would extend south past Playa Avenue to also permit 12-minute headways.

Northeasterly View at Playa Avenue Grade Crossing (MP 122.60)

Westerly View at Playa Avenue toward Shopping Center (MP 122.60)

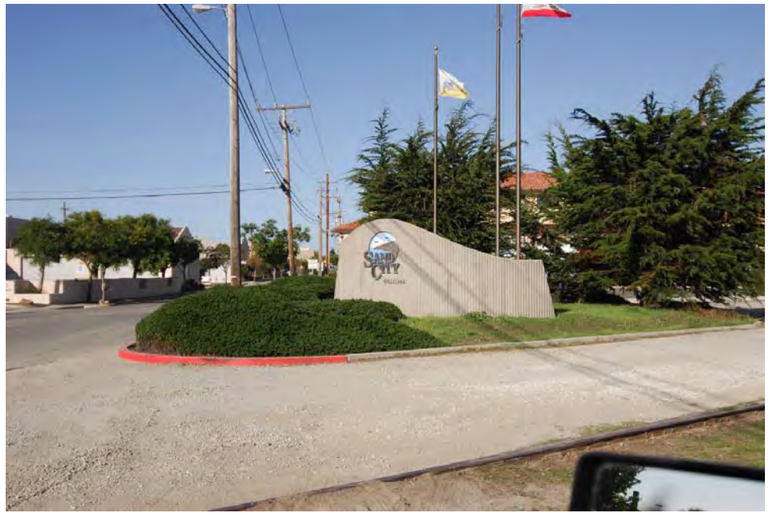
From about MP 119.70 to MP **123.50,** the rail line passes through the cities of Sand City and Seaside. The abutting land on the west side is generally developed with commercial and industrial buildings, and automobile sales dealerships. The east side is abutted by a variety of industrial, commercial and retail land uses. The rest of the segment has industrial and commercial buildings on the east side.

There are seven grade crossings that will require replacement along this segment: Monterey Road, Playa Avenue, Tioga Avenue, a private crossing at the Granite Rock property (closed), Contra Costa Street and Olympia Avenue, and Canyon del Rey Boulevard (SR 218). **To alleviate existing traffic congestion on the Monterey Road/Highway 1/ Fremont Boulevard ramp terminal intersections, local circulation improvements will be constructed with or without the LPA project. These improvements are considered to be part of the LPA, since they address grade crossing safety requirements of the California Public Utilities Commission.** The portion of the rail line right-of-way which is owned by the Transportation Agency for Monterey County terminates just east of Contra Costa Street within the limits of Sand City (MP 123.3). Thereafter, until MP 125.81, the right-of-way is owned by the City of Seaside and City of Monterey. Light rail stations will be located at Playa Avenue and Contra Costa Street.

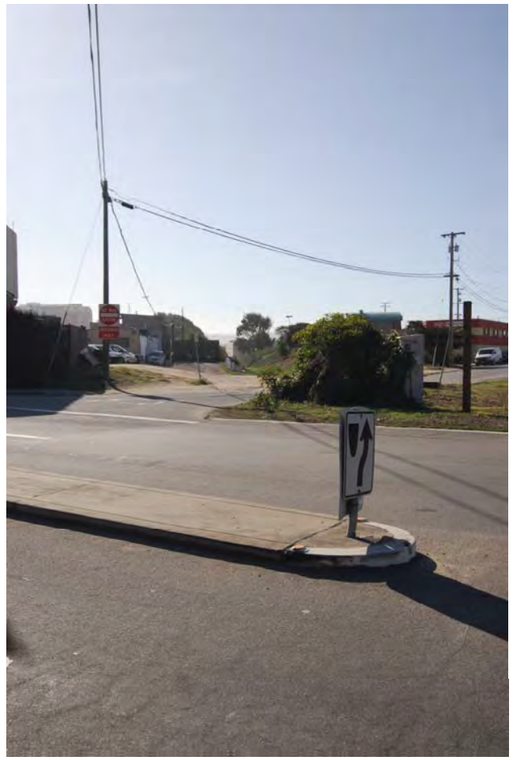
Northerly View of Grade Crossing at Tioga Avenue (MP 122.80)

A two-platform station will be constructed just north of Playa Avenue. A small park-and-ride lot would adjoin this station. Between Playa Avenue and Tioga Avenue, the track alignment will shift to the east from its historic alignment to accommodate an extension of California Avenue between these two roadways. **This extension of California Avenue will be constructed by others and is not part of the LPA.** At some time in the future, the double-track may be extended to south of Contra Costa Street to enhance operating flexibility.

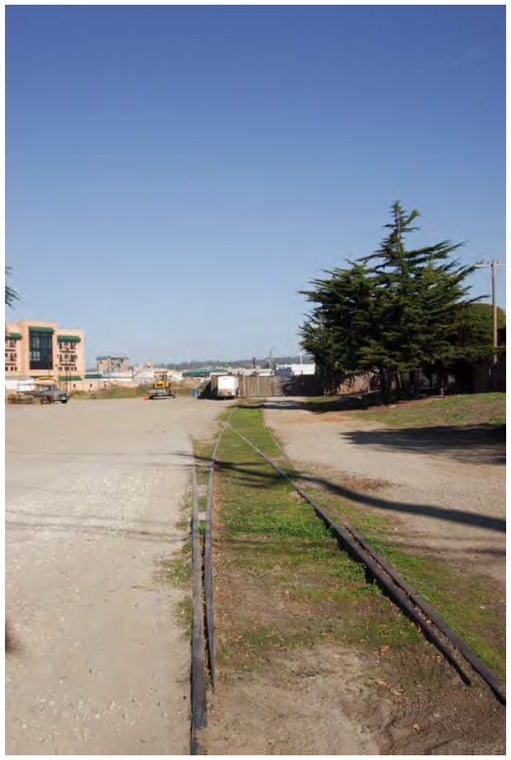
Easterly View of Grade Crossing at Tioga Avenue (MP 122.80)



Grade Crossing at Contra Costa Street (MP 123.36)



Westerly View of Grade Crossing at Contra Costa Street (MP 123.36)



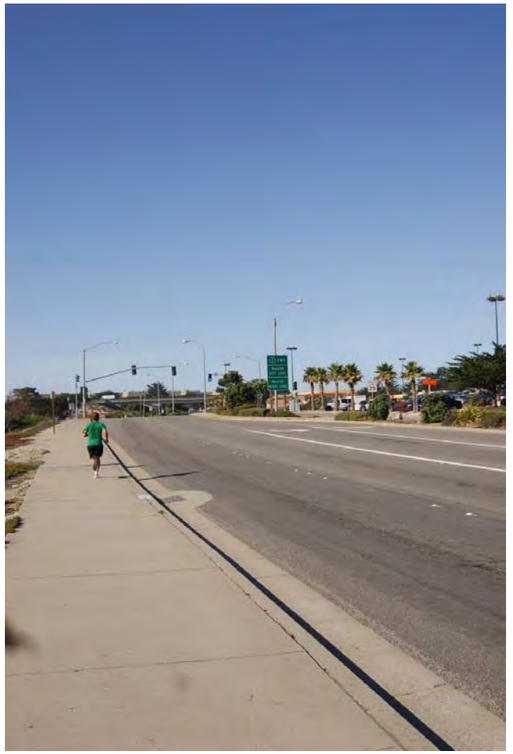
Easterly View of Railroad Right-of-Way at Contra Costa Street (MP 123.36)

As mentioned previously, the Transportation Agency for Monterey County-owned portion of the railroad right-of-way extends from Castroville to MP 123.30, a location approximately 372 feet north of the Contra Costa Street centerline. Between Tioga Avenue and the limit of its right-of-way ownership, the Transportation Agency for Monterey County currently leases a portion of its lands to adjacent businesses. These leases will be terminated or modified by the LPA construction. South of MP 123.30, the former Southern Pacific Transportation Company right-of-way is owned by the City of Seaside to its own city limits with Monterey. A single, outboard platform station will be constructed south of Contra Costa Street. A second track and station platform could be constructed in the future at this location, requiring noise wall and vibration mitigation to adjacent residential units. Olympia Avenue will be terminated south of Contra Costa Street and **converted from one-way eastbound to two-way operations.** A cul de sac will be constructed to permit vehicle turnaround.

The portion of the right-of-way between Contra Costa Street in Seaside and Canyon Del Rey Boulevard is undeveloped and contains remnants of the original branch line track. The right-of-way is 100 feet wide. A lease of approximately 30 feet of right-of-way width has been granted by the City of Seaside to the Starbucks Coffee Shop located on the northwest corner of Canyon del Rey Boulevard and Del Monte Avenue, for the purpose of providing customer parking. The restoration of passenger rail service will not effect this encroachment.

From Contra Costa Street to the Monterey city boundary at Roberts Avenue, the corridor lies wholly within the city of Seaside and is bounded by Sand City to the north. After crossing Canyon Del Rey Boulevard, a state-owned arterial highway, the corridor forms the south edge of Roberts Lake and crosses the estuary between Roberts Lake and Laguna Grande Lake with a 45-foot-long railroad bridge. **The project will construct a pedestrian/bicycle bridge to accommodate recreational trail users displaced by the passenger rail track restoration.** Beyond Roberts Avenue, the railroad right-of-way extends to west of Washington Street at MP 125.81 in Monterey, a distance of about 2.0 miles. The right-of-way is 100-feet wide; however, the width narrows to about 80 feet near the Naval Postgraduate School and close its western edge. The original corridor right-of-way then widens to about 400 feet in the old Monterey station area, between Camino El Estero and Washington Street.

Easterly View near Canyon del Rey Boulevard (MP123.60)



Northerly View near Canyon del Rey Boulevard (MP 123.60)

Westerly View near Canyon del Rey Boulevard (MP 123.60)

The corridor crosses under the northbound and southbound Highway 1 overpasses and the Del Monte Avenue off-ramp. A short pass track will be required at MP 123.95 to accommodate service frequencies of 10- or 20-minute headways. A single, outboard platform station will be constructed east of Casa Verde Way and this station will include a relatively large park-and-ride parking lot. The corridor proceeds southwest until it curves west in the vicinity of Palo Verde Avenue, skirting around stabilized sand dunes within U.S. Navy property. A center platform and double-track section will be constructed at the Naval Postgraduate School **at Sloat Avenue**.

Westerly View at Casa Verde Way (MP 124.30)

The double-track section **at** the Naval Postgraduate School **station** will allow for 10-, 12-, and 15-minute frequencies of service. Just west of La Playa**/Park Avenues** is the eastern limit of what is commonly referred to as the "Window on the Bay Park"—an area along Del Monte Avenue which affords glimpses of **bay-facing** views. At the very west end of the study area, near Monterey Marina, the corridor curves slightly to the north, heading toward Fisherman's Wharf. The historic railroad right-of-way, purchased by the City of Monterey using State of California transportation funding, ends at MP 128.81, just west of Washington Street. An end of the line LRT station will be constructed at this location, adjacent to the **Monterey** Maritime **and History** Museum, or between Figueroa and Washington Streets. A Monterey–Salinas Transit "super stop" or Transit Exchange would be constructed nearby to accommodate local bus/LRT interface at this end of the line station.

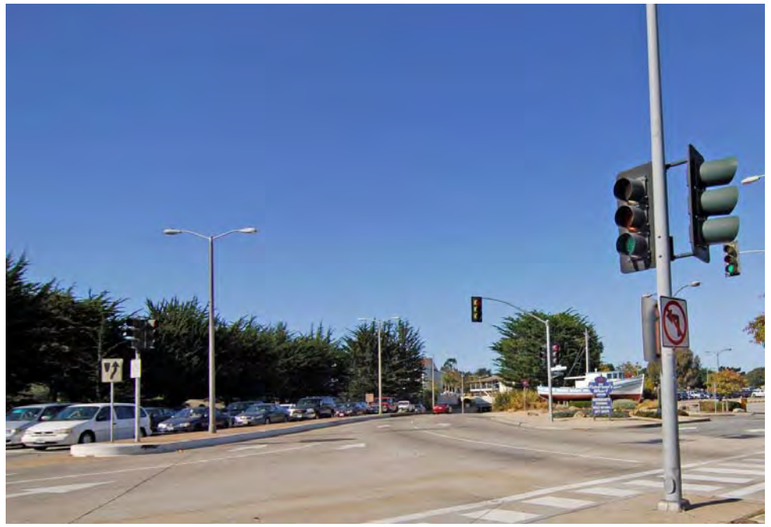
The alignment of the single-track LPA would depart from the historic alignment **between Sloat and** La Playa**/Park Avenues**. It would run adjacent and parallel to Del Monte Avenue in a side-running, exclusive LRT trackway to the end of the project limit, east or west of Washington Street. **Between Sloat and La Playa Avenues, the City of Monterey intends to purchase right-of-way along the coastal side of Del Monte Avenue. This right-of-way would be utilized to widen Del Monte Avenue to provide an additional east-bound and a median turn-lane, and to construct an off-street surface parking lot for Window on the Bay visitors. The LPA plans depict two alignment alternatives between Sloat and Park Avenue. One option is to move the track alignment adjacent to Del Monte Avenue along this segment, while the second option would follow the southerly edge of the historic railroad right-of-way.**

Easterly View near Naval Postgraduate School (MP 124.10)

Window on the Bay Park View from Del Monte Avenue

Westerly View East of Washington Street

Westerly View near Old Train Depot



Northwesterly View at Washington Street toward Lighthouse Avenue

Within the city of Monterey, the railroad right-of-way and LPA alignment crosses low traffic volume local streets and driveways. These grade crossings will remain at-grade, but will be reconstructed at Roberts Avenue (a local street), a private property driveway (to be closed), Casa Verde Way (a local/collector street), the Monterey Wastewater Treatment Plant driveway, **possibly a parking lot driveway,** La Playa Avenue/ **Park Avenue** (a local street), **a parking lot driveway,** Figueroa Street, and possibly Washington Street. Both Figueroa Street and Washington Street function as driveways to the public parking lots located north of Del Monte Avenue.

Three significant structures are present along this segment including the Roberts Lake Bridge (MP 123.80), the Highway 1 freeway overcrossing (MP 123.98), and the Del Monte Avenue freeway off-ramp overcrossing (MP 124.03).

The Roberts Lake Bridge is a 22.5 foot, 2-span bridge, most likely designed for a minimum E72 live load. It requires no repairs prior to re-establishing train service. It is anticipated that no or very limited seismic retrofitting would be required. The existing recreational trail would be relocated toward Del Monte on a new pedestrian bridge constructed over the estuary**, as noted previously**. West of Roberts Avenue, the recreational trail will be relocated where necessary to accommodate the restoration of passenger rail service, as stipulated in the "Southern Pacific Railroad Right of Way Development Agreement Between The State of California Department of Transportation and the Cities of Monterey and Seaside," dated January 26, 2000.

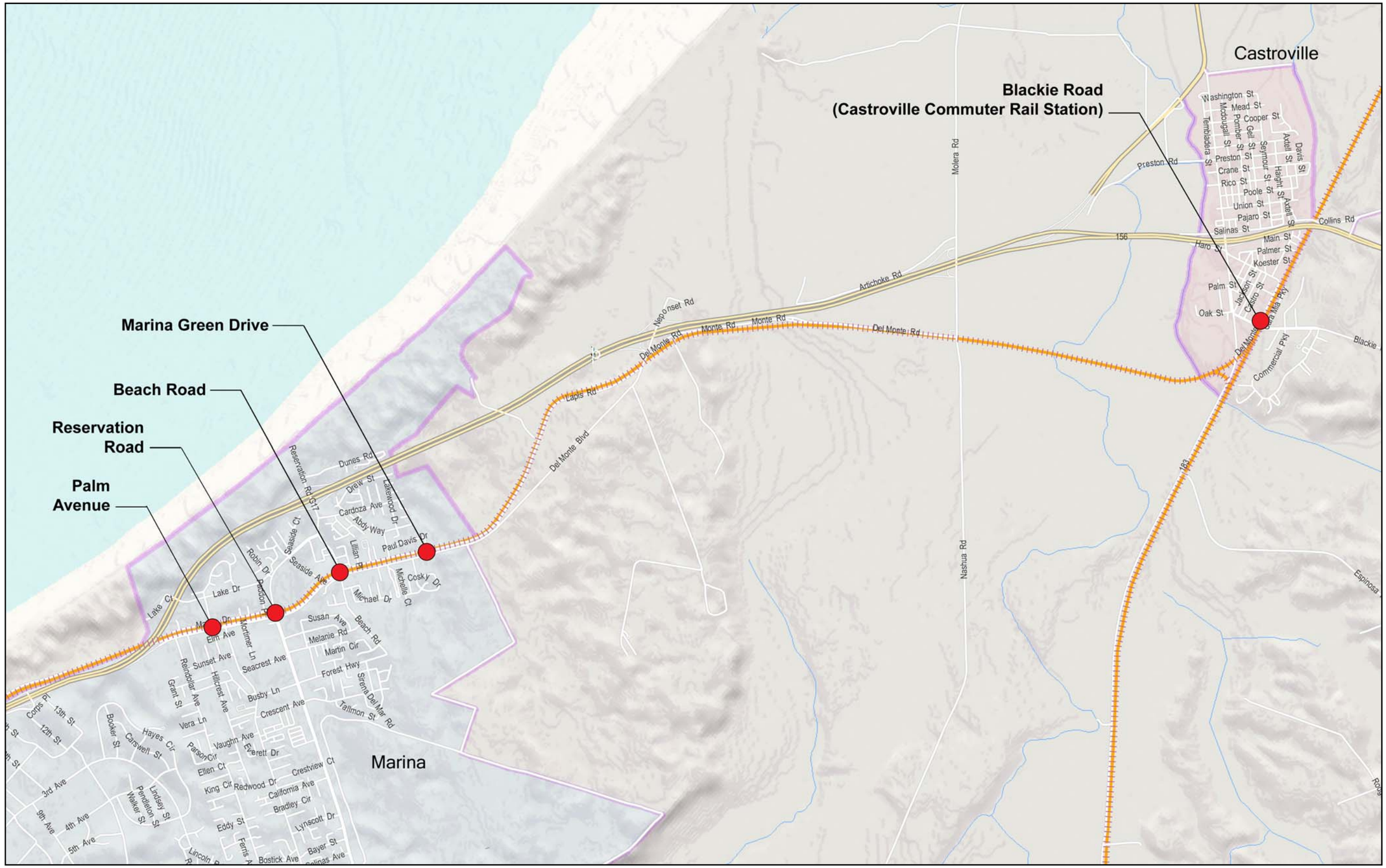
Roberts Lake Bridge (MP 123.80)

3 Fixed Guideway Station Locations

3. Fixed Guideway Station Locations

Monterey Peninsula Fixed Guideway Station Locations *(1 of 2)*

Monterey Peninsula Fixed Guideway Station Locations *(2 of 2)*



4 Conceptual Plan for Fixed Guideway Restoration of Passenger Rail Service

4. Conceptual Plan for Fixed Guideway Restoration of Passenger Rail Service

Existing Features

Track and Right-of-Way

The Monterey Branch Line originally extended from Del Monte Junction (Castroville) to Lake Majella in Pacific Grove, a distance of approximately 20 miles. The track remains in place from Castroville to the vicinity of Fisherman's Wharf in Monterey. The track that remains is generally in unusable condition. This chapter describes the general setting of the track from Castroville to Monterey with respect to its reconstruction for Monterey Peninsula passenger rail service.

The original branch line connected to the Coast Main Line at former Southern Pacific MP 110.15,[1] about 1,000 feet north of Wood Street in Castroville. It ran parallel to the main line for about 0.7 miles before turning west on a separate right-of-way. The connection to the main line has been removed, and the track no longer exists, except for the crossing of Blackie Road. The right-of-way is flanked on either side by commercial and agricultural warehouses.

From its junction with the main line right-of-way, the track runs in a southwesterly direction to Monterey. The right-of-way is generally 100 feet wide. The track is in poor condition. The ballast is fouled with fines that have been blown from the adjacent fields or sand dunes. The rails are very worn and pre-date the invention of controlled-cooling, which reduced the propagation of internal rail flaws. The timber cross ties are also in poor condition. The ballast could be cleaned and re-used as subballast for a new track.

The first three miles (MP 111 to MP 114) are generally straight and flat, passing through artichoke fields.[2] The track is slightly above the adjacent ground. There are no parallel drainage ditches to prevent water from accumulating in the track structure. There are several timber trestle bridges that cross drainage sloughs. The track crosses the Salinas River on a five-span steel through truss bridge at about MP 113.5, near the west end of this segment. There are two grade crossings east of the Salinas River Bridge at State Route (SR) 183 and Nashua Road.

About one-quarter mile west of the Salinas River, the track passes by the Dole refrigeration plant located on the south side. There are two entrances to the plant which cross the track at grade. The second crossing (identified as South Dole) is also used for access to private properties to the west. There is a chain link fence separating the Dole crossing from the other road. There is another grade crossing, Del Monte Road, located about one-quarter mile west of South Dole. This area previously had a station named Neponset.

The terrain begins to change in this area from flat agricultural fields to rolling sand dunes. The track alignment becomes curved, following the terrain. For the next two miles (MP 114 to MP 116), the track follows the southern edge of the Lapis Sand Plant. Lapis Road is located immediately to the south. There is a turnout to the plant in the middle of a relatively sharp curve in the branch line. This curve will restrict speed to 35 or 40 miles per hour (mph). The turnout is set so that the straight movement is to the plant spur. The spur track extends about one mile, passing under SR 1.[3] There are two private crossings in this segment, one to the Lapis plant and one to an adjacent agricultural field. The track is in low cuts and fills through this area.

The next section (MP 116 to MP 118) passes through the city of Marina. It begins at Marina Green Drive and ends at the SR 1 overcrossing, and is slightly less than two miles long. Del Monte Boulevard abuts the right-of-way on the south. On the north side, there are parallel streets abutting the right-of-way at two locations, totaling about 4,000 feet. The rest of the segment is abutted by undeveloped land. The terrain varies in this segment. The portion between Marina Green Drive and Beach Road, about one-half mile, is flat. The track is at grade and partially buried by the adjacent ground. There is poor drainage in this section. For the next 0.7 mile, until about halfway between Reservation Road and Palm Avenue, the track is in low cuts and fills, and is not constrained by adjacent streets. From this point until the SR 1 overcrossing, the track is again between two parallel streets, Del Monte Boulevard on the south and Marina Drive on the north. The existing ground is at the same elevation as the ties, and there is poor drainage. The ballast is fouled with sand.

There are four grade crossings in Marina: Marina Green Drive, Beach Road, Reservation Road and Palm Avenue.

The alignment in Marina is generally straight, with two curves between Beach Road and Reservation Road. Marina Drive north of the track generally has residences on its north side. The Marina Del Mar Elementary School is located on the west end of Marina Drive.

The next four miles (MP 118 to MP 122) are located within the boundaries of the former Fort Ord military reservation. The track follows a generally curvilinear alignment and rolling profile through sand dunes. About one-half of the route was realigned in the 1960's in conjunction with the SR 1 freeway construction. This work included the construction of about two miles of new track with continuously welded rail, plus a 4,500-foot-long passing siding. Both of these tracks are in excellent condition. There was a spur track to the south at Fifth Street, passing under SR 1, which previously served Fort Ord. This spur track has been removed or paved over and replaced by a pedestrian/bicycle trail. The adjacent lands south (east) of SR 1 are owned by the Transportation Agency for Monterey County. There are also turnouts on the north side to tracks previously owned by the U.S. Army. The turnouts form a "balloon" or turnaround loop track. There is also a turnout from the west leg of the balloon track which leads to two stub-ended loading tracks previously used by the U.S. Army.

There are no grade crossings of the branch line is this segment. There are two grade separations: an overcrossing at Eighth Street and an underpass at First Street. A pedestrian/bicycle path crosses the former Fifth Street spur to the south.

From MP 122 to MP 123.5, the track passes through Sand City and Seaside. The abutting land on the south side is generally developed with commercial and industrial buildings and automobile sales dealerships. The north side is abutted by a variety of industrial, commercial and retail land uses. California Avenue and the Edgewater and Sand Dollar shopping centers extend for about the first 0.7 mile. The rest of the segment has industrial and commercial buildings on the north side. The portion of the line from Tioga Avenue to Contra Costa Street is either buried in the ground or covered by parked vehicles and equipment.

There are six grade crossings in this segment: Monterey Road (formerly Ord Avenue), Playa Avenue, Tioga Avenue, a private crossing at the Granite Rock property, Contra Costa Street and Olympia Avenue. The last two crossings are very close to each other, and traffic movements are restricted by curbs.

The portion of the branch line right-of-way which is owned by the Transportation Agency for Monterey County terminates just east of Contra Costa Street within the limits of Sand City at MP 123.36. Thereafter to MP 125.81, the right-of-way is owned by the cities of Seaside and Monterey. The Seaside/Sand City line is on the north edge of Olympia Avenue. Olympia Avenue is in Seaside, while Contra Costa Street is in Sand City. The Southern Pacific Transportation Company's operating timetable shows the end of the line as Seaside and for the purposes of this report, this segment is described as being within the cities of Seaside and Monterey. However, the grade crossing of Contra Costa Street and a short segment of track at the beginning of the segment are in Sand City.

The railroad right-of-way stretches from Contra Costa Street in Seaside to west of Washington Street in Monterey, a distance of about 2.5 miles. The corridor generally runs along the north side of the coastal arterial road known as Del Monte Boulevard in Seaside and Del Monte Avenue in Monterey. There are strips of

[1] The main line mileposts have been revised since the Union Pacific acquisition. Current main line mileposts are 3.3 miles less than the original. The Monterey Branch Line mileposts used in this report and for this study are the original mileposts, except as noted.
[2] Castroville calls itself "The artichoke center of the world." Marilyn Monroe was the first "Miss Artichoke" in 1949.
[3] It is not clear how much of this track was previously owned by the railroad and how much was privately owned.

property between the original rail corridor and Del Monte Boulevard/Avenue east of Canyon Del Ray Boulevard and west of the Naval Postgraduate School area.

A recreational trail meanders within the corridor from Canyon Del Rey Boulevard in Seaside to the Fisherman's Wharf area in Monterey. The original railroad tracks, which were left in place when the trail was constructed, are generally covered over by the trail and adjacent landscaping. The portion of the right-of-way between Canyon Del Rey Boulevard and Contra Costa Street in Seaside, about 1,400 feet long, is undeveloped and still contains remnants of the original railroad track. Vestiges of the original Southern Pacific track are occasionally visible along the corridor from Canyon Del Rey Boulevard to Fisherman's Wharf. The right-of-way is generally 100 feet wide. The width narrows to about 80 feet near the Naval Postgraduate School and at the west end, the original corridor right-of-way widens to about 400 feet in the old Monterey station area, between Figueroa Street and Washington Street.

From Contra Costa Street in Seaside to the Monterey city boundary at Roberts Avenue, the corridor is relatively straight with a southwest trend. This portion of the corridor lies within the city of Seaside and is bounded by Sand City to the north. After crossing Canyon Del Rey Boulevard, which is a state owned arterial road, the corridor forms the south edge of Roberts Lake and crosses the estuary connecting Roberts Lake and Laguna Grande Lake with a 45-foot-long railroad bridge.

The corridor crosses under the northbound and southbound SR 1 overpasses and the Del Monte Avenue off-ramp. The State of California has overhead structure easements associated with these structures. There is also a utility easement of varying widths running along the north side of the existing rail trace.

The corridor proceeds southwest until it curves west in the vicinity of Palo Verde Avenue, skirting around stabilized sand dunes within U.S. Navy property. West of Sloat Avenue, the corridor continues roughly due west, adjacent to the beachfront. At the very west end of the study area, by the Monterey Marina, the corridor curves slightly to the north, heading towards Fisherman's Wharf and Custom House Plaza.

The overall profile of the corridor is relatively flat. The main topographic features in this segment are large, stabilized sand dunes on the north side of the corridor at the U.S. Navy property. Just east of Canyon del Rey Boulevard, the original tracks lie within a U-shaped cut about 15 feet deep. The original tracks are in shallower cut as they pass next to the SR 1 abutments and the adjacent sand dunes immediately to the north. Elsewhere, the original tracks appear to have been generally at the same level as the surrounding ground or on a low embankment such as along Roberts Lake. Between Casa Verde Avenue and Sloat Avenue, the stabilized sand dunes often encroach within the north edge of the corridor right-of-way.

Figure 4-1, which follows this text, illustrates the Monterey Branch line alignment and land use setting. It also indicates the approximate locations of branch line mileposts, significant features and potential locations for fixed-guideway transit stations.

Recreation Trail

There is an existing recreation path or trail that generally follows the railroad from the vicinity of Lapis Road to Monterey Road (Ord Avenue) in Sand City. The path is outside the railroad right-of-way, and generally follows adjacent roads. The path crosses the Fort Ord Fifth Street spur at grade, and is located within the railroad right-of-way for about 0.2 mile just east of Ord Avenue.

Seaside and Sand City at one time proposed to extend this bicycle/pedestrian trail along (within) the Monterey Branch Line right-of-way between Monterey Road and Canyon del Rey Boulevard, located south of Contra Costa Street and Olympia Avenue. This extension proposal, which is no longer active, would then join an existing recreational trail which extends from Canyon Del Rey Boulevard in Seaside to Washington Street in Monterey. The trail consists of a 12-foot wide asphalt pavement, striped for two bicycle lanes. Throughout much of Monterey, the trail is provided with decorative light poles.

The portion of recreational trail which begins at Canyon Del Rey Boulevard runs along the south side of the original track. The trail shifts on top of the original track alignment to use the existing railroad bridge by Roberts Lake and then moves back to the south side until it reaches Roberts Avenue. West of Roberts Avenue, the trail continues on the north side of the track but crosses to the south side just east of SR 1. A branch connects the main trail with Del Monte Avenue at English Avenue.

The trail crosses back to the north side of the original track just east of Ramona Avenue. There are two branches on either side of Casa Verde Way, connecting the trail with Del Monte Avenue. Through the sand dune and eucalyptus tree grove areas from Palo Verde Avenue to Sloat Avenue, the trail lies mainly on the north side but meanders back and forth across or directly on top of the original track at several locations. At Sloat Avenue, two diagonal trail branches join with Del Monte Avenue.

The trail continues along the north side of the tracks from Sloat Avenue adjacent to the Del Monte Beach Townhouses and runs within the Windows on the Bay Park before skirting the perimeter of a parking lot to the west of Washington Street.

Streets and Grade Crossings

The corridor crosses the streets listed in Table 4-1. Except as noted, all the existing crossing surfaces are in poor condition and need to be replaced, and all the grade crossing warning devices are obsolete, in disrepair and non-functioning, and need to be replaced with new equipment.

Drainage

There are currently four timber trestle structures between Castroville and the Salinas River that pass over drainage courses. A detailed description of these structures plus the Salinas River Bridge is documented in a separate report entitled *Bridge Strategy Report for the Monterey Branch Line* dated July 2005.

West of the Salinas River, there are very few drainage structures. The ground is sandy and permeable, and there are no well-defined drainage courses. The track is at-grade or in shallow excavation and some work to improve drainage may be necessary in these locations:

- West of Marina Green Drive
- Vicinity of Palm Avenue
- Tioga Avenue to Canyon Del Rey.

West of Canyon Del Rey Boulevard, the main drainage facilities along the corridor serve Del Monte Avenue/ Boulevard. These include conventional curb and gutter and storm drain systems along the road. These are complemented by percolation ponds and graded ditches at various locations in the space between the street and the original track. The percolation ponds were installed as part of the 1995 Del Monte Avenue widening project.

In the cut areas east of Canyon Del Ray Boulevard and in the vicinity of SR 1, storm water would be expected to collect in the existing track area, which lies in the low point. Due to the sandy nature of the soil, the rate of infiltration can be expected to be quite rapid.

Utilities

Based on a utility survey, former Southern Pacific track charts, and right-of-way and track maps, there are no parallel utilities within branch line right-of-way between Castroville and Marina, except for a fiber optic line in the Castroville segment. Through the city of Marina, between Marina Green Drive and SR 1, sewer and water lines parallel the branch line with segments within the right-of-way.

Figure 4-1
Monterey Branch Line Alignment *(1 of 2)*

Figure 4-1
Monterey Branch Line Alignment *(2 of 2)*

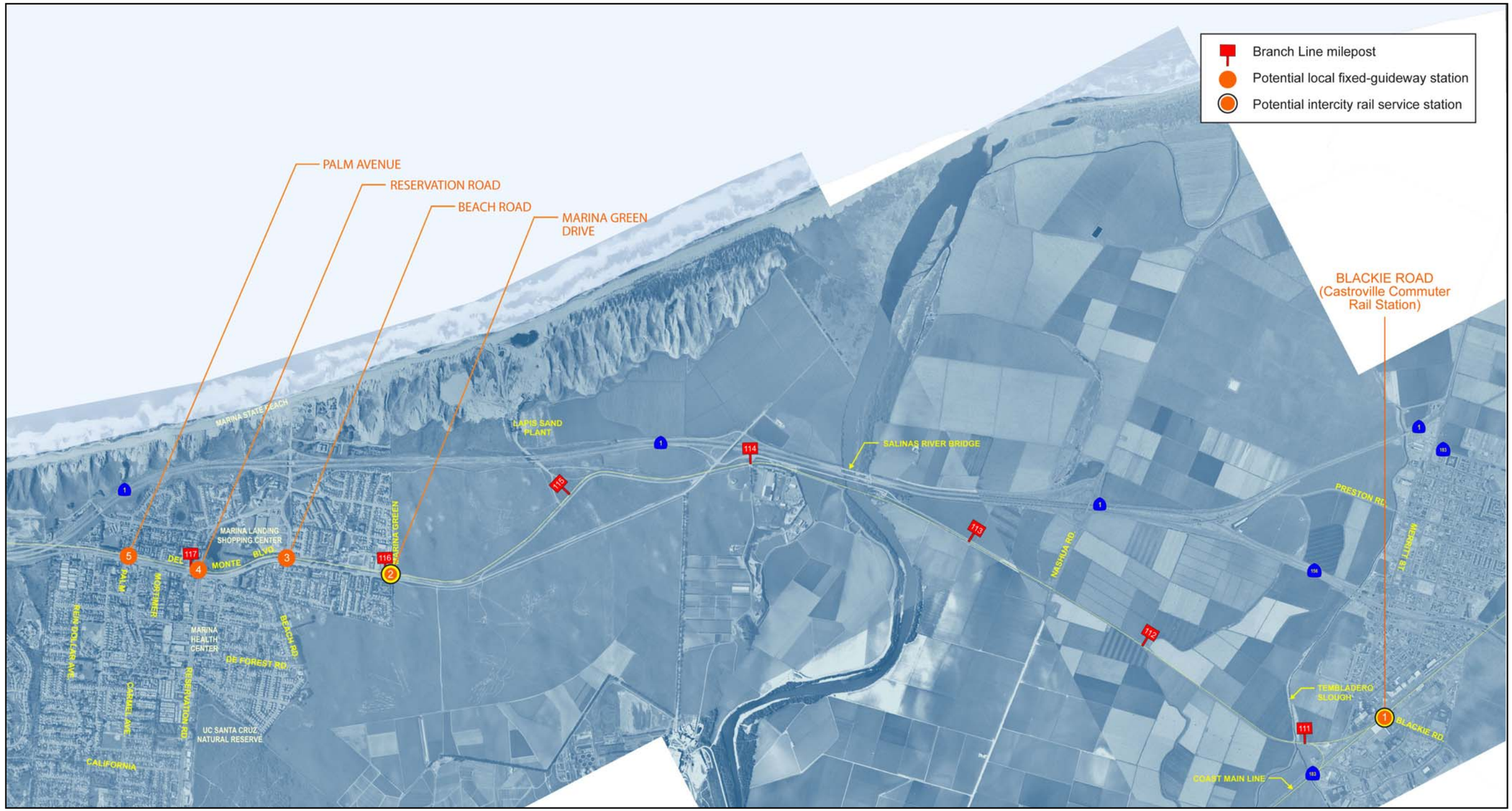


Table 4-1
GRADE CROSSINGS

MP	Crossing	Description	Note
107.30 (Coast Main Line)	Blackie Road	4-lane street	Existing tracks and panels can be re-used; existing grade crossing warning device is functional and can be used with additional circuit for Monterey Branch Line track.
110.80	SR 183	2-lane highway	
112.50	Nashua Road	2-lane street	
113.80	North Dole	2-lane street	Private driveway
114.07	South Dole/Ranch Access	Two 2-lane streets	Two crossings separated by fence
114.30	Del Monte Avenue	2-lane street	
114.64	Private Driveway	Unpaved private driveway	
115.04	Lapis (RMC Pacific Materials)	Paved private driveway	
116.00	Marina Green Drive (formerly Diane Avenue)	2-way, up to 4-lane street	Existing crossing panels and track can be re-used; existing grade crossing warning device controller and gate posts can be re-used. Road may be realigned by adjacent development.
116.50	Beach Road	2-lane road	Road will be widened to 5 lanes
116.90	Reservation Road	3-lane road	
117.30	Palm Avenue	2-lane road	Future 3-lane
119.50	Bicycle and Pedestrian Path		Fort Ord spur at Fifth Street
122.20	Monterey Road (formerly Ord Avenue)	5-lane road	Between two adjacent signalized intersections
122.60	Playa Avenue	4-lane road	Existing grade crossing warning device equipment can be re-used
122.80	Tioga Avenue	3-lane road	
122.92	Granite Rock	Unpaved driveway	Private crossing (currently closed)
123.36	Contra Costa Street	3-lane street	
123.38	Olympia Avenue	1-lane, 1-way street	Intersects with Contra Costa Street; right turn only
123.60	Canyon Del Rey Boulevard (SR 218)	6-lane arterial	
123.80	Roberts Avenue	2-lane street	
123.90	Bicycle and Pedestrian Path		
124.10	Bicycle and Pedestrian Path		
124.20	Maris property driveway	2-lane private driveway	
124.30	Casa Verde Way	4-lane street	
124.60	Monterey Wastewater Treatment Plant Driveway	Paved private driveway	
125.00	Sloat Avenue Pedestrian Trail	2-leg crossing	
125.20	La Playa Avenue	2-lane street	Access to Del Monte Beach Townhouses
125.50	Camino El Estero Pedestrian Trail		
125.70	Figueroa Street	4-lane street	
125.80	Washington Street	2-lane street	

Source: Parsons

Utility plans received for this study indicate the presence of a variety of utilities both alongside and crossing the corridor at various locations. These utilities include electricity, gas, water, cable television, telephone and sanitary sewer systems. There are also irrigation and lighting systems associated with the recreation trail in Monterey. It is apparent that the widening of Del Monte Avenue between Palo Verde Avenue and Roberts Avenue included placing utilities underground. Above-ground, joint-use poles are still present west of the widened area.

Within the existing rail corridor along the Del Monte Avenue widening area, a joint PG&E power, telephone, and cable television trench was installed along the north side of the existing track. Drawings indicate that the trench is generally set back at least nine feet from the nearest rail of the original track. One exception is a short segment of the trench that traverses directly beneath the track where it diverts around a SR 1/Del Monte Avenue off-ramp column.

These utilities, parallel and crossing, are located on easements from the Transportation Agency for Monterey County, Seaside, and Monterey; and are subject to relocation depending on the alignment of the fixed-guideway deployment. Chapter 9 of this document includes documentation of known or potential utility conflicts.

Structures

Structures are listed in Table 4-2. The timber trestles, Salinas River Bridge, and Roberts Lake concrete trestle are described in the report entitled *Bridge Strategy Report for the Monterey Branch Line* dated July 2005, **updated in May 2010**.

Table 4-2
STRUCTURES

MP	Structure	Description	Note
111.05	Trembladero Slough	150-foot 10-span timber trestle	
111.93	Alisal Slough	45-foot 3-span timber trestle	
112.54	Drainage channel	120-foot 8-span timber trestle	
112.80	Floodplain equalizer	225-foot 15-span timber trestle	
113.04	Floodplain equalizer	90-foot 6-span timber trestle	
113.50	Salinas River	715-foot 5-span steel through truss	
117.17	SR 1	Freeway overcrossing; 2 reinforced concrete roadway structures	
119.00	Eighth Street	2-lane pre-stressed concrete overcrossing	
119.64	First Street	2-lane pre-stressed concrete undercrossing	
122.15	SR 1	Freeway overcrossing; 2 reinforced concrete roadway structures	
123.65	Roberts Lake (Lake George)	45-foot 2-span prestressed concrete trestle	
123.98	SR 1	Freeway overcrossing; 2 reinforced concrete roadway structures	
124.03	Del Monte Avenue off-ramp	Freeway off-ramp overcrossing	Nearest support column, on north side, clears centerline of original track by approximately 8.5 feet

Source: Parsons
*FRA: Federal Railroad Administration

Conceptual Engineering

Elements

The main work elements required for the restoration of rail service to the Monterey Peninsula consist of track, structures, grade crossings, and passenger train stations including parking. Minor items related to the work include signals, drainage and street work. Optional items include electrification and signals.

Codes, Regulations and Criteria

REGULATORY REQUIREMENTS

The principal agencies and their areas of jurisdiction are described in this section. Different regulations and authorities apply to conventional railroads (FRA-compliant equipment) and light rail (non-FRA-compliant equipment). Conventional railroads are those that are connected to the national freight and passenger railroad network. The Federal Railroad Administration has jurisdiction over certain areas of operation on these railroads, including equipment requirements, track and signaling requirements. In addition, the Federal Railroad Administration is establishing standards for at-grade crossings with roads and highways. The Federal Railroad Administration does not have jurisdiction over light rail or rail transit systems which are not connected to the national rail network. However, it does have authority where light rail crosses or runs adjacent to conventional railroad tracks.

CALIFORNIA PUBLIC UTILITIES COMMISSION

The California Public Utilities Commission (CPUC) is the primary agency regulating railroad construction and operation. The CPUC's regulations are promulgated in a series of general orders. The general orders that govern railroad-related construction are:

- G.O. 26-D Railroad Clearances. This regulation applies to conventional railroads.
- G.O. 72-B Construction and Maintenance of Grade Crossings
- G.O. 75-D Grade Crossing Protection
- G.O. 88-B Rules for Altering Public Grade Crossings
- G.O. 95 Overhead Electric Line Construction
- G.O. 118 Maintenance Walkways Adjacent to Tracks
- G.O 128 Underground Electric Supply And Communication System
- G.O. 135 Occupancy of Public Grade Crossings by Railroads
- G.O. 143-B Construction and Operation of Light Rail Transit[4]
- G.O. 145 Crossings Exempt from Mandatory Stop Requirements

Clearances for conventional railroad equipment are stipulated in G.O. 26-D. The minimum horizontal clearance from track centerline to any fixed object more than 8 inches above top of rail is 8 feet 6 inches. This includes platforms. There are no conventional railroads in California with platforms higher than 8 inches above top of rail. The North County Transit District "Sprinter" light rail transit service between Oceanside and Escondido, California, which shares its tracks with freight service, is a special case exception. The Federal Transit Administration is requiring new commuter rail projects with Federal Transit Administration funding to have level boarding to comply with the Americans with Disabilities Act regulations. This requirement is incompatible with G.O. 26-D for floor-level platforms or any platforms higher than 8 inches above top of rail. There are several options that could be explored at later stages of the project to accommodate the conflicting requirements. Among them are:

- Obtain a waiver of the clearance requirements in G.O. 26-D for floor-level boarding. This would depend on who operates the service. The North County Transit District Sprinter line provides a precedent in California. Other states allow floor-level platforms for passenger operation, even with mixed freight traffic.
- Use low-level platforms with mini-high or moveable ramps for handicapped boarding. This could be done if there is no federal funding.
- Obtain a waiver of Federal Transit Administration requirements and use low-level platforms. A future intercity passenger rail service to Monterey would stop at a number of the existing Caltrain stations north of Gilroy to San Francisco, all of which have low-level platforms.
- Provide retractable bridge plates on the mid- to high-level platforms. The bridge plates would have to be retracted to allow passage of the wider body intercity trains.

This situation would not be a factor with sole operation on the Monterey Branch Line by light rail or non-FRA-compliant diesel multiple units (DMU), as G.O. 26-D does not apply to these modes.

With regard to clearances, the existing railroad has sufficient horizontal and vertical clearances for any kind of rail operation between Castroville and Canyon del Rey Boulevard. Minimum clearance from track centerline to fixed objects more than 8 inches above top of rail is 8 feet 6 inches on tangent track, and 9 feet 6 inches on curved track, though 10 feet is preferred everywhere. For railroads not used for freight, a side clearance of 30 inches from the side of the widest equipment is permitted. On this basis, with passenger equipment about 10 feet to 10 feet 6 inches wide, the minimum lateral clearance could be as little as 7 feet 9 inches. However, as a practical matter, the required clearance would be governed by future potential intercity rail passenger service options on this line. This equipment could require the same clearances as freight railroads.

The provisions of G.O. 143-B would apply for the operation of light rail service to Portola Plaza in downtown Monterey. Clearances under this regulation are measured from the dynamic outlines of vehicles. A minimum of 18 inches is required where passengers or employees are normally prohibited. Along emergency walkways and where people are permitted, a minimum of 30 inches is required. Light rail vehicles are typical 8 feet 6 inches to 10 feet wide, so the minimum horizontal clearance from track centerline to fixed objects (other than catenary poles) could vary from 6 feet to 7 feet 6 inches. Additional clearance is added for curves and superelevation.

Minimum vertical clearance is not stipulated. While diesel electric light rail vehicles are proposed, for electrified light rail, the minimum vertical clearance is a function of the "lock down" height of the pantograph arm. This is typically about 13 feet above top of rail. At street crossings, G.O. 95 requires a minimum wire height of 19 feet 6 inches. The only vertical obstruction along this segment is the SR 1 off-ramp to Del Monte Avenue overcrossing, which has sufficient vertical clearance.

CPUC G.O. 143-B contains requirements for maximum authorized speed of light rail vehicles, based on train protection (signals or operating rules) and the configuration of the track with respect to adjacent streets. The maximum speeds based on track configuration (alignment classification) are summarized in Table 4-3.

For operation without signals, some sort of train control is required. In the absence of block signals, cab signals, timetable, train order, current of traffic, or manual block system; speed is restricted to 25 mph or less.

FEDERAL RAILROAD ADMINISTRATION

The Federal Railroad Administration has rules and regulations that govern operation on railroads, track maintenance and train control signals, as well as requirements for equipment (brakes, couplers, hand rails, etc.) and reporting requirements for grade crossing signals. Federal Railroad Administration regulations are contained in the Code of Federal Regulations, Volume 49, Chapter II, Parts 200–266. The principal regulations relevant to

[4] Light rail vehicles are defined in G.O 143 as being electrically propelled. So, in principle, there are no regulations for non-FRA-compliant DMUs in California. It is presumed that G.O. 143-B will apply to DMUs.

Table 4-3
MAXIMUM PERMITTED SPEEDS FOR LIGHT-RAIL TRANSIT SYSTEMS

Alignment Classification	Location	Crossing or Intersection Control	Train Control	Maximum Speed
Fenced right-of-way with at-grade crossings	Between crossings		ATP and ATS*	No limit
			ABS	55 mph
			None required	45 mph
	At crossings	Flashing lights and gates	Same as between crossings	
		Traffic signal or other device (may) be authorized only in special locations	None required	35 mph
Street median or side alignment with 6-inch curb and fence	Between crossings		None required	Parallel traffic + 10 mph, but 45 mph maximum
	At crossings	Flashing lights and gates (side alignment only)	Same as between crossings	
		Traffic signal or other approved device	None required	Parallel traffic, but 35 mph maximum
Street median or side alignment with 6-inch curb		Traffic signal or other approved device	None required	Parallel traffic, but 35 mph maximum
Mountable curb or transit lane		Traffic signal or other approved device	None required	Parallel traffic, but 35 mph maximum
Pedestrian mall		Traffic signal or other approved device	None required	20 mph (lower speed may be required for malls paved flush with tracks)

Source: CPUC G.O. 143-B, Table 1
*ATP = automatic train protection; ATS = automatic train supervision

the proposed passenger rail service are Part 213, Track Safety Standards, Part 236, which deals with rules related to train control signals (as opposed to grade crossing signals), and Part 238, vehicle safety requirements.

Part 238.405 (b) requires a car to resist a minimum longitudinal static compressive force of 800,000 pounds without permanent deformation of the car. This requirement effectively precludes any light rail vehicle or any of the DMUs used in Europe or other countries from running on conventional railroad tracks, except under what the Federal Railroad Administration calls “time separation,” where there is no concurrent operation of conventional railroad and non-compliant equipment. Until recently, the last compliant DMUs were manufactured in the 1950’s. There are a few of these, known as “Budd” cars, still around. The Colorado Railcar Manufacturing LLC (purchased by US Railcar in 2009) has recently developed an FRA-compliant DMU, and its first units have been placed into service as part of a Federal Transit Administration grant in Florida. So there is, at the moment, the reality of a compliant DMU which could be used for the Monterey Peninsula rail service.

Part 213 establishes classes of track on the basis of the condition of the rails, ties and subgrade. Maximum allowable speeds are established for each class of track as shown in Table 4-4. For the proposed service, a maximum speed of 60 mph is adequate. A Class 3 track will therefore need to be maintained.

It is important to keep in mind that the Track Safety Standards are basically maintenance requirements. When the condition of a track falls below the standard established for a particular class of track, then the maximum operating speed along that section of track must be reduced until the condition of the track is improved. The tolerances and track conditions specified in the Track Safety Standards are much less restrictive than normal construction specifications. If a track were to be constructed to the tolerances specified for a particular class of track, then it would immediately fall into a lower class as soon as operation started. As a practical matter, any new track would conform to a Class 6 or higher track using typical track construction specifications.

Part 236 of the Federal Railroad Administration regulations establishes requirements for train control signaling; that is, signals which keep trains a safe distance apart from each other on the same track. This regulation establishes requirements for different types of signals depending on the maximum authorized speed. For passenger train speeds of less than 60 mph, or freight train speeds of less than 50 mph, no signals are required.

CALIFORNIA DEPARTMENT OF TRANSPORTATION

The California Department of Transportation (Caltrans) Division of Rail is responsible for disbursing railroad operating and capital improvement funding. They have established standards and specifications for railroad related facilities such as Amtrak stations which they fund. A document entitled *Standard Caltrans/Amtrak Specifications for Unstaffed Amtrak Stations in California*, dated March 1994, states that, “The minimum standard length of platform shall be 800 feet. Longer or shorter platforms will be constructed on an exception basis.” At this conceptual design stage, based on the train service options identified to date, the platform length does not need to conform to this standard, even if Amtrak operates the Monterey intercity passenger rail service at some time in the future.

At SR 183 in Castroville and Canyon Del Rey Boulevard (SR 218) in Seaside, Caltrans standards for the design and construction of the grade crossing road work and signals will need to be followed. Modifications to the traffic signalization at Monterey Road and the SR 1 interchange ramps at Fremont Boulevard will also need to conform to Caltrans standards.

LOCAL JURISDICTIONS

The project is located within the incorporated cities of Marina, Sand City, Seaside, and Monterey as well as unincorporated areas of Monterey County to include the Castroville community. Each of these entities will have standards for road construction that will apply to grade crossing and related street, sidewalk, drainage, and utility work. Permits from these governments will be required for station and related site work within their jurisdiction. The California Coastal Commission, the Fort Ord Re-Use Authority, and the State of California Department of Parks and Recreation will also need to be consulted regarding proposed stations and maintenance facilities in the Fort Ord area.

Table 4-4
CLASSES OF TRACK; OPERATING SPEED LIMITS *(mph)*

Track Class	Maximum Allowable Speed for	
	Freight Trains	Passenger Trains
1	10	15
2	25	30
3	40	60
4	60	80
5	80	90
6		110
7		125
8		160
9		200

Source: CFR Vol. 49, Article 213.9 and 213.307

Design Criteria

There are several sources of standards and criteria that will be applicable to the restoration of passenger rail service to the Monterey Peninsula. A brief listing and description of the main sources is given below. Specific criteria would need to be established at the beginning of preliminary engineering.

AMERICAN RAILWAY ENGINEERING AND MAINTENANCE OF WAY ASSOCIATION

The American Railway Engineering and Maintenance of Way Association (AREMA), *Manual for Railway Engineering*, is a compendium of criteria and standards that are generally followed in the railroad industry. A companion volume, *Portfolio of Trackwork Plans*, has details for track construction which are applicable to this project. Both of these volumes are updated annually, with minor revisions. The American Railway Engineering and Maintenance of Way Association also publishes a *Signal Manual* that contains standards for grade crossing signal devices.

FEDERAL HIGHWAY ADMINISTRATION

The Federal Highway Administration *Manual on Uniform Traffic Control Devices* establishes standards for street signing and pavement marking, including railroad-highway grade crossings.

AMERICAN WITH DISABILITIES ACT

The Americans with Disabilities Act and subsequent regulations have established criteria and standards for handicapped accessibility. Recreation trail, station, and parking lot design must conform to these standards. As noted above, the interpretation of the Americans with Disabilities Act requirements as applied to platform boarding may be an issue with FRA-compliant equipment.

RAILROADS

Individual railroads each have their own design and construction criteria and engineering standards. Amtrak has its own standards for stations. The Peninsula Corridor Joint Powers Board has generally adopted former Southern Pacific Transportation Company standards as its own. The individual railroad standards generally conform to the American Railway Engineering and Maintenance of Way Association standards with slight variations. With the Transportation Agency for Monterey County ownership of the branch line, there would be no requirement to follow a particular railroad standard for the FRA-compliant service. For light rail or non-compliant DMU, there are numerous transit agencies in California whose standards could be adopted.

Physical Improvements

This section describes the types of construction and modifications to existing facilities that will be required for the restoration of passenger rail service to the Monterey Peninsula.

TRACK

Except for approximately two miles of track in the former Fort Ord area, the existing track is unusable. New, ballasted track construction with 115 pound continuous welded rail is needed. Ties could be either timber or concrete, as the prices are similar, and can be determined during the design phase. Based on field observations, it appears that where the new track is on the existing alignment, the existing ballast can be re-used as subballast, with cleaning and some additional material added. Some geotechnical analysis will be needed during the design to determine the amount and gradation of the additional material.

Ballasted track would be constructed on all timber trestles. For the Salinas River Bridge, the track on the existing bridge would be open deck (timber bridge ties fastened directly to the steel cross members, as they are now). For track on a new bridge, ballasted track is assumed.

For the segment of track north and east of Contra Costa Street in Seaside, track restoration would follow the original branch line alignment except for implementation options which require the construction of a new Salinas River Bridge. **(Repair of the existing bridge is the locally preferred option.)** Southwest of Contra Costa Street, the track will run in its former location to just west of Roberts Avenue in Monterey. It will use the existing bridge over the Roberts Lake estuary which was designed and constructed for railroad loading when the Southern Pacific Transportation Company still owned the line. A new pedestrian bridge will be constructed for the recreation trail south of the existing bridge. The track will pass between two columns which support the northbound off-ramp from SR 1 to Del Monte Avenue. After passing under the SR 1 overpass, the track will be run adjacent to Del Monte Avenue on an alignment slightly south of the original trace.

West of Casa Verde **Way**, there is just enough space for the track to fit between the back of the bus stop sidewalk and the recreation trail. Between Casa Verde **Way** and Sloat Avenue, the track alignment will be set to avoid large trees and encroachment on the sand dunes. West of Sloat Avenue, the alignment has been shifted to the south to avoid a tree line adjacent to the recreational trail and to utilize available right-of-way. **An alternative alignment would shift the track to an alignment immediately adjacent to Del Monte Avenue, on lands to be acquired by the City of Monterey for the purpose of widening Del Monte Avenue and constructing a surface parking lot for the Window on the Bay park**. West of La Playa/**Park** Avenue, an alignment running adjacent to Del Monte Avenue to a station platform west of Figueroa Street or an extension to the Monterey Maritime Museum at **Custom House** Plaza is proposed.

Yard track, essentially the same as new track, would be constructed for storage and layover. Storage of local service trains would be on lands of the former Fort Ord quartermaster facilities, located east of SR 1**, or west of SR 1 on TAMC lands previously used as a trailer/tank on flatcar loading ramp for Fort Ord military equipment**.

SPECIAL TRACKWORK

Special trackwork (turnouts, diamond crossings, derails) would be constructed along the route. Turnouts will be constructed at passing sidings and junctions of the branch line with the main line in Castroville. For unsignaled operation, turnouts at passing sidings would have spring switches. With this type of switch, the switch point rails are held in position by a spring with a damper mechanism. When a train approaches the turnouts facing the switch points (facing point move), the train is diverted to the track to which the points are aligned. When a train approaches from the other direction (trailing point move), the flanges of the wheels force the switch points to open, and the damper retards the points from closing to allow train to pass through. This type of operation works when the facing point movement is always to the same track. The points can always be manually switched to allow facing point moves to the other track, but this is not normally necessary for passing operations.

For turnouts where facing point movements to either track are required, such as at the Fifth Street turnout to the maintenance and storage yard, a push-button operated switch machine is proposed. The train operator would stop before the turnout and throw the switch points to the correct position if necessary prior to proceeding through the switch.

For the compliant DMU intercity passenger service alternatives, the turnout to the branch line at the Castroville station would be motorized and remotely controlled in the same manner as the turnouts from the main line.

In Monterey, special trackwork would be required for the section running parallel to the Window on the Bay to minimize visual impacts of the rail restoration. A photosimulation of the “lawn track” proposed for this section is illustrated on Figure 4-2. Alternative design treatments will be explored during the **Preliminary Engineering** phase of design refinement.

Figure 4-2
Light Rail Transit Lawn Track

CIVIL

Civil works include miscellaneous street and traffic signals, earthwork, drainage and utility relocation associated with the project. The reconstruction of the bicycle/pedestrian trail in Monterey is included in this category.

Street improvements consist of **adding right turn lanes and security fencing or** guard rail at specific locations shown on the drawings. **Local circulation improvements will be constructed at the Highway 1/Fremont Boulevard interchange to improve traffic level of service and allow LRT vehicles to cross Monterey Road at grade, without need for a grade separation structure over or under Monterey Road. These improvements are illustrated on Figure 4-3 and are described in the *Traffic Impact Report for the Monterey Peninsula Fixed Guideway Corridor Study*, September 2010 update. Additional, minor geometric changes will be needed at the intersection of SR 183/Del Monte Road in Castroville to address California Public Utility Commission safety concerns.**

Traffic signals at intersections adjacent to grade crossings of the track or busway will be pre-empted to allow traffic to clear the crossings. In most cases, this involves adding preemption to existing traffic signals. New signals with pre-emption would be constructed at Roberts Avenue in Monterey.

Very little earthwork other than grading is anticipated for this project.

Pedestrian facilities include walkways, trail reconstruction, and fences as shown on the drawings.

The existing recreation trail southwest of Canyon Del Rey Boulevard will be used as much as possible in conjunction with and adjacent to the restored rail line. (See **Figures 4-4** through 4-6 for illustrative views of the track restoration adjacent to the recreation trail.) The recreation trail will be reconstructed at various locations where its current location conflicts with the proposed railroad track alignment. The locations of the relocated segments of the recreation trail were selected to minimize grade crossings of the track. Between Canyon Del Rey Boulevard and Roberts Avenue, the existing trail is located between the railroad right-of-way and Del Monte Boulevard. The trail crosses over the estuary to Roberts Lake on a concrete bridge that is located along the former railroad track alignment. A new pedestrian bridge will be constructed over the estuary south of the railroad, and the existing bridge will be used for the new railroad track.

The trail will cross to the north side of the railroad track at Roberts Avenue, where a new signalized grade crossing is proposed. From Roberts Avenue to the west end of the recreation trail at Camino Estero, the trail generally meanders across the alignment proposed for the railroad track. The trail will be reconstructed where necessary so that the trail remains on the north side of the new track.

There are a few places where access paths to the recreation trail will cross the fixed guideway. At Casa Verde Way, there are two paths, one on each side of the street, which are proposed to be closed so that pedestrian traffic will be channeled to the sidewalks on Casa Verde Way, which will be controlled by a grade crossing signal and gates. At Sloat Avenue, there are two forks to the pedestrian path from Del Monte Avenue. One of these forks will be closed to minimize the number of grade crossings. Pedestrian grade crossing warning signals will be installed at all the remaining crossings.

The trail would be generally at the same level as the light rail transit tracks. At two locations, one just west of the SR 1 overpass and the other just west of Palo Verde Avenue, the trail would be elevated to avoid excavation into the adjacent sand dunes on the north side of the right-of-way. (See Figures 4-7 and 4-8 for illustrative cross sections of the track restoration and elevated recreational trail.)

Figure 4-3
Highway 1/Fremont Boulevard Interchange Local Circulation Improvements *(Alternative B)*

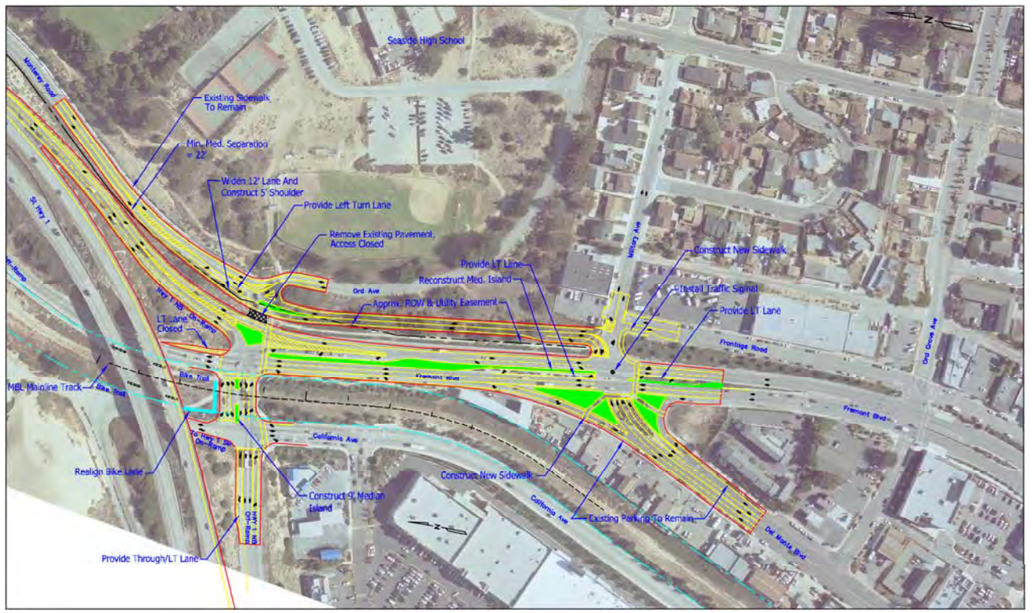
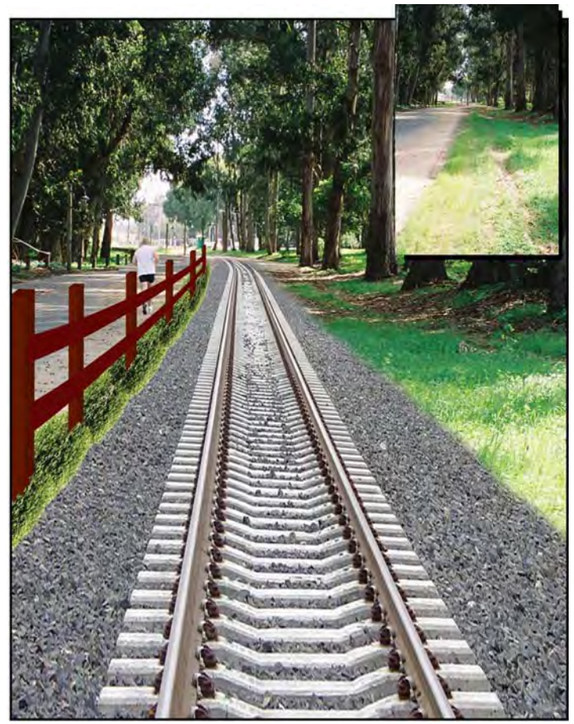


Figure 4-4
Artist Rendering: Southwesterly View at Route 1 Off-Ramp *(Station 702+00)*

Figure 4-5
Artist Rendering: Westerly View at Casa Verda Way *(Station 724+50)*

Figure 4-6
Artist Rendering: Easterly View toward Naval Post Graduate School Gate
(Station 754+00)



Very little drainage improvements other than the replacement of the four remaining timber trestles and the improvements to or replacement of the Salinas River Bridge are needed. Drainage facilities are assumed to include cross drains or culverts between Tioga Street and Canyon del Rey Boulevard and the inclusion of an underdrain in areas where the adjacent ground is flat. **A drainage study of the corridor is included in Chapter 9 of this document.** Chapter 9 **also** includes an inventory of known or potential utility conflicts to be addressed by the project or utility providers.

GRADE CROSSINGS

As discussed earlier, the California Public Utilities Commission has jurisdiction over the installation of highway-railroad grade crossings, including pedestrian crossings. A permit is needed from CPUC to install or modify any public grade crossing. The CPUC determines what types of grade crossing warning devices are to be installed. Although a grade crossing warning device can be a sign (CPUC Standard No. 1), there are two basic types of warning devices that are currently being approved by the CPUC:

- Flashing lights and bells mounted on a pole adjacent to the road in each direction (Standard No. 8)
- Flashing lights, bells and automatic gates mounted on poles adjacent to the road in each direction (Standard No. 9).

Figure 4-7
Typical Section Opposite Palo Verde Avenue *(approximately 500± east of treatment plant driveway)*

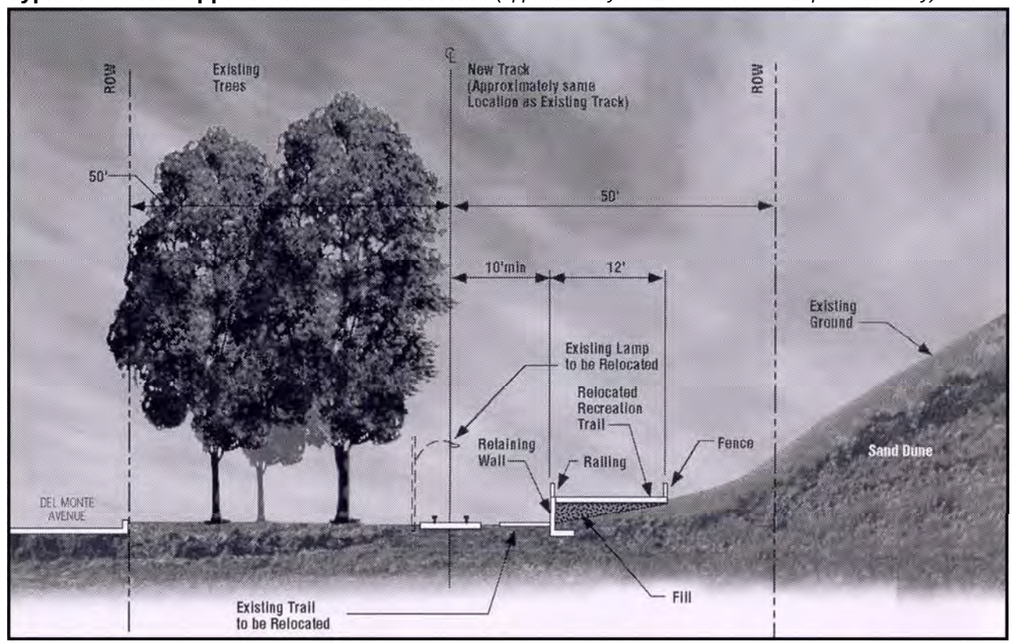
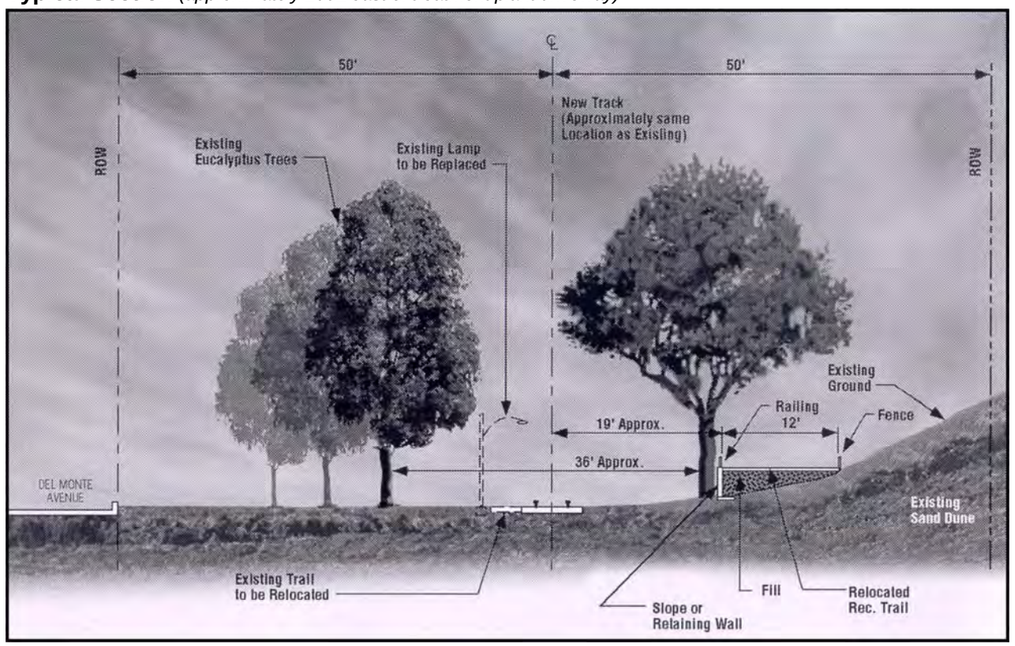


Figure 4-8
Typical Section *(approximately 100± east of treatment plant driveway)*



With each type of installation, a cantilever arm with flashing lights extending over the roadway above traffic can be added. When this is done, the suffix "A" is added to the type of installation. A 9-A installation would therefore consist of flashing lights and automatic gates with a cantilever arm. Cantilever arms are usually installed on multi-lane roads (more than one lane in each direction), but the CPUC may require cantilevers even on single-lane roadways as an added warning measure.

Pedestrian-only grade crossing warning devices usually consist of a post with a flashing light and bell (Standard No. 10). Gates are available for pedestrian crossings, but they are generally not used as people can duck under them or go around them, and they pose a risk of trapping handicapped people on the wrong side of the gate.

Private crossings are not under the jurisdiction of the CPUC. The types of grade crossing warning devices at private crossings are usually established by negotiations between the railroad and the party owning the road.

Grade crossing warning devices that will be required for this project are summarized in Table 4-5. Except as noted, each crossing would be constructed with a high durability pre-cast concrete crossing surface.

Chapter 9 of this report includes intersection layouts illustrating the location and type of grade crossing protection devices, traffic signalization, signing, and pavement markings.

STRUCTURES

Major bridge work including the Salinas River Bridge and the replacement of the five timber trestles to the east is described in the *Bridge Strategy Report for the Monterey Branch Line* dated July 2005**, updated in May 2010**.

STATIONS

Stations will be constructed at locations shown on the drawings and identified in Table 4-6. Figure 4-1 illustrates the approximate location of all proposed branch line stations, while Figures 4-9 through **4-20** illustrate the proposed location of station platforms in Castroville, Marina, Seaside**,** Sand City **and Monterey**. Each station would consist of a low-level platform[5] with passenger amenities.

At the two stations in the Fort Ord area at Eighth Street and First Street, vertical transportation will be needed to the adjacent streets. A staircase and an elevator are assumed at each location.

Park-and-ride lots are proposed for construction at the stations identified in Table 4-6. The size of each lot would be based on the projected demand at each station. Specific locations have been conceptually identified. Bicycle and walk access to the proposed stations would be strongly encouraged and supported with bicycle storage lockers and pedestrian walkway access improvements.

SYSTEMS

The Phase I Marina to Monterey implementation scenarios are planned to run without train signals. Trains would be diverted to passing sidings with spring switches as described under Special Trackwork. Some signals will be needed at track junctions and crossings, and between Marina and Castroville in Phase II to permit higher speeds. The signals proposed would consist of wayside signal masts at the specific locations described in Special Trackwork. At motorized turnouts, the signals would display the orientation of the switch points as set by the operator using the wayside push buttons.

[5]Low level means 8 inches above top of rail for FRA-compliant vehicles, or up to about 23 inches above top of rail for non-compliant equipment not governed by CPUC G.O. 26-D.

Table 4-5
GRADE CROSSING WARNING DEVICES

MP	Crossing Street	Type of Device	Comments
107.30 (Coast Main Line)	Blackie Road	Existing devices and controller to remain	Relocate gates and add detector for new branch line track crossing.
110.80	SR 183	No. 9-A	
112.50	Nashua Road	No. 9	
113.80	North Dole	No. 1-X, R1-1	
114.07	South Dole/Ranch Access	No. 1-X, R1-1; TBD for ranch access	
114.30	Del Monte Avenue	No. 9-A	
114.64	Private Driveway	No. 1-X, R1-1	Asphalt concrete crossing surface
115.04	Lapis	No. 1-X, R1-1	
116.00	Marina Green Drive (formerly Diane Avenue)	Replace gates (No. 9)	Existing pedestals, controller and concrete panels to remain. Extend track circuits. Crossing may be relocated. Pre-empt traffic signal at Del Monte Boulevard.
116.50	Beach Road	No. 9 NB, No. 9-A SB	Pre-empt traffic signal at Del Monte Boulevard
116.90	Reservation Road	No. 9	Pre-empt traffic signal at Del Monte Boulevard
117.30	Palm Avenue	No. 9 NB, No. 9-A SB	Pre-empt traffic signal at Del Monte Boulevard. Add cantilever lights to ocean side approach.
119.50	Bicycle and pedestrian path	No. 1-D, R1-1	
119.00	Eighth Street Station	No. 1-D, R1-1	Pedestrian crossing
122.20	Monterey Road (formerly Ord Avenue)	No. 9-A EB, No. 9 WB	Pre-empt traffic signals at Fremont Boulevard and California Avenue
122.60	Playa Avenue	No. 9	Extend track circuits. Pre-empt traffic signal at Del Monte Boulevard
122.80	Tioga Avenue	No. 9-A	Pre-empt traffic signal at Del Monte Boulevard
122.92	Granite Rock	No. 8, No. 1-X on mast	
123.37	Contra Costa Street	No. 9	Pre-empt traffic signal at Del Monte Boulevard
123.38	Olympia Avenue	No. 9	May need supplementary signal with pre-emption at Contra Costa Street
123.60	Canyon Del Rey Boulevard	No. 9 NB, No. 9-A SB	Pre-empt traffic signal at Del Monte Boulevard. Widen median for center gates.
123.80	Roberts Avenue	No. 9	New pre-empted traffic signal at Del Monte Avenue. Recreation trail crosses at this location.
123.90	Bicycle and pedestrian path	No. 8, No. 1-X on mast	Recreation trail access from English Avenue
124.20	Maris driveway	No. 1-X, R1-1	Exit only from property to Del Monte Avenue. Close driveway.
124.30	Casa Verde Way	No. 9 NB, No. 9-A SB	Pre-empt traffic signal at Del Monte Avenue. Access to recreation trail will be on sidewalks.
124.60	Treatment Plant driveway	No. 1-X, R1-1	Private crossing
125.00	Pedestrian Trail	No. 1-D, R1-1	Recreation trail access from Sloat Avenue
125.20	La Playa Avenue	No. 9	Pre-empt traffic signal at Del Monte Avenue
125.50	Camino El Estero	No. 1-D, R1-1	Recreation trail crossing
125.70	Figueroa Street	No. 9-A NB, No. 9 SB	Pre-empt traffic signal at Del Monte Avenue
125.80	Washington Street	No. 9	Pre-empt traffic signal at Del Monte Avenue

Table 4-6
POTENTIAL FIXED-GUIDEWAY TRANSIT STATIONS/STOPS

Station	City	Stop Location	Approximate Platform Location	Distance to Adjacent Station (miles)	Parking
1. Blackie Road	Castroville	North of crossing	5661 + 50		Yes
				5.32	
2. Marina Station	Marina	North of Marina Green Drive	275 + 50		Yes
				0.54	
3. Beach	Marina	North of Beach Road	304 + 00		**Yes**[1]
				0.57	
4. Reservation	Marina	South of Reservation Road	334 + 00		**Yes**[1]
				0.37	
5. Palm	Marina	South of Palm Avenue	353 + 50		Yes[1]
				1.70	
6. Eighth Street	Marina	Eighth Street	443 + 00		Yes
				0.58	
7. First Street	Seaside	North of First Street	**473 + 00**		No
				2.90	
8. Playa	Seaside/Sand City	North of Playa Avenue	626 + 50		Yes
				0.87	
9. Contra Costa	Seaside/Sand City	West of Contra Costa Street	672 + 50		No
				0.89	
10. Casa Verde	Monterey	East of Casa Verde Way	720 + 00		Yes
				0.68	
11. USN Postgraduate School	Monterey	**At Sloat Avenue**	**756 + 00**		**Yes**[2]
				0.75	
12. Figueroa	Monterey	West of Figueroa Street	795 + 50	or	**Yes**[2]
or		or		**0.83**	
12. **Custom House** Plaza		At Maritime Museum	800 + 00		**Yes**[2]

[1] Pick up and drop off
[2] City owned public parking

Automatic block signaling (ABS) is an optional item for Phase I operation between Marina and Monterey, as it is not necessary for accommodation of the operating schedule. ABS is the simplest form of railroad signals and consists of wayside signals activated by track circuits to prevent trains from getting too close to each other. This does not replace procedures for authorizing trains to occupy segments or blocks of track, similar to an unsignaled railroad. As discussed in Chapter 7, ABS signals are proposed for the Castroville to Marina segment, where higher speeds (55 mph) are required to meet the operating schedule. Signaling may also be required through the Fort Ord segment to reduce travel times under the 10-minute headway operating scenario.

No elaborate communications systems are planned for the Monterey Peninsula service. Communications between a dispatcher and the cab operators would be via two-way radio or cell phone.

A light maintenance and inspection facility for local passenger rail service would be constructed near the Fort Ord quartermaster warehousing area **east of SR 1, or near the Fort Ord balloon track on the trailer on flatcar (TOFC) siding west of SR 1**. For intercity service, a layover facility for inspection and very minor maintenance, such as cleaning, could be constructed at the Fort Ord balloon track.

NextBus technology or an equivalent automatic vehicle location system is planned. NextBus is a system that keeps track of vehicle locations and conveys anticipated arrival times to individual stations. The system consists of a central computer operated and maintained by NextBus, on-board transmitters so that GPS satellites can track the locations of vehicles, and station-mounted message boards. Data is transmitted via the internet.

RIGHT-OF-WAY

Some property will need to be acquired as part of the project, depending on implementation phase. Property would be acquired for park-and-ride lots **and local circulation improvements**, or could be furnished by land development projects such as the Marina Station mixed use retail and housing entitled development north of Marina Green Drive**, and the Del Monte Avenue widening project in downtown Monterey**.

Figure 4-9
Blackie Road, Castroville Light Rail Transit Station Location *(Phase II)*

Figure 4-10
Marina Station/Marina Green Drive, Marina Light Rail Transit Station Location

Figure 4-11
Beach Road, Marina Light Rail Transit Station Location

Figure 4-12
Reservation Road, Marina Light Rail Transit Station Location

Figure 4-13
Palm Avenue, Marina Light Rail Transit Station Location

Figure 4-14
Eighth Street, Marina Light Rail Transit Station Location

Figure 4-15
First Street, Seaside Light Rail Transit Station Location *(Phase II)*

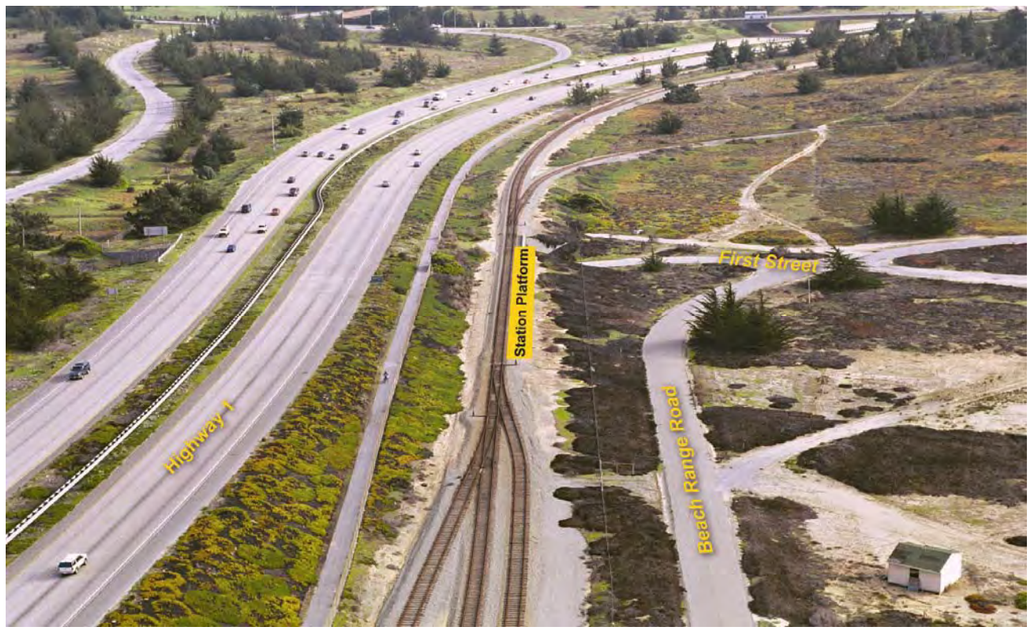


Figure 4-16
Playa Avenue, Seaside/Sand City Light Rail Transit Station Location

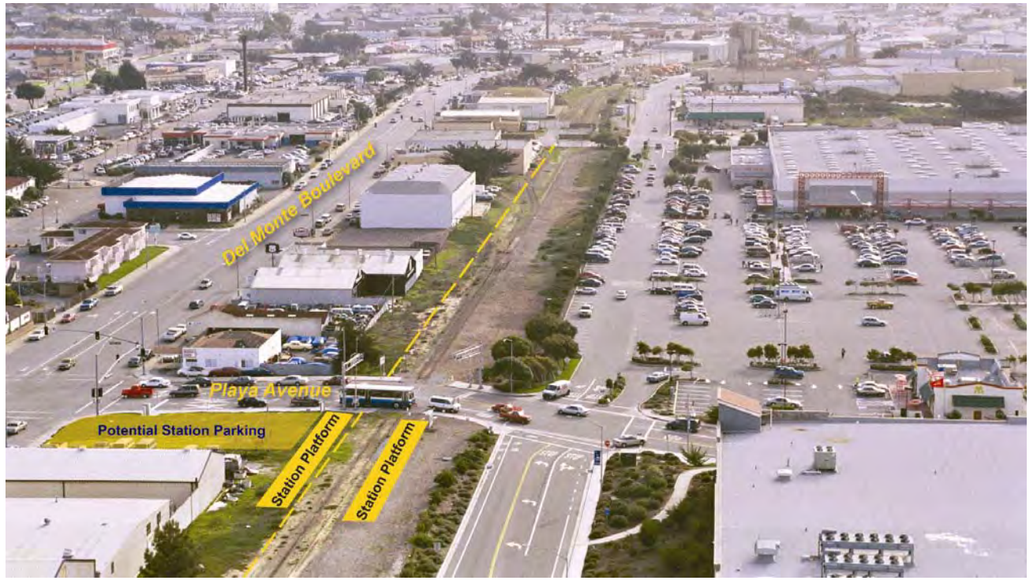


Figure 4-17
Contra Costa Street, Seaside/Sand City Light Rail Transit Station Location

Figure 4-18
Case Verde Way Light Rail Transit Station Location

Figure 4-19
Naval Postgraduate School Light Rail Transit Station Location

Figure 4-20
Downtown Monterey Light Rail Transit Station Location at Custom House Plaza

5 Transit Station Design Guidelines and Architectural Concepts

5. Transit Station Design Guidelines and Architectural Concepts

Introduction

This section summarizes design guidelines to be applied in the conceptual engineering of transit stations for the Monterey Peninsula Fixed Guideway *Project Approval/Environmental Document*. The focus is on the architectural program requirements of stations and station amenities.

This section is a companion to Chapter 4, Conceptual Plan for Fixed-Guideway Restoration, which documents preliminary criteria guiding the design of transit facilities associated with implementing the Locally Preferred Alternative modal option (light rail transit).

Station Types and Design Basis

For the purpose of refining the conceptual designs, light rail transit stations would be open and consist of a platform with entries and exits, a shelter with windscreens, lighting, ticketing equipment and various patron amenities.

The prototypical stations are based on a set of design criteria formulated on basic assumptions about site conditions, transit vehicles, traffic flow, street configurations, and pedestrian access. Although a variety of conditions exist along the Monterey Branch Line corridor, the station prototypes are adaptable to specific sites and conditions with minor modification. All station types include a preliminary list of amenities to be used with appropriate discretion during the process.

The design and construction of public transit stations are subject to several state and national codes and statutes. Compliance with these codes and statutes in the development of the station models ensures a high degree of public safety and affords accessibility for all transit patrons. Of the several codes and statutes applicable to this study, the primary ones include:

- California Building Code (CBC-1998)
- California Title 24
- Americans with Disabilities Act *Accessibility Guidelines for Buildings and Facilities*
- U.S. Department of Transportation guidelines for major capital investments
- National Fire Protection Association documents such as NFPA 101 and NFPA 130
- State of California Public Utilities Commission General Order 143-A

Assumptions and Design Guidelines

An important element influencing station design is the type of transit vehicle. Light rail transit stations would be served by manually operated vehicles running along a standard gauge fixed-guideway. A variety of vehicles that share a number of defining characteristics are available for this type of service application. A prototypical light rail transit vehicle has been assumed which incorporates desired features from available (and proven) light rail technologies in the U.S. and abroad. A detailed vehicle specification, or requirement, has not been established. The vehicle architecture has been purposely left open to consider various advanced design vehicles which add to the convenience and attractiveness of the proposed transit improvements.

Similarly, station architecture has been kept open and flexible to accommodate desired flexibility in the —design vehicle." The guidelines presented need to be viewed with these issues in mind. The guidelines are preliminary, in line with the conceptual nature of the transit improvements at this Project Approval/ Environmental Document phase of program development.

Vehicle and Station Design Standards

LIGHT RAIL TRANSIT VEHICLE

- Articulated, low- to mid-floor light rail vehicle, approximately 103 to 135 feet in length; 112 to 118 inches in body width; 12 to 14 feet in height (top of rail to top of roof equipment)
- Minimum door width of 50 inches, minimum two per side, both sides of vehicle
- Floor height above top of rail (unloaded vehicle) 22 inches
- Bridge plate option to cover floor-platform gap at station, meet requirements of 36 CFR part 1192 or 49 CFR part 28; maximum horizontal gap of 3 inches
- Seated capacity of 90 to 136; total capacity (normal) of 184 to 226 persons
- Maximum consist size of two vehicles
- Fare collection off-vehicle; validation option on-vehicle only

For the purpose of conceptual planning and cost estimating, a Stadler GTW 2/6 light rail diesel–electric multiple unit vehicle is assumed. A Siemens AG Transportation Systems "Desiro" diesel multiple unit vehicle is assumed as the alternative.

CORRESPONDING LIGHT RAIL TRANSIT STATION GUIDELINES

- Station length 255 feet including ramps
- Platform height approximately 22 inches above top of rail (which in paved sections is essentially at pavement surface)
- Side platform width of 15 feet; center platform width of 20 feet
- Distance from track centerline to edge of platform is 5 feet 0 inches or less, depending on vehicle selection. To accommodate the dynamic envelope of intercity rail vehicles, a centerline of track to edge of platform spacing of 5 feet 4 inches may be required. Providing for this flexibility will require the platforms to be equipped with retractable platform extenders.

INTERCITY RAIL VEHICLE

- No FRA-compliant intercity rail vehicle has been identified as meeting local (Monterey Peninsula) community acceptance requirements for size, mass, and noise.

For the purpose of conceptual design, single level diesel multiple unit pairs (power plus trailer car) by US Railcar LLC (formerly Colorado Railcar Manufacturing, LLC) are assumed.

STATION AMENITIES

- Ticket vending machines and validators; minimum of one each per side platform (two ticket vending machines desirable at busiest stations) and two each per center platform.
- Passenger information kiosk/flags with (a) active data display and audio capability as required by the Americans with Disabilities Act indicating train arrival time (real time) and other limited information, and (b) display space for other passenger static information such as maps or schedules.
- Windscreens, canopy shelters, and benches for limited seating
- Americans with Disabilities Act access and tactile warning bands
- Phone/intercom as required at major transfer station/transit center (an option at less busy stations)
- Lighting, trash receptacles

- Protective railings where required or appropriate for safety
- Space allowance (e.g., cabinets, cases, duct banks, etc.) for electrical and communications systems [not shown on prototypes]
- If space is available, bike lockers at or adjacent to stations [not shown on prototypes]
- Landscaping an option where space available [not shown in prototypes]
- Some items are optional and may not be required at all stations.
- All platform amenities and structures are located so that there is no interference with the dynamic envelope of the vehicles. The centerline of track for the light rail transit is assumed to be 5 feet 0 inches from the edge of platform. In addition, no catenary poles are located on the platforms or ramps.
- The station design assumes a pedestrian ramp maximum slope of 1:20 (5.0 percent). The maximum slope allowed by code and the Americans with Disabilities Act guidelines is 1:12 (8.33 percent). It is assumed that the top of the ramp at the platform is 22 inches above the top of rail for light rail transit stations. For the light rail station, the bottom of the ramp is assumed to be 12 inches above the top of rail and connected to a down sloping sidewalk. This situation requires a ramp length of 20 feet. Since only one of the two means of egress is required to be accessible, stairs may be used at the opposite end of the platform; however, ramps are shown on the prototypes.
- All pedestrian transitions are from one side of the street directly to the other and occur only at street intersections. No flares are assumed at the crosswalk ends of ramps, since vehicular traffic does not actually flow across the ramp or end-of-ramp area.

Codes, Station Access, and Fire and Life Safety

Several codes and statutes govern the design of public transit facilities. For the purposes of alternative definition, certain salient points from these codes and statutes are listed below and provide explanation for elements and conditions integrated into the prototypical station designs. A number pertain to the Americans with Disabilities Act accessibility requirements.

GENERAL

- Station platforms are "Group A" occupancy.
- Station platforms are "at-grade opens stations."
- Construction types allowed for open transit stations are Type I, Type II-FR or Type II-One Hour.
- Stations shall have at least two exits. All accessible spaces shall be provided with, at minimum, one accessible means of egress.
- At-grade open stations need not provide emergency lighting or exit signs.
- No automatic sprinklers are required for open stations.
- The top of guardrails shall not be less than 42 inches in height. Open guardrails shall have intermediate rails or ornamental pattern such that a sphere 4 inches in diameter cannot pass through.
- Bridge plates must meet the requirements stated in 36 CFR Part 1192 or 49 CFR Part 38. The maximum horizontal gap between vehicle and edge of platform is 3 inches.

STAIRWAYS

- A stairway shall have two or more risers.
- The rise of stairs shall not be less than 4 inches or more than 7 inches. The greatest riser height shall not exceed the smallest by 3/8 inch.
- The run of stairs shall not be less than 11 inches. The largest tread shall not exceed the smallest by more than 3/8 inch.
- Stair width shall be a minimum of 44 inches.
- Stair handrails shall be 34 to 38 inches above the nosing of the treads. Handrails shall extend a minimum of 12 inches beyond the top nosing and 12 inches, plus the tread width, beyond the bottom nosing.
- Stairs shall not be part of an accessible route.

RAMPS

- Ramps located within an accessible route shall not be steeper than one unit vertical in twelve units horizontal (8.33 percent slope).
- Ramps having an occupant load of 300 or more shall have a minimum clear width of 60 inches.
- Bottom landings shall have a dimension in the direction of the ramp run not less than 72 inches. Bottom landings are at least as wide as the required ramp width.
- Handrails are required on ramps that provide access if slope exceeds 1 foot rise in 20 feet of horizontal run (5 percent slope). Where required, handrails shall be placed on each side of each ramp, shall be 34 to 38 inches above the ramp surface and shall extend a minimum of 1 foot beyond the top and bottom of the ramp.
- Handrails are not required on ramps with less than a 6 inch rise or 72 inches in length.
- Ramps open on one or both sides shall have guardrails.
- Wheel guides are not required on ramps less than 10 feet in length. The cross slope of ramp surfaces shall be no greater than 1 unit vertical in 50 units horizontal (2 percent slope).
- Outdoor ramps will not accumulate water on walking surfaces.

DETECTABLE WARNINGS

- Transit platform edges bordering a drop-off and not protected by platform guardrails shall be provided with detectable warnings. Transit boarding platforms shall have a detectable warning texture 24 to 36 inches in width extending the full length of the loading area.
- At transit boarding platforms, the pedestrian access shall be identified with a detectable directional texture. The width of the directional texture shall be equal to the width of the transit vehicle door opening. The depth (i.e., length from edge of platform) of the texture shall not be less than 36 inches.
- If a walk crosses or adjoins a vehicular way, and the walking surfaces are not separated by curbs, railings or other elements between the pedestrian and vehicular areas, the boundary between the areas shall be defined by a continuous detectable warning band 36 inches wide.

SIDEWALKS

- Sidewalks shall be a minimum of 48 inches in clear width.

WHEELCHAIRS

- The minimum clear ground space required to accommodate a single, stationary wheelchair and occupant is 30 by 48 inches.

- The minimum clear width for a wheelchair to pass is 32 inches at a point and 36 inches continuously.
- The minimum width for two wheelchairs to pass is 60 inches.
- The space required for a wheelchair to make a 180-degree turn is a clear space of 60 inches.

Prototypical Station Platforms

Two prototypical station designs have been developed based on alignment configuration, right-of-way constraints, site conditions, and vehicle type. The prototypical station platforms are shown in the attached figures. No architectural design should be inferred from the prototypical station platform drawings. Photographic examples of representative station platforms and shelters follow the prototypical station platform drawings.

SHELTERS AND FURNITURE

These criteria have been developed as a technical guide to safe and efficient station design while promoting community pride. Stations are the public focus of the rail system in that they are central to modal interchange and serve thousands of passengers on a daily basis. It is key to the operation of the entire transit system that station platforms are easily understood, friendly and efficient for passengers. Station design should not only consider the functional and operational efficiencies, but also integrate humanistic and community spirit into the design.

Passenger Shelters
The following is a list of objectives that light rail transit shelters should achieve:

- Provide passengers with comfort and protection from expected adverse weather conditions—winter rain, wind and summer sun.
- Provide identity for the station as well as the surrounding area.
- Provide a feeling of security and means of surveillance.
- Help provide adequate lighting.
- Utilize materials and construction practices that minimize maintenance requirements.
- Utilize materials and construction practices that minimize life cycle costs.
- Standardize materials and construction practices.
- Utilize materials and construction practices that are compatible with existing Monterey–Salinas Transit facilities.
- Arrange and articulate shelters to create an enjoyable experience.
- Height of shelter protective edge should be no greater than 10 feet 6 inches or eave height to match height of window head of passenger car.
- Minimum length of shelter to be 40 feet.
- Width of shelters shall not infringe on the dynamic envelope for the rail cars. A minimum width is not specified.

Windscreens
The following is a list of criteria for windscreens:

- Maximum height 6 feet 8 inches.
- 75 percent of the surface area must be translucent or transparent.
- Overall width depends on flow of pedestrians and location of the screen.
- Place where most effective in blocking prevailing winds.
- Provide a minimum of one bench on the lee side of the windscreen.
- Comply with ADAAG for access and circulation around the windscreen.

Furniture
The following is a list of furniture to be used at the stations:

- Benches
- Trash receptacle
- Bicycle lockers/racks. These are not to be placed on the platform, only on the transition plaza or adjacent to parking supplies.

Materials and Finishes
The quality and character of station materials utilizing simple, durable materials has a direct effect on maintenance requirements and the image of each facility. Simple, durable materials in minimal sizes with long-standing availability, installed to facilitate replacement can diminish damage and maintenance while balancing the character and visual quality of each station. Because vandalism tends to breed upon itself, materials should be used such that repair time is reduced and stations never appear underused or abandoned.

In specifying manufactured items or materials, preference shall be given to standard off-the-shelf items available from more than one supplier over custom-made or single-source items. In specifying finish, size, color, pattern or composition, slight variations in appearance should be allowed so less costly products or materials of equal quality can be utilized.

Performance Standards

- *Durability:* Durable and cost-effective materials shall be used that have consistent wear, strength and weathering qualities. Materials shall be capable of good appearance throughout their useful life and shall be colorfast.
- *Low Maintenance:* Life cycle maintenance costs should be considered in the evaluation of all materials and finishes.
- *Quality of Appearance:* Materials should be appealing and harmonious in appearance and texture. They should reinforce system continuity while relating to the local context.
- *Cleaning:* Materials that do not soil nor stain easily shall be used and shall have surfaces that are easily cleaned in a single operation. Minor soiling should not be apparent. Commonly used equipment and cleaning agents should be able to be utilized. All porous finishes subject to public contact shall be treated or finished in a manner that allows easy removal of ~~–e~~asual vandalism."
- *Repair or Replacement:* To reduce inventory and maintenance costs, materials shall be standardized as much as possible for easy repair or replacement without undue cost or disruption of LRT operation. For example, hose bibs, electrical outlets, lighting fixtures and lamps, glass or plastic lights, information panels, signs, shelter materials, etc., shall be standardized on commonly available sizes and finishes for easy inventory stocking and installation.
- *Nonslip:* Entrances, stairways, platforms, platform edge strips, and areas around equipment shall be high nonslip properties. Floor finishes shall be nonslip even when wet. This is particularly important at stairs, elevators and other areas near station entrances, as well as platform areas.
- *Corrosion Resistance:* Because of moisture and coastal winds, special consideration must be given to prevention of corrosion. Non-corrosive metals shall be utilized when possible or required.
- *Compatibility:* Selected materials shall be compatible with the Monterey Bay region metropolitan area climate and consistent with existing materials within the station vicinity. Materials for structures should harmonize with existing facilities on a site-specific basis.

- *Availability:* Selection of materials shall permit competitive bidding and emphasize regional products and processes over those not locally available.
- *Fire Resistance:* –Flame spread" ratings shall conform to the applicable building code definition for the material being used.
- *Finish Materials:* Dense, hard, nonporous materials shall be used in all applications. Finish materials shall be corrosion, acid, and alkali resistant and shall be compatible with chemical compounds required for maintenance.
- *Detailing:* Detailing of finishes shall avoid unnecessary surfaces which may collect dirt and complicate cleaning. Wall surfaces shall be vertical and flush allowing for texture. All edge and finish materials shall be detailed, incorporation joints and textures which reduce the requirements for true, visually perfect installation over long distances.
- *Waterproofing:* All finish materials in underground spaces shall be selected and detailed with proper attention to waterproofing, cavity walls, drainage and venting. All drainage cavities shall be provisions for cleanout.
- *Texture:* Materials within reach of passengers shall be easily cleaned, with a finish to prevent or conceal scratching, soiling, and to maintain desired illumination levels. Materials with homogeneous colors shall be selected. The use of paint, stains and coatings shall be minimized.

  Graffiti resistant products shall be used to protect surfaces susceptible to graffiti. Graffiti resistant products shall allow for removal of graffiti without damage to the surface.

STATION EQUIPMENT

Fare Collection
All platforms shall have provisions for either free standing or integrated fare vending machines.

The Transportation Agency for Monterey County shall determine the number of initial machines and future provisions. Weather protection shall be provided for each machine unless otherwise approved by the Transportation Agency for Monterey County. At no time shall the front face of the vending machines be oriented to the south, west, or southwest, unless protection from the sun is provided.

COMMUNICATIONS

Directional Signs
Obvious, simple and clear signage between modes of transportation and throughout stations reduces confusion and frustration while increasing patron comfort. The less time spent searching for connections, the more time will be available for enjoying the convenience of transit. Signage shall conform to Section 4.30 of –Standards for Accessible Transportation Facilities," U.S. Department of Transportation, NFPA 130 3-1.3 Warning Signs and the MUTCD.

Platform Kiosk
Free standing or integrated information kiosk shall be provided in all stations. Kiosks shall be sized to accommodate standard Monterey–Salinas Transit information materials, including light rail transit and bus system maps and schedules and to accommodate internal maintenance that may be required.

Platform Identification Blade Signs
Free standing or integrated blade signs shall provide system, station and destination identification.

Two blade signs shall be provided on each platform to cover the areas that are not covered by the pylons.

Shelter Signage
Provisions shall be made for station identification signs in passenger shelters and shall conform to current ADAAG standards.

Telephones
Provisions for emergency telephones shall be provided as required in each station and shall conform to the requirements of Section 4.31 of –Standards for Accessible Transportation Facilities," U.S. Department of Transportation.

Public phones are not to be located on the platforms but shall be located at or near the edge between the platform and the transition plaza.

Public phones shall be easily visible from the station platforms, but located outside of circulation areas where the noise level is acceptable.

CCTV (Closed Circuit Television) and VMS (Variable Message Signs) Displays
Provisions shall be made for initial or future CCTV VMS displays; either free standing or integrated, as required by the Transportation Agency for Monterey County.

LIGHTING

Standard Elements
All luminaries and lamp types shall be standardized system wide to provide design and perceptual unity and simplify maintenance requirements.

Illumination Levels
Illumination levels shall define and differentiate between task areas, decision and transition points, and areas of potential hazard. In addition to quantity of light, it is essential that illumination be designed to minimize glare and provide uniform distribution. Luminaries shall be selected, located, and/or aimed to accomplish their primary purpose while producing a minimum of objectionable glare and/or interference with task accuracy, vehicular traffic and neighboring areas.

Minimum illumination levels are shown below:

Locations	Minimum foot-candles
Station platform and plaza areas	5 minimum
Fare vending area	8 minimum
Parking lots and accessways	(0.5 minimum at property line) 2 average
Tunnels and pedestrian accessways	5 minimum

Station Site Lighting
Station lighting includes internal site circulation and access to the station. The placement of luminaries shall not obstruct the movement of vehicles. Luminary placement shall be coordinated with the landscape and site plan to protect light standards which are located adjacent to roadways, and to ensure that plantings will not obscure the lighting distribution pattern.

Vehicular Access Lighting
Vehicular access lighting shall provide a natural lead-in to the bus area and Kiss and Rides. The illumination on all access and egress roads shall be graduated up or down to the illumination level of the adjacent street or highway.

Pedestrian Accessways Lighting
Pedestrian accessways lighting shall define pedestrian walkways, crosswalks, ramps, stairs, tunnels and bridges.

Platform Lighting
Platform area lighting shall be in any area that is used to load and unload a train. The lighting elements shall extend the entire length of the platform and shall demarcate the platform and emphasize the platform edge and vertical vehicle surfaces. Care shall be taken to avoid "blinding" LRT operators or other vehicle drivers with excessive or misdirected lighting.

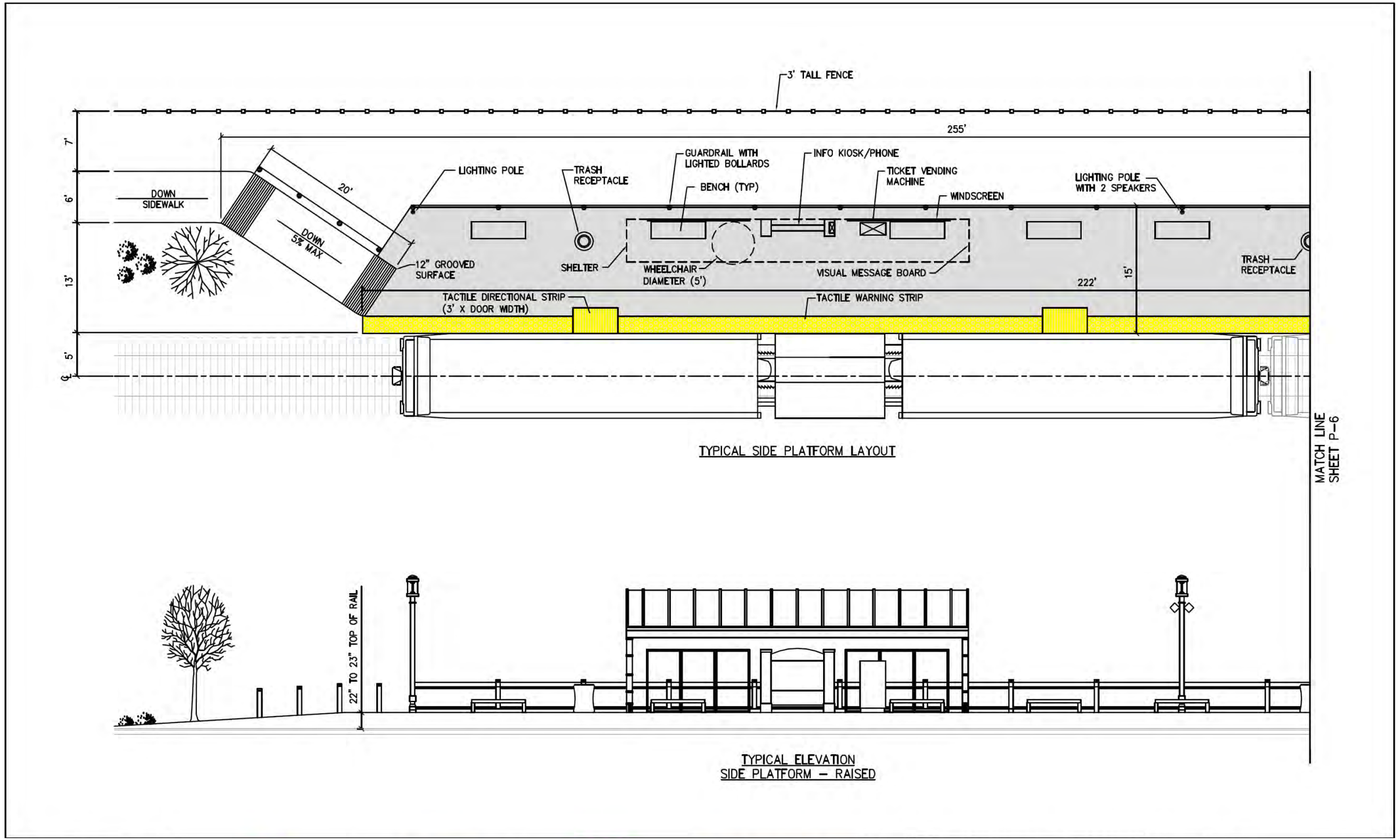
Control of Lighting Systems
Lighting control shall be designed to use energy efficiently. Automatic and manual control arrangements shall ensure efficient utilization of energy and maintenance procedures. All exterior site areas shall be illuminated by a photocell with time clock or manual override.

Site Specific Station Design

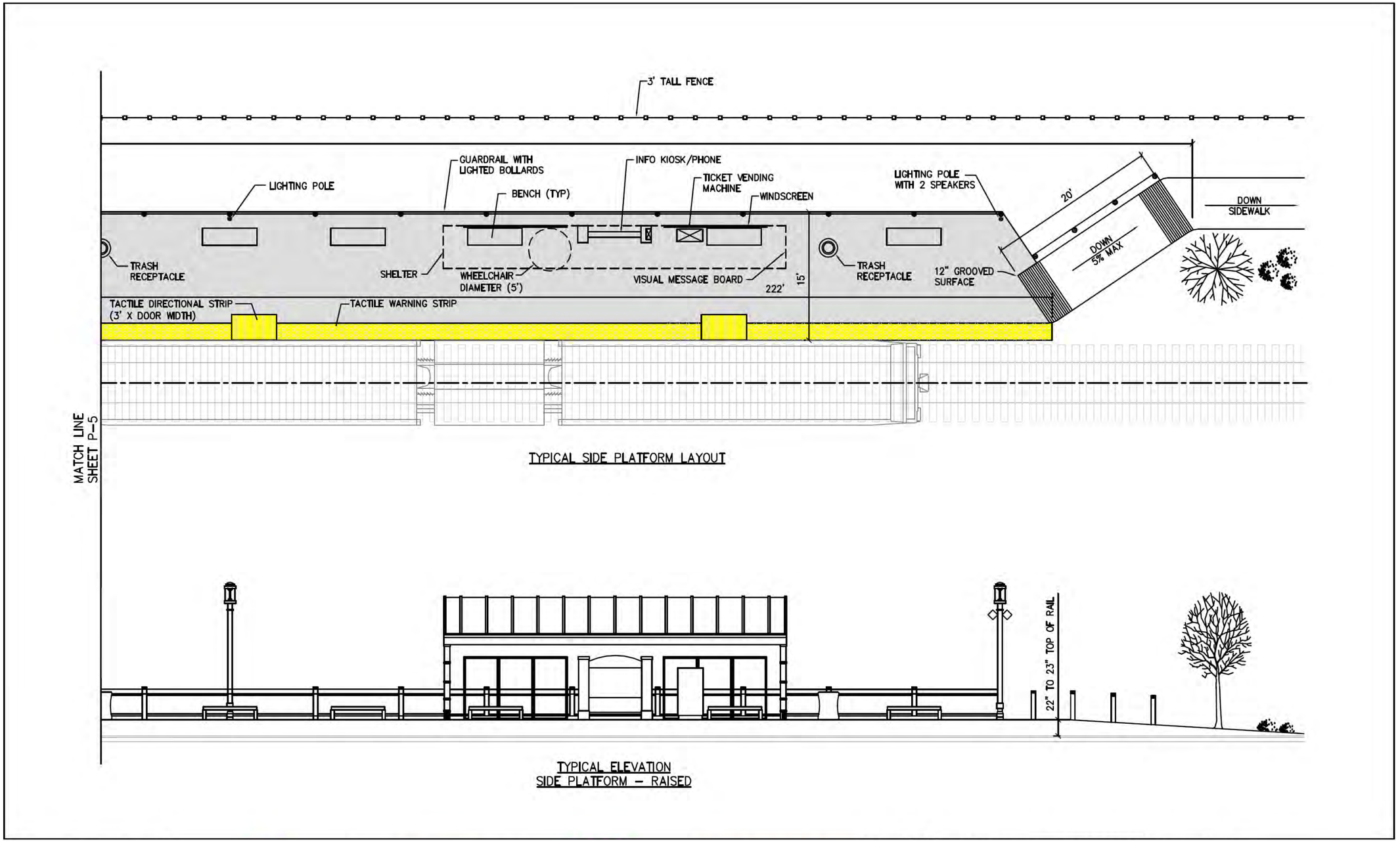
Architectural renderings of conceptual station designs have been prepared by VBN Architects to further define the character and spatial arrangement of boarding platforms and shelters within the context of the overall station environment and neighborhood surroundings. The case study renderings have been prepared for the following locations, and are illustrated at the end of this chapter.

- **Eighth Street Station, Marina with shelter option A**
- **Eighth Street Station, Marina with shelter option B**
- **Reservation Road Station, Marina with shelter option C**
- **Reservation Road Station, Marina with shelter option D**
- **Downtown Seaside at West Broadway/Contra Costa, Seaside with shelter option B**
- **Custom House Plaza, Monterey with shelter option B**

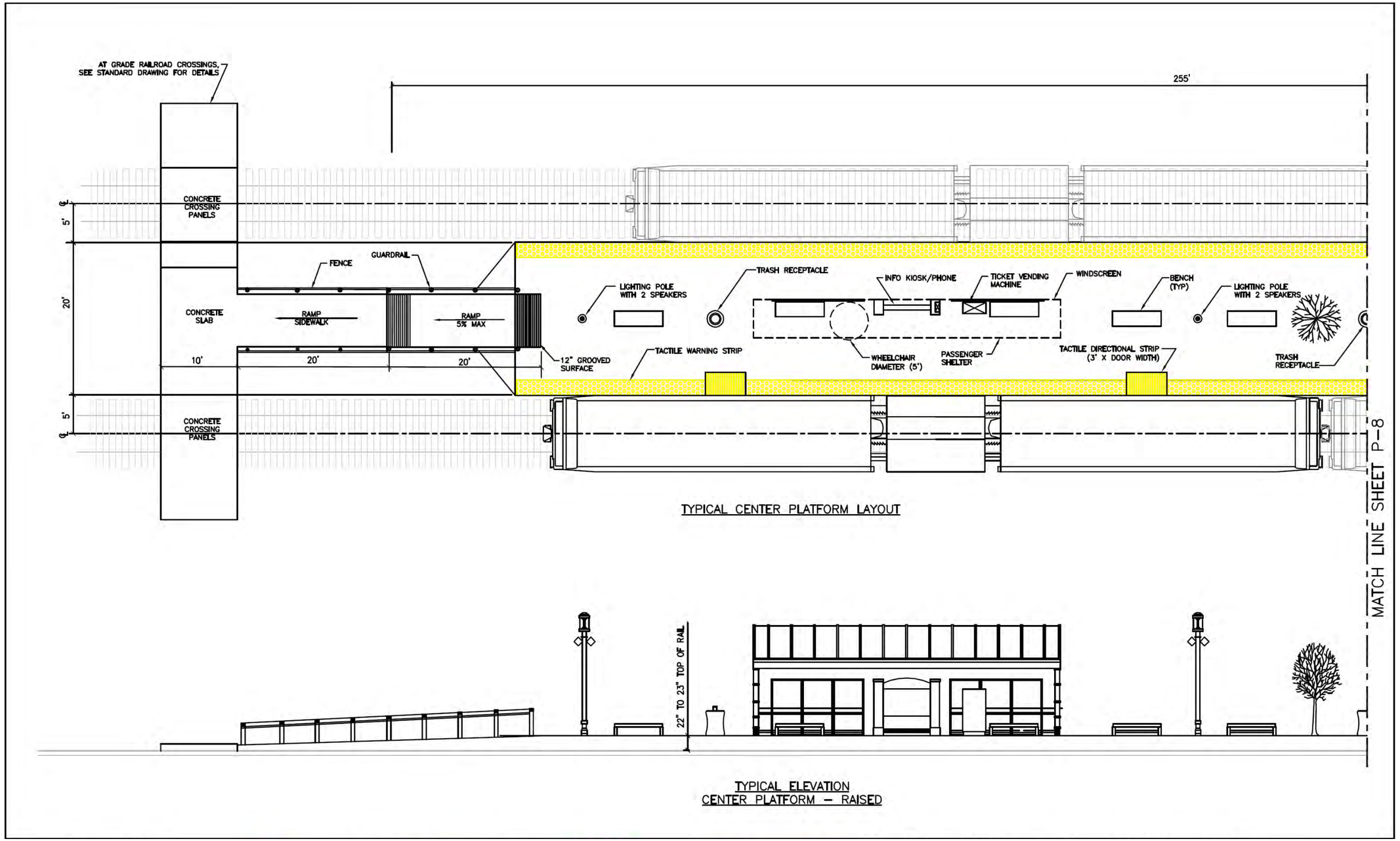
LRT Side Platform *(1 of 2)*



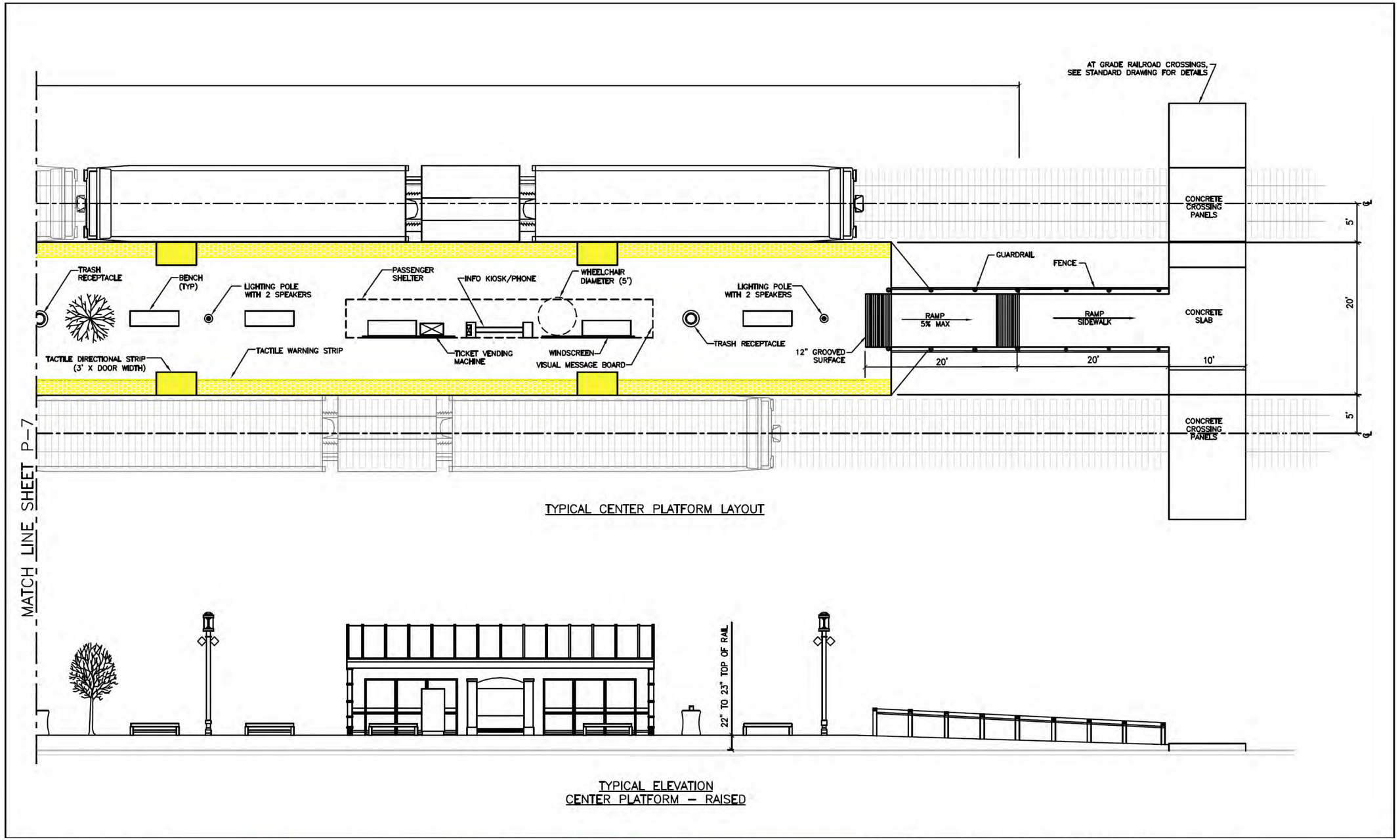
LRT Side Platform *(2 of 2)*



LRT Center Platform *(1 of 2)*

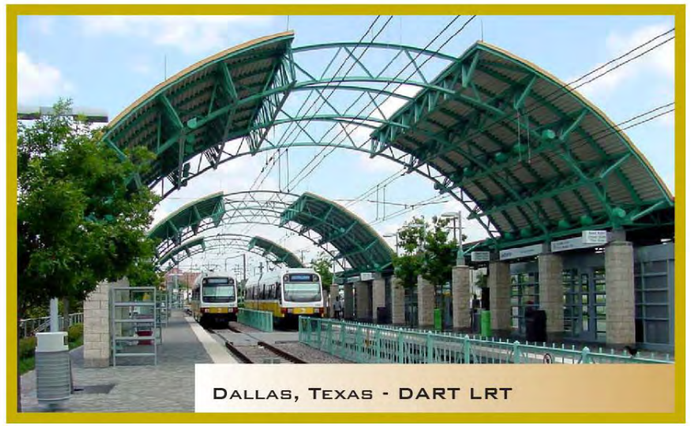


LRT Center Platform *(2 of 2)*



Light Rail Transit Station Platforms and Shelters

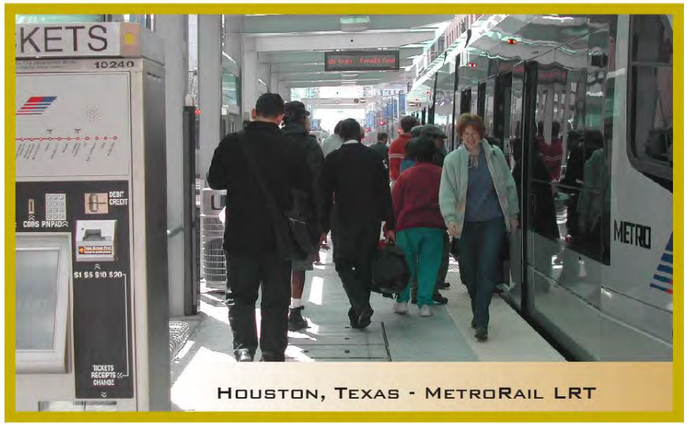
Camden, New Jersey - RiverLine LRT


Dallas, Texas - DART LRT


San Diego, California - MTS

Santa Clara, California - VTA LRT

Calgary, Alberta - C-Train LRT



Houston, Texas - MetroRail LRT

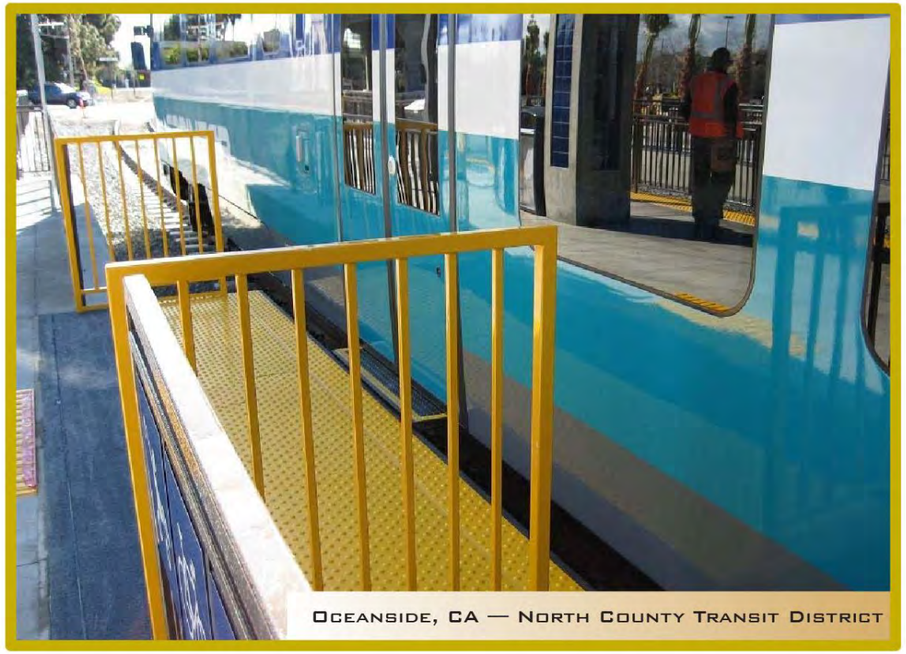
Retractable Platform Extenders

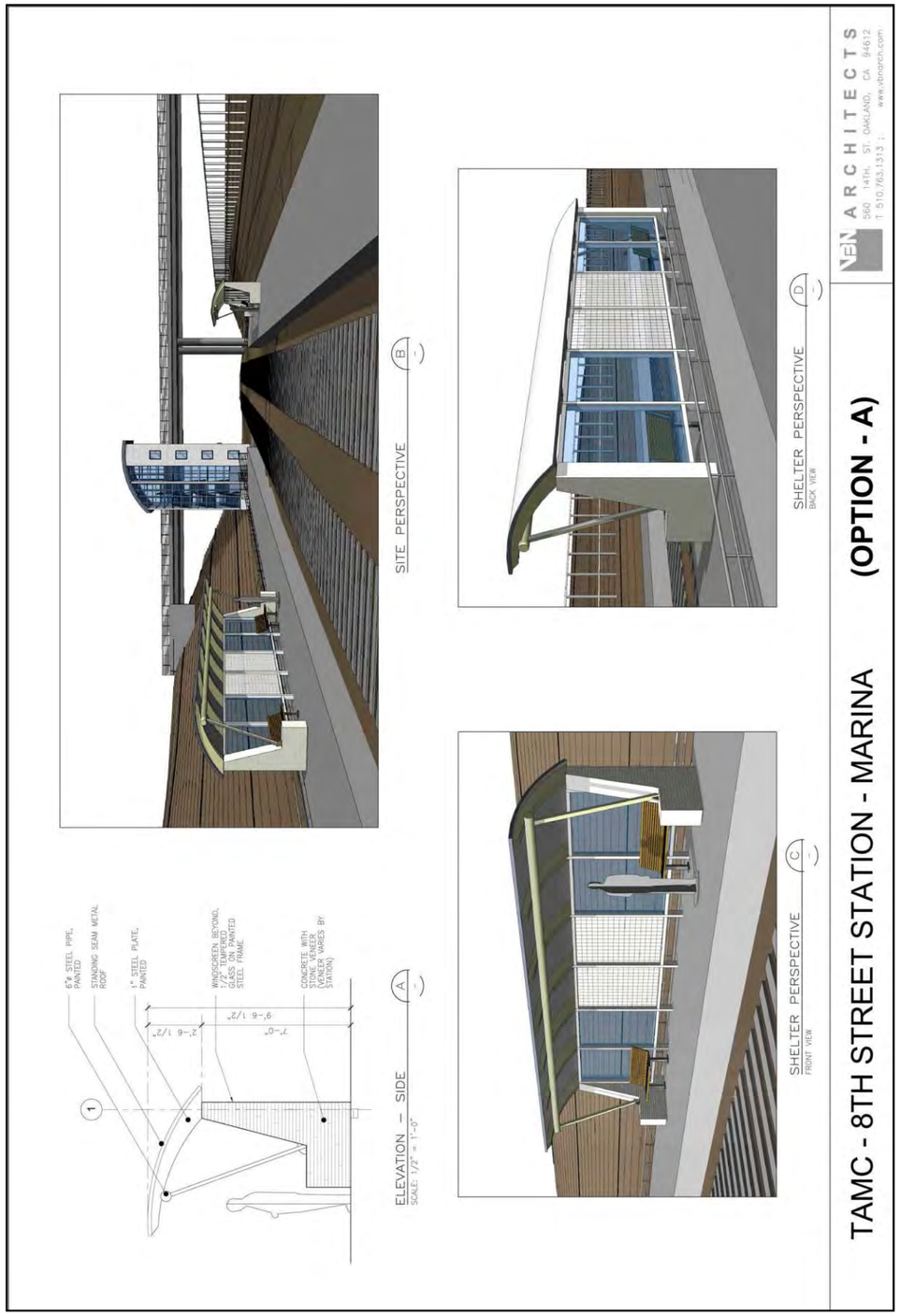
Westfield Station, NJ — New Jersey Transit

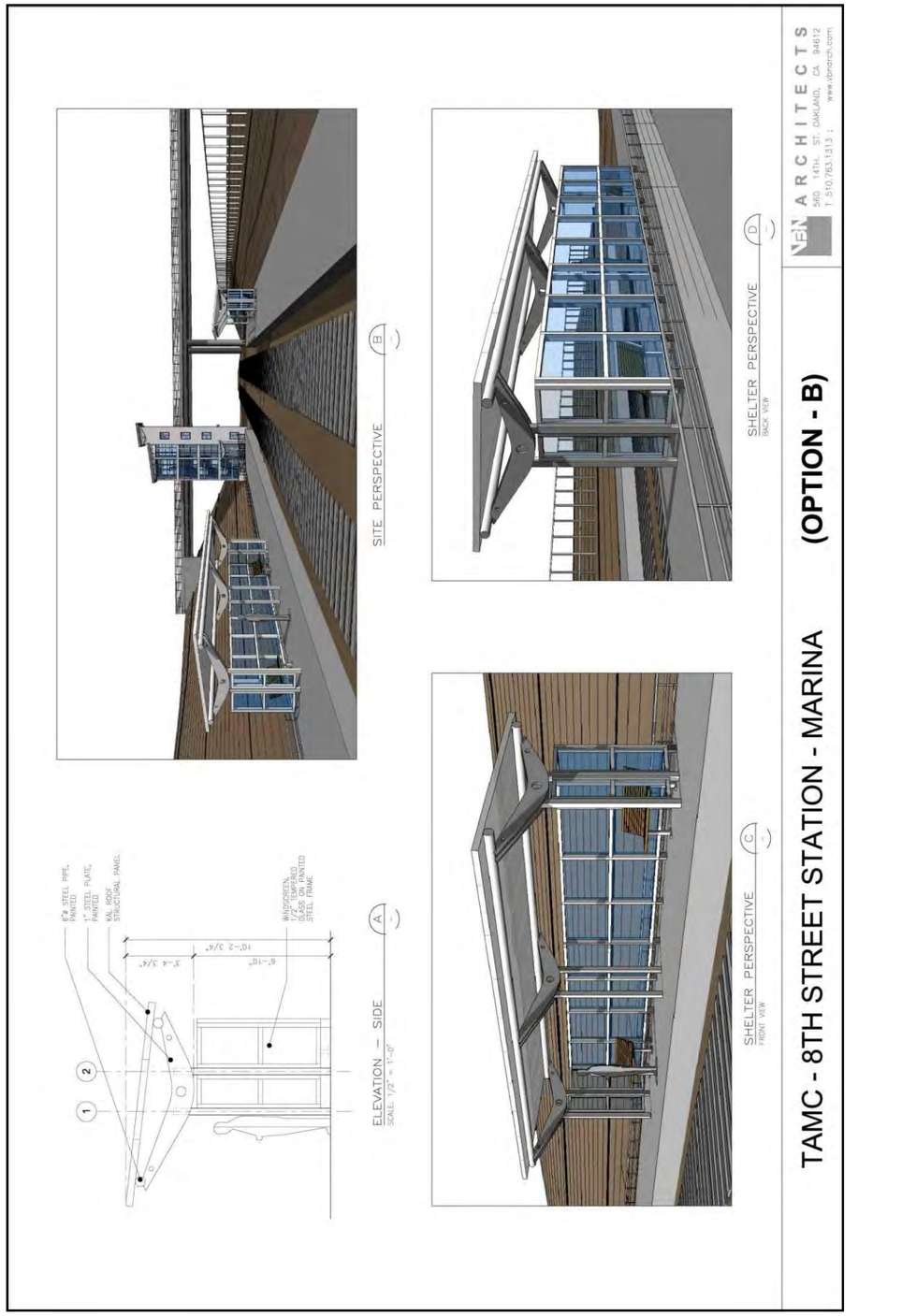
Westfield Station, NJ — New Jersey Transit

Carleton, Ottawa — O-Train


Redbank Station, NJ — New Jersey Transit


Oceanside, CA — North County Transit District


SITE PERSPECTIVE
B
SHELTER PERSPECTIVE
BACK VIEW
D
VBN ARCHITECTS
560 14TH. ST. OAKLAND, CA 94612
T. 510.763.1313 ; www.vbnarch.com
(OPTION - A)
TAMC - 8TH STREET STATION - MARINA
8"ø STEEL PIPE, PAINTED
STANDING SEAM METAL ROOF
1" STEEL PLATE, PAINTED
WINDSCREEN BEYOND, 1/2" TEMPERED GLASS ON PAINTED STEEL FRAME
CONCRETE WITH STONE VENEER (VENEER VARIES BY STATION)
9'-6 1/2"
2'-6 1/2"
7'-0"
1
ELEVATION — SIDE
SCALE: 1/2" = 1'-0"
A
SHELTER PERSPECTIVE
FRONT VIEW
C


SITE PERSPECTIVE
B
SHELTER PERSPECTIVE
BACK VIEW
D
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(OPTION - B)
TAMC - 8TH STREET STATION - MARINA
8"ø STEEL PIPE, PAINTED
1" STEEL PLATE, PAINTED
KAL ROOF STRUCTURAL PANEL
WINDSCREEN, 1/2" TEMPERED GLASS ON PAINTED STEEL FRAME
10'-2 3/4"
3'-4 3/4"
6'-10"
1
2
ELEVATION — SIDE
SCALE: 1/2" = 1'-0"
A
SHELTER PERSPECTIVE
FRONT VIEW
C

RESERVATION ROAD AMENITIES PACKAGE 2

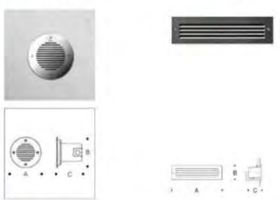
SHELTER OPTION C

EXISTING LIGHT STANDARD

PETOSKEY BENCH

PETOSKEY LITTER

PETOSKEY MATERIAL OPTIONS



BEGA RECESSED WALKWAY & STEP LIGHT

BOLLARD LIGHT

BICYCLE LOCKER OPTIONS

RESERVATION ROAD STATION - SHELTER OPTION C - AMENITIES PACKAGE 2 WITH EXISTING LIGHT STANDARD

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RESERVATION ROAD AMENITIES PACKAGE 2

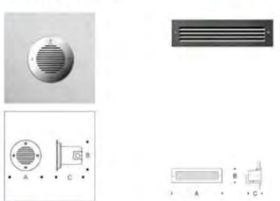
SHELTER OPTION C

PHILLIPS LUMEC CITYSCAPE LIGHT STANDARD

PETOSKEY BENCH

PETOSKEY LITTER

PETOSKEY MATERIAL OPTIONS



BEGA RECESSED WALKWAY & STEP LIGHT

BOLLARD LIGHT

BICYCLE LOCKER OPTIONS

RESERVATION ROAD STATION - SHELTER OPTION C - AMENITIES PACKAGE 2

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2 P001 Residential side

1 P001 Plaza

TAMC - RESERVATION ROAD STATION - OPTION C-1

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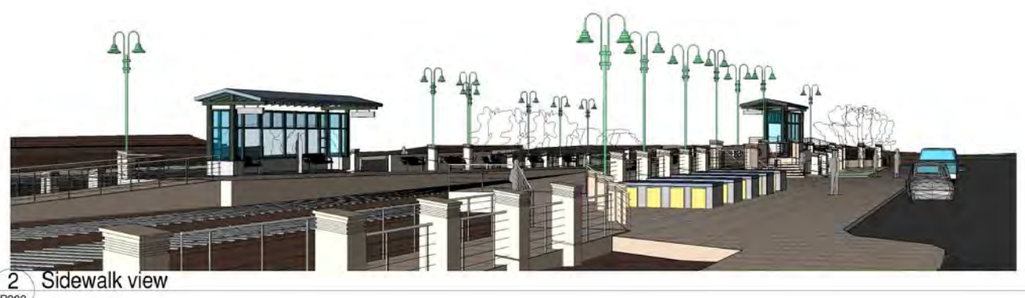
1 P002 Platform view



2 P002 Sidewalk view

TAMC - RESERVATION ROAD STATION - OPTION C-1

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2 P001 Residential side

1 P001 Plaza

TAMC - RESERVATION ROAD STATION - OPTION C-2

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1 P002 Platform view

2 P002 Sidewalk view

TAMC - RESERVATION ROAD STATION - OPTION C-2

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SHELTER OPTION D

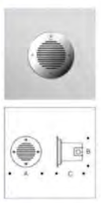
RESERVATION ROAD AMENITIES PACKAGE 1

EXISTING LIGHT STANDARD

AUSTIN BENCH

AUSTIN LITTER

AUSTIN MATERIAL OPTIONS



BEGA RECESSED WALKWAY & STEP LIGHT

BOLLARD LIGHT

eCS2 BICYCLE LOCKER

RESERVATION ROAD STATION - SHELTER OPTION D - AMENITIES PACKAGE 1 W/ EXISTING LIGHT STANDARDS

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SHELTER OPTION D

RESERVATION ROAD AMENITIES PACKAGE 1

PHILLIPS LUMEC LEONIS LIGHT STANDARD

AUSTIN BENCH

AUSTIN LITTER

AUSTIN MATERIAL OPTIONS

BEGA RECESSED WALKWAY & STEP LIGHT

BOLLARD LIGHT

eCS2 BICYCLE LOCKER

RESERVATION ROAD STATION - SHELTER OPTION D - AMENITIES PACKAGE 1

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2 P001 Residential side

1 P001 Plaza

TAMC - RESERVATION ROAD STATION - OPTION D-1

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1 P002 Platform view

2 P002 Sidewalk view

TAMC - RESERVATION ROAD STATION - OPTION D-1

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2 P001 Residential side

1 P001 Plaza

TAMC - RESERVATION ROAD STATION - OPTION D-2

VBN ARCHITECTS
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1 P002 Platform view

2 P002 Sidewalk view

TAMC - RESERVATION ROAD STATION - OPTION D-2

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1 P1 Perspective_1 - Gateway

2 P1 Perspective_2 - Station Front

TAMC - DOWNTOWN SEASIDE STATION - SEASIDE

VBN ARCHITECTS
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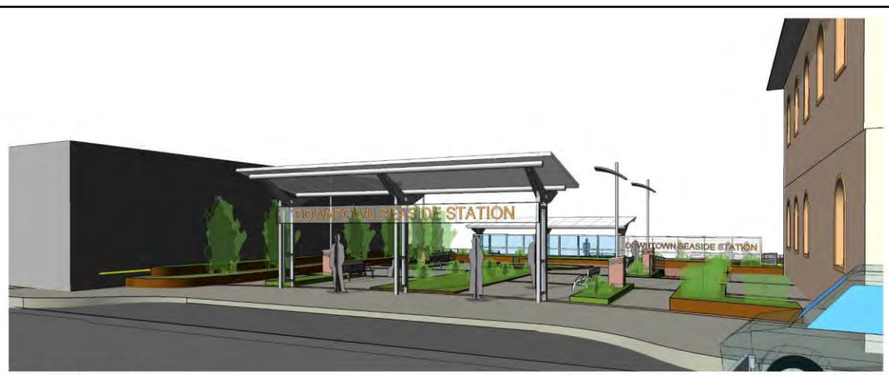
T (510)763-1313; www.vbnarch.com



1 P2 Perspective_3- Kiss & Ride

2 P2 Perspective_4 - Plaza

TAMC - DOWNTOWN SEASIDE STATION - SEASIDE

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1 P.3 PHOTO MONTAGE 1 - GATEWAY ON CONTRA COSTA ST.

2 P.3 PHOTO MONTAGE 2 - BIRD'S EYE VIEW

TAMC - DOWNTOWN SEASIDE STATION - SEASIDE

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1 PERSPECTIVE 1 - STATION FRONT VIEW

2 PERSPECTIVE 2 - BICYCLE PATH

TAMC - CUSTOM HOUSE PLAZA STATION - MONTEREY

VBN ARCHITECTS
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3 PERSPECTIVE 3 - FROM THE BRIDGE

4 PERSPECTIVE 4 - PLAZA VIEW

TAMC - CUSTOM HOUSE PLAZA STATION - MONTEREY

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5 PERSPECTIVE 5 - BIRD'S EYE VIEW

TAMC - CUSTOM HOUSE PLAZA STATION - MONTEREY

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6

Monterey Peninsula Light Rail Transit
Maintenance and Operations Facility

6. Monterey Peninsula Light Rail Transit Maintenance and Operations Center

This section outlines the requirements for vehicle and right-of-way maintenance to support the Monterey Peninsula Light Rail project.

The operation of light rail transit services requires a facility to maintain, repair and store the light rail transit vehicles. Such a facility also typically includes offices and parking for maintenance employees and train operators. An example of a maintenance facility for a diesel multiple unit vehicle fleet is illustrated in Figure 6-1. The illustrated facility supports the Tri-County Metropolitan Transit District of Oregon (TriMet) Westside Express Service which runs between the Portland suburbs of Wilsonville and Beaverton. The facility has a diesel multiple unit coach shop, outdoor layover/storage tracks, and a parking area for maintenance personnel and train operators.

The proposed location for the Monterey Peninsula Light Rail Transit Maintenance and Operations Center is east of Highway 1, adjacent to former Fort Ord Quartermaster warehouse buildings, on lands owned by the Transportation Agency for Monterey County and Monterey–Salinas Transit**; or west of Highway 1, at the Fort Ord trailer/tank on flat car loading ramp (Workfield Siding), on lands owned by TAMC**.

Activities undertaken at this facility would likely include:

- Train storage and consist changing
- Head-end power yard connections (for train heating and air conditioning)
- Exterior train washing
- Interior train cleaning
- Major component steam cleaning
- Daily and other CPUC required inspections, tests, and maintenance
- Repairs due to wear out and failure
- Major component removal and replacement (trucks, wheels, traction motors couplers, HVAC units, compressors, brake valves, door operators, etc.).
- Wheel truing (recontouring steel wheels)
- Paint and body repair
- Storage of parts, material, supplies, spares, etc.
- Component and parts repair (excluding prime mover, traction motors, generators, major damage, etc.).
- Dispatch center
- Employee facilities for transportation and rolling stock personnel (restrooms, lockers, conference and training rooms, etc.).
- Maintenance-of-way equipment storage.

Selection of a site for the maintenance facility was based upon proximity to the Monterey Branch Line, the distance between the maintenance facility and the line terminus points, availability and size of the site, and adjacent land uses.

Figure 6-1
Maintenance Facility Servicing a Diesel Multiple Unit Vehicle Fleet
(Westside Express Service, Tri-County Metropolitan Transportation District of Oregon)

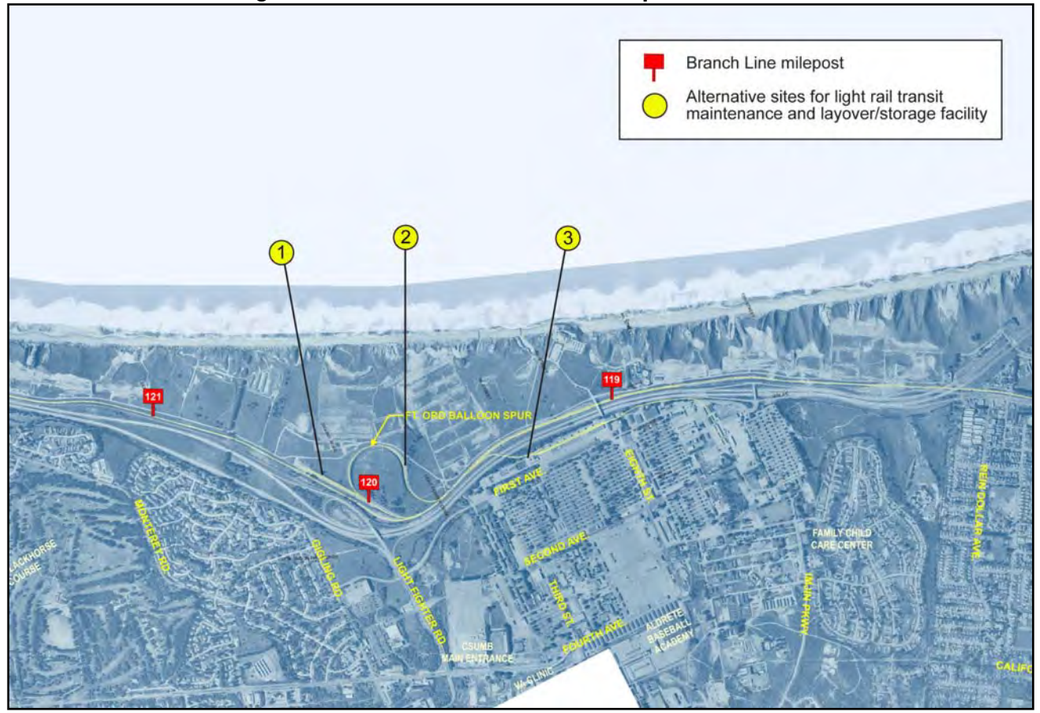
One additional site **was** considered for the Light Rail Transit Maintenance and Operations Center**, i.e., the Fort Ord balloon track,** located west of Highway 1, on lands owned by the Transportation Agency for Monterey County surrounded by the Fort Ord Dunes State Park. Figure 6-2 illustrates all three of the alternative locations considered for the Light Rail Transit Maintenance and Operations Facility.

1. At the Fort Ord trailer/tank on flat car (TOFC) loading ramp **(Workfield Siding)**
2. Along the Fort Ord balloon track **(Gigling Siding)**
3. Adjacent to the Fort Ord Quartermaster warehouses

The conceptual site plan for the Monterey Peninsula Light Rail Transit Maintenance and Operations Center **at Site 3** is illustrated on Figure 6-3. The facility is sized to accommodate 15 vehicles 103 feet in length, or 10 vehicles 136 feet in length. Two service/repair and three layover tracks (five total) are illustrated, with each track capable of accommodating three vehicles at 103 feet each, or two vehicles at 136 feet each. A pre-engineered steel frame building is assumed. Layover tracks would be enclosed or open air. The "Butler" type building could be constructed in two phases. Phase 1 would construct and enclose the two service/repair tracks along with parts storage, machine shop, offices and employee dispatch and welfare spaces. Phase 2 would construct and/or enclose the three layover tracks at such time that additional storage capacity (beyond six vehicles) was required.

Two potential orientations for the facility are illustrated on Figure 6-3. One orientation aligns the tracks from north to south, parallel to Highway 1, while the second orientation aligns the tracks from west to east. Selection of an orientation for the facility is discussed at the end of this chapter, under the topic of "Other Considerations."

Figure 6-2
Alternative Sites for Light Rail Transit Maintenance and Operations Center



A conceptual site plan for the Monterey Peninsula Light Rail Transit Maintenance and Operations Center at Site 1 is illustrated on Figure 6-4. As illustrated, the facility is sized to accommodate 12 vehicles 103 feet in length, or 10 vehicles 136 feet in length. One service/repair and one layover track are illustrated along with a third track for maintenance of way (MOW) track borne equipment. The layover track could be enclosed, as illustrated, or open air. A pre-engineered steel frame building is assumed, constructed in two phases as defined above.

Of special note for the consideration of environmental impacts are the following operational/physical attributes of the facility.

Major Elements/Areas

The proposed facility includes the following major elements/areas:

- Outdoor storage/layover track. These may be enclosed, if microclimate conditions warrant, to minimize life cycle maintenance expense.
- Indoor service and inspection track and shop
- Stores and support shop area
- Office and employee welfare area
- Ancillary support areas (fuel pump house, below ground tank storage, dumpster area, oil/water separator)
- Yard lead tracks and turnouts
- Parking and internal roadways

An eight-foot-high steel bar fence is proposed to secure the portion of the site devoted to outdoor vehicle and equipment storage, if so provided.

Building Design

The basic building configuration and massing proposed for the maintenance facility is dictated by the type of activity that would occur in the building. The position of the building within the **lands owned by the** Transportation Agency for Monterey County and Monterey–Salinas Transit **at Site 3** is constrained by yard lead track and turnout geometric requirements, the dimensions of the available right-of-way, and *Highway 1 Design Corridor Design Guidelines.* The design guidelines specify a building setback of 100 feet from the Caltrans Highway 1 right-of-way. The design guidelines further stipulate that building heights should not exceed a height of 40 feet being visible from Highway 1. As Highway 1 is elevated adjacent to the proposed building site, a taller structure could be permitted under the design guideline.

As conceptually designed, the shop and service building **at Site 3** would occupy a footprint of approximately 340 feet by 90 to 150 feet. Transportation division office and employee welfare areas would occupy a second floor above the maintenance division's machine shop and stores areas within the enclosed building shell. Generally, the building is expected to be pre-engineered steel, with pre-engineered non-reflective metal and glass wall panels. The total building height will be approximately 35 to 40 feet.

The maintenance facility **at Site 3** will be surrounded by a proposed transit oriented development (multi-family housing and retail) to the north, single family housing to the east, office/research and development buildings to the south and Highway 1 to the west. **Figure 6-5** illustrates the location of land uses surrounding the site.

Figure 6-3
Conceptual Site Plan for the Monterey Peninsula Light Rail Transit Maintenance and Operations Center *(East–West Orientation of Track)*

Figure 6-3 *(continued)*
Conceptual Site Plan for the Monterey Peninsula Light Rail Transit Maintenance and Operations Center *(North–South Orientation of Track)*

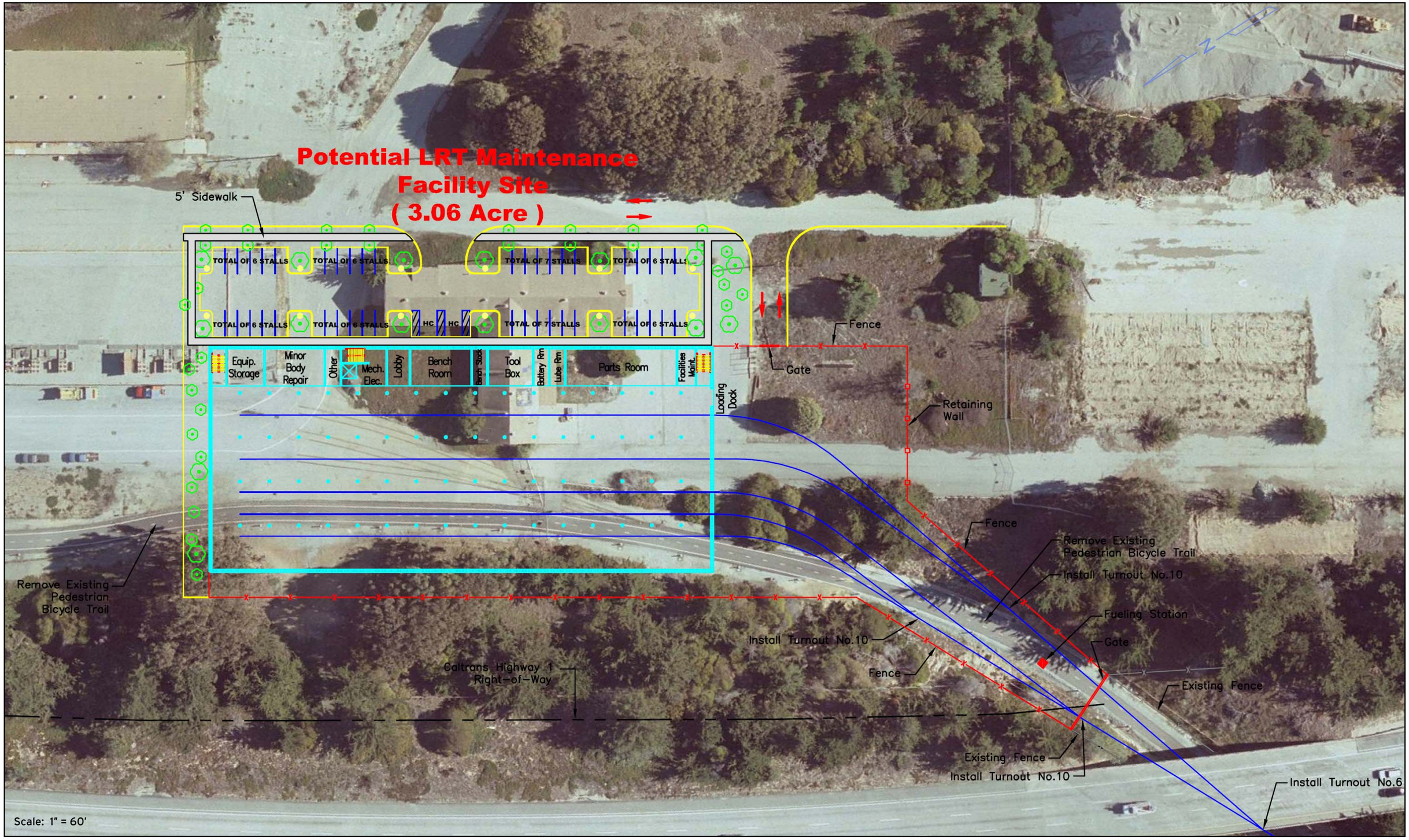
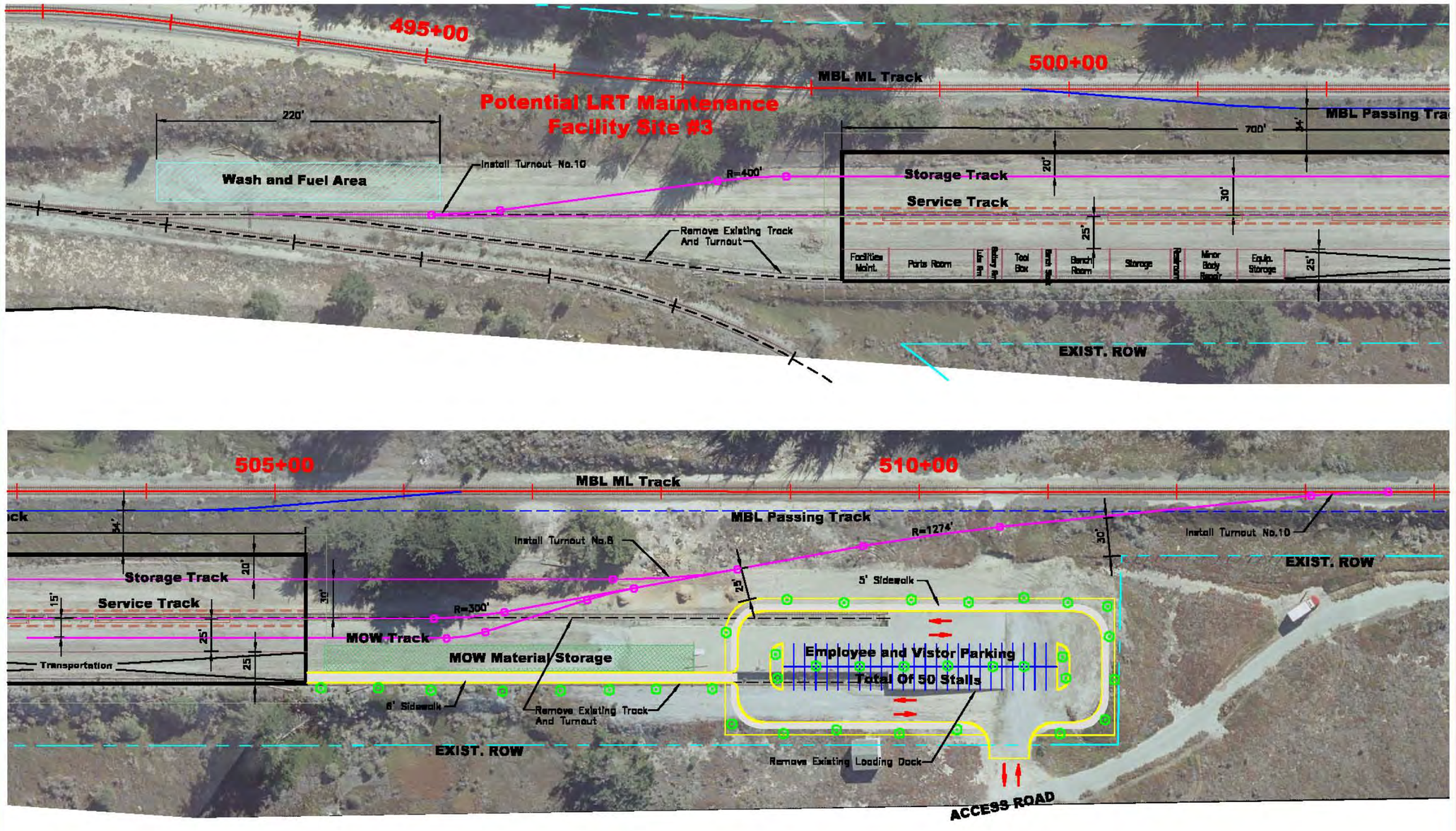


Figure 6-4
Conceptual Site Plan for the Monterey Peninsula Light Rail Transit Maintenance and Operations Center at Site 1



Revision	By	Approved	Date

TAMC TRANSPORTATION AGENCY FOR MONTEREY COUNTY
55-B Plaza Circle
Salinas, CA 93901

MST MONTEREY-SALINAS TRANSIT

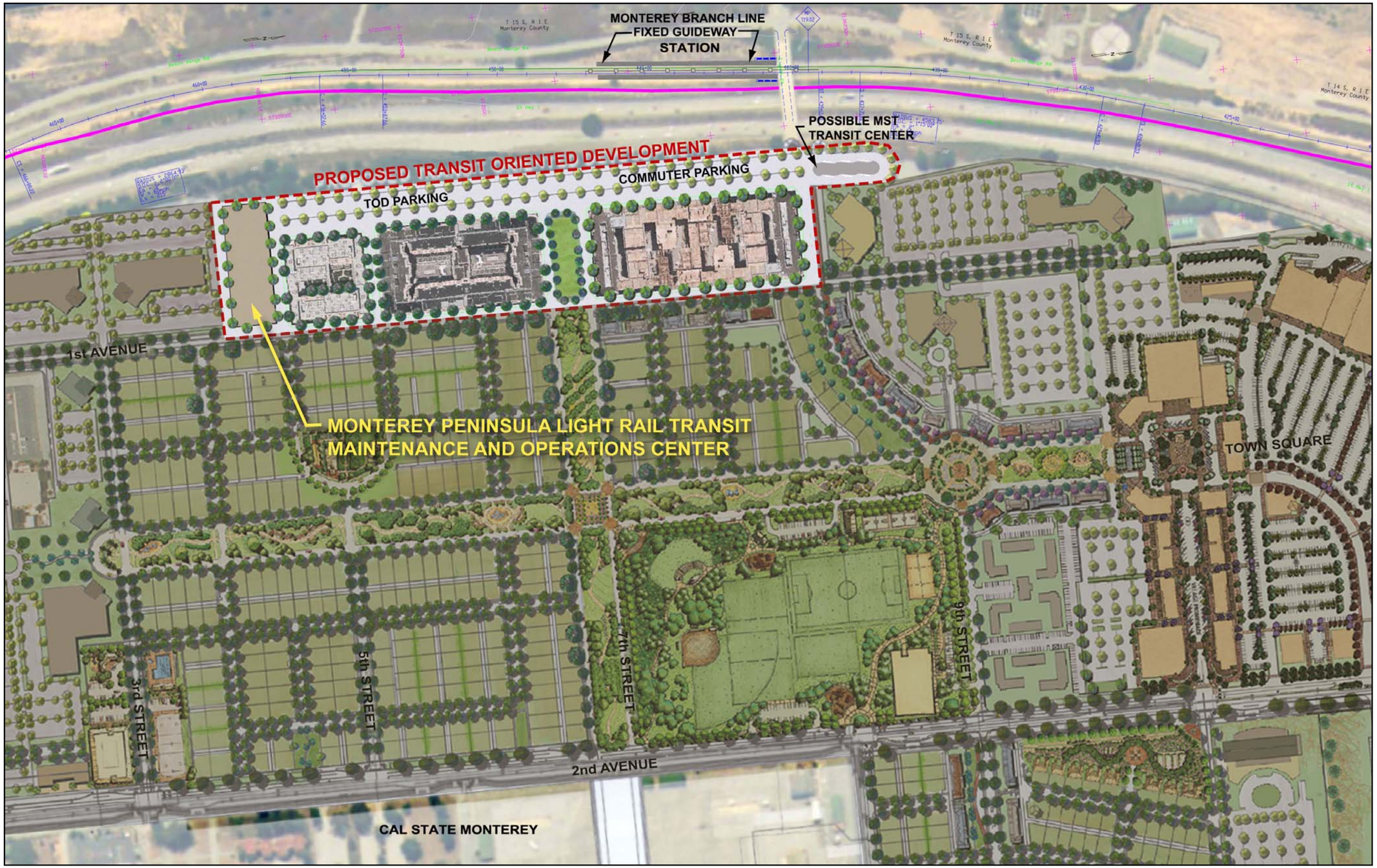
PARSONS
100 Park Center Plaza, Suite 450
San Jose, California 95113

Scale 1" = 70'
Drawn By
Approved By
Date Sept. 2010

MONTEREY BRANCH LINE
MONTEREY COUNTY
CALIFORNIA

Sheet Title
CONCEPTUAL PLAN
MAINTENANCE FACILITY
ALTERNATIVE 3
LRT-17(J)

Figure 6-5
Monterey Peninsula Light Rail Transit Maintenance and Operations Center (at Site 3) Land Use Context



To address the sensitive context of this site, the exterior of the maintenance facility building will be designed to resemble an office/R&D building, similar to the buildings expected to be developed on the sites adjacent to the south.

An example of the same construction type and exterior envisioned for the Monterey Peninsula Light Rail Transit Maintenance and Operations Center **at Site 3** is illustrated as **Figure 6-6**. The direction of view toward the proposed facility would be westerly, looking from First Avenue. The light rail yard lead tracks would, for the most part, not be visible from First Avenue.

Figure 6-6
Representative Example of Proposed Building Type and Exterior Finish

Photo credit: Butler Manufacturing

Structural System:	Widespan™
Wall System:	Shadowall™, Engineered Panel
Roof System:	MR-24®
End Use:	Manufacturing/industrial, office
Location:	Raynham, MA
Size:	33,000 ft²

The light rail vehicle storage tracks running along the south or west side of the site would also not be visible, if enclosed by an expanded building, as discussed above.

Insofar as Site 1, the maintenance facility building would be located on the coastal side of the Lightfighter Drive on-ramp to southbound Highway 1 (see Figure 6-7). The site and the proposed building would not be visible to southbound motorists on Highway 1. Northbound motorists on Highway 1 would experience difficulty seeing the building, as several groves of cypress trees obscure site lines to the proposed building site. (Additional cypress trees would be planted to further obscure views of the building from northbound Highway 1, wherever needed.)

As conceptually designed, the shop and service building at Site 1 would occupy a footprint of approximately 700 feet long by 70 to 100 feet wide. Transportation division office and employee welfare areas would occupy a portion of the ground floor adjacent to the maintenance division's machine shop and stores area within the enclosed building's shell. The building would be approximately 25 to 30 feet high and would be designed to resemble a U.S. Army warehouse. The approximate size and shape of the building envisioned for this site is illustrated as an inset to Figure 6-7.

Employee access to the proposed facility at Site 1 would be by way of First Street and Beach Range Road, as similarly proposed for the Fort Ord Dunes State Park support facilities and administration buildings proposed site within the balloon spur track alignment.

Artificial lighting will be required to perform the proposed activities. The proposed project includes interior lighting and exterior lighting in employee parking areas, fueling and storage track areas. Low level lighting will also be located in yard lead track and switching areas.

Train Operations

If the maintenance facility is constructed at Site 3, light rail trains would access the Monterey Branch Line track using the existing railroad spur line running beneath Highway 1, at approximately milepost 119.50, as depicted in **Figure 6-8**. The spur line track, ties and ballast have been temporarily paved with an asphalt overlay to connect the Monterey Peninsula Recreational Trail with the Dunes development. This asphalt overlay would be removed by the project.

Train movements between the maintenance facility and the Monterey Branch Line track would occur to add or reduce service. Table 7-4, provided in the following section, indicates that one to eight trains could be operated along the Monterey Branch Line, providing headways ranging from 10 to 60 minutes. These additions and subtractions of service could number as high as the following:

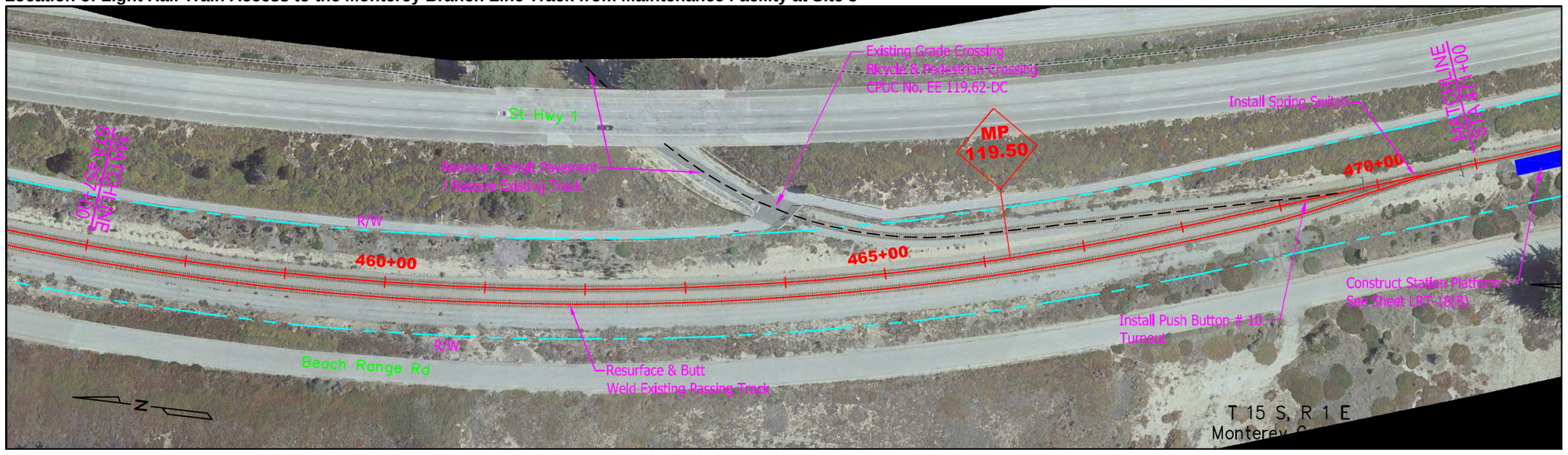
- 5:00 a.m. to 8:00 a.m.: Up to 8 outbound movements
- 9:00 a.m. to noon: Up to 4 inbound movements
- Noon to 3:00 p.m.: Up to 4 outbound movements
- 6:00 p.m. to 8:00 p.m.: Up to 4 inbound movements
- 8:00 p.m. to midnight: Up to 4 inbound movements

Total 24 movements

No trains would operate in revenue service between the hours of midnight and 5:00 a.m. Vehicle maintenance activities could occur 24-hours per day, however. Within the enclosed maintenance facility building, while up to six vehicles (diesel multiple units) could operate at idle on the repair track, operation of three units on idle would be a more realistic assumption. As many vehicles as practical would be shut down after servicing, utilizing hot start equipment and yard hotel power, as required.

Figure 6-7
Monterey Peninsula Light Rail Transit Maintenance and Operations Center (at Site 1) Land Use Context

Figure 6-8
Location of Light Rail Train Access to the Monterey Branch Line Track from Maintenance Facility at Site 3



Maintenance Operations

Daily Inspection and Servicing

Upon completion of each service day, each vehicle or trainset will be cycled into the proposed maintenance facility where initial servicing is performed. Regular train service includes fueling, inspection, and cleaning.

FUELING

The operational range of a single DMU rail car is ±500 miles. The maximum daily mileage accrued by a vehicle could approach 400 miles, thereby necessitating daily refueling. Fueling would occur out of doors, at the location indicated on **Figures 6-3 and 6-4,** or equivalent.

An underground fuel storage tank is assumed, located beneath or adjacent to the employee parking lot. The maximum daily fuel consumption of 12 vehicles in active service with three spares could be as high as 2,500 gallons per day. A 44-foot-long fuel tanker truck has a 9,000 gallon capacity. Fuel deliveries could thus be expected to occur twice weekly.

INSPECTION

Daily inspection activities include:

- Engine audio/visual inspection for abnormal noises or leaks
- Bottom deck inspections of wheels, trucks, brake shoes, running gear, and safety appliances
- Inspections of carbody exterior, exterior mounted system components and trainlines
- Cleaning of control cab windows and cab
- System operational integrity checks of doors, lighting, communications, and HVAC control functions
- Daily repair items
- Initial terminal brake tests
- Testing and downloading of data, as required

CLEANING

Daily cleaning activities include:

- Sweeping aisles and bagging refuse
- Wiping windows with window cleaner
- Cleaning window sills, arm rests, and heater boxes
- Removing gum and other adhesives from upholstery and floor
- Mopping floors
- Replacing seat cushions as required
- Brushing seats and seat backs
- Removal of graffiti from interior panels, fittings, ceiling, and seats
- Cleaning door tracks
- Cleaning stairs
- Cleaning control cab area
- Vacuuming

- Picking up newspapers and all litter
- Removal of torn advertising placards, damaged or expired public notices, unauthorized stickers/ posters (including tapes and adhesives) and other unsightly items

Preventive, Periodic and Unscheduled Maintenance

Preventive and periodic maintenance work is scheduled to maximize equipment availability. These activities are intended to address potential component defects prior to actual failure. Unscheduled repairs include:

- Wheel change outs
- Overhauls
- Mechanical and electrical repairs
- Interior work
- Body work
- Repair or replacement of couplers, doors, brakes, and air conditioning units
- Power assemblies
- Engines
- Car body restorative painting.

Some of these activities may be performed at Monterey–Salinas Transit's Frank J. Lichtanski Monterey Bay Operations Center, or elsewhere.

STAFFING LEVELS

The number of light rail transit vehicle maintenance staff is estimated to number 1.25 per vehicle, or up to 19 for a 15 vehicle fleet. These personnel would be assigned to three shifts and shifts would overlap from one to two hours, resulting in a maximum of 15 employees on site at a given time.

Maintenance of way personnel could operate from the Light Rail Transit Maintenance and Operations Center or from Monterey–Salinas Transit's Frank J. Lichtanski Monterey Bay Operations Center, to be constructed between 7th Avenue and 8th Avenue, north of Gigling Road, approximately 1.4 miles inland from the Light Rail Transit Maintenance and Operations Center **(if located at Site 3)**. Given space constraints at the Light Rail Transit Maintenance and Operations Center, some of these personnel are expected to be based at Monterey–Salinas Transit's Monterey Bay Operations Center.

Train operators and train dispatch/control personnel are expected to be based at the Light Rail Transit Maintenance and Operations facility. The maximum number of these transportation function employees on site would be 10. With employee shift change and overlap, the maximum number could approach 20 staff members.

BUILDING SPACE REQUIREMENTS

Table 6-1 summarizes the preliminary maintenance building space requirements identified for the Project Approval/Environmental Document phase of project development. The listed space allocations are preliminary and are subject to refinement during subsequent phases of engineering design.

Equipment housed or operated within the building will likely include:

- A vehicle inspection pit
- Mobile vehicle lifts

Table 6-1
PRELIMINARY SPACE REQUIREMENTS FOR MONTEREY PENINSULA LIGHT RAIL TRANSIT MAINTENANCE AND OPERATIONS CENTER

Function	Type of Space	Building Floor	Area
Vehicle Layover/Equipment Storage	Shell, unconditioned	1	**20,400**
Vehicle Inspection and Repair	Conditioned (HVAC)	1	**20,400**
Offices and Shops			
Building lobby/security		1	375
Vertical circulation		1, 2	1,500
Horizontal circulation		1, 2	3,700
		Subtotal	**5,575**
Maintenance Division—Administrative	Conditioned (HVAC)		
Division manager		2	200
Secretary/file clerk		2	130
Foreman		2	250
Locker room		2	500
Lunch room		2	600
Janitor closet		2	120
		Subtotal	**1,800**
Maintenance Division—Repair	Conditioned (HVAC)		
Bench room		1	1,000
Equipment storage area		1	1,000
Bench stock room		1	100
Lube room		1	200
Tool box storage room		1	400
Battery room		1	120
First aid closet		1	25
Mechanical room		1	400
Electrical equipment room		1	200
Parts room		1	2,300
Inactive storage		2	400
Lab room		1	80
Minor body repair work area		1	1,000
Facility maintenance room		1	400
		Subtotal	**7,625**
Transportation Division Operations	Conditioned (HVAC)		
Division manager		2	200
Secretary		2	140
Line supervisors		2	200
Conference room		2	250
Dispatch/communications center		2	450
Employee welfare/fitness		2	400
Operators lounge		2	600
Lunch room		2	400
Locker room		2	380
Restrooms/showers		2	400
Bid room		2	80
Fleet control		2	200
		Subtotal	**3,700**

Building Summary	**Site 3**	**Site 1**
Building pad	51,000 ft²	70,000 ft²
Exterior dimensions	150 feet × 340 feet	100 feet × 700 feet
Unconditional space	20,400 ft²	21,000 ft²
Ground floor conditioned space	30,600 ft²	49,000 ft²
Second floor conditioned space	8,500 ft²	—
Approximate height of building	35 to 40 feet	25 to 30 feet

- Overhead crane
- Truck repair hoist, truck lifting and turning device
- Truck turntables
- Truck test stand
- Wheel and axle lathes
- Wheel press and boring machines
- Forklift
- Railcar mover
- Mobile train washer
- Track maintenance equipment

OTHER CONSIDERATIONS

The noise levels from yard and shop activities generally will satisfy the daytime noise criteria of the residential sites near the Light Rail Transit Maintenance and Operations Center. The Transportation Agency for Monterey Bay and/or Monterey–Salinas Transit will ensure that noise-producing yard activities will be limited to daytime hours to the extent possible. Nighttime yard activities, other than trains moving in the yard, will be performed inside the enclosed shop building, which is normal practice for maintenance facilities.

If located at Site 3, the orientation of the Light Rail Transit Maintenance and Operations Center building and yard tracks will depend on the vehicle ultimately selected to provide the service. A north–south orientation, running parallel to Highway 1, allows for the selection of a wider range of vehicle types, having a minimum turning radius of up to ±300 feet. An east–west orientation, running perpendicular to Highway 1, restricts the selection of vehicles to those having a smaller minimum turning radius of ±150 feet. The Siemens Desiro prototype vehicle discussed in Chapter 5 falls into the larger turning radius category, while the Stadler GTW 2/6 prototype vehicle has a relatively small turn radius (132 feet). **Site 1 would impose no such vehicle selection constraints.**

7 Guideway Operating Plan

7. Guideway Operating Plan

Overview

Light rail service would be implemented in two phases. In the first phase, the Monterey Branch Line railroad track would be restored or constructed between downtown Monterey at **Custom House** Plaza and North Marina, with bus service continuing to Castroville on local roadways (Figure 7-1). The second phase would extend the guideway restoration to Castroville, at the intercity rail station near Blackie Road (Figure 7-2). A single-track line with new ties, ballast and grade crossing protection would be constructed for a distance of 10.0 miles in the first phase and extend another 5.35 miles to the Castroville intercity rail station during the second project phase. Existing track within the Fort Ord area (laid in 1971) would be reused. Passing sidings would be constructed where needed to allow for two-way train operations.

Figure 7-1
Light Rail Transit—Phase I *(LRT-1)*

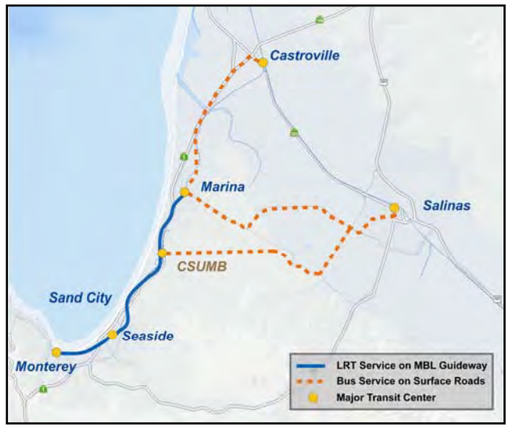
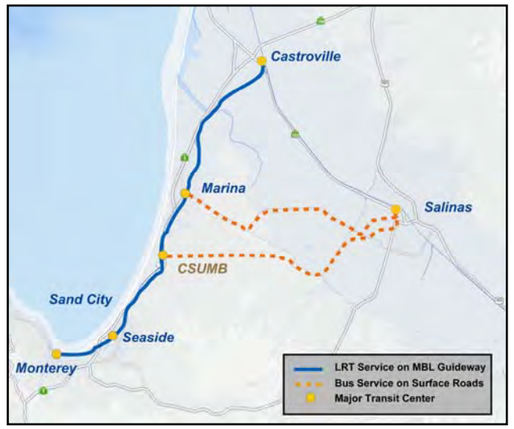


Figure 7-2
Light Rail Transit—Phase II *(LRT-2)*



Local bus service from Salinas to Marina and the California State University at Monterey Bay (CSUMB) would complement local rail service.

Local light rail transit service on the Monterey Branch Line would be accessed by stations serving all existing and projected population, employment, and educational concentrations along the Peninsula. Five stops are proposed to serve Marina at Marina Green Drive, Beach Road, Reservation Road, Palm Avenue and Eighth Street (CSUMB). Three stations are proposed to serve Seaside and Sand City at First Street, Playa Avenue, and Contra Costa Street. In Monterey, **three** stops are proposed at Casa Verde Way, the U.S. Naval Postgraduate School **(at Sloat Avenue)**, **and** Figueroa Street or the **Monterey** Maritime **and History** Museum at **Custom House** Plaza. Light rail transit service would also serve the Castroville intercity rail station at Blackie Road. Peninsula travelers could transfer to commuter rail and intercity trains in Castroville.

As noted above, light rail transit service would operate between Monterey and Marina initially, with connecting bus service to Castroville. Ten- to thirty-minute headways would be offered from 5:00 a.m. to 8:00 p.m., with less frequent service running to midnight. All train equipment would be interchangeable, thereby minimizing requirements for spare vehicles. The fleet would be stored at the former Fort Ord military reservation on lands owned by the Transportation Agency for Monterey County.

Intercity service would initially be provided via light rail transit and bus connections between Monterey and Castroville, with transfers to commuter rail and Amtrak trains at the Castroville Station.

Limits of Operation

The project will restore passenger rail service to the Monterey Peninsula. As noted above, track restoration, refurbishment and/or replacement will extend from Blackie Road in Castroville (milepost EE 110.6) to downtown Monterey at **Custom House** Plaza, running along the former Southern Pacific Railroad Monterey Branch Line right-of-way for 15.2 miles to the vicinity of the historic train depot west of Figueroa Street, and/or henceforth to the Monterey Maritime **and History** Museum, adjacent to **Custom House** Plaza in downtown Monterey. Two limits of service are addressed by this operations plan:

1. Fixed guideway light rail transit service from north of Marina Green Drive in the city of Marina (at approximately milepost EE 115.9) to **Custom House** Plaza in the city of Monterey (equivalent to milepost 125.85).
2. Fixed guideway light rail transit service from north of Blackie Road in the unincorporated community of Castroville (at approximately milepost EE 110.6) to **Custom House** Plaza in Monterey.

One extension of the Castroville to Monterey interurban light rail transit service has been considered, but is not addressed by this project:

3. From the light rail transit/intercity rail station in Castroville, north of Blackie Road at milepost E 107.2, to the Salinas Intermodal Transportation Center at milepost E 114.9, a distance of 7.7 miles.

In addition to interurban light rail transit service, operation of intercity passenger rail service between the Monterey Peninsula and San Francisco has been considered. This service would utilize Federal Railroad Administration (FRA)-compliant vehicles and offer a one seat ride. This intercity passenger rail service is considered to be a future potential service and is not addressed by this project.

Hours of Operation

The Monterey Peninsula light rail service would replicate a portion of existing Monterey–Salinas Transit bus Line 20. The first southbound bus currently leaves the Marina Transit Exchange at 5:20 a.m. on weekdays and Saturdays. The last northbound trip currently arrives at the Marina Transit Exchange at 11:42 p.m.

For the purpose of the Project Approval/Environmental Document, the hours of operation are therefore assumed to be 5:00 a.m. to midnight on weekdays and Saturdays.

On Sundays and holidays, the first Line 20 service of the morning departs the Monterey Transit Plaza at 7:45 a.m. and the last trip of the evening arrives at 7:49 p.m. Therefore, Sunday and holiday service will be assumed to operate between 7:30 a.m. and 8:00 p.m.

Operating Pattern

Light rail transit trains will make all station stops between the route limits identified above. No express trains or skip stop trains are assumed.

Regarding potential intercity rail passenger service, a draft operations schedule for intercity passenger rail service was prepared by the National Railroad Passenger Corporation (Amtrak) on June 3, 2003, at the request of the Transportation Agency for Monterey County. The proposed service would operate two round trip trains on weekdays and three round trip trains on weekends from a Monterey Bay station located at First

Street in Seaside (Fort Ord) to San Francisco. Table 7-1 is a reproduction of the proposed service schedule. While this service was proposed to originate from a station at Fort Ord, operation to/from a station located in downtown Monterey at Figueroa Street or to/from a station located in north Marina, is assumed to be equally addressed by Amtrak's draft operations schedule.

Table 7-1
DRAFT OPERATIONS SCHEDULE FOR INTERCITY PASSENGER RAIL SERVICE*

Monterey Bay - San Jose - San Francisco

Northward	***M1***	M5	M209	M109		
	Daily	Daily	Su	Sa		
Monterey Bay	5:20 AM	12:20 PM	6:15 PM	7:00 PM		
Castroville	5:32 AM	12:32 PM	6:30 PM	7:11 PM		
Pajaro	5:49 AM	12:50 PM	6:45 PM	7:28 PM		
San Jose (Diridon)	6:56 AM	1:55 PM	7:50 PM	8:35 PM		
Millbrae	7:35 AM	2:35 PM	8:23 PM	9:08 PM		
San Francisco (4th & **King)**	8:00 AM	2:55 PM	8:45 PM	9:35 PM		
(Turn)	M2	M6	M210	M110		
Southward	M2	M206	M106	M6	M210	M110
	Daily	Su	Sa	XSaSu	Su	Sa
San Francisco (4th & **King)**	8:25 AM	3:00 PM	3:30 PM	4:25 PM	9:30 PM	10:25 PM
Millbrae	8:42 AM	3:18 PM	3:48 PM	4:44 PM	9:48 PM	10:43 PM
San Jose (Diridon)	9:25 AM	4:00 PM	4:30 PM	5:25 PM	10:30 PM	11:25 PM
Pajaro	10:20 AM	5:00 PM	5:30 PM	6:20 PM	11:30 PM	12:25 AM
Castroville	10:35 AM	5:20 PM	5:50 PM	6:35 PM	11:50 PM	12:45 AM
Monterey Bay	10:50 AM	5:35 PM	6:05 PM	6:50 PM	12:05 AM	1:00 AM
	---	---	---	---	---	---
(Turn)	M5	M209	M109	M1	M1	M1

Source: Amtrak
*Prepared by the National Railroad Passenger Corporation (Amtrak)

Operation of intercity trains over the same track used by non-FRA-compliant light rail transit vehicles would, at this time, require temporal separation of intercity and light rail transit operations. For the time period while the intercity train was occupying the "joint use" track, light rail transit service would be suspended.

While the future potential operations of intercity rail service is not part of this project, accommodation of this future service should be considered in the design provided that such accommodation does not materially add to the cost of implementation and/or environmental impacts.

Operating Speeds

California Public Utilities Commission General Order 143-B contains requirements for maximum authorized speed of light rail vehicles based on train protection (signals or operating rules) and the configuration of the track with respect to adjacent streets. The maximum speeds based on track configuration (alignment classification) are summarized in Table 7-2.

Some sort of train control is required for operation without signals. In the absence of block signals, cab signals, timetable, train order, current of traffic, or manual block system; speed is restricted to 25 miles per hour (mph) or less.

Table 7-2
MAXIMUM PERMITTED SPEEDS FOR LIGHT-RAIL TRANSIT SYSTEMS

Alignment Classification	Location	Crossing or Intersection Control	Train Control	Maximum Speed
Fenced right-of-way with at-grade crossings	Between crossings		ATP and ATS*	No limit
			ABS*	55 mph
			None required	45 mph
	At crossings	Flashing lights and gates	Same as between crossings	
		Traffic signal or other device (may) be authorized only in special locations	None required	35 mph
Street median or side alignment with 6-inch curb and fence	Between crossings		None required	Parallel traffic + 10 mph, but 45 mph maximum
	At crossings	Flashing lights and gates (side alignment only)	Same as between crossings	
		Traffic signal or other approved device	None required	Parallel traffic, but 35 mph maximum
Street median or side alignment with 6-inch curb		Traffic signal or other approved device	None required	Parallel traffic, but 35 mph maximum
Mountable curb or transit lane		Traffic signal or other approved device	None required	Parallel traffic, but 35 mph maximum
Pedestrian mall		Traffic signal or other approved device	None required	20 mph (lower speed may be required for malls paved flush with tracks)

Source: CPUC G.O. 143-B, Table 1
*ATP = automatic train protection; ATS = automatic train supervision; ABS = automatic block signaling

The Phase 1 Marina to Monterey service has been designed to run without train signals. Trains would be diverted to passing sidings with spring switches. Some signals will be needed at track junctions and crossings and between Marina and Castroville in Phase 2 to permit higher speeds. At motorized turnouts, the signals would display the orientation of the switch points as set by the operator using the wayside push buttons.

As noted above, for unsignalled operation, turnouts at passing sidings would have spring switches. With this type of switch, the switch point rails are held in position by a spring with a damper mechanism. When a train approaches the turnouts facing the switch points (facing point move), the train is diverted to the track to

which the points are aligned. When a train approaches from the other direction (trailing point move), the flanges of the wheels force the switch points to open, and the damper retards the points from closing to allow the train to pass through. This type of operation works when the facing point movement is always to the same track. The points can always be manually switched to allow facing point moves to the other track, but this is not normally necessary for passing operations.

Automatic block signaling is an optional item for Phase 1 operation between Marina and Monterey, as it is not necessary for accommodation of the operating schedule. Automatic block signaling is, however, assumed for the Marina to Castroville segment of track in Phase 2 of the passenger rail service restoration plan. Automatic block signaling may be added through the former Fort Ord lands, between Palm Avenue and Monterey Road, if shortened travel times are required to allow for unscheduled delay at grade crossings. Automatic block signaling is the simplest form of railroad signals and consists of wayside signals activated by track circuits to prevent trains from getting too close to each other. This does not replace procedures for authorizing trains to occupy segments or blocks of track, similar to an unsignalled railroad.

No elaborate communication systems are planned for the Monterey Peninsula service. Communications between a dispatcher and the cab operator would be via two-way radio or cell phone. Dispatchers will aid train movement and control using NextBus technology or an equivalent automatic vehicle location system. NextBus is a system that keeps track of vehicle locations and conveys anticipated arrival times to individual stations. The system consists of a central computer operated and maintained by NextBus on-board transmitters so that global positioning system (GPS) satellites can track the locations of vehicles, and station-mounted message boards. Data is transmitted via the internet.

For the computation of running times and the locations of train meets and passing tracks, the maximum speeds listed in Table 7-3 are assumed.

Table 7-3
MAXIMUM SPEEDS BETWEEN MONTEREY BRANCH LINE SEGMENTS

Segment	Phase 1	Phase 2
Castroville to Marina Green Drive	N/A	55 mph
Marina Green Drive to Palm Avenue	45 mph	45 mph
Palm Avenue to Monterey Road	45 mph	55 mph*
Monterey Road to Canyon del Rey Boulevard	45 mph	45 mph
Canyon Del Rey Boulevard to Figueroa Street	35 mph	35 mph
Figueroa Street to Maritime Museum at Portola Plaza	35 mph	35 mph

*If needed to maintain schedule, otherwise 45 mph

Train Movement Control

Light rail trains operation will be governed by a set of operating rules. Safety rules and regulations governing light rail transit are specified in CPUC G.O. 143-B as cited previously. In addition to CPUC standards, the Monterey Peninsula light rail transit system will establish operating rules and regulations which are consistent with G.O. 143-B, and specific with respect to the Monterey Branch Line operating environment.

Monterey–Salinas Transit is the presumed operator of the light rail transit service. It will likely use a "standard" rulebook, such as the *General Code of Operating Rules* as the basis of its rule making, along with operating rules adopted by other single-track light rail transit systems, such as the North County Transit District's Sprinter line and New Jersey Transit's River line.

All trains must have authority to occupy a main track. A *timetable*, which shows a schedule for each train, authorizes a train operator to move his/her train along the main track. When trains operate in opposing directions on a single-line railroad, "meets" of opposing trains are scheduled, where each train waits for the other at a point where they may pass. Neither train is permitted to move beyond this point until the other train arrives.

By itself, a timetable is inefficient, because delays cannot be accounted for efficiently. To accommodate the dissemination of alternations to the timetable, *train orders* are issued by the dispatcher. These override the timetable, allowing the cancellation, rescheduling and addition of trains, along with most anything else. While timetable and train order control has been phased out in favor of radio dispatching and electronic signaling, the basics of train control remain largely unchanged as specified below.

Trains running along the Monterey Branch Line will operate under *restricted speeds*, as identified earlier in Table 7-2. Restricted speed or line of sight operation implies that train operators will control the trains so that they can come to a stop within one-half the range of the operator's vision or line of sight. The basic working theory is that two trains, approaching head on along a single track, will each be able to come to a complete stop upon seeing one another.

As an additional safety precaution, trains will operate under a *manual block system*. The rail line between Castroville and Monterey will be divided into predefined "blocks" or segments of track. Authority to occupy a block will be granted by a dispatcher using the *direct traffic control*, or DTC system. Direct traffic control is similar to automatic block signaling without the signals. Dispatchers authorize trains to proceed through a specified number of blocks. Only one train may occupy a stretch of authority, which may consist of one or several blocks, at any given time. DTC may be combined with automatic block signaling in high-traffic areas to aid with train separation and safety.

Dispatchers will be aided by an *automatic vehicle location* system, using GPS and radio communications. The NextBus vehicle tracking system is an example of the technology likely to be deployed. Each vehicle will be fitted with a GPS receiver, which transmits speed and location data to a central location. A console located within the dispatch office will display the location and movement of all vehicles that are active within the system.

Running Time and Headways

The round trip running time from the Marina Green Station to the **Monterey** Maritime **and History** Museum Station at **Custom House** Plaza and return is 60 minutes. This running time includes four to six minutes of schedule recovery time at each end of the line, stopping at all intermediate stations, with 25 second dwell times, scheduled delays of 30 seconds at non-station location "meets," and 60 seconds of additional delay at one highly congested intersection (Monterey Road/State Route (SR) 1) where full traffic signal pre-emption would overly disrupt traffic flows. Acceleration and deceleration rates of two miles per hour per second (mphps) are assumed based on the candidate vehicle technology.

Extending the service to include Castroville in Phase 2 adds a minimum of 15 minutes to the round trip, with additional time required for scheduling headways other than 15 minutes.

Table 7-4 lists the various headways which can be efficiently provided by the Monterey Peninsula light rail service, along with the vehicle requirement, assuming single car trains.

Table 7-4
MONTEREY PENINSULA LRT CANDIDATE HEADWAYS AND VEHICLE REQUIREMENTS

Headway	Vehicle Requirements*	
	Phase 1 Marina to Monterey	Phase 2 Castroville to Monterey
60 minutes	1	N/A
30 minutes	2	3
20 minutes	3	4
15 minutes	4	5
12 minutes	5	7
10 minutes	6	8

*Excludes spares

Location of Meets and Passing Tracks

The above calculations of running times and headway options can be combined to identify the location of "meets" and the need for passing tracks. Where the meets occur at stations, on-board passengers will not notice delays, as the trains must stop in any event to board and discharge passengers. Where the meets occur at congested intersections, such as Monterey Road and the SR 1 on-/off-ramps, no trip delay will be apparent, as travelers are conditioned to wait at busy intersections. Where the meets occur along lengthy sections of double track, passing trains will be able to "fly" by one another, again with no apparent delay. In some cases, however, the meets will need to occur at passing track locations where no other event happens, other than waiting for the opposing train to pass.

Timetables and schedules have been devised to minimize non-event delays. Figures 7-3 through 7-15 illustrate *stringline diagrams* of where northbound and southbound trains will be expected to meet one another. Train movement control will ensure that the meets occur when and where expected. Using the Phase 1 service between Marina and Monterey as an example, Figure 7-8 illustrates that no meets will occur when 60-minute headways, requiring one vehicle to operate, are provided. With 30-minute headways, one meet will occur at or near the Monterey Road intersection with the SR 1 on- and off-ramps at Fremont Boulevard and California Avenue. If 20-minute service is provided, two train meets will occur. Going from north to south, or east to west, the first of these meets will occur between Eighth Street in Marina and First Street in Seaside, and the second meet will occur at Roberts Avenue on the border of Seaside and Monterey.

Note: **Subsequent to the preparation of the stringline diagrams illustrated in Figures 7-3 through 7-15, the location of the Naval Postgraduate School station was shifted westerly, from opposite the Del Monte Avenue Naval Postgraduate School gate, at milepost 124.85, to Sloat Avenue, at milepost 125.00. The proposed station at El Estero Park/La Plaza, at milepost 125.20, was then eliminated from the definition of the locally preferred alternative. The stringline diagrams have not been updated to reflect this station consolidation.**

Table 7-5 and Figure 7-16 provide an inventory and map of the meet locations for various headway operations. For the purpose of the Project Approval/Environmental Document, the combination of all train meeting locations is assumed for double-track requirements.

Table 7-5
MONTEREY PENINSULA LIGHT RAIL TRANSIT PASS TRACK LOCATION REQUIREMENTS

Location	Milepost	Headway (minutes) Option
South of Tembladero Slough	111.35	10
Lapis Sand Plant Access Road	115.10	10, 12, 15, 20, 30
Reservation Road Station	117.05	10
Palm Avenue Station	117.35	12
South of SR 1 overpass	118.00	15
Between Eighth Street and First Street	119.25	10, 20
South of Fort Ord balloon spur	120.15	12
Monterey Road	122.20	10, 15, 30
Playa Avenue Station	122.5	12
Roberts Avenue	123.95	10, 20
Naval Postgraduate School Station	**125.00**	**10,** 12, 15

For the purpose of determining capital and operating costs, a maximum of 15-minute headways is assumed for the initial deployment of Phase 1 service between Marina and Monterey. The conceptual track restoration plans depicted in Chapter 8, however, reflect the maximum amount of double tracking required for 10-minute headways between Monterey and Castroville. This maximum headway double track requirement includes all intervening headway intervals, such as 12, 15, 20, and 30 minutes.

Operating schedules for all headway combinations are presented in Tables 7-6 through 7-18. These tables accompany and are the basis of the stringline diagrams illustrated as Figures 7-3 through 7-15. **The tables have not been updated to reflect the westerly shift of the Naval Postgraduate School station platform.**

Future Track and Station Platforms

The conceptual track and station plans illustrated in Chapter 8 reference "future track and/or station platforms." These segments of double track and second station platforms are illustrated to identify where additional investment may occur to simplify train control by increasing the amount of double track operation, where such investment would improve running times and/or simplify train control and operations. The conceptual plans, to include the future track and station platforms, define the "area of potential effects" or APE, for the environmental impact assessment.

Figure 7-3
Light Rail Transit Stringline Diagram for Marina to Monterey Service with 10-minute Headways

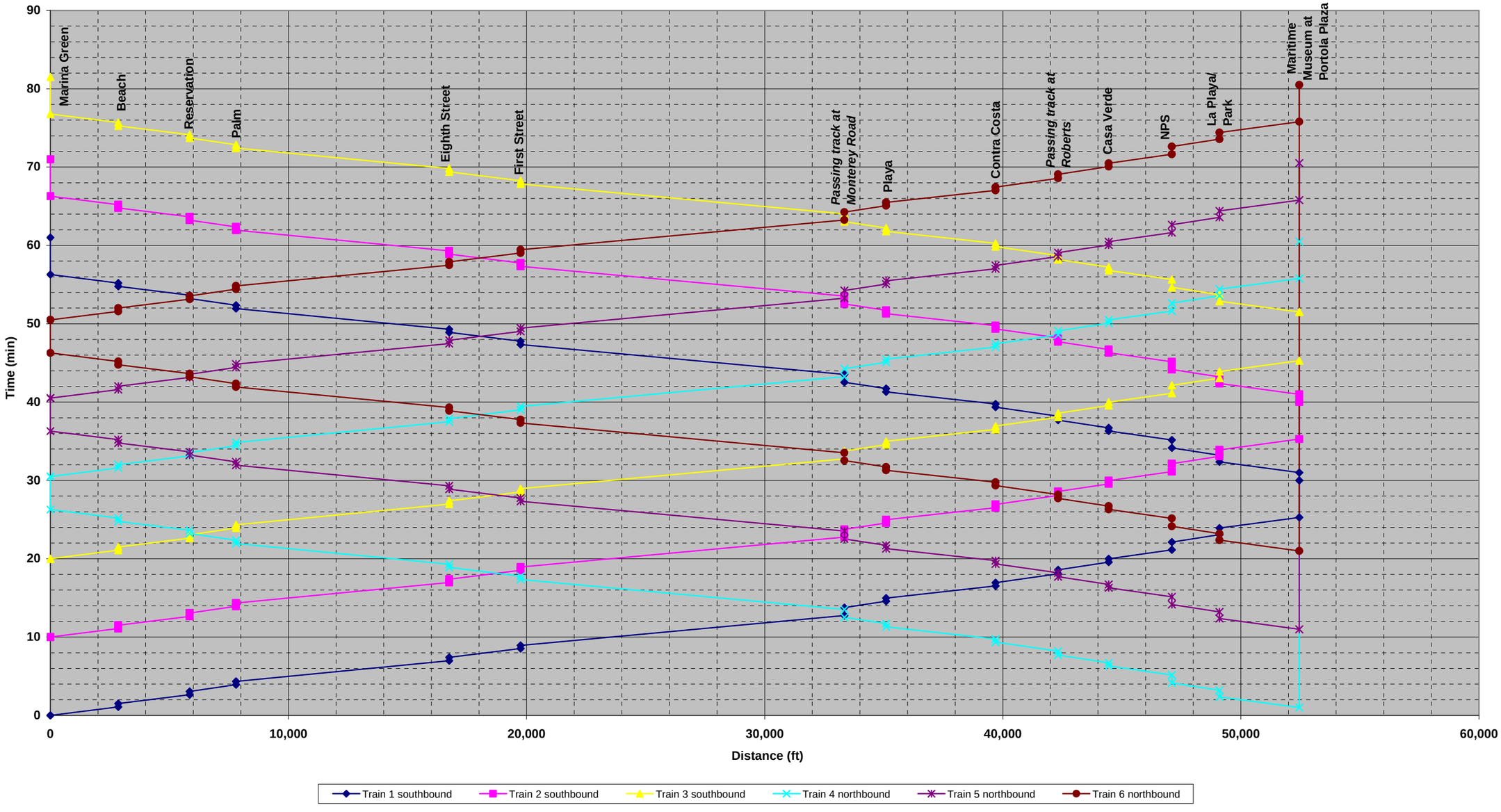


Table 7-6 *(1 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR MARINA TO MONTEREY SERVICE WITH 10-MINUTE HEADWAYS *(Southbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 10-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
SOUTHBOUND																		
Marina Green Sta 275+50														0.00		10.00		20.00
Beach Sta 304+00	2850	45	742.50	22.5	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.5113636	1.09	1.51	11.09	11.51	21.09	21.51
Reservation Sta 334+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.5492424	2.64	3.06	12.64	13.06	22.64	23.06
Palm Sta 353+50	1950	45	742.50	22.5	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.2840909	3.93	4.34	13.93	14.34	23.93	24.34
Eighth Street Sta 443+00	8950	45	742.50	22.5	742.50	22.5	7465.00	113.11	25.00000	0.00	183.11	3.0517677	6.98	7.40	16.98	17.40	26.98	27.40
First Street Sta 473+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.5492424	8.53	8.95	18.53	18.95	28.53	28.95
Passing Track at Monterey Sta 609+00	13600	45	742.50	22.5	742.50	22.5	12115.00	183.56	0.00000	60.00	288.56	4.8093434	12.76	13.76	22.76	23.76	32.76	33.76
Playa Sta 626+50	1750	45	742.50	22.5	742.50	22.5	265.00	4.02	25.00000	0.00	74.02	1.2335859	14.57	14.99	24.57	24.99	34.57	34.99
Contra Costa Sta 674+00	4600	45	742.50	22.5	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.9532828	16.53	16.94	26.53	26.94	36.53	36.94
Passing Track at Roberts Sta 700+20	2620	35	449.17	17.50	449.17	17.5	1721.67	33.54	0.00000	30.00	98.54	1.642316	18.08	18.58	28.08	28.58	38.08	38.58
Casa Verde Sta 720+00	2130	35	449.17	17.50	449.17	17.5	1231.66	23.99	25.00000	0.00	83.99	1.3998896	19.57	19.98	29.57	29.98	39.57	39.98
NPS Sta 746+50	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	60.00000	0.00	129.12	2.1520563	21.14	22.14	31.14	32.14	41.14	42.14
Park Sta 766+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	50.00000	0.00	106.46	1.7743506	23.08	23.91	33.08	33.91	43.08	43.91
Maritime Museum at Portola Plaza Sta 800+00	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	282.60835		365.37	6.0894683	25.29	30.00	35.29	40.00	45.29	50.00

Table 7-6 *(2 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR MARINA TO MONTEREY SERVICE WITH 10-MINUTE HEADWAYS *(Northbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 10-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
NORTHBOUND																		
Maritime Museum at Portola Plaza Sta 800+00									282.60835					0.00		10.00		20.00
Park Sta 766+50	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	50.00000	0.00	115.26	1.9209957	1.38	2.21	11.38	12.21	21.38	22.21
NPS Sta 746+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	60.00000	0.00	116.46	1.9410173	3.15	4.15	13.15	14.15	23.15	24.15
Casa Verde Sta 720+00	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	25.00000	0.00	94.12	1.5687229	5.31	5.72	15.31	15.72	25.31	25.72
Passing Track at Roberts Sta 700+20	2130	35	449.17	17.50	449.17	17.5	1231.67	23.99	0.00000	30.00	88.99	1.4832251	6.71	7.21	16.71	17.21	26.71	27.21
Contra Costa Sta 674+00	2620	35	449.17	17.50	449.17	17.5	1721.66	33.54	25.00000	0.00	93.54	1.5589805	8.35	8.76	18.35	18.76	28.35	28.76
Playa Sta 626+50	4600	45	742.50	22.50	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.9532828	10.30	10.72	20.30	20.72	30.30	30.72
Passing Track at Monterey Sta 609+00	1750	45	742.50	22.50	742.50	22.5	265.00	4.02	0.00000	60.00	109.02	1.8169192	11.53	12.53	21.53	22.53	31.53	32.53
First Street Sta 473+00	13600	45	742.50	22.50	742.50	22.5	12115.00	183.56	25.00000	0.00	253.56	4.2260101	16.34	16.76	26.34	26.76	36.34	36.76
Eighth Street Sta 443+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.5492424	17.89	18.31	27.89	28.31	37.89	38.31
Palm Sta 353+50	8950	45	742.50	22.50	742.50	22.5	7465.00	113.11	25.00000	0.00	183.11	3.0517677	20.95	21.36	30.95	31.36	40.95	41.36
Reservation Sta 334+00	1950	45	742.50	22.50	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.2840909	22.23	22.65	32.23	32.65	42.23	42.65
Beach Sta 304+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.5492424	23.78	24.20	33.78	34.20	43.78	44.20
Marina Green Sta 275+50	2850	45	742.50	22.50	742.50	22.5	1365.00	20.68	282.70835	0.00	348.39	5.8065029	25.29	30.00	35.29	40.00	45.29	50.00

Figure 7-4
Light Rail Transit Stringline Diagram for Marina to Monterey Service with 12-minute Headways

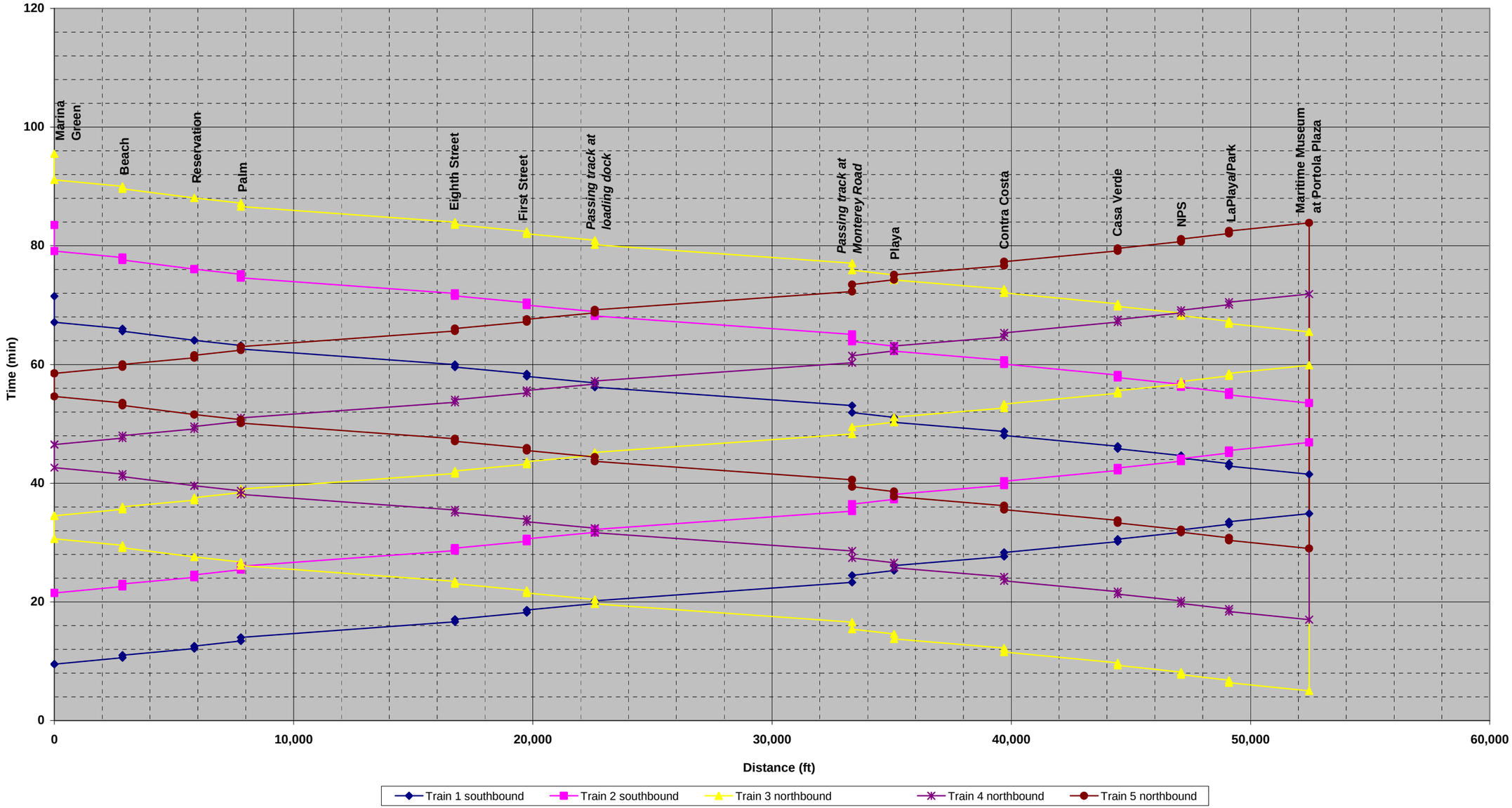


Table 7-7 *(1 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR MARINA TO MONTEREY SERVICE WITH 12-MINUTE HEADWAYS *(Southbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 12-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
SOUTHBOUND																		
Marina Green Sta 275+50														9.50		21.50		33.50
Beach Sta 304+00	2850	45	742.50	22.5	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.5113636	10.59	11.01	22.59	23.01	34.59	35.01
Reservation Sta 334+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.5492424	12.14	12.56	24.14	24.56	36.14	36.56
Palm Sta 353+50	1950	45	742.50	22.5	742.50	22.5	465.00	7.05	25.00000	10.00	87.05	1.4507576	13.43	14.01	25.43	26.01	37.43	38.01
Eighth Street Sta 443+00	8950	45	742.50	22.5	742.50	22.5	7465.00	113.11	25.00000	0.00	183.11	3.0517677	16.65	17.06	28.65	29.06	40.65	41.06
First Street Sta 473+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.5492424	18.20	18.61	30.20	30.61	42.20	42.61
Passing track at loading dock Sta 501+40	2840	45	742.50	22.5	742.50	22.5	1355.00	20.53	0.00000	30.00	95.53	1.5921717	19.70	20.20	31.70	32.20	43.70	44.20
Passing track at Monterey Road Sta 609+00	10760	45	742.50	22.5	742.50	22.5	9275.00	140.53	0.00000	70.00	255.53	4.2588384	23.30	24.46	35.30	36.46	47.30	48.46
Playa Sta 626+50	1750	45	742.50	22.5	742.50	22.5	265.00	4.02	50.00000	0.00	99.02	1.6502525	25.28	26.11	37.28	38.11	49.28	50.11
Contra Costa Sta 674+00	4600	45	742.50	22.5	742.50	22.5	3115.00	47.20	25.00000	15.00	132.20	2.2032828	27.65	28.32	39.65	40.32	51.65	52.32
Casa Verde Sta 720+00	4750	35	449.17	17.50	449.17	17.5	3851.67	75.03	25.00000	0.00	135.03	2.2505411	30.15	30.57	42.15	42.57	54.15	54.57
NPS Sta 746+50	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	25.00000	0.00	94.12	1.5687229	31.72	32.14	43.72	44.14	55.72	56.14
Park Sta 766+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	25.00000	0.00	81.46	1.357684	33.08	33.49	45.08	45.49	57.08	57.49
Maritime Museum at Portola Plaza Sta 800+00	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	277.60823	0.00	360.37	6.0061328	34.87	39.50	46.87	51.50	58.87	63.50

Table 7-7 *(2 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR MARINA TO MONTEREY SERVICE WITH 12-MINUTE HEADWAYS *(Northbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 12-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
NORTHBOUND																		
Maritime Museum at Portola Plaza Sta 800+00									277.60823					0.00		12.00		24.00
Park Sta 766+50	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	25.00000	0.00	107.76	1.7959957	1.38	1.80	13.38	13.80	25.38	25.80
NPS Sta 746+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	25.00000	0.00	81.46	1.357684	2.74	3.15	14.74	15.15	26.74	27.15
Casa Verde Sta 720+00	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	25.00000	0.00	94.12	1.5687229	4.31	4.72	16.31	16.72	28.31	28.72
Contra Costa Sta 674+00	4750	35	449.17	17.50	449.17	17.5	3851.67	75.03	25.00000	15.00	150.03	2.5005411	6.56	7.22	18.56	19.22	30.56	31.22
Playa Sta 626+50	4600	45	742.50	22.50	742.50	22.5	3115.00	47.20	50.00000	0.00	142.20	2.3699495	8.76	9.59	20.76	21.59	32.76	33.59
Passing track at Monterey Road Sta 609+00	1750	45	742.50	22.50	742.50	22.5	265.00	4.02	0.00000	70.00	119.02	1.9835859	10.41	11.58	22.41	23.58	34.41	35.58
Passing track at loading dock Sta 501+40	10760	45	742.50	22.50	742.50	22.5	9275.00	140.53	0.00000	45.00	230.53	3.8421717	14.67	15.42	26.67	27.42	38.67	39.42
First Street Sta 473+00	2840	45	742.50	22.50	742.50	22.5	1355.00	20.53	25.00000	0.00	90.53	1.5088384	16.51	16.93	28.51	28.93	40.51	40.93
Eighth Street Sta 443+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.5492424	18.06	18.48	30.06	30.48	42.06	42.48
Palm Sta 353+50	8950	45	742.50	22.50	742.50	22.5	7465.00	113.11	25.00000	10.00	193.11	3.2184343	21.11	21.70	33.11	33.70	45.11	45.70
Reservation Sta 334+00	1950	45	742.50	22.50	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.2840909	22.56	22.98	34.56	34.98	46.56	46.98
Beach Sta 304+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.5492424	24.11	24.53	36.11	36.53	48.11	48.53
Marina Green Sta 275+50	2850	45	742.50	22.50	742.50	22.5	1365.00	20.68	262.60823	0.00	328.29	5.4715007	25.62	30.00	37.62	42.00	49.62	54.00

Figure 7-5
Light Rail Transit Stringline Diagram for Marina to Monterey Service with 15-minute Headways

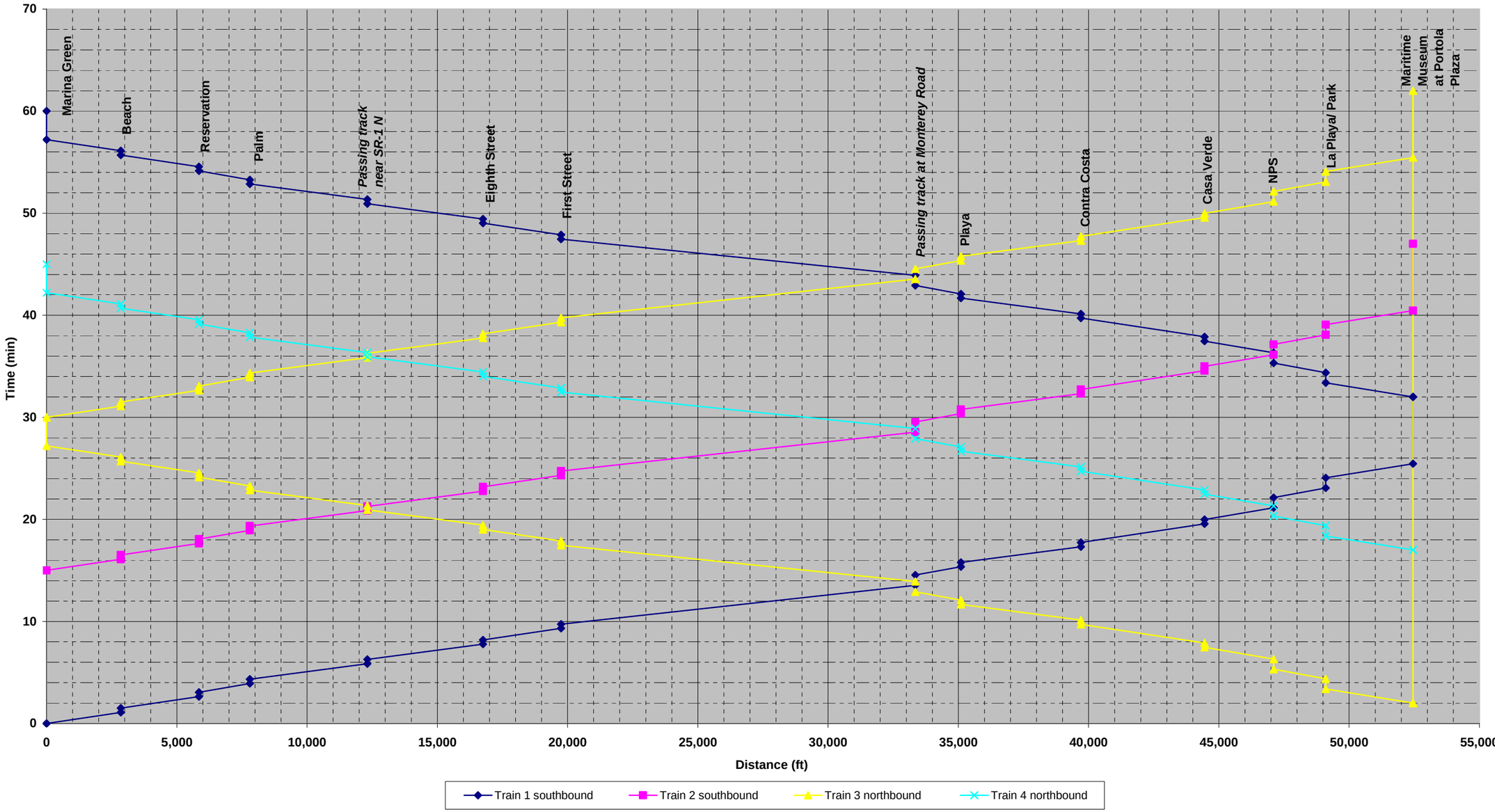


Table 7-8 *(1 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR MARINA TO MONTEREY SERVICE WITH 15-MINUTE HEADWAYS *(Southbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 15-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
SOUTHBOUND																		
Marina Green Sta 275+50														0.00		15.00		30.00
Beach Sta 304+00	2850	45	742.50	22.5	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.511364	1.09	1.51	16.09	16.51	31.09	31.51
Reservation Sta 334+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	2.64	3.06	17.64	18.06	32.64	33.06
Palm Sta 353+50	1950	45	742.50	22.5	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	3.93	4.34	18.93	19.34	33.93	34.34
Passing track near SR-1 N Sta 398+60	4510	45	742.50	22.5	742.50	22.5	3025.00	45.83	0.00000	25.00	115.83	1.930556	5.86	6.28	20.86	21.28	35.86	36.28
Eighth Street Sta 443+00	4440	45	742.50	22.5	742.50	22.5	2955.00	44.77	25.00000	0.00	114.77	1.912879	7.77	8.19	22.77	23.19	37.77	38.19
First Street Sta 473+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	9.32	9.74	24.32	24.74	39.32	39.74
Passing track at Monterey Road Sta 609+00	13600	45	742.50	22.5	742.50	22.5	12115.00	183.56	0.00000	60.00	288.56	4.809343	13.55	14.55	28.55	29.55	43.55	44.55
Playa Sta 626+50	1750	45	742.50	22.5	742.50	22.5	265.00	4.02	25.00000	0.00	74.02	1.233586	15.36	15.78	30.36	30.78	45.36	45.78
Contra Costa Sta 674+00	4600	45	742.50	22.5	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.953283	17.32	17.73	32.32	32.73	47.32	47.73
Casa Verde Sta 720+00	4750	35	449.17	17.50	449.17	17.5	3851.67	75.03	25.00000	0.00	135.03	2.250541	19.57	19.98	34.57	34.98	49.57	49.98
NPS Sta 746+50	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	60.00000	0.00	129.12	2.152056	21.14	22.14	36.14	37.14	51.14	52.14
La Playa/Park Sta 766+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	60.00000	0.00	116.46	1.941017	23.08	24.08	38.08	39.08	53.08	54.08
Maritime Museum at Portola Plaza Sta 800+00	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	272.60823	0.00	355.37	5.922799	25.46	30.00	40.46	45.00	55.46	60.00

Table 7-8 *(2 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR MARINA TO MONTEREY SERVICE WITH 15-MINUTE HEADWAYS *(Northbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 15-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
NORTHBOUND																		
Maritime Museum at Portola Plaza Sta 800+00													2.00	2.00	17.00	17.00	32.00	32.00
La Playa/Park Sta 766+50	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	60.00000	0.00	142.76	2.379329	3.38	4.38	18.38	19.38	33.38	34.38
NPS Sta 746+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	60.00000	0.00	116.46	1.941017	5.32	6.32	20.32	21.32	35.32	36.32
Casa Verde Sta 720+00	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	25.00000	0.00	94.12	1.568723	7.47	7.89	22.47	22.89	37.47	37.89
Contra Costa Sta 674+00	4750	35	449.17	17.50	449.17	17.5	3851.67	75.03	25.00000	0.00	135.03	2.250541	9.72	10.14	24.72	25.14	39.72	40.14
Playa Sta 626+50	4600	45	742.50	22.50	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.953283	11.68	12.09	26.68	27.09	41.68	42.09
Passing track at Monterey Road Sta 609+00	2750	45	742.50	22.50	742.50	22.5	1265.00	19.17	0.00000	60.00	124.17	2.069444	13.16	14.16	28.16	29.16	43.16	44.16
First Street Sta 473+00	12600	45	742.50	22.50	742.50	22.5	11115.00	168.41	0.00000	25.00	238.41	3.973485	17.72	18.14	32.72	33.14	47.72	48.14
Eighth Street Sta 443+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	19.27	19.69	34.27	34.69	49.27	49.69
Passing track near SR-1 N Sta 398+60	4440	45	742.50	22.50	742.50	22.5	2955.00	44.77	0.00000	25.00	114.77	1.912879	21.18	21.60	36.18	36.60	51.18	51.60
Palm Sta 353+50	4510	45	742.50	22.50	742.50	22.5	3025.00	45.83	25.00000	0.00	115.83	1.930556	23.11	23.53	38.11	38.53	53.11	53.53
Reservation Sta 334+00	1950	45	742.50	22.50	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	24.40	24.81	39.40	39.81	54.40	54.81
Beach Sta 304+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	25.95	26.36	40.95	41.36	55.95	56.36
Marina Green Sta 275+50	2850	45	742.50	22.50	742.50	22.5	1365.00	20.68	272.60823	0.00	338.29	5.638167	27.46	30.00	42.46	45.00	57.46	60.00

Figure 7-6
Light Rail Transit Stringline Diagram for Marina to Monterey Service with 20-minute Headways

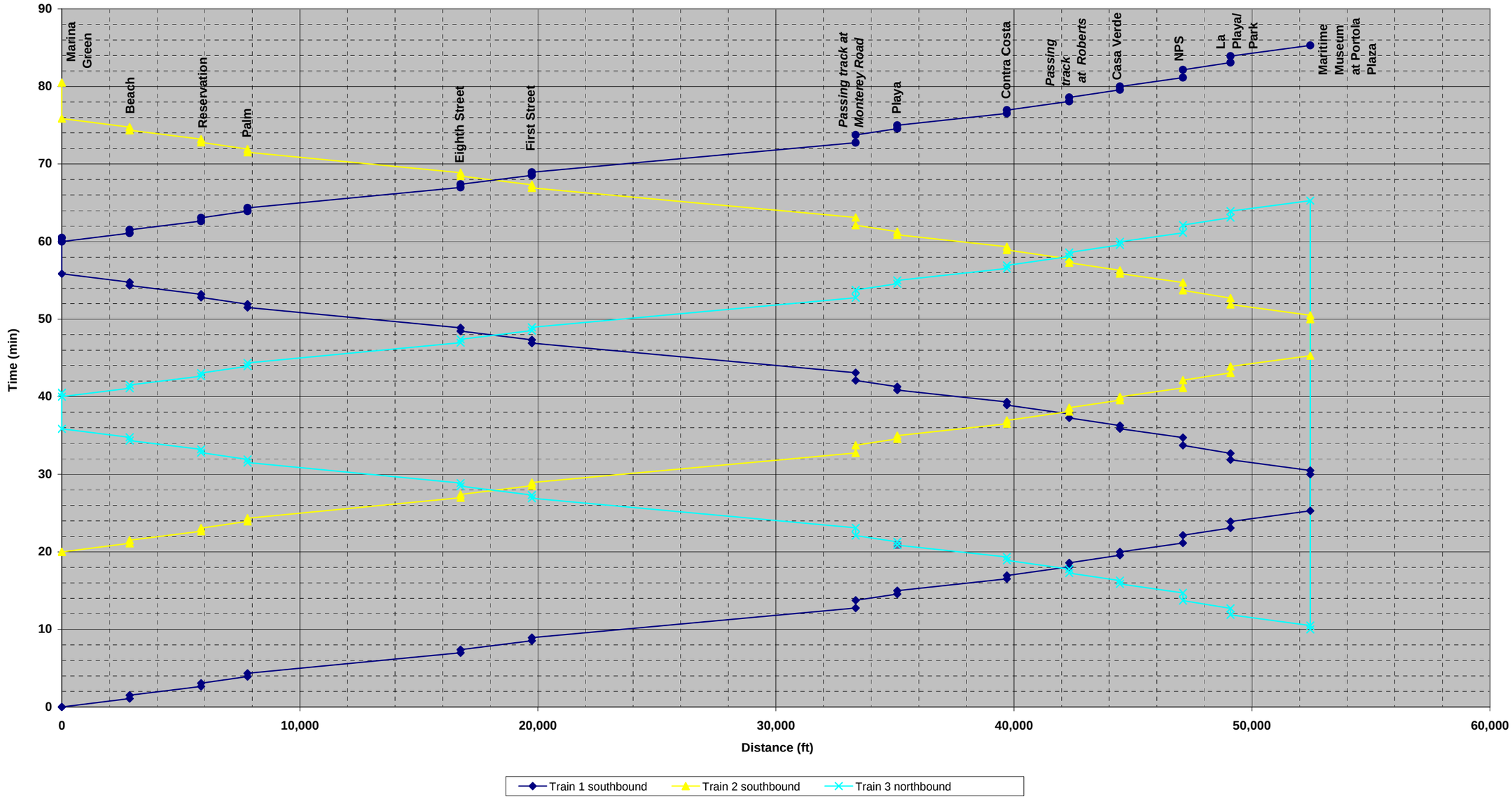


Table 7-9 *(1 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR MARINA TO MONTEREY SERVICE WITH 20-MINUTE HEADWAYS *(Southbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 20-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
SOUTHBOUND																		
Marina Green Sta 275+50														0.00		20.00		40.00
Beach Sta 304+00	2850	45	742.50	22.5	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.5113636	1.09	1.51	21.09	21.51	41.09	41.51
Reservation Sta 334+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.5492424	2.64	3.06	22.64	23.06	42.64	43.06
Palm Sta 353+50	1950	45	742.50	22.5	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.2840909	3.93	4.34	23.93	24.34	43.93	44.34
Eighth Street Sta 443+00	8950	45	742.50	22.5	742.50	22.5	7465.00	113.11	25.00000	0.00	183.11	3.0517677	6.98	7.40	26.98	27.40	46.98	47.40
First Street Sta 473+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.5492424	8.53	8.95	28.53	28.95	48.53	48.95
Passing track at Monterey Road Sta 609+00	13600	45	742.50	22.5	742.50	22.5	12115.00	183.56	0.00000	60.00	288.56	4.8093434	12.76	13.76	32.76	33.76	52.76	53.76
Playa Sta 626+00	1750	45	742.50	22.5	742.50	22.5	265.00	4.02	25.00000	0.00	74.02	1.2335859	14.57	14.99	34.57	34.99	54.57	54.99
Contra Costa Sta 674+00	4600	45	742.50	22.5	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.9532828	16.53	16.94	36.53	36.94	56.53	56.94
Passing track at Roberts Sta 700+20	2620	35	449.17	17.50	449.17	17.5	1721.67	33.54	0.00000	30.00	98.54	1.642316	18.08	18.58	38.08	38.58	58.08	58.58
Casa Verde Sta 720+00	2130	35	449.17	17.50	449.17	17.5	1231.66	23.99	25.00000	0.00	83.99	1.3998896	19.57	19.98	39.57	39.98	59.57	59.98
NPS Sta 744+50	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	60.00000	0.00	129.12	2.1520563	21.14	22.14	41.14	42.14	61.14	62.14
Park Sta 766+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	50.00000	0.00	106.46	1.7743506	23.08	23.91	43.08	43.91	63.08	63.91
Maritime Museum at Portola Plaza Sta 800+00	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	282.60835		365.37	6.0894683	25.29	30.00	45.29	50.00	65.29	70.00

Table 7-9 *(2 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR MARINA TO MONTEREY SERVICE WITH 20-MINUTE HEADWAYS *(Northbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 20-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
NORTHBOUND																		
Maritime Museum at Portola Plaza Sta 800+00									282.60835					0.00		20.00		40.00
Park Sta 766+50	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	50.00000	0.00	132.76	2.2126623	1.38	2.21	21.38	22.21	41.38	42.21
NPS Sta 744+50	2200	35	449.17	17.50	449.17	17.5	1301.67	25.36	60.00000	0.00	120.36	2.0059524	3.22	4.22	23.22	24.22	43.22	44.22
Casa Verde Sta 720+00	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	25.00000	0.00	94.12	1.5687229	5.37	5.79	25.37	25.79	45.37	45.79
Passing track at Roberts Sta 700+20	2130	35	449.17	17.50	449.17	17.5	1231.67	23.99	0.00000	30.00	88.99	1.4832251	6.77	7.27	26.77	27.27	46.77	47.27
Contra Costa Sta 674+00	2620	35	449.17	17.50	449.17	17.5	1721.66	33.54	25.00000	0.00	93.54	1.5589805	8.41	8.83	28.41	28.83	48.41	48.83
Playa Sta 626+00	4600	45	742.50	22.50	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.9532828	10.37	10.78	30.37	30.78	50.37	50.78
Passing track at Monterey Road Sta 609+00	1750	45	742.50	22.50	742.50	22.5	265.00	4.02	0.00000	60.00	109.02	1.8169192	11.60	12.60	31.60	32.60	51.60	52.60
First Street Sta 473+00	13600	45	742.50	22.50	742.50	22.5	12115.00	183.56	25.00000	0.00	253.56	4.2260101	16.41	16.83	36.41	36.83	56.41	56.83
Eighth Street Sta 443+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.5492424	17.96	18.37	37.96	38.37	57.96	58.37
Palm Sta 353+50	8950	45	742.50	22.50	742.50	22.5	7465.00	113.11	25.00000	0.00	183.11	3.0517677	21.01	21.43	41.01	41.43	61.01	61.43
Reservation Sta 334+00	1950	45	742.50	22.50	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.2840909	22.29	22.71	42.29	42.71	62.29	62.71
Beach Sta 304+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.5492424	23.84	24.26	43.84	44.26	63.84	64.26
Marina Green Sta 275+50	2850	45	742.50	22.50	742.50	22.5	1365.00	20.68	278.71225	0.00	344.39	5.7399012	25.35	30.00	45.35	50.00	65.35	70.00

Figure 7-7
Light Rail Transit Stringline Diagram for Marina to Monterey Service with 30-minute Headways

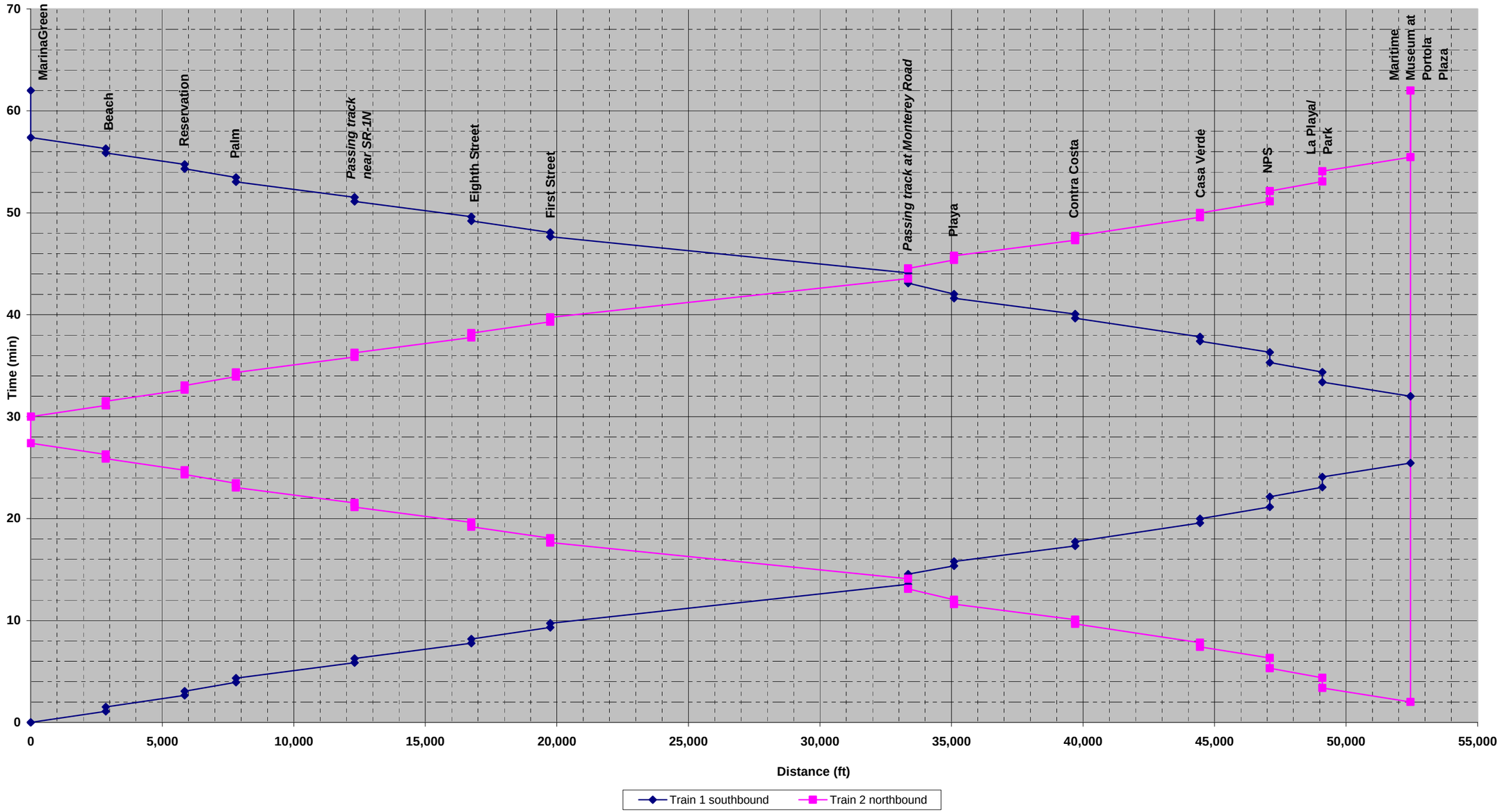


Table 7-10 *(1 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR MARINA TO MONTEREY SERVICE WITH 30-MINUTE HEADWAYS *(Southbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 30-minute Headway	
													Arrive	Depart
SOUTHBOUND														
Marina Green Sta 275+50														0.00
Beach Sta 304+00	2850	45	742.50	22.5	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.511364	1.09	1.51
Reservation Sta 334+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	2.64	3.06
Palm Sta 353+50	1950	45	742.50	22.5	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	3.93	4.34
Passing track near SR-1 N Sta 398+60	4510	45	742.50	22.5	742.50	22.5	3025.00	45.83	0.00000	25.00	115.83	1.930556	5.86	6.28
Eighth Street Sta 443+00	4440	45	742.50	22.5	742.50	22.5	2955.00	44.77	25.00000	0.00	114.77	1.912879	7.77	8.19
First Street Sta 473+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	9.32	9.74
Passing track at Monterey Road Sta 609+00	13600	45	742.50	22.5	742.50	22.5	12115.00	183.56	0.00000	60.00	288.56	4.809343	13.55	14.55
Playa Sta 626+50	1750	45	742.50	22.5	742.50	22.5	265.00	4.02	25.00000	0.00	74.02	1.233586	15.36	15.78
Contra Costa Sta 674+00	4600	45	742.50	22.5	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.953283	17.32	17.73
Casa Verde Sta 720+00	4750	35	449.17	17.50	449.17	17.5	3851.67	75.03	25.00000	0.00	135.03	2.250541	19.57	19.98
NPS Sta 744+50	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	60.00000	0.00	129.12	2.152056	21.14	22.14
La Playa/Park Sta 766+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	60.00000	0.00	116.46	1.941017	23.08	24.08
Maritime Museum at Portola Plaza Sta 800+00	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	272.60823	0.00	355.37	5.922799	25.46	30.00

Table 7-10 *(2 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR MARINA TO MONTEREY SERVICE WITH 30-MINUTE HEADWAYS *(Northbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 30-minute Headway	
													Arrive	Depart
NORTHBOUND														
Maritime Museum at Portola Plaza Sta 800+00									272.60823					0.00
La Playa/Park Sta 766+50	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	60.00000	0.00	142.76	2.379329	1.38	2.38
NPS Sta 744+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	60.00000	0.00	116.46	1.941017	3.32	4.32
Casa Verde Sta 720+00	2450	35	449.17	17.50	449.17	17.5	1551.67	30.23	25.00000	0.00	90.23	1.503788	5.41	5.82
Contra Costa Sta 674+00	4750	35	449.17	17.50	449.17	17.5	3851.67	75.03	25.00000	0.00	135.03	2.250541	7.66	8.07
Playa Sta 626+50	4600	45	742.50	22.50	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.953283	9.61	10.03
Passing track at Monterey Road Sta 609+00	2750	45	742.50	22.50	742.50	22.5	1265.00	19.17	0.00000	60.00	124.17	2.069444	11.10	12.10
First Street Sta 473+00	12600	45	742.50	22.50	742.50	22.5	11115.00	168.41	25.00000	0.00	238.41	3.973485	15.65	16.07
Eighth Street Sta 443+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	17.20	17.62
Passing track near SR-1 N Sta 609+00	4440	45	742.50	22.50	742.50	22.5	2955.00	44.77	0.00000	25.00	114.77	1.912879	19.12	19.53
Palm Sta 353+50	4510	45	742.50	22.50	742.50	22.5	3025.00	45.83	25.00000	0.00	115.83	1.930556	21.05	21.46
Reservation Sta 334+00	1950	45	742.50	22.50	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	22.33	22.75
Beach Sta 304+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	23.88	24.30
Marina Green Sta 275+50	2850	45	742.50	22.50	742.50	22.5	1365.00	20.68	276.50433	0.00	342.19	5.703102	25.39	30.00

Figure 7-8
Light Rail Transit Stringline Diagram for Marina to Monterey Service with 60-minute Headways

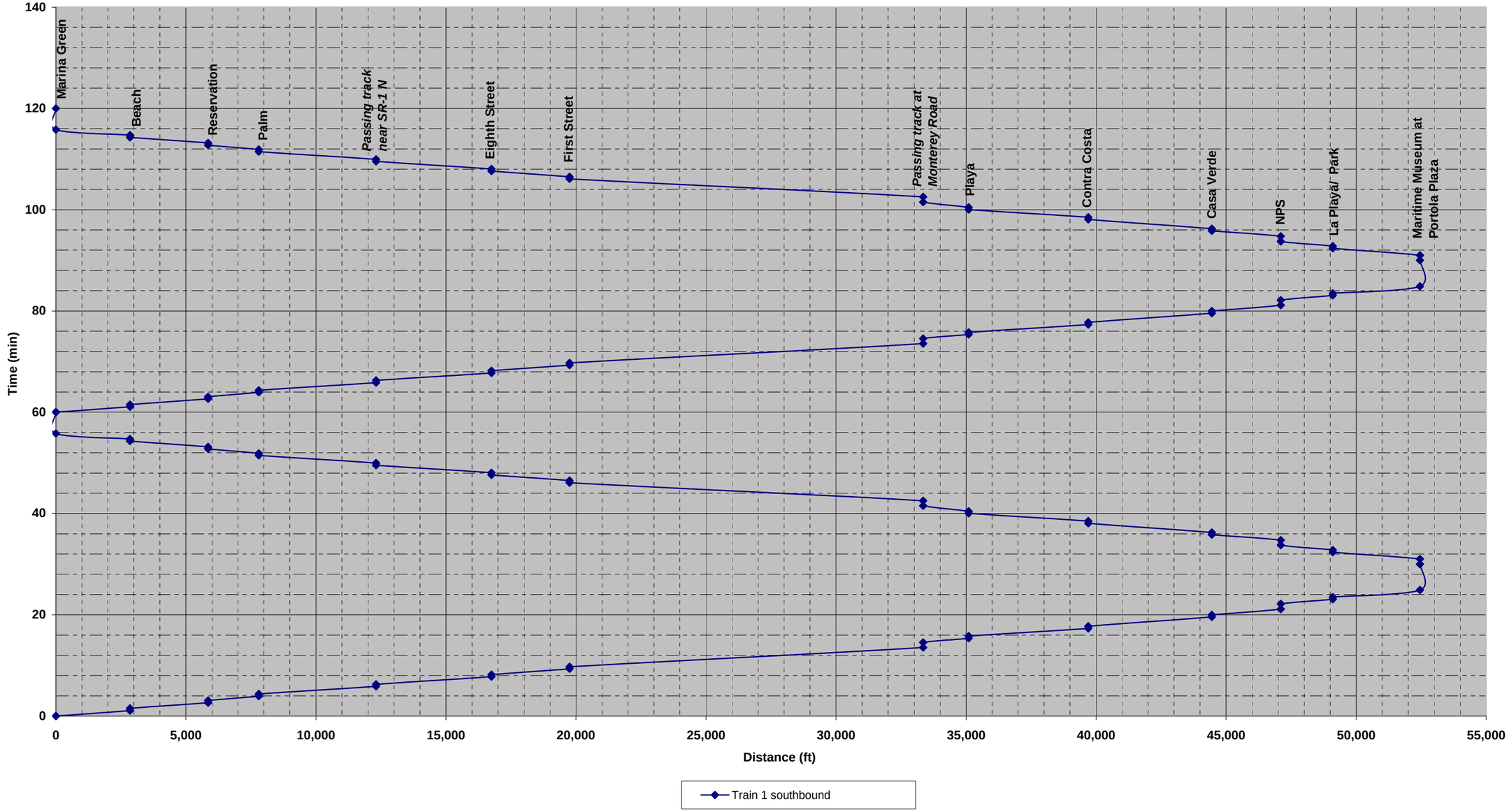


Table 7-11 *(1 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR MARINA TO MONTEREY SERVICE WITH 60-MINUTE HEADWAYS *(Southbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 60-minute Headway	
													Arrive	Depart
SOUTHBOUND														
Marina Green Sta 275+50														0.00
Beach Sta 304+00	2850	45	742.50	22.5	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.511364	1.09	1.51
Reservation Sta 334+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	2.64	3.06
Palm Sta 353+50	1950	45	742.50	22.5	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	3.93	4.34
Passing track near SR-1 N Sta 398+60	4510	45	742.50	22.5	742.50	22.5	3025.00	45.83	0.00000	25.00	115.83	1.930556	5.86	6.28
Eighth Street Sta 443+00	4440	45	742.50	22.5	742.50	22.5	2955.00	44.77	25.00000	0.00	114.77	1.912879	7.77	8.19
First Street Sta 473+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	9.32	9.74
Passing track at Monterey Road Sta 609+00	13600	45	742.50	22.5	742.50	22.5	12115.00	183.56	0.00000	60.00	288.56	4.809343	13.55	14.55
Playa Sta 626+50	1750	45	742.50	22.5	742.50	22.5	265.00	4.02	25.00000	0.00	74.02	1.233586	15.36	15.78
Contra Costa Sta 674+00	4600	45	742.50	22.5	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.953283	17.32	17.73
Casa Verde Sta 720+00	4750	35	449.17	17.50	449.17	17.5	3851.67	75.03	25.00000	0.00	135.03	2.250541	19.57	19.98
NPS Sta 746+50	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	60.00000	0.00	129.12	2.152056	21.14	22.14
La Playa/Park Sta 766+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	25.00000	0.00	81.46	1.357684	23.08	23.49
Maritime Museum at Portola Plaza Sta 800+00	3350	35	449.17	17.50	449.17	17.5	2451.66	47.76	307.60829	0.00	390.37	6.506133	24.87	30.00

Table 7-11 *(2 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR MARINA TO MONTEREY SERVICE WITH 60-MINUTE HEADWAYS *(Northbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 60-minute Headway	
													Arrive	Depart
NORTHBOUND														
Maritime Museum at Portola Plaza Sta 800+00									307.60829					1.00
La Playa/Park Sta 766+50	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	25.00000	0.00	107.76	1.795996	2.38	2.80
NPS Sta 746+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	60.00000	0.00	116.46	1.941017	3.74	4.74
Casa Verde Sta 720+00	2450	35	449.17	17.50	449.17	17.5	1551.67	30.23	25.00000	0.00	90.23	1.503788	5.82	6.24
Contra Costa Sta 674+00	4750	35	449.17	17.50	449.17	17.5	3851.67	75.03	25.00000	0.00	135.03	2.250541	8.07	8.49
Playa Sta 626+50	4600	45	742.50	22.50	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.953283	10.03	10.44
Passing track at Monterey Road Sta 609+00	2750	45	742.50	22.50	742.50	22.5	1265.00	19.17	0.00000	60.00	124.17	2.069444	11.51	12.51
First Street Sta 473+00	12600	45	742.50	22.50	742.50	22.5	11115.00	168.41	25.00000	0.00	238.41	3.973485	16.07	16.49
Eighth Street Sta 443+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	17.62	18.04
Passing track near SR-1 N Sta398+60	4440	45	742.50	22.50	742.50	22.5	2955.00	44.77	0.00000	25.00	114.77	1.912879	19.53	19.95
Palm Sta 353+50	4510	45	742.50	22.50	742.50	22.5	3025.00	45.83	25.00000	0.00	115.83	1.930556	21.46	21.88
Reservation Sta 334+00	1950	45	742.50	22.50	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	22.75	23.16
Beach Sta 304+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	24.30	24.71
Marina Green Sta 275+50	2850	45	742.50	22.50	742.50	22.5	1365.00	20.68	311.50433	0.00	377.19	6.286436	25.81	30.00

Figure 7-9
Light Rail Transit Stringline Diagram for Castroville to Monterey Service with 10-minute Headways

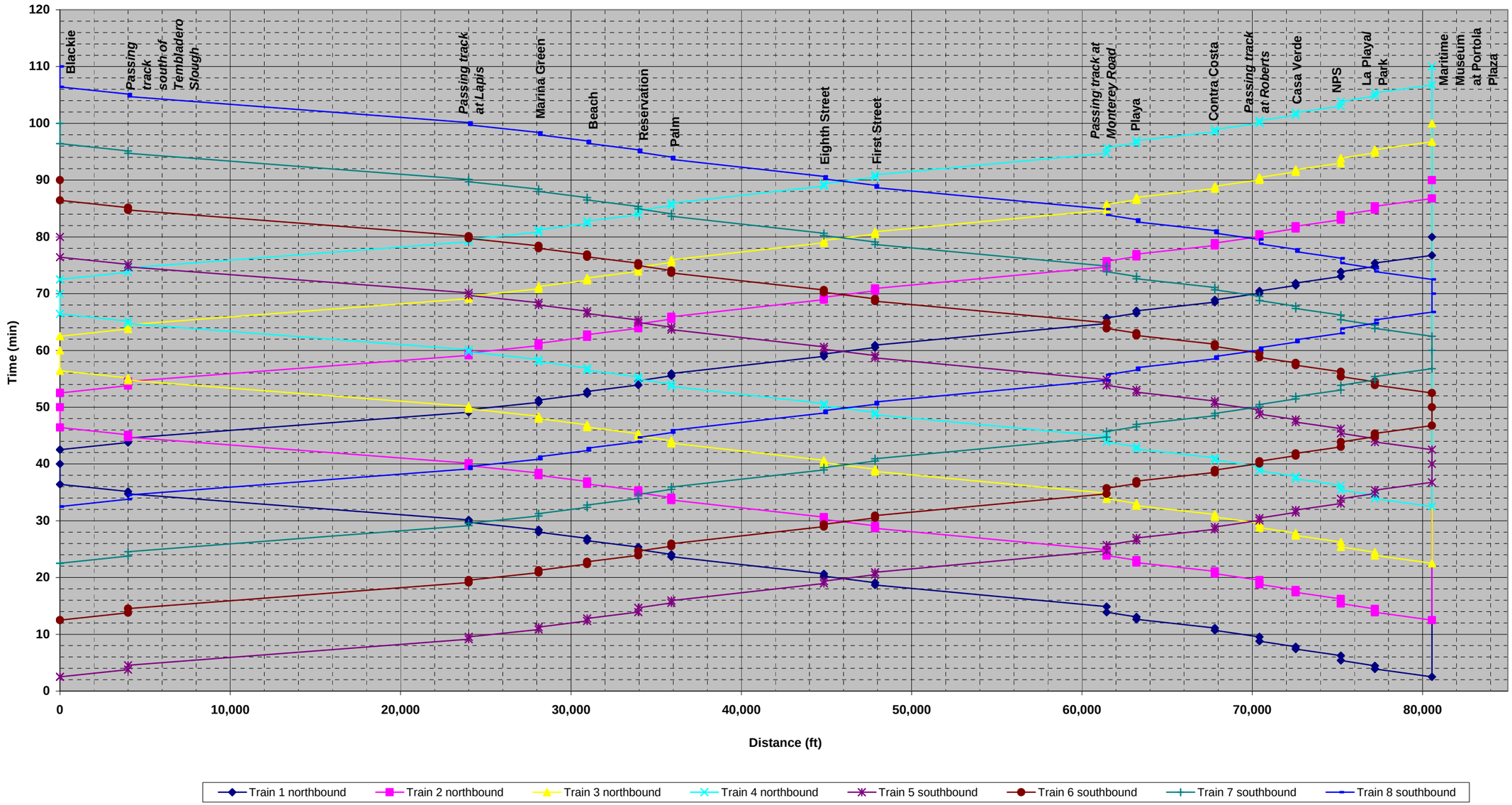


Table 7-12 *(1 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR CASTROVILLE TO MONTEREY SERVICE WITH 10-MINUTE HEADWAYS *(Southbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 10-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
SOUTHBOUND																		
Blackie Rd Sta 5661+50														2.50		12.50		22.50
Passing track south of Tembladero Slough Sta 34+50	4000	55	1109.17	27.5	1109.17	27.5	1781.67	22.09	0	45.00	122.09	2.03478	3.78	4.53	13.78	14.53	23.78	24.53
Passing track at Lapis Sta 234+50	20000	55	1109.17	27.5	1109.17	27.5	17781.66	220.43	0	25.00	300.43	5.00723	9.13	9.54	19.13	19.54	29.13	29.54
Marina Green Sta 275+50	4100	55	1109.17	27.5	1109.17	27.5	1881.66	23.33	25.00000	0.00	103.33	1.722106	10.85	11.26	20.85	21.26	30.85	31.26
Beach Sta 304+00	2850	45	742.50	22.5	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.511364	12.36	12.78	22.36	22.78	32.36	32.78
Reservation Sta 334+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	20.00	112.95	1.882576	13.91	14.66	23.91	24.66	33.91	34.66
Palm Sta 353+50	1950	45	742.50	22.5	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	15.53	15.94	25.53	25.94	35.53	35.94
Eighth Street Sta 443+00	8950	45	742.50	22.5	742.50	22.5	8950.00	135.61	25.00000	0.00	205.61	3.426768	18.95	19.37	28.95	29.37	38.95	39.37
First Street Sta 473+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	20.50	20.92	30.50	30.92	40.50	40.92
Passing track at Monterey Road Sta 609+00	13600	45	742.50	22.5	742.50	22.5	12115.00	183.56	0.00000	60.00	288.56	4.809343	24.73	25.73	34.73	35.73	44.73	45.73
Playa Sta 626+50	1750	45	742.50	22.5	742.50	22.5	265.00	4.02	25.00000	0.00	74.02	1.233586	26.54	26.96	36.54	36.96	46.54	46.96
Contra Costa Sta 674+00	4600	45	742.50	22.5	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.953283	28.50	28.91	38.50	38.91	48.50	48.91
Passing track at Roberts Sta 700+20	2620	35	449.17	17.50	449.17	17.5	1721.67	33.54	0.00000	25.00	93.54	1.558983	30.06	30.47	40.06	40.47	50.06	50.47
Casa Verde Sta 720+00	2130	35	449.17	17.50	449.17	17.5	1231.66	23.99	25.00000	0.00	83.99	1.39989	31.46	31.87	41.46	41.87	51.46	51.87
NPS Sta 746+50	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	50.00000	0.00	119.12	1.98539	33.03	33.86	43.03	43.86	53.03	53.86
Park Sta 766+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	35.00000	0.00	91.46	1.524351	34.80	35.38	44.80	45.38	54.80	55.38
Maritime Museum at Portola Plaza Sta 800+50	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	194.26141	0.00	277.02	4.617019	36.76	40.00	46.76	50.00	56.76	60.00

Table 7-12 *(2 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR CASTROVILLE TO MONTEREY SERVICE WITH 10-MINUTE HEADWAYS *(Northbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 10-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
NORTHBOUND																		
Maritime Museum at Portola Plaza Sta 800+50														2.50		12.50		21
Park Sta 766+50	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	35.00000	0.00	117.76	1.962662	3.88	4.46	13.88	14.46	22.38	22.96
NPS Sta 746+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	50.00000	0.00	106.46	1.774351	5.40	6.24	15.40	16.24	23.90	24.74
Casa Verde Sta 720+00	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	25.00000	0.00	94.12	1.568723	7.39	7.81	17.39	17.81	25.89	26.31
Passing track at Roberts Sta 700+20	2130	35	449.17	17.50	449.17	17.5	1231.67	23.99	0.00000	45.00	103.99	1.733225	8.79	9.54	18.79	19.54	27.29	28.04
Contra Costa Sta 674+00	2620	35	449.17	17.50	449.17	17.5	1721.66	33.54	25.00000	0.00	93.54	1.558981	10.68	11.10	20.68	21.10	29.18	29.60
Playa Sta 626+50	4600	45	742.50	22.50	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.953283	12.63	13.05	22.63	23.05	31.13	31.55
Passing track at Monterey Road Sta 609+00	1750	45	742.50	22.50	742.50	22.5	265.00	4.02	0.00000	60.00	109.02	1.816919	13.87	14.87	23.87	24.87	32.37	33.37
First Street Sta 473+00	13600	45	742.50	22.50	742.50	22.5	12115.00	183.56	25.00000	0.00	253.56	4.22601	18.68	19.09	28.68	29.09	37.18	37.59
Eighth Street Sta 443+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	20.23	20.64	30.23	30.64	38.73	39.14
Palm Sta 353+50	8950	45	742.50	22.50	742.50	22.5	8950.00	135.61	25.00000	0.00	205.61	3.426768	23.65	24.07	33.65	34.07	42.15	42.57
Reservation Sta 334+00	1950	45	742.50	22.50	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	24.94	25.35	34.94	35.35	43.44	43.85
Beach Sta 304+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	26.49	26.90	36.49	36.90	44.99	45.40
Marina Green Sta 275+50	2850	45	742.50	22.50	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.511364	28.00	28.41	38.00	38.41	46.50	46.91
Passing track at Lapis Sta 234+50	4100	55	1109.17	27.5	1109.17	27.5	1881.66	23.33	0.00000	25.00	103.33	1.722106	29.72	30.14	39.72	40.14	48.22	48.64
Passing track south of Tembladero Slough Sta 34+50	20000	55	1109.17	27.5	1109.17	27.5	17781.66	220.43	0.00000	25.00	300.43	5.00723	34.73	35.14	44.73	45.14	53.23	53.64
Blackie Rd Sta 5661+50	4000	55	1109.17	27.5	1109.17	27.5	1781.67	22.09	214.26141	0.00	291.35	4.855803	36.43	40.00	46.43	50.00	54.93	58.50

Figure 7-10
Stringline Diagram for Light Rail Transit Service between Castroville and Monterey with 10-minute and 30-minute Headways
(30-minute service between Castroville and Marina; 10-minute service between Marina and Monterey)

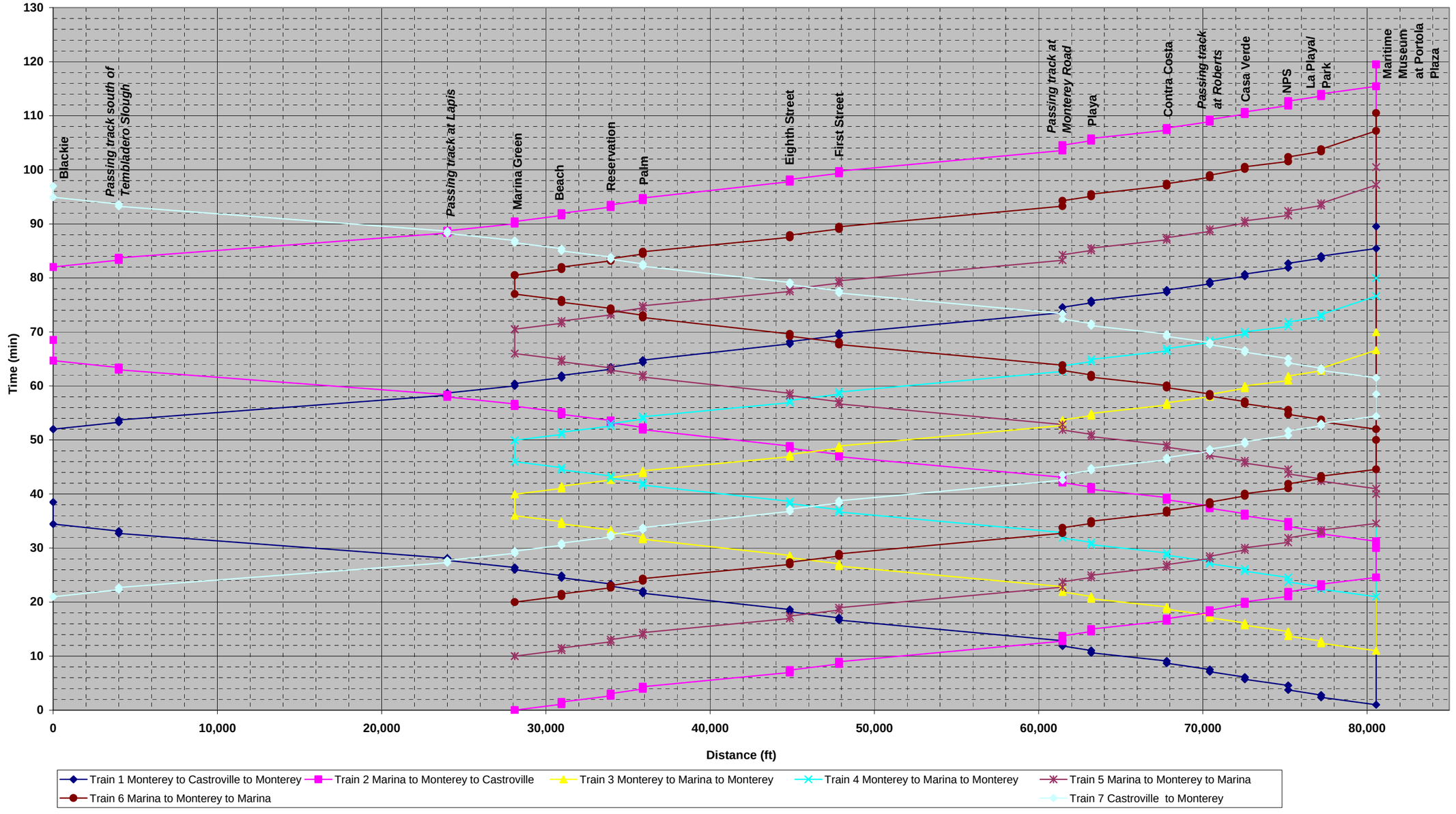


Table 7-13 *(1 of 2)*
OPERATING SCHEDULE FOR LIGHT RAIL TRANSIT SERVICE BETWEEN CASTROVILLE AND MONTEREY WITH 10-MINUTE AND 30-MINUTE HEADWAYS *(Southbound)*
(30-minute service between Castroville and Marina; 10-minute service between Marina and Monterey)

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
SOUTHBOUND																		
Blackie Rd Sta 5661+50														2.00		12.00		22.00
Passing track south of Tembladero Slough Sta 34+50	4000	55	1109.17	27.5	1109.17	27.5	1781.67	22.09	0	25.00	102.09	1.701446	3.28	3.70	13.28	13.70	23.28	23.70
Passing track at Lapis Sta 234+50	20000	55	1109.17	27.5	1109.17	27.5	17781.66	220.43	0	25.00	300.43	5.00723	8.29	8.71	18.29	18.71	28.29	28.71
Marina Green Sta 275+50	4100	55	1109.17	27.5	1109.17	27.5	1881.66	23.33	25.00000	0.00	103.33	1.722106	10.01	10.43	20.01	20.43	30.01	30.43
Beach Sta 304+00	2850	45	742.50	22.5	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.511364	11.53	11.94	21.53	21.94	31.53	31.94
Reservation Sta 334+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	13.07	13.49	23.07	23.49	33.07	33.49
Palm Sta 353+50	1950	45	742.50	22.5	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	14.36	14.78	24.36	24.78	34.36	34.78
Eighth Street Sta 443+00	8950	45	742.50	22.5	742.50	22.5	8950.00	135.61	25.00000	0.00	205.61	3.426768	17.79	18.20	27.79	28.20	37.79	38.20
First Street Sta 473+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	19.33	19.75	29.33	29.75	39.33	39.75
Passing track at Monterey Road Sta 609+00	13600	45	742.50	22.5	742.50	22.5	12115.00	183.56	0.00000	60.00	288.56	4.809343	23.56	24.56	33.56	34.56	43.56	44.56
Playa Sta 626+50	1750	45	742.50	22.5	742.50	22.5	265.00	4.02	25.00000	0.00	74.02	1.233586	25.38	25.79	35.38	35.79	45.38	45.79
Contra Costa Sta 674+00	4600	45	742.50	22.5	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.953283	27.33	27.75	37.33	37.75	47.33	47.75
Passing track at Roberts Sta 700+20	2620	35	449.17	17.50	449.17	17.5	1721.67	33.54	0.00000	25.00	93.54	1.558983	28.89	29.31	38.89	39.31	48.89	49.31
Casa Verde Sta 720+00	2130	35	449.17	17.50	449.17	17.5	1231.66	23.99	25.00000	0.00	83.99	1.39989	30.29	30.71	40.29	40.71	50.29	50.71
NPS Sta 744+50	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	50.00000	0.00	119.12	1.98539	31.86	32.69	41.86	42.69	51.86	52.69
Park Sta 766+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	25.00000	0.00	81.46	1.357684	33.63	34.05	43.63	44.05	53.63	54.05
Maritime Museum at Portola Plaza Sta 800+00	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	244.26141	0.00	327.02	5.450353	35.43	39.50	45.43	49.50	55.43	59.50

Table 7-13 *(2 of 2)*
OPERATING SCHEDULE FOR LIGHT RAIL TRANSIT SERVICE BETWEEN CASTROVILLE AND MONTEREY WITH 10-MINUTE AND 30-MINUTE HEADWAYS *(Northbound)*
(30-minute service between Castroville and Marina; 10-minute service between Marina and Monterey)

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
NORTHBOUND																		
Maritime Museum at Portola Plaza Sta 800+00														1.00		11.00		20.5
Park Sta 766+50	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	25.00000	0.00	107.76	1.795996	2.38	2.80	12.38	12.80	21.88	22.30
NPS Sta 744+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	50.00000	0.00	106.46	1.774351	3.74	4.57	13.74	14.57	23.24	24.07
Casa Verde Sta 720+00	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	25.00000	0.00	94.12	1.568723	5.72	6.14	15.72	16.14	25.22	25.64
Passing track at Roberts Sta 700+20	2130	35	449.17	17.50	449.17	17.5	1231.67	23.99	0.00000	25.00	83.99	1.399892	7.12	7.54	17.12	17.54	26.62	27.04
Contra Costa Sta 674+00	2620	35	449.17	17.50	449.17	17.5	1721.66	33.54	25.00000	0.00	93.54	1.558981	8.68	9.10	18.68	19.10	28.18	28.60
Playa Sta 626+50	4600	45	742.50	22.50	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.953283	10.63	11.05	20.63	21.05	30.13	30.55
Passing track at Monterey Road Sta 609+00	1750	45	742.50	22.50	742.50	22.5	265.00	4.02	0.00000	60.00	109.02	1.816919	11.87	12.87	21.87	22.87	31.37	32.37
First Street Sta 473+00	13600	45	742.50	22.50	742.50	22.5	12115.00	183.56	25.00000	0.00	253.56	4.22601	16.68	17.09	26.68	27.09	36.18	36.59
Eighth Street Sta 443+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	18.23	18.64	28.23	28.64	37.73	38.14
Palm Sta 353+50	8950	45	742.50	22.50	742.50	22.5	8950.00	135.61	25.00000	0.00	205.61	3.426768	21.65	22.07	31.65	32.07	41.15	41.57
Reservation Sta 334+00	1950	45	742.50	22.50	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	22.94	23.35	32.94	33.35	42.44	42.85
Beach Sta 304+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	24.49	24.90	34.49	34.90	43.99	44.40
Marina Green Sta 275+50	2850	45	742.50	22.50	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.511364	26.00	26.41	36.00	36.41	45.50	45.91
Passing track at Lapis Sta 234+50	4100	55	1109.17	27.5	1109.17	27.5	1881.66	23.33	0.00000	25.00	103.33	1.722106	27.72	28.14	37.72	38.14	47.22	47.64
Passing track south of Tembladero Slough Sta 34+50	20000	55	1109.17	27.5	1109.17	27.5	17781.66	220.43	0.00000	25.00	300.43	5.00723	32.73	33.14	42.73	43.14	52.23	52.64
Blackie Rd Sta 5661+50	4000	55	1109.17	27.5	1109.17	27.5	1781.67	22.09	244.26141	0.00	321.35	5.355803	34.43	38.50	44.43	48.50	53.93	58.00

Figure 7-11
Light Rail Transit Stringline Diagram for Castroville to Monterey Service with 12-minute Headways

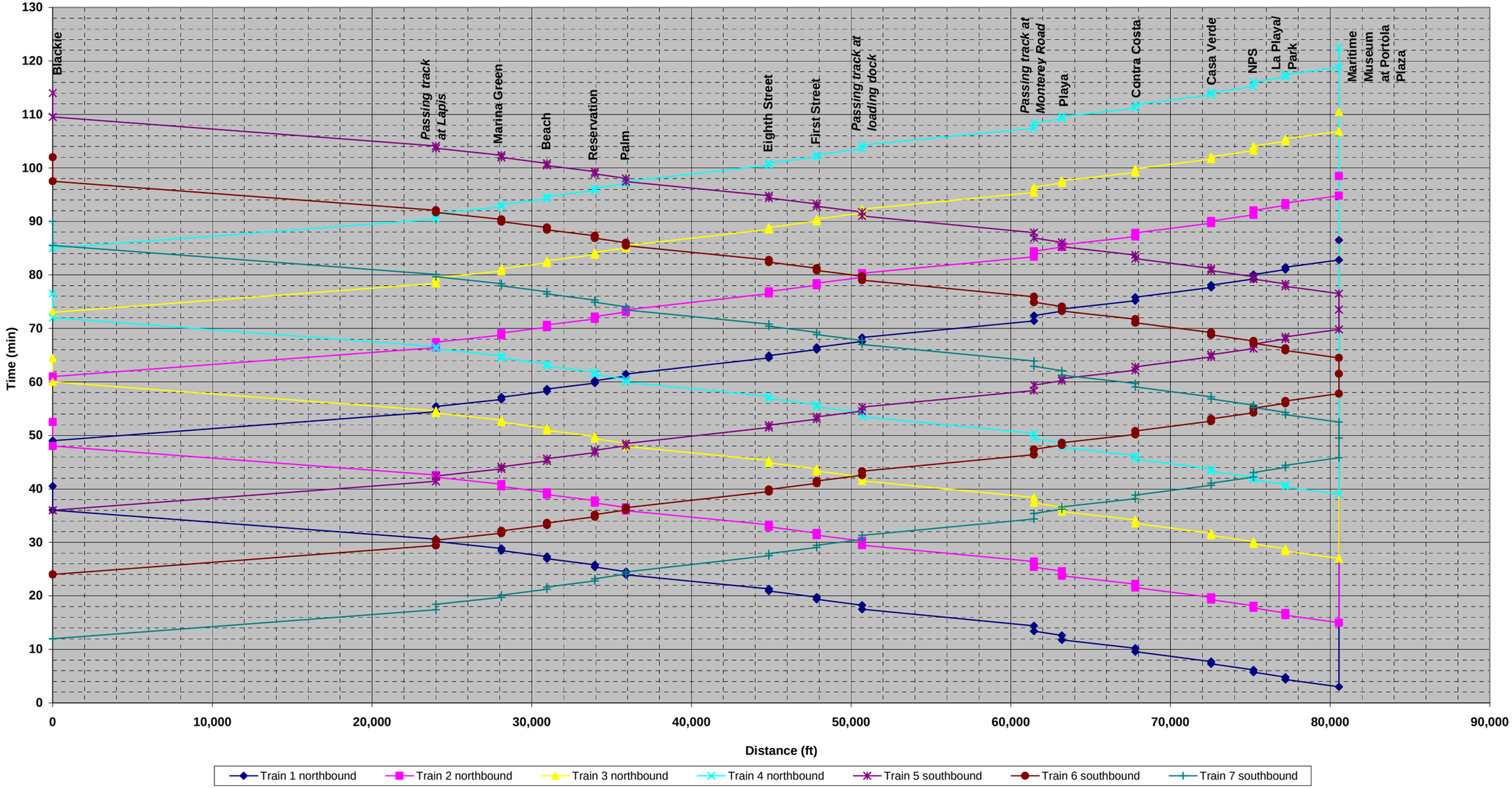


Table 7-14 *(1 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR CASTROVILLE TO MONTEREY SERVICE WITH 12-MINUTE HEADWAYS *(Southbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 12-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
SOUTHBOUND																		
Blackie Rd Sta 5661+50														9.50		21.50		33.50
Passing track at Lapis Sta 234+50	24000	55	1109.17	27.5	1109.17	27.5	21781.67	270.02	0	60.00	385.02	6.417011	14.92	15.92	26.92	27.92	38.92	39.92
Marina Green Sta 275+50	4100	55	1109.17	27.5	1109.17	27.5	1881.66	23.33	25.00000	0.00	103.33	1.722106	17.22	17.64	29.22	29.64	41.22	41.64
Beach Sta 304+00	2850	45	742.50	22.5	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.511364	18.73	19.15	30.73	31.15	42.73	43.15
Reservation Sta 334+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	20.28	20.70	32.28	32.70	44.28	44.70
Palm Sta 353+50	1950	45	742.50	22.5	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	21.57	21.98	33.57	33.98	45.57	45.98
Eighth Street Sta 443+00	8950	45	742.50	22.5	742.50	22.5	8950.00	135.61	25.00000	0.00	205.61	3.426768	24.99	25.41	36.99	37.41	48.99	49.41
First Street Sta 473+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	26.54	26.96	38.54	38.96	50.54	50.96
Passing track at loading dock Sta 501+40	2840	45	742.50	22.5	742.50	22.5	1355.00	20.53	0.00000	45.00	110.53	1.842172	28.05	28.80	40.05	40.80	52.05	52.80
Passing track at Monterey Road Sta 609+00	10760	45	742.50	22.5	742.50	22.5	9275.00	140.53	0.00000	60.00	245.53	4.092172	31.89	32.89	43.89	44.89	55.89	56.89
Playa Sta 626+50	1750	45	742.50	22.5	742.50	22.5	265.00	4.02	25.00000	0.00	74.02	1.233586	33.71	34.13	45.71	46.13	57.71	58.13
Contra Costa Sta 674+00	4600	45	742.50	22.5	742.50	22.5	3115.00	47.20	25.00000	15.00	132.20	2.203283	35.66	36.33	47.66	48.33	59.66	60.33
Casa Verde Sta 720+00	4750	35	449.17	17.50	449.17	17.5	3851.67	75.03	25.00000	0.00	135.03	2.250541	38.16	38.58	50.16	50.58	62.16	62.58
NPS Sta 744+50	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	50.00000	0.00	119.12	1.98539	39.73	40.57	51.73	52.57	63.73	64.57
Park Sta 766+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	25.00000	0.00	81.46	1.357684	41.51	41.92	53.51	53.92	65.51	65.92
Maritime Museum at Portola Plaza Sta 804+00	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	221.76120	0.00	304.52	5.075349	43.30	47.00	55.30	59.00	67.30	71.00

Table 7-14 *(2 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR CASTROVILLE TO MONTEREY SERVICE WITH 12-MINUTE HEADWAYS *(Northbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 12-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
NORTHBOUND																		
Maritime Museum at Portola Plaza Sta 804+00														2.00		14.00		26.00
Park Sta 766+50	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	25.00000	0.00	107.76	1.795996	3.38	3.80	15.38	15.80	27.38	27.80
NPS Sta 744+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	25.00000	0.00	81.46	1.357684	4.74	5.15	16.74	17.15	28.74	29.15
Casa Verde Sta 720+00	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	25.00000	0.00	94.12	1.568723	6.31	6.72	18.31	18.72	30.31	30.72
Contra Costa Sta 674+00	4750	35	449.17	17.50	449.17	17.5	3851.66	75.03	25.00000	15.00	150.03	2.500539	8.56	9.22	20.56	21.22	32.56	33.22
Playa Sta 626+50	4600	45	742.50	22.50	742.50	22.5	3115.00	47.20	50.00000	0.00	142.20	2.369949	10.76	11.59	22.76	23.59	34.76	35.59
Passing track at Monterey Road Sta 609+00	1750	45	742.50	22.50	742.50	22.5	265.00	4.02	0.00000	60.00	109.02	1.816919	12.41	13.41	24.41	25.41	36.41	37.41
Passing track at loading dock Sta 501+40	10760	45	742.50	22.50	742.50	22.5	9275.00	140.53	0.00000	45.00	230.53	3.842172	16.50	17.25	28.50	29.25	40.50	41.25
First Street Sta 473+00	2840	45	742.50	22.50	742.50	22.5	1355.00 0.00	20.53	25.00000	0.00	90.53	1.508838	18.34	18.76	30.34	30.76	42.34	42.76
Eighth Street Sta 443+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	19.89	20.31	31.89	32.31	43.89	44.31
Palm Sta 353+50	8950	45	742.50	22.50	742.50	22.5	7465.00	113.11	25.00000	10.00	193.11	3.218434	22.95	23.53	34.95	35.53	46.95	47.53
Reservation Sta 334+00	1950	45	742.50	22.50	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	24.40	24.81	36.40	36.81	48.40	48.81
Beach Sta 304+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	25.95	26.36	37.95	38.36	49.95	50.36
Marina Green Sta 275+50	2850	45	742.50	22.50	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.511364	27.46	27.87	39.46	39.87	51.46	51.87
Passing track at Lapis Sta 234+50	4100	55	1109.17	27.5	1109.17	27.5	1881.66	23.33	0.00000	25.00	103.33	1.722106	29.18	29.60	41.18	41.60	53.18	53.60
Blackie Rd Sta 5661+50	24000	55	1109.17	27.5	1109.17	27.5	21781.67	270.02	269.26133	0.00	594.28	9.9047	35.01	39.50	47.01	51.50	59.01	63.50

Figure 7-13
Light Rail Transit Stringline Diagram for Castroville to Monterey Service with 15-minute Headways

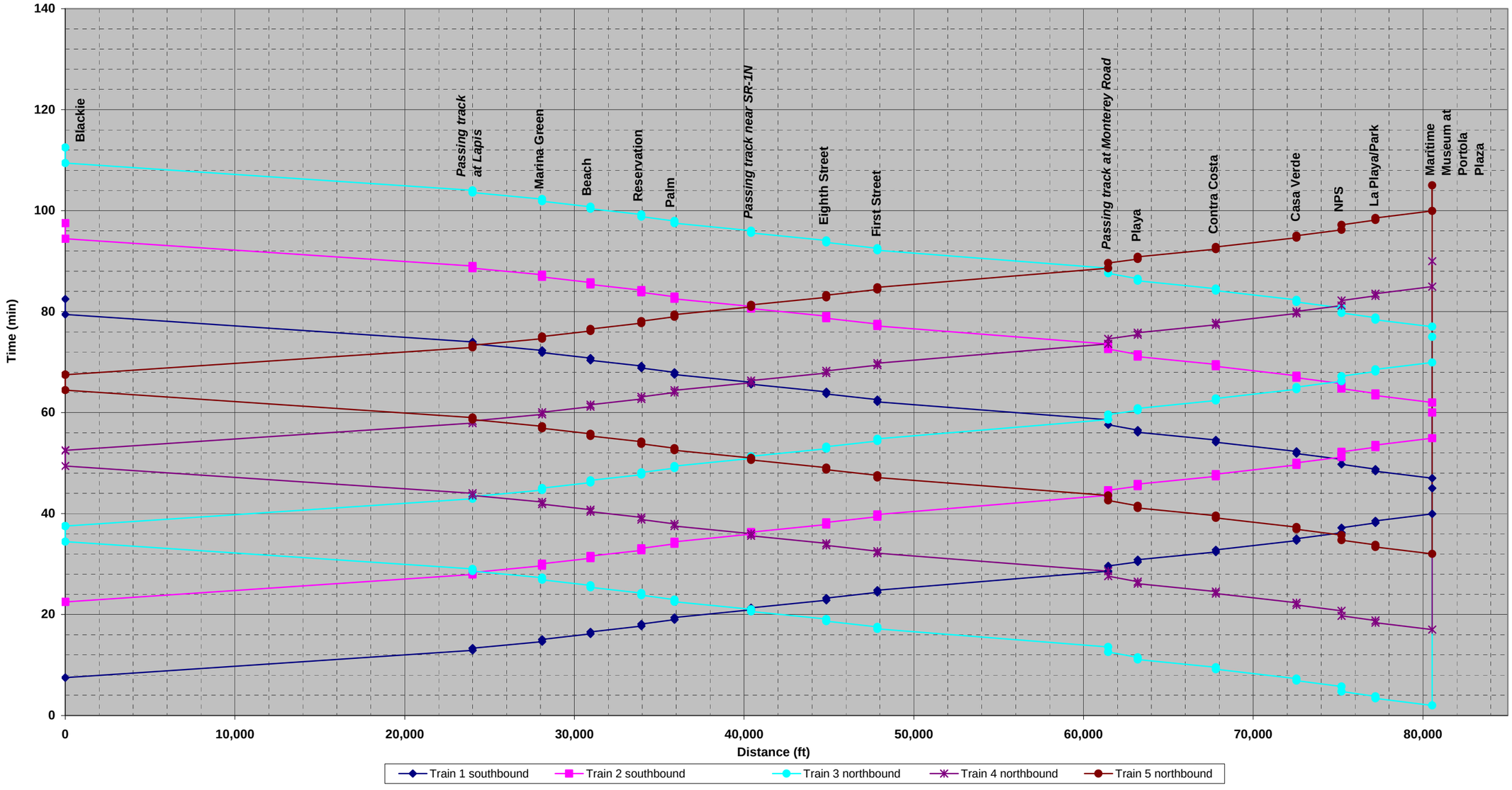


Table 7-16 *(1 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR CASTROVILLE TO MONTEREY SERVICE WITH 15-MINUTE HEADWAYS *(Southbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 15-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
SOUTHBOUND																		
Blackie Rd Sta 5661+50														7.50		22.50		37.50
Pass track at Lapis Sta 234+50	24000	55	1109.17	27.5	1109.17	27.5	21781.67	270.02	0.00000	25.00	350.02	5.833678	12.92	13.33	27.92	28.33	42.92	43.33
Marina Green Sta 275+50	4100	55	1109.17	27.5	1109.17	27.5	1881.67	23.33	25.00000	0.00	103.33	1.722107	14.64	15.06	29.64	30.06	44.64	45.06
Beach Sta 304+00	2850	45	742.50	22.5	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.511364	16.15	16.57	31.15	31.57	46.15	46.57
Reservation Sta 334+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	17.70	18.12	32.70	33.12	47.70	48.12
Palm Sta 353+50	1950	45	742.50	22.5	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	18.98	19.40	33.98	34.40	48.98	49.40
Passing track near SR-1 N Sta 398+60	4510	45	742.50	22.5	742.50	22.5	3025.00	45.83	0.00000	25.00	115.83	1.930556	20.91	21.33	35.91	36.33	50.91	51.33
Eighth Street Sta 443+00	4440	45	742.50	22.5	742.50	22.5	2955.00	44.77	25.00000	0.00	114.77	1.912879	22.83	23.24	37.83	38.24	52.83	53.24
First Street Sta 473+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	24.38	24.79	39.38	39.79	54.38	54.79
Passing track at Monterey Road Sta 609+00	13600	45	742.50	22.5	742.50	22.5	12115.00	183.56	0.00000	60.00	288.56	4.809343	28.60	29.60	43.60	44.60	58.60	59.60
Playa Sta 626+50	1750	45	742.50	22.5	742.50	22.5	265.00	4.02	25.00000	0.00	74.02	1.233586	30.42	30.84	45.42	45.84	60.42	60.84
Contra Costa Sta 674+00	4600	45	742.50	22.5	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.953283	32.37	32.79	47.37	47.79	62.37	62.79
Casa Verde Sta 720+00	4750	35	449.17	17.50	449.17	17.5	3851.67	75.03	25.00000	0.00	135.03	2.250541	34.62	35.04	49.62	50.04	64.62	65.04
NPS Sta 744+50	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	60.00000	0.00	129.12	2.152056	36.19	37.19	51.19	52.19	66.19	67.19
Park Sta 766+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	25.00000	0.00	81.46	1.357684	38.13	38.55	53.13	53.55	68.13	68.55
Maritime Museum at Portola Plaza Sta 800+00	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	304.26112	0.00	387.02	6.450348	39.93	45.00	54.93	60.00	69.93	75.00

Table 7-16 *(2 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR CASTROVILLE TO MONTEREY SERVICE WITH 15-MINUTE HEADWAYS *(Northbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 15-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
NORTHBOUND																		
Maritime Museum at Portola Plaza Sta 800+00														0.00		15.00		30
Park Sta 766+50	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	25.00000	0.00	107.76	1.795996	1.38	1.80	16.38	16.80	31.38	31.80
NPS Sta 744+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	60.00000	0.00	116.46	1.941017	2.74	3.74	17.74	18.74	32.74	33.74
Casa Verde Sta 720+00	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	25.00000	0.00	94.12	1.568723	4.89	5.31	19.89	20.31	34.89	35.31
Contra Costa Sta 674+00	4750	35	449.17	17.50	449.17	17.5	3851.67	75.03	25.00000	0.00	135.03	2.250541	7.14	7.56	22.14	22.56	37.14	37.56
Playa Sta 626+50	4600	45	742.50	22.50	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.953283	9.09	9.51	24.09	24.51	39.09	39.51
Passing track at Monterey Road Sta 609+00	2750	45	742.50	22.50	742.50	22.5	1265.00	19.17	0.00000	60.00	124.17	2.069444	10.58	11.58	25.58	26.58	40.58	41.58
First Street Sta 473+00	12600	45	742.50	22.50	742.50	22.5	11115.00	168.41	25.00000	0.00	238.41	3.973485	15.14	15.55	30.14	30.55	45.14	45.55
Eighth Street Sta 443+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	16.69	17.10	31.69	32.10	46.69	47.10
Passing track near SR-1 N Sta 398+60	4440	45	742.50	22.50	742.50	22.5	2955.00	44.77	0.00000	25.00	114.77	1.912879	18.60	19.01	33.60	34.01	48.60	49.01
Palm Sta 353+50	4510	45	742.50	22.50	742.50	22.5	3025.00	45.83	25.00000	0.00	115.83	1.930556	20.53	20.95	35.53	35.95	50.53	50.95
Reservation Sta 334+00	1950	45	742.50	22.50	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	21.81	22.23	36.81	37.23	51.81	52.23
Beach Sta 304+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	23.36	23.78	38.36	38.78	53.36	53.78
Marina Green Sta 275+50	2850	45	742.50	22.50	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.511364	24.87	25.29	39.87	40.29	54.87	55.29
Pass track at Lapis Sta 234+50	4100	55	1109.17	27.5	1109.17	27.5	1881.67	23.33	0	25.00	103.33	1.722107	26.60	27.01	41.60	42.01	56.60	57.01
Blackie Rd Sta 5661+50	24000	55	1109.17	27.5	1109.17	27.5	21781.67	270.02	304.26112	0.00	629.28	10.48803	32.43	37.50	47.43	52.50	62.43	67.50

Figure 7-14
Light Rail Transit Stringline Diagram for Castroville to Monterey Service with 20-minute Headways

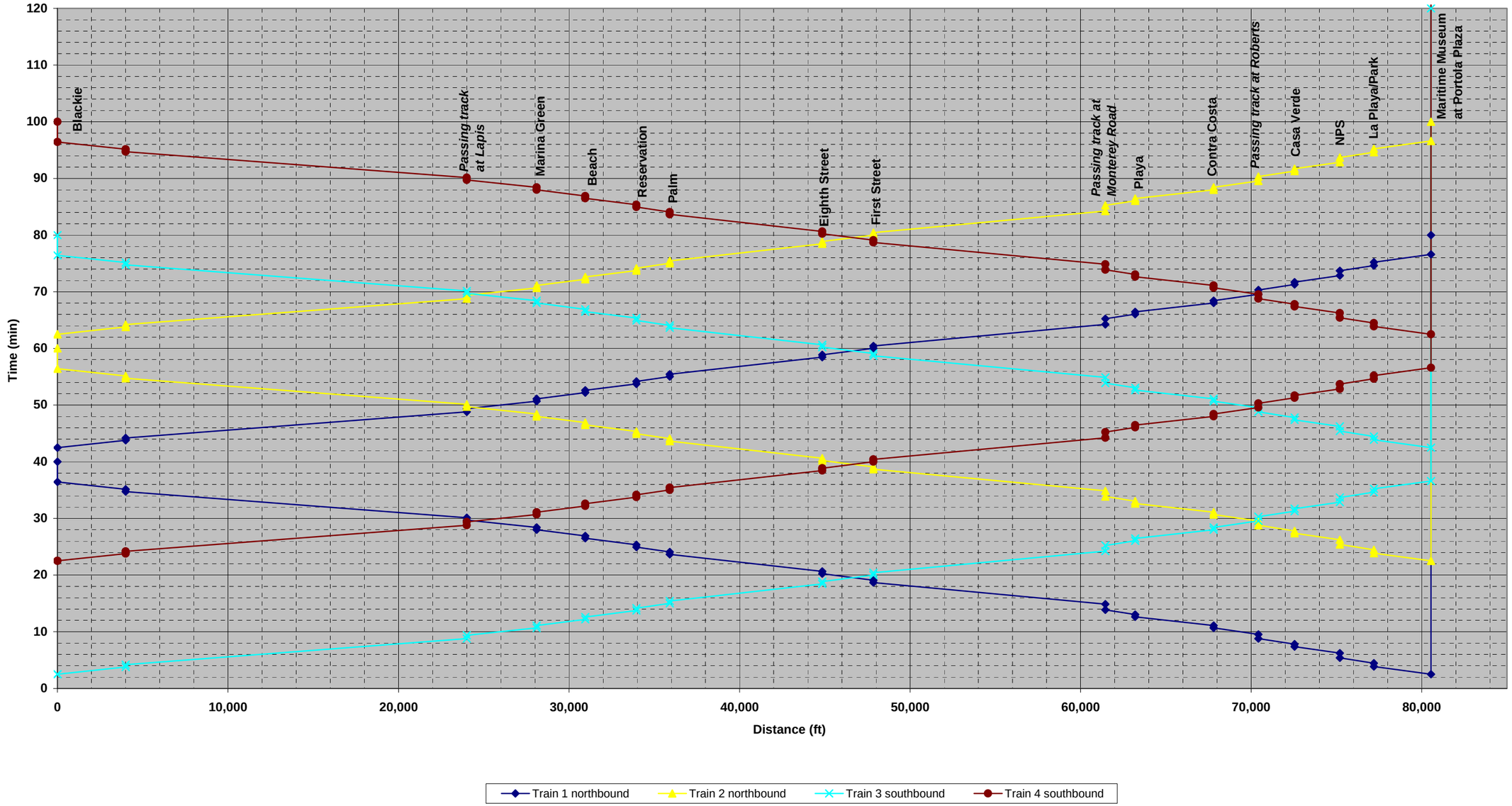


Table 7-17 *(1 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR CASTROVILLE TO MONTEREY SERVICE WITH 20-MINUTE HEADWAYS *(Southbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 20-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
SOUTHBOUND																		
Blackie Rd Sta 5661+50														2.00		22.00		42.00
Passing track south of Tembladero Slough Sta 34+50	4000	55	1109.17	27.5	1109.17	27.5	1781.67	22.09	0	25.00	102.09	1.701446	3.28	3.70	23.28	23.70	43.28	43.70
Passing track at Lapis Sta 234+50	20000	55	1109.17	27.5	1109.17	27.5	17781.66	220.43	0	35.00	310.43	5.173897	8.29	8.88	28.29	28.88	48.29	48.88
Marina Green Sta 275+50	4100	55	1109.17	27.5	1109.17	27.5	1881.66	23.33	25.00000	0.00	103.33	1.722106	10.18	10.60	30.18	30.60	50.18	50.60
Beach Sta 304+00	2850	45	742.50	22.5	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.511364	11.69	12.11	31.69	32.11	51.69	52.11
Reservation Sta 334+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	13.24	13.66	33.24	33.66	53.24	53.66
Palm Sta 353+50	1950	45	742.50	22.5	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	14.53	14.94	34.53	34.94	54.53	54.94
Eighth Street Sta 443+00	8950	45	742.50	22.5	742.50	22.5	8950.00	135.61	25.00000	0.00	205.61	3.426768	17.95	18.37	37.95	38.37	57.95	58.37
First Street Sta 473+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	19.50	19.92	39.50	39.92	59.50	59.92
Passing track at Monterey Road Sta 609+00	13600	45	742.50	22.5	742.50	22.5	12115.00	183.56	0.00000	60.00	288.56	4.809343	23.73	24.73	43.73	44.73	63.73	64.73
Playa Sta 626+50	1750	45	742.50	22.5	742.50	22.5	265.00	4.02	25.00000	0.00	74.02	1.233586	25.54	25.96	45.54	45.96	65.54	65.96
Contra Costa Sta 674+00	4600	45	742.50	22.5	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.953283	27.50	27.91	47.50	47.91	67.50	67.91
Passing track at Roberts Sta 700+20	2620	35	449.17	17.50	449.17	17.5	1721.67	33.54	0.00000	45.00	113.54	1.892316	29.06	29.81	49.06	49.81	69.06	69.81
Casa Verde Sta 720+00	2130	35	449.17	17.50	449.17	17.5	1231.66	23.99	25.00000	0.00	83.99	1.39989	30.79	31.21	50.79	51.21	70.79	71.21
NPS Sta 744+50	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	50.00000	0.00	119.12	1.98539	32.36	33.19	52.36	53.19	72.36	73.19
Park Sta 766+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	35.00000	0.00	91.46	1.524351	34.13	34.72	54.13	54.72	74.13	74.72
Maritime Museum at Portola Plaza Sta 800+00	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	204.26141	0.00	287.02	4.783686	36.10	39.50	56.10	59.50	76.10	79.50

Table 7-17 *(2 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR CASTROVILLE TO MONTEREY SERVICE WITH 20-MINUTE HEADWAYS *(Norhbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 20-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
NORTHBOUND																		
Maritime Museum at Portola Plaza Sta 800+00														0.00		20.00		40.00
Park Sta 766+50	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	35.00000	0.00	117.76	1.962662	1.38	1.96	21.38	21.96	41.38	41.96
NPS Sta 744+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	50.00000	0.00	106.46	1.774351	2.90	3.74	22.90	23.74	42.90	43.74
Casa Verde Sta 720+00	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	25.00000	0.00	94.12	1.568723	4.89	5.31	24.89	25.31	44.89	45.31
Passing track at Roberts Sta 700+20	2130	35	449.17	17.50	449.17	17.5	1231.67	23.99	0.00000	45.00	103.99	1.733225	6.29	7.04	26.29	27.04	46.29	47.04
Contra Costa Sta 674+00	2620	35	449.17	17.50	449.17	17.5	1721.66	33.54	25.00000	0.00	93.54	1.558981	8.18	8.60	28.18	28.60	48.18	48.60
Playa Sta 626+50	4600	45	742.50	22.50	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.953283	10.13	10.55	30.13	30.55	50.13	50.55
Passing track at Monterey Road Sta 609+00	1750	45	742.50	22.50	742.50	22.5	265.00	4.02	0.00000	60.00	109.02	1.816919	11.37	12.37	31.37	32.37	51.37	52.37
First Street Sta 473+00	13600	45	742.50	22.50	742.50	22.5	12115.00	183.56	25.00000	0.00	253.56	4.22601	16.18	16.59	36.18	36.59	56.18	56.59
Eighth Street Sta 443+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	17.73	18.14	37.73	38.14	57.73	58.14
Palm Sta 353+50	8950	45	742.50	22.50	742.50	22.5	8950.00	135.61	25.00000	0.00	205.61	3.426768	21.15	21.57	41.15	41.57	61.15	61.57
Reservation Sta 334+00	1950	45	742.50	22.50	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	22.44	22.85	42.44	42.85	62.44	62.85
Beach Sta 304+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	23.99	24.40	43.99	44.40	63.99	64.40
Marina Green Sta 275+50	2850	45	742.50	22.50	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.511364	25.50	25.91	45.50	45.91	65.50	65.91
Passing track at Lapis Sta 234+50	4100	55	1109.17	27.5	1109.17	27.5	1881.66	23.33	0.00000	25.00	103.33	1.722106	27.22	27.64	47.22	47.64	67.22	67.64
Passing track south of Tembladero Slough Sta 34+50	20000	55	1109.17	27.5	1109.17	27.5	17781.66	220.43	0.00000	25.00	300.43	5.00723	32.23	32.64	52.23	52.64	72.23	72.64
Blackie Rd Sta 5661+50	4000	55	1109.17	27.5	1109.17	27.5	1781.67	22.09	214.26141	0.00	291.35	4.855803	33.93	37.50	53.93	57.50	73.93	77.50

Figure 7-15
Light Rail Transit Stringline Diagram for Castroville to Monterey Service with 30-minute Headways

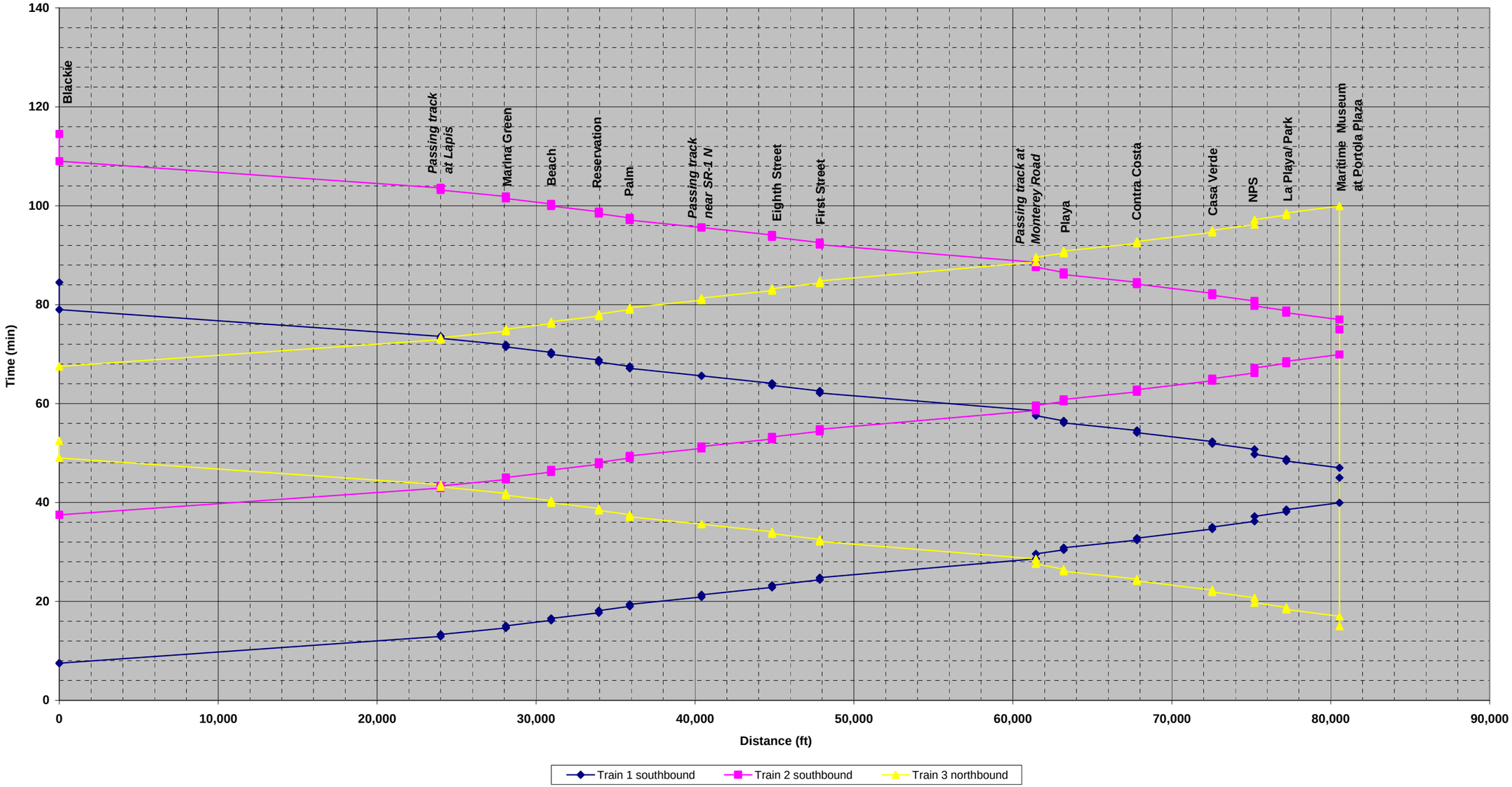


Table 7-18 *(1 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR CASTROVILLE TO MONTEREY SERVICE WITH 30-MINUTE HEADWAYS *(Southbound)*

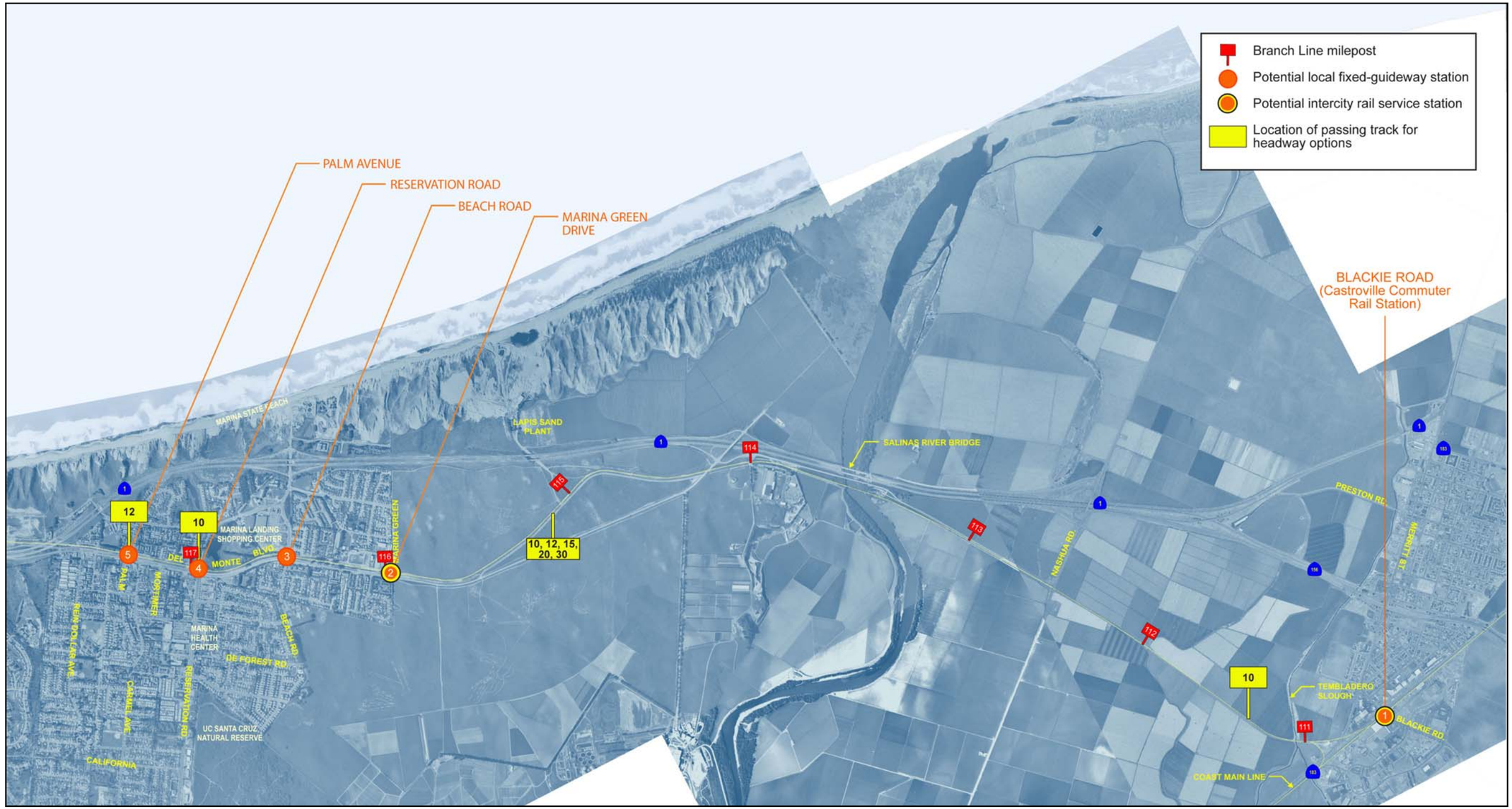
Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 30-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
SOUTHBOUND																		
Blackie Rd Sta 5661+50													0.00	7.50		37.50		
Passing track at Lapis Sta 234+50	24000	55	1109.17	27.5	1109.17	27.5	21781.67	270.02	0.00000	25.00	350.02	5.833678	12.92	13.33	42.92	43.33		
Marina Green Sta 275+50	4100	55	1109.17	27.5	1109.17	27.5	1881.67	23.33	25.00000	0.00	103.33	1.722107	14.64	15.06	44.64	45.06		
Beach Sta 304+00	2850	45	742.50	22.5	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.511364	16.15	16.57	46.15	46.57		
Reservation Sta 334+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	17.70	18.12	47.70	48.12		
Palm Sta 353+50	1950	45	742.50	22.5	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	18.98	19.40	48.98	49.40		
Passing track near SR-1 N Sta 398+60	4510	45	742.50	22.5	742.50	22.5	3025.00	45.83	0.00000	25.00	115.83	1.930556	20.91	21.33	50.91	51.33		
Eighth Street Sta 443+00	4440	45	742.50	22.5	742.50	22.5	2955.00	44.77	25.00000	0.00	114.77	1.912879	22.83	23.24	52.83	53.24		
First Street Sta 473+00	3000	45	742.50	22.5	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	24.38	24.79	54.38	54.79		
Passing track at Monterey Road Sta 609+00	13600	45	742.50	22.5	742.50	22.5	12115.00	183.56	0.00000	60.00	288.56	4.809343	28.60	29.60	58.60	59.60		
Playa Sta 626+50	1750	45	742.50	22.5	742.50	22.5	265.00	4.02	25.00000	0.00	74.02	1.233586	30.42	30.84	60.42	60.84		
Contra Costa Sta 674+00	4600	45	742.50	22.5	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.953283	32.37	32.79	62.37	62.79		
Casa Verde Sta 720+00	4750	35	449.17	17.50	449.17	17.5	3851.67	75.03	25.00000	0.00	135.03	2.250541	34.62	35.04	64.62	65.04		
NPS Sra 744+50	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	60.00000	0.00	129.12	2.152056	36.19	37.19	66.19	67.19		
Park Sta 766+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	25.00000	0.00	81.46	1.357684	38.13	38.55	68.13	68.55		
Maritime Museum at Portola Plaza Sta 800+00	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	304.26112	0.00	387.02	6.450348	39.93	45.00	69.93	75.00		

Table 7-18 *(2 of 2)*
LIGHT RAIL TRANSIT OPERATING SCHEDULE FOR CASTROVILLE TO MONTEREY SERVICE WITH 30-MINUTE HEADWAYS *(Northbound)*

Station	Distance between Stations (ft)	Maximum Speed Limit (mph)	Distance Covered during Acceleration (ft)	Time for Acceleration (sec)	Distance Covered during Deceleration (ft)	Time for Deceleration (sec)	Distance to Cruise (ft)	Time Taken to Cover the Cruising Distance (sec)	Station Dwell Time (sec)	Added Delays	Total Time between Leaving One Station and Leaving the Next Station (sec)	Time (min)	Schedule with 30-minute Headway					
													Arrive	Depart	Arrive	Depart	Arrive	Depart
NORTHBOUND																		
Maritime Museum at Portola Plaza Sta 800+00													0.00	0.00		30.00		
Park Sta 766+50	3350	35	449.17	17.50	449.17	17.5	2451.67	47.76	25.00000	0.00	107.76	1.795996	1.38	1.80	31.38	31.80		
NPS Sra 744+50	2000	35	449.17	17.50	449.17	17.5	1101.67	21.46	60.00000	0.00	116.46	1.941017	2.74	3.74	32.74	33.74		
Casa Verde Sta 720+00	2650	35	449.17	17.50	449.17	17.5	1751.67	34.12	25.00000	0.00	94.12	1.568723	4.89	5.31	34.89	35.31		
Contra Costa Sta 674+00	4750	35	449.17	17.50	449.17	17.5	3851.67	75.03	25.00000	0.00	135.03	2.250541	7.14	7.56	37.14	37.56		
Playa Sta 626+50	4600	45	742.50	22.50	742.50	22.5	3115.00	47.20	25.00000	0.00	117.20	1.953283	9.09	9.51	39.09	39.51		
Passing track at Monterey Road Sta 609+00	2750	45	742.50	22.50	742.50	22.5	1265.00	19.17	0.00000	60.00	124.17	2.069444	10.58	11.58	40.58	41.58		
First Street Sta 473+00	12600	45	742.50	22.50	742.50	22.5	11115.00	168.41	25.00000	0.00	238.41	3.973485	15.14	15.55	45.14	45.55		
Eighth Street Sta 443+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	16.69	17.10	46.69	47.10		
Passing track near SR-1 N Sta 398+60	4440	45	742.50	22.50	742.50	22.5	2955.00	44.77	0.00000	0.00	89.77	1.496212	18.60	18.60	48.60	48.60		
Palm Sta 353+50	4510	45	742.50	22.50	742.50	22.5	3025.00	45.83	25.00000	0.00	115.83	1.930556	20.11	20.53	50.11	50.53		
Reservation Sta 334+00	1950	45	742.50	22.50	742.50	22.5	465.00	7.05	25.00000	0.00	77.05	1.284091	21.40	21.81	51.40	51.81		
Beach Sta 304+00	3000	45	742.50	22.50	742.50	22.5	1515.00	22.95	25.00000	0.00	92.95	1.549242	22.95	23.36	52.95	53.36		
Marina Green Sta 275+50	2850	45	742.50	22.50	742.50	22.5	1365.00	20.68	25.00000	0.00	90.68	1.511364	24.46	24.87	54.46	54.87		
Passing track at Lapis Sta 234+50	4100	55	1109.17	27.5	1109.17	27.5	1881.67	23.33	0	25.00	103.33	1.722107	26.18	26.60	56.18	56.60		
Blackie Rd Sta 5661+50	24000	55	1109.17	27.5	1109.17	27.5	21781.67	270.02	329.26112	0.00	654.28	10.9047	32.01	37.50	62.01	67.50		

Figure 7-16
Monterey Peninsula Light Rail Transit—Location of Passing Tracks *(1 of 2)*

Figure 7-16
Monterey Peninsula Light Rail Transit—Location of Passing Tracks *(2 of 2)*



8 Rail Guideway Design Criteria and Alignment Plans

8. Rail Guideway Design Criteria and Alignment Plans

Rail Guideway Design Criteria

This section of the Conceptual Design Report details minimum standards and design policies to govern the engineering, materials and construction standards for trackwork and its interfaces with other elements of the light rail transit (LRT) system. The interfacing elements of the system include but are not limited to, track-way, stations, structures, communications, signal systems, utilities and drainage. Except for the requirements established by the California Public Utilities Commission (CPUC) and the criteria listed in this chapter, construction plans and specifications shall generally follow the AREMA Manual for Railway Engineering and Portfolio of Trackwork Plans and the Transit Cooperative Research Program (TCRP) Report 57 "Track Design Handbook for Light Rail Transit," modified as necessary to reflect the physical requirements and the operating characteristics of the Monterey Peninsula LRT system. Track construction and maintenance standards shall at all times exceed the current track safety standards of the Federal Railroad Administration.

In addition, where the LRT operates in or adjacent to a public street, the design requirements and concepts of the American Association of State Highway and Transportation Officials (AASHTO), the California Department of Transportation (Caltrans), the CPUC and the local municipality shall also be utilized.

These design criteria take into consideration many factors including passenger comfort, vehicle-operating envelope and track safety requirements. Passenger comfort requirements normally will drive the final track geometry design. For this reason, there are desired maximum and minimum values and absolute maximum and minimum. The desired values are based on passenger comfort, initial construction cost and maintenance considerations. Absolute values are determined primarily by the vehicle design, with passenger comfort a secondary consideration.

The track designer shall make every attempt not to exceed the desired values outlined by these design criteria. Where desired values cannot be met, absolute values may be used. Use of "standard" shall mean required without exception.

Track Gauge

Track gauge shall be a standard gauge of 4 feet 8-1/2 inches. The gauge is the distance between the inner sides of the head of rails measured 5/8 inches below and perpendicular to the top of rail (TOR). LRT track construction tolerances shall comply with Figure 8-1.

The track gauge shall be widened by 1/4 inch for all curves requiring restraining rails with a radius less than 600 feet. Although the restraining rail is primarily designed to reduce rail wear, it also inhibits lateral vehicle movement. Therefore no allowance will be made in the clearance calculation for the gauge widening.

General Track Alignment

The track alignment shall be designed to maximize passenger ride quality at the highest permissible operating speeds. Where cost, geometric or other physical constraints permit, the design engineer shall establish alignment, superelevation and track clearance conditions which will permit 55 mph operation by adjusting the actual superelevation. (See Tables 7-2 and 7-3 for maximum speeds by line segment.)

The LRT track alignment for each line section shall be stationed along the centerline of the historic mainline track (ML). Stationing along track ML shall be the basic control for locating all other system facilities along the route. Separate stationing shall be used for the pass track (PT) where tracks are neither parallel nor concentric, where widened track centers are required around curves, or where tracks are in separate structures. The stationing along track PT shall be equated to track ML at the points where parallel alignment resumes. Separate stationing shall also be used for yard track (YT).

Horizontal Track Alignment

In general the horizontal alignment shall consist of tangent sections connected by circular curves with spiral transition curves.

Tangent Sections

The minimum length of tangent track between curved sections is based on passenger comfort and vehicle truck/wheel forces. Based on the AREMA Manual, Chapter 5, the minimum length is equal to the longest car that will traverse the system. Due to the forces between the trucks/wheels on the light rail vehicle (LRV) it is recommended that all trucks be on tangent track before negotiating a curve, at a minimum two sets of trucks should be on tangent track.

The minimum length of tangent between curved sections (except those with compound curves) shall be as follows.

Table 8-1
TANGENT LENGTHS BETWEEN CURVED SECTIONS

Condition	Tangent Length
Desirable minimum	165 feet (or three times the design speed in mph)
Minimum	100 feet
Absolute minimum	50 feet

(Not applicable with compound curves)

The minimum length of tangent track preceding a point of switch shall be as follows.

Table 8-2
TANGENT LENGTHS PRECEDING A POINT OF SWITCH

Condition	Tangent Length
Desirable minimum	50 feet
Minimum	30 feet
Absolute minimum	12 feet

The horizontal and vertical alignment shall be tangent along all station platforms and continue a minimum of 50 feet from the end of platform. All special trackwork shall be located on horizontal tangent track.

Curved Sections

CIRCULAR CURVES

Circular curves are required to connect tangent track alignments. While North American freight railroads use chord-defined curves, circular curves for LRT designs shall be defined by the arc definition of curvature, and specified by their radius rather than the degree of curvature. If a comparison between curve radius and degree of curvature is required the following conversion approximation can be made:

$$D_C = \frac{5729.578}{R} \qquad R = \frac{5729.578}{D_C}$$

Where:

R = radius of curvature
Dc = degree of curvature

The minimum curve radius is determined by the characteristics of the LRV. The distance between the truck centers on the LRV play the critical role in determining minimum radius. For the Monterey Peninsula LRVs, the absolute minimum curve radius is 132 or 300 feet, depending on the selection of vehicle.

It is recommended that curved sections of track be designed with a radius greater than 500 feet since track maintenance and wheel squeal is drastically increased on small radius curves. For curves with a radius less than 500 feet, restraining rail will be required.

The minimum radius for a given curve is based on design speed, length of spiral and superelevation through the curve.

Table 8-3
MINIMUM CURVE RADII

Condition	Curve Radius
Desirable minimum	300 feet
Absolute minimum	132 or 300 feet, depending on vehicle requirements

The desired minimum length in feet of each curve element (spiral, simple curve, spiral) is three times the maximum speed in mph, or 100 feet, whichever is longer.

SPIRAL CURVES

Spiral curves shall be provided between circular curves with radii less than 10,000 feet and horizontal tangents. Spirals shall be Barnett or Talbot as defined by the AREMA Manual for Railway Engineering. See Figure 8-2 for spiral nomenclature. The minimum length of spiral shall be the greatest length determined from the following formulas:

1. $L_S = 1.10\ E_u V$
2. $L_S = 30\ E_a$
3. $L_S = 1.17\ E_a V$
4. $L_S = 50$ feet

Where:

L_S = Length of spiral curve (in feet)
E_a = Track superelevation for the circular curve (in inches)
E_u = Unbalanced superelevation for the circular curve (in inches)
V = Design speed (in mph)

If the minimum spiral length obtained above is less than 1/100 of the curve radius, then spirals may be omitted between compound circular curves provided that:

$$R_{CL} - R_{CS} \leq 0.34\ \frac{(R_{CS})^2}{V}$$

Where:

R_{CL} = Radius of larger curve
R_{CS} = Radius of smaller curve
V = Design speed (in mph)

SUPERELEVATION

Mainline tracks are designed with superelevations that permit desired design speeds to be achieved without resorting to excessively large curve radii. The design speed criteria stated below are based on a maximum lateral passenger acceleration of 0.1 g.

$$E_t = E_a + E_u = \frac{4V^2}{R} = 0.0007\ V^2\ D_C$$

Where:

E_t = Total superelevation required to balance the centrifugal force at a given speed (in inches)
E_a = Actual track superelevation to be constructed (in inches)
E_u = Unbalanced superelevation the difference between E_t and E_a (in inches)
V = Design speed (in mph)
R = Radius of curve (in feet)
D_C = Degree of curve

The amount of superelevation shall vary gradually as follows:

$$E_u = 1.33\ \frac{V^2}{R} + 0.67$$

$$E_a = 2.66\ \frac{V^2}{R} - 0.66$$

Actual track superelevation (E_a) shall not exceed 6 inches with a desired 4 inch maximum.

A minimum of 1/2 inch of superelevation should be used on all mainline curves with radii less than 10,000 feet.

Unbalanced superelevation (E_u) shall not exceed 4 inches with a desired 1.5 inch maximum. Actual superelevation should be attained and removed linearly throughout the full length of the spiral transition curve by raising the outside rail while maintaining the inside rail at the rail profile grade. Superelevation shall not extend in tangent track.

Yard tracks shall not be superelevated.

REVERSE CURVES

Reverse curves without tangent track between them shall be avoided on mainline track. Every attempt shall be made to use standard circular curves and spirals with tangent sections as described previously. For those sections where reverse curves must be used, the following criteria may be used:

- Reverse curves shall have spiral transition curves that meet at the point of reverse curvature, with the rate of change of superelevation constant through both of the spiral curves.
- If either of the reverse curves is less than 170 feet in radius, each spiral shall be at least 62 feet in total length. The length of spirals shall conform to the previously cited criteria.
- The superelevation transition through the spirals shall be accomplished by sloping both rails through the entire transition, as shown in Figure 8-3.

COMPOUND CIRCULAR CURVES

Compound circular curves may be used provided that they are connected by an adequate spiral transition curve. In order to provide a comfortable ride at lower speeds, the superelevation of the circular curve should be maintained through the spiral transition curve. The length of the spiral curve shall be determined by the criteria listed under *Spiral Curves and Superelevation.*

For high-speed conditions where the spiral transition curves are longer, a differential in the superelevation of the two circular curves may be allowed, provided the design does not compromise safety or riding comfort. For this condition, the minimum length of spiral shall be the greatest length of spiral determined from the criteria listed under *Curved Sections*.

The minimum length of spiral between compound circular curves shall be 62 feet. Spiral transition curves need not be used between compound circular curves when:

$R_L - R_S$ less than or equal to $0.34 (R_S/V)^2$

Where:

R_L = Radius of the larger curve (in feet)
R_S = Radius of the smaller curve (in feet)
V = Design speed (in mph)

Clearances

GENERAL

The criteria developed in this section apply to the design of the entire system. All designs shall provide not less than the minimum clearances as specified in this section.

Assurance of adequate and appropriate clearance for the passage of LRVs throughout the mainline trackage, switches and special trackwork, stations, storage yards and operations facilities is one of the most fundamental concerns inherent in the design process and must be rigorously monitored during the construction phase. Design criteria for clearances are complex and are based on numerous assumptions and interfaces.

It is in the development of clearance requirements that the buildup of concurrent, multiple tolerances must be scrutinized and balanced with the practicality of available space and other functional requirements.

The Design Engineer shall confirm that all structural elements provide adequate clearance for the rail maintenance of way (MOW) equipment.

CLEARANCE ENVELOPE

The clearance envelope (CE) represents the space in or into which, other than the LRV, no physical part of the system may be placed or constructed or may protrude. The clearance envelope is normally referenced from, or represented by its relationship to, the theoretical centerline of track at TOR.

Clearance on Tangent Sections
Horizontal clearance from the centerline of the track shall be no less than 8 feet 6 inches in tangent sections.

CE = 8 feet 6 inches (tangent)

Clearance on Curved Sections
The minimum horizontal clearance from track centerline to fixed objects more than 8 inches above top of rail on curved track is 9 feet 6 inches.

Clearance on curved sections shall be calculated and or computer modeled to insure that the nose, tail and mid section of the LRV does not “chord” the curve less than the tangent CE (see Figure 8-4). There are several methods of calculating the appropriate distance.

For horizontal curves with spirals, the tangent clearance envelope shall end 50 feet before the point of tangent-to-spiral (TS) and 50 feet after the point of spiral-to-tangent (ST). The full curvature clearance envelope shall begin 25 feet prior to the point of spiral-to-curve (SC) and end 25 feet beyond the point of curve-to-spiral (CS). The horizontal component of the vehicle dynamic envelope between these two offset points (i.e., 50 feet before TS and 25 feet before SC) shall be considered to vary linearly with distance between the two points. Horizontal offsets at intermediate locations shall be calculated with straight line interpolation. For horizontal curves that do not include spiral transition curves, the full curvature clearance envelope shall begin 50 feet prior to the point of curvature (PC) and extend to 50 feet beyond the point of tangency (PT). More detailed computer simulations with more precise geometry may be used to define the clearance envelope in place of these 25 foot and 50 foot locations and straight line interpolations. The clearance envelope through turnouts shall be calculated based on the turnout centerline radius.

Superelevation correction (e) = 2.15 inches per inch of actual superelevation (E_a) at car mirror, but not to exceed 10 inches for outside end overhang, 1.15 inches per inch of E_a at 5.5 feet above TOR.

Vertical Clearance
Vertical clearance from TOR to the underside of fixed obstructions shall be no less than 15 feet (see Figure 8-5).

SPECIAL CLEARANCE SITUATIONS

In addition to the more routine clearance envelope determinations above, there are several special clearance situations warranting further attention and definition. These special situations include undercar clearances, vehicle interface at station platforms, and general walkway areas along the right-of-way (ROW) where applicable.

Undercar Clearances
Vertical undercar clearance is defined from TOR with the maximum suspension deflection and car body roll, minimum vertical curve radius and fully worn wheels. The minimum vertical undercar clearance envelope shall be determined following vehicle selection.

Station Platform Interface
The relationship of the vehicle at rest and the station platform is one of the most fundamental interfaces in any rail transit system. Horizontal and vertical static clearances or gaps (between platform edge and vehicle step) determine the ease of boarding/alighting for passengers, and platform edges often must be placed within the strict confines of clearance envelopes so as to permit safe and practical passenger movement.

The station platform interface shall include a platform edge provisionally located 60 inches horizontally from centerline of track and 22 or 23 inches vertically from TOR with a tolerance of +0.5 inches vertically and 0.0 inches horizontally from track centerline on tangent track. To accommodate the range of prototype vehicles, a platform extender may be required to accommodate the Siemens AG Desiro vehicle.

Walkways along Structures
An emergency/maintenance walkway shall be provided along structures. There shall be at least one walkway per track. Single track structures only need one walkway. This walkway shall be above top of tie and below TOR at the track edge and shall be located at a horizontal distance from track centerline as determined by regulations. The walkway shall have a minimum width of 30 inches.

Walkway Area along Trackway
In addition to the clearance envelope requirement described above, it is desirable that space be provided for unpaved maintenance walkways adjacent to the trackway. The walkway envelope shall extend at least 2 feet-6 inches from the edge of the clearance envelope. Desirably, walkways shall be provided on both sides of the ROW, and shall permit unobstructed passage from which passengers can be evacuated. Permanent obstructions such as retaining walls and safety fencing may limit the provision of maintenance walkways on one or both sides of the trackway clearance envelope.

This requirement is not applicable to paved track sections in or adjacent to street ROW.

Face of Curb
The minimum clearance from the track centerline to the face of curb shall be no less than 7 feet 0 inches.

Figure 8-6 provides a simplified outline of the dynamic envelope of the LRV.

VERTICAL TRACK ALIGNMENT

General

Vertical alignment shall be defined by the "top-of-rail profile" along tangent sections and the low rail in superelevated sections. Parabolic vertical curves having a constant rate of change in grade shall be employed for changes in gradient.

Grades

Grades shall not exceed the maximums specified below:

Table 8-4
MAXIMUM VERTICAL GRADES

Condition	Desirable Maximum	Absolute Maximum
Mainline track	4.0%	6.0% (not more than 1,500 ft)
Stations	1.0%	2.5%
Yard	0%	0.5%
Storage Track	0%	0.25%
Special trackwork	0%	4.5%

All tracks entering the yard shall be pitched downward away from the main line, or dished to prevent any vehicles from rolling onto the mainline tracks. Grade shall be equalized to the most practical extent possible.

The minimum length of constant profile grade between vertical curves shall be determined as follows:

$$L_g = 3V$$

Where:
L_g = Minimum length of constant profile grade (feet)
V = Design velocity through tangent (miles per hour)

Absolute minimum L_g shall be 90 feet.

Vertical Curves

LENGTH OF VERTICAL CURVES

The required length of vertical curve shall be the largest length as calculated from the following formula, rounded off to the nearest 1 foot:

$$L \text{ (desirable)} = 200 (G_1 - G_2)$$
$$L \text{ (preferred minimum)} = 100 (G_1 - G_2)$$
$$L \text{ (absolute minimum crest curve)} = \frac{(G_1 - G_2) V^2}{25}$$
$$L \text{ (absolute minimum sag curve)} = \frac{(G_1 - G_2) V^2}{45}$$

Where:
L = Minimum length of vertical curve, feet
$G_1 - G_2$ = Algebraic difference in grades, expressed in %
V = Design speed, mph

Standard vertical curves are shown in Figure 8-7.

The minimum length of any vertical curve shall be as follows.

Table 8-5
VERTICAL CURVES—MINIMUM LENGTH

Condition	Length of Vertical Curve
Desirable minimum	200 feet
Absolute minimum	150 feet

Vertical curves shall not exceed the limits identified below for combined vertical and horizontal curves.

REVERSE VERTICAL CURVES

Reverse vertical curves may be used provided the minimum length of each curve is not less than that defined in Table 8-5.

COMPOUND VERTICAL CURVES

Compound or non-symmetrical vertical curves may be used provided the requirements for the length of vertical curves are met.

COMBINED VERTICAL AND HORIZONTAL CURVES

A two-car train shall be capable of negotiating a combined (horizontal and vertical) curved section involving:

- 132 or 300 foot radius horizontal curve and 1640 foot vertical curve either crest or sag.
- 143 or 325 foot radius horizontal curve and an 1150 foot vertical sag curve.
- 153 or 348 foot radius horizontal curve and an 820 foot vertical crest curve.

Combined horizontal and vertical curves shall not be more restrictive than these absolute minimum requirements.

Mainline Track

For typical track sections, refer to Figures 8-8, 8-9 and 8-10. For track sections at undercrossings, see Figures 8-11A and 8-11B.

Subgrade

The subgrade 11 feet both sides of track centerline shall be compacted to a minimum density of 95 percent of the maximum density determined in accordance with AASHTO T 180. The subgrade shall be in a moist condition (within ±2 percent of the optimum moisture content as determined by AASHTO T 180).

If laboratory results indicate that existing material is unsuitable, the material must be removed and replaced with clean, sound and properly compacted material, per ASTM standards.

The compacted subgrade shall be sloped at 40:1 downward and away from the center point located midway between the two tracks in double track territory. In single track areas, the compacted subgrade shall slope toward the underdrain (if provided) at 40:1. Refer to Figures 8-8, 8-9 and 8-10 for typical subgrade configurations.

Configurations other than those mentioned above may be adopted if drainage requirements or specific locations dictate a special treatment.

Subballast

Subballast is the transition zone between the subgrade and the ballast. The subballast acts as a barrier filter separating the ballast section from the subgrade material. This material plays an integral role in the track structure. The quality of the subballast has a direct relationship to the overall performance of the track structure. This layer acts as a drainage median for the track bed.

An 8-inch layer of subballast shall be installed on top of the subgrade. The subballast shall conform to AREMA specifications. Subballast should extend the full width of the subgrade and at a minimum 24 inches past the toe of the ballast.

Geotextile Fabrics

Geotextile fabrics shall be placed under all special trackwork (on the mainline and in the yard) and tracks with potential subgrade stability issues. Fabric will extend the entire interface zone between the ballast and subballast. Fabric will extend 20 feet before point of switch and 10 feet after the last long tie. Geotextile fabric specifications shall be as recommended by a geotechnical engineer.

Ballast

No. 4 (1-1/2 inches to 3/4 inches) and or No. 3 (2 inches to 1 inch) ballast conforming to AREMA specifications shall be used on all main tracks except for those in streets and yards, where No. 5 (1 inch to 3/8 inch) ballast will be used. All ballast is to be thoroughly washed and or re-screened (0.5 percent maximum passing #200 sieve) as necessary to remove fine particles prior to placement.

A minimum depth of 8 inches of ballast shall be used between the bottom of ties and top of the subballast. The ballast shoulder shall extend 16 inches beyond the ends of the ties parallel to the plane formed by the top of the rails. Ballast shoulder shall then slope downward to the subballast at a 2:1 slope. The final top of ballast elevation shall be one inch below the top of tie, when compacted. Refer to Figures 8-8, 8-9 and 8-10.

Ballast shall be placed in-between track, around platforms and other areas where the tracks are splayed out.

Concrete Cross Ties

Mainline tracks shall use concrete cross ties, approximately 8 feet 3 inches in length and 7 inches by 9 inches in cross section spaced 30 inches, center to center. Tie spacing through curves with less than 1000 feet radii shall be 27 inches. All concrete cross ties shall conform to AREMA specifications. For track to be retained through the former Fort Ord area, and for segments adjacent to the pedestrian/bicycle recreational trail, use of timber ties is an acceptable alternative.

Timber Switch Ties

Timber switch ties shall be of various lengths conforming to the specific requirements of the turnouts used. Anti-splitting devices shall be used on all wood ties. Ties shall be free of twist, bow and detrimental splitting.

Rail

Rail for all mainline track shall be 115 RE section, new Premium or Standard rail manufactured in accordance with current AREMA specifications (see Figure 8-12). Used No. 1 or new industrial quality (IQ) rails may be used in yard and other non-main tracks.

High carbon (0.90 percent carbon minimum) rails shall be used in all special trackwork and on all curves of radii equal to or less than 600 feet and extending into the spiral until the point of radius on spiral exceeds 600 feet. High carbon rails shall not be installed on seldom used emergency or storage tracks, even though they may satisfy the above criteria. High Carbon rails may be used in other locations where excessive rail wear is anticipated. All rails shall be ground to remove mill scale from the top and gauge side profile of the rail head prior to the start of integrated/acceptance testing.

Rail in curves of radii equal to or less than 300 feet shall be precurved using standard shop practices.

Restraining Rails

Restraining rails are used to provide continuous support to LRVs negotiating sharp radius curves. This use of restraining rails reduces the wear to the flanges and to the rail also reducing the possibilities of a derailment.

All mainline track excluding special trackwork with a centerline radius of 500 feet or less shall have inner restraining rail mounted adjacent to the low rail. The flangeway shall be set at 1-7/8 inches wide to engage the back of the inside wheel. Restraining rail shall extend beyond the curve on both ends a minimum distance of 10 feet. Restraining rail shall be continuously welded (CWR) or jointed to prevent rail end offset. Restraining rail detail is shown on Figure 8-13. Restraining rail joints shall be bolted using D-bar installation.

Emergency Guardrails

Emergency guardrails are used as a safety device. In the event of a derailment, the guardrail is designed to catch the inside of the wheel and guide the LRT along the track until it stops and/or to prevent derailed LRV from striking an abutment wall or any support structure. Emergency guardrails shall be installed adjacent to the inside running rail of all tracks on bridges and fills with a vertical drop of more than 3 feet. Guardrails shall also be applied where the guideway is located adjacent to major structures, unless that structure is constructed with an approved safety barrier. Emergency guardrails will not be installed within the limits of special trackwork or restraining rail. Guardrail is required under overhead bridges unless the overhead structure has sufficient crash wall protection.

Emergency guardrail shall be designed so as to retain the wheels of a derailed vehicle moving at maximum speed. The striking face of the emergency rail shall be uniformly located approximately 1 foot from the gauge line of the running rail. Guardrail shall be fastened to every second tie in ballasted track.

Rail Seats and Fastenings

Rail seats and fasteners hold the rail to the ties (see Figure 8-14). To allow for future electrification of the line, concrete and wooden cross ties may use spring clips isolated from the tie using plastic insulators and placed on an insulating pad (to be determined in final design). Rail anchors will not be needed or used.

Other rail fastening methods shall be evaluated for street track, ballasted track and Special Trackwork. Direct fixation rail fasteners shall provide the required lateral and longitudinal restraint for continuous welded rail (CWR) and provide a 40:1 cant of the rail.

Rail fasteners for use in direct fixation special trackwork shall be of a design compatible with the standard fastener used in conventional direct fixation track.

Rail clips or other devices used in direct fixation fasteners shall produce the required longitudinal rail restraint after repeated load testing in accordance with AREMA Chapter 10, except load application angle in that test shall be 27 degrees. The clearance envelope for direct fixation fasteners is shown in Figure 8-15.

Rail Welds

Rail shall be welded into CWR strings of site-specific length by the electric flash-butt or aluminothermic weld processes in accordance with AREMA specifications. The ends of the welded rail strings will then be field-welded together by the thermite welding or flash-butt process according to AREMA specifications. All welds will be ultrasonically proof tested prior to service operation.

Rail Joints

Insulated and standard rail joints shall be placed only at locations where required to accommodate signal track circuits and connections to special trackwork. The insulated rail joints for signal operations shall be prefabricated miter cut plugs, welded into the CWR rail using the welding techniques specified above. Insulated plugs should be trimmed down to 14 feet. Only frogs may be bolted. Insulated joints shall use huckbolts. In no case will joints be located within street or pedestrian crossings.

Special Trackwork

Special trackwork shall be manufactured and installed generally following AREMA plans and specifications. All frogs and flangeways shall be designed to accommodate the LRV wheel profile.

All special trackwork shall be fabricated using galvanized lag screws and Pandrol e-clips (no spikes).

The preferred location of special trackwork is in ballasted at-grade areas. Single crossovers shall be used in lieu of double crossovers unless space restrictions dictate their use. Special trackwork in paved track shall be kept to an absolute minimum; however, when it must be so located, it shall be designed to reduce the exposure of pedestrians to the operating mechanisms. Switch points shall not be located in areas designated as pedestrian crossings.

All special trackwork shall be located on vertical and horizontal tangents. The desirable minimum horizontal and vertical tangent distance preceding a point of switch shall be 50 feet (absolute minimum shall be 20 feet. Special trackwork shall not be superelevated.

As special trackwork is a source of noise and vibration, its location shall be selected to minimize their effect.

Turnout geometry and operating speed through turnouts shall be as indicated in Figure 8-16. Turnouts and crossovers for various applications shall be selected in accordance with the following criteria:

- No. 10 turnouts (19 feet-6 inch curved switch points) shall be used on mainline ballasted track.
- No. 8 turnouts (19 feet-6 inch curved switch points) shall be the standard mainline turnout in paved track areas.
- No. 6 turnouts (13 feet-0 inch curved switch points) shall be used on the mainline in areas where space limitations prevent the use of No. 8s.

Rail clips shall be installed in lieu of cut spikes on ties for special trackwork.

All turnouts shall use AREMA Point Detail 5100 with graduated risers. All mainline track frogs shall be of the rail-bound manganese type with high Carbon steel guardrails. Self guarded frogs are to be used in yard tracks. Paved track switch points shall be bolted to closure rails with a solid heel block.

Special drainage provisions shall be made in paved track turnouts to preclude standing water in flangeways, switch points and in switch-throwing mechanisms.

Special trackwork in paved areas shall have removable replaceable precast concrete panels throughout the special trackwork limits.

Paved Track

All road and street design shall be in accordance with the current specifications and design guidelines of the involved local jurisdictions. For those cases where the local jurisdictions have no design guidelines, Caltrans Design Standards shall be used.

Corrosion preventive measures must be utilized on all embedded track components.

Trackwork located in streets shall use 115RE rail on concrete ties, except for special trackwork, which will use timber switch ties on AREMA No. 5 ballast. Figure 8-17 shows paved track with a concrete surface. Figure 8-18 shows typical section of rail connection detail in embedded track. Flangeway filler material shall have a volume resistivity of 1012 ohm-cm or greater. Flangeway filler shall be a “Polypro EPFLEX RAILSEAL field side spec 12-621 and gauge side 12-622” or approved equal. The flangeway filler shall be formed to tightly surround the e-clips and or other specified railroad tie fasteners. Fasteners under the flangeway filler shall be coated with a corrosion resistant material “Petrolatum” or approved equal.

Particular attention shall be directed toward proper drainage of street trackage. The adjacent surface pavement shall be designed so surface water will drain away from the track. Track drains shall be used to prevent water from standing. In areas of special trackwork, particular attention will be directed to provide drainage for the special trackwork units and switchthrowing mechanisms. When possible, track drains shall be located in tangent track.

The pavement material shall be 1/4 inches below the TOR on the field side to prevent the wheel tread from damaging the pavement material. An elastic or filler material shall be placed between the rails and pavement materials in order to prevent damage to the pavement materials. Any application of flangeway filler shall allow for the future removal of the rail. Rail clips in paved track shall be protected from corrosion.

Direct Fixation Track (DF)

Direct fixation (DF) track is a ballastless track structure in which the rail is mounted on direct fixation fasteners that are attached to a concrete deck or slab. Trackwork located on DF shall use 115RE rail attached to the direct fixation fasteners using spring clips and isolated from the structure using elastomeric pad and plastic insulators.

Any grade separated structure longer than 400 feet in length will require DF. It shall consist of a second pour concrete plinth block and a fastening system to hold the running rails onto the concrete surface canted 1:40 toward the track centerline. An approach slab shall be provided at each transition between DF and ballasted track.

DF sections shall be designed for storm water runoff of a 100-year storm event.

Grade Crossings

Mainline grade crossings shall be prefabricated and made of durable, longlasting materials. Grade crossing panels shall be constructed with due regard to removability for track maintenance, electrical isolation, to non-interference with electrical track circuits or rail fastenings, tire adhesion and slip resistance for vehicles and pedestrians.

Grade crossings shall be located on tangent track and away from special trackwork areas unless infeasible. Rail joints and thermite welds shall not be located in grade crossings.

Cross tie size and spacing at grade crossings shall be in accordance with the grade crossing manufacturer's recommendations.

Crosswalks shall be provided at areas where pedestrians will be crossing mainline tracks. They shall be located on tangent track, if possible, and away from special trackwork areas.

Maintenance Access Point

Access points for maintenance personnel and equipment shall be provided everywhere possible. Areas shall be provided at or near wayside equipment for the parking of maintenance vehicles to prevent infringing on highway travel lanes or pedestrian areas.

High-rail access points shall be provided at least every 2 miles. They shall be located on tangent track and be constructed of grade crossing materials durable enough to withstand maintenance vehicles. High-rail access points shall be adequately secured to prevent unauthorized entry.

Track Bumping Posts

Track bumping posts shall be designed to clear the coupler and engage the car’s anti-climber. They shall be installed at the ends of all stub-end yard and mainline tracks. Track bumping post shall be primed and painted yellow.

Rail Expansion Joints

During final design, locations where rail expansion/contraction is anticipated to present a problem (on bridges and certain sharp curves on ballasted track), shall be analyzed for methods of control. If mechanical rail expansion joints are used, the expansion capacity of the joints shall be greater than the anticipated rail movement within the full range of rail temperatures. Expansion joints must be bonded for negative return electrical conductivity.

Noise and Vibration

Noise and vibration shall be measured and mitigated, if necessary, according to environmental studies and the current FTA guidelines.

Yard Track

Yard tracks will be constructed to the same standards as mainline track, with the following exceptions.

Subballast

Subballast will not be required unless it is needed for subgrade stabilization. Use of subballast shall be as recommended by a geotechnical engineer.

Ballast

No. 5 ballast conforming to AREMA specifications shall be used on at least the top 2 inches on all yard tracks. No. 4 ballast may be used for the remainder of the section.

A minimum depth of 9 inches of ballast shall be used between the bottom of tie and top of subgrade. The top of ballast elevation shall be at least 1 inch below the base of rail yet fills the tie crib to 1 inch from top of tie. The ballasted shoulder shall extend level 18 inches level on the field side with a maximum slope of 2 foot horizontal to 1 foot vertical beyond the 18 inches. Crushed slag ballast will not be permitted.

Cross Ties

Yard tracks shall use timber cross ties 9 feet in length spaced 26 inches center to center, except at braced and guarded track, where spacing shall be 24 inches. All cross ties shall be size 7 inches by 9 inches and conform to AREMA specifications. Switch ties shall be of various lengths as required for a No. 6 AREMA turnout with 13 feet-0 inch switch points.

Rail

Yard tracks shall be constructed with 115 pound CWR new Standard or IQ (Industrial Quality). Used No. 1 rail may be used.

Restraining Rails

All yard track curves, with a centerline radius of 300 feet or less, shall have restraining rails mounted adjacent to the inside rail in accordance with AREMA plans and specifications.

Guardrails

Emergency guardrails shall be installed on tracks adjacent to all major structures that may cause extensive damage to a car in the event of a derailment or intrusion into the mainline envelope.

Rail Joints

Rail joints shall not be used.

Special Trackwork

Special trackwork shall conform to the requirements for mainline track.

All yard turnouts shall be AREMA No. 6s or greater with 13 feet-0 inch curve switch points conforming to AREMA Point detail 5100 with graduated risers. Self guarded frogs shall be used.

The switch stand area shall have a level and sufficient area for switch tending.

The operating speed through the turnouts shall be as indicated in Figure 8-16.

Grade Crossings

Grade crossings shall conform to the requirements for mainline track, except yard grade crossings may consist of asphalt with flangeway liners.

Crosswalks

Crosswalks shall conform to the requirements for mainline track. In the yard, they may be located on curves and may consist of asphalt.

Yard Lighting

The yard is to be illuminated to provide a safe working environment for ultimate 24-hour operation of the facility. Yard lighting will also provide an element of security. Yard lighting shall be in conformance with local requirements.

Service Roads

Service roads shall be provided around the operations facility and between alternate pairs of tracks in the LRV storage areas. Service roads shall also be provided to access switches within the yard. Service roads shall be designed as applicable to the need.

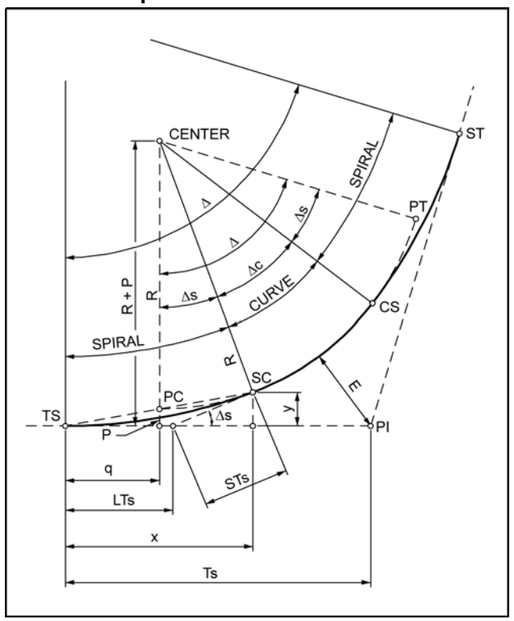
List of Figures

Figure 8-1
Track Construction Tolerances

TYPE OF TRACK	GAUGE VARIATION[1]	CROSS LEVEL AND SUPERELEVATION VARIATION[1]	VERTICAL TRACK ALIGNMENT		HORIZONTAL TRACK ALIGNMENT	
			TOTAL DEVIATION[2]	MIDDLE ORDINATE IN 62′ CHORD	TOTAL DEVIATION[2]	MIDDLE ORDINATE IN 62′ CHORD
MAIN LINE	± 1/8″	± 1/8″	± 1/2″	± 1/8″	± 1/2″	± 1/8″
YARD	+ 1/4″ – 1/8″	± 1/4″	± 1″	± 1/4″	± 1/2″	± 1/8″

NOTES:
1. Variations of gauge, cross level and superelevation shall not exceed 1/8-inch per 31 feet of track.
2. Total deviation is measured between the theoretical and actual alignments at any point in the track. Total deviation in station area 1/4-inch.

Figure 8-2
Curve and Spiral Nomenclature



$\Delta = \frac{DL_S}{200}$

$i = \frac{\Delta_S}{3}$

$S = \frac{DI^2}{200\ L_S}$

$x = I \cos i$

$y = \frac{D(rad)\ L^2_S}{600}$

$q = X - R \sin \Delta_S$

$P = Y - R \text{ vers } \Delta_S$

$(\text{vers})\ \Delta_S = 1 - (\cos \Delta_S)$

$T_S = (R + P) \tan \Delta/2 + q$

$E = (R + P) \text{ ex sec } \Delta/2 + P$

$LT_S = X - (y/\tan \Delta_S)$

$ST_S = y/\sin \Delta_S$

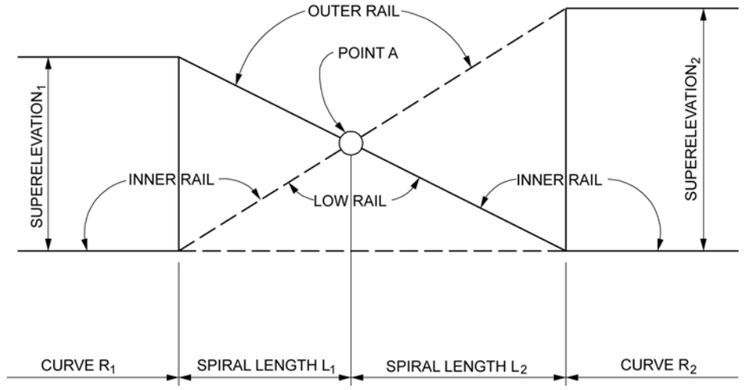
$T_C = R \tan \Delta_C/2$

$D_C = \frac{5730}{R}$

$L_C = \frac{100\ \Delta_C}{D}$

R = radius
D_C = degree of curvature
P = offset of the PC/PT of simple curve, measured from main tangent of spiral
q = distance form TS/ST to the PC/PT of simple curve, measured along main tangent of spiral
X = distance from TS/ST to the SC/CS, measured along main tangent of spiral
Y = offset of SC/SC, measured from main tangent of spiral
E = external distance
L_S = length of spiral arc (limiting value of 1)
L_C = length of curve
I = length of spiral arc from Δ_S to any point on spiral
LT_S = long tangent of spiral
ST_C = short tangent of spiral
TS = total tangent distance TS/ST to PI
Δ = total central angle
Δ_S = total spiral central angle
Δ_C = simple curve central angle
i = deflection at Δ_S from tangent to any spiral point

Figure 8-3
Superelevation Transitions for Reverse Curves



NOTE

On superelevation curve, top of rail elevations shown on profile are for the lower rail.

1. Point “A” = point of reverse curves
2. Rate of superelevation change to be same for both spirals.
3. Spirals must be 62 feet minimum.

Figure 8-4A
Additional Width for Chorded Construction

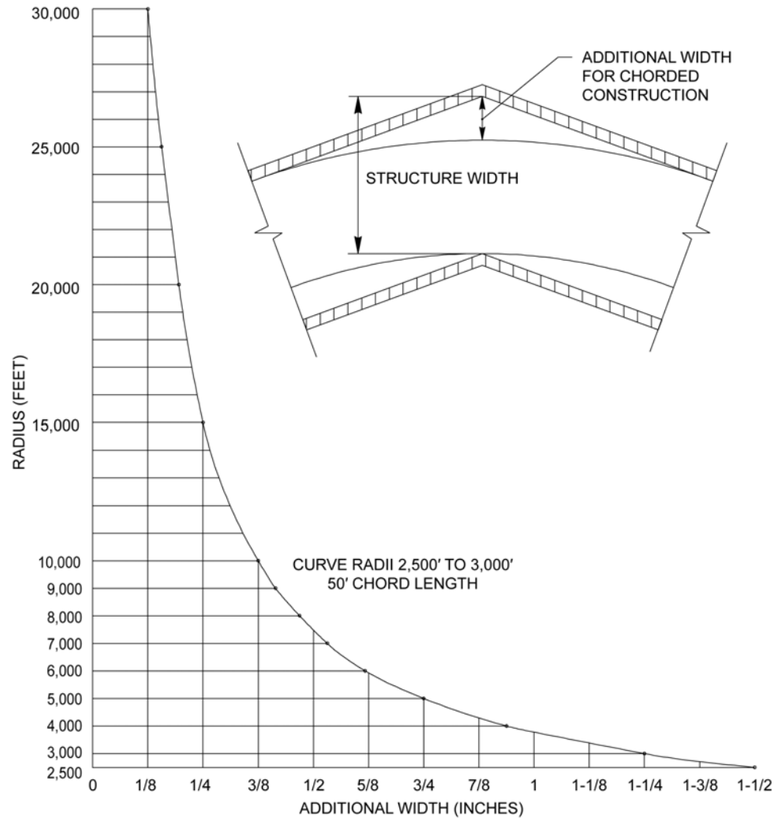


Figure 8-4B
Additional Width for Chorded Construction

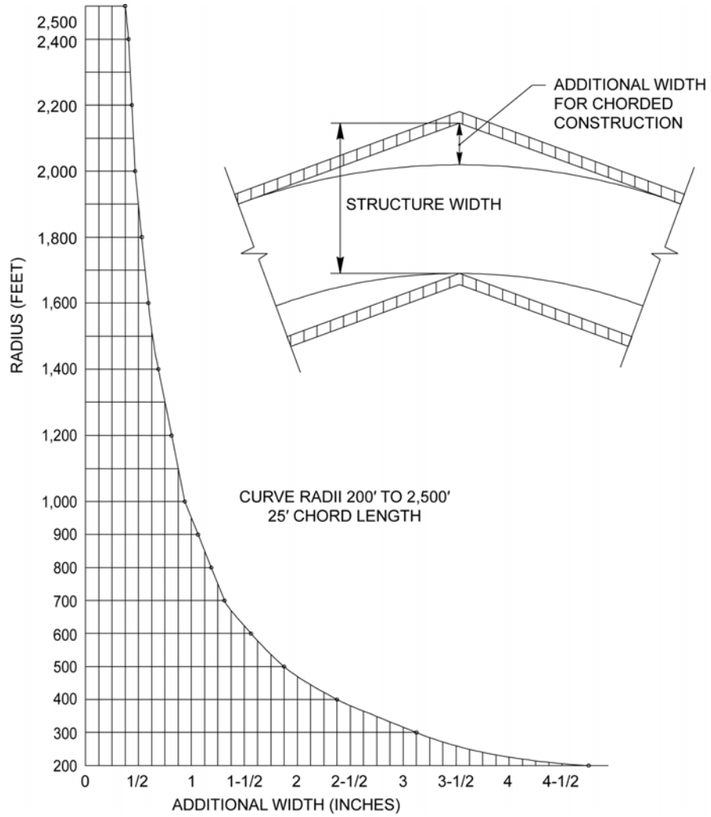
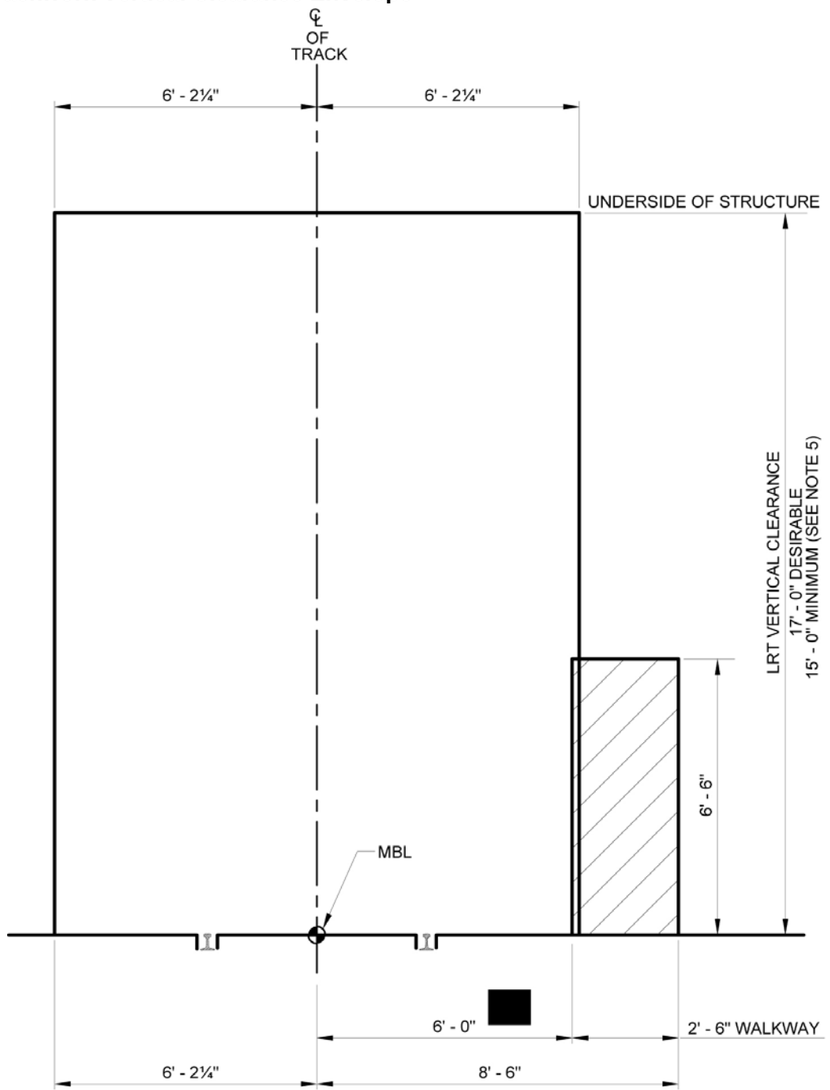
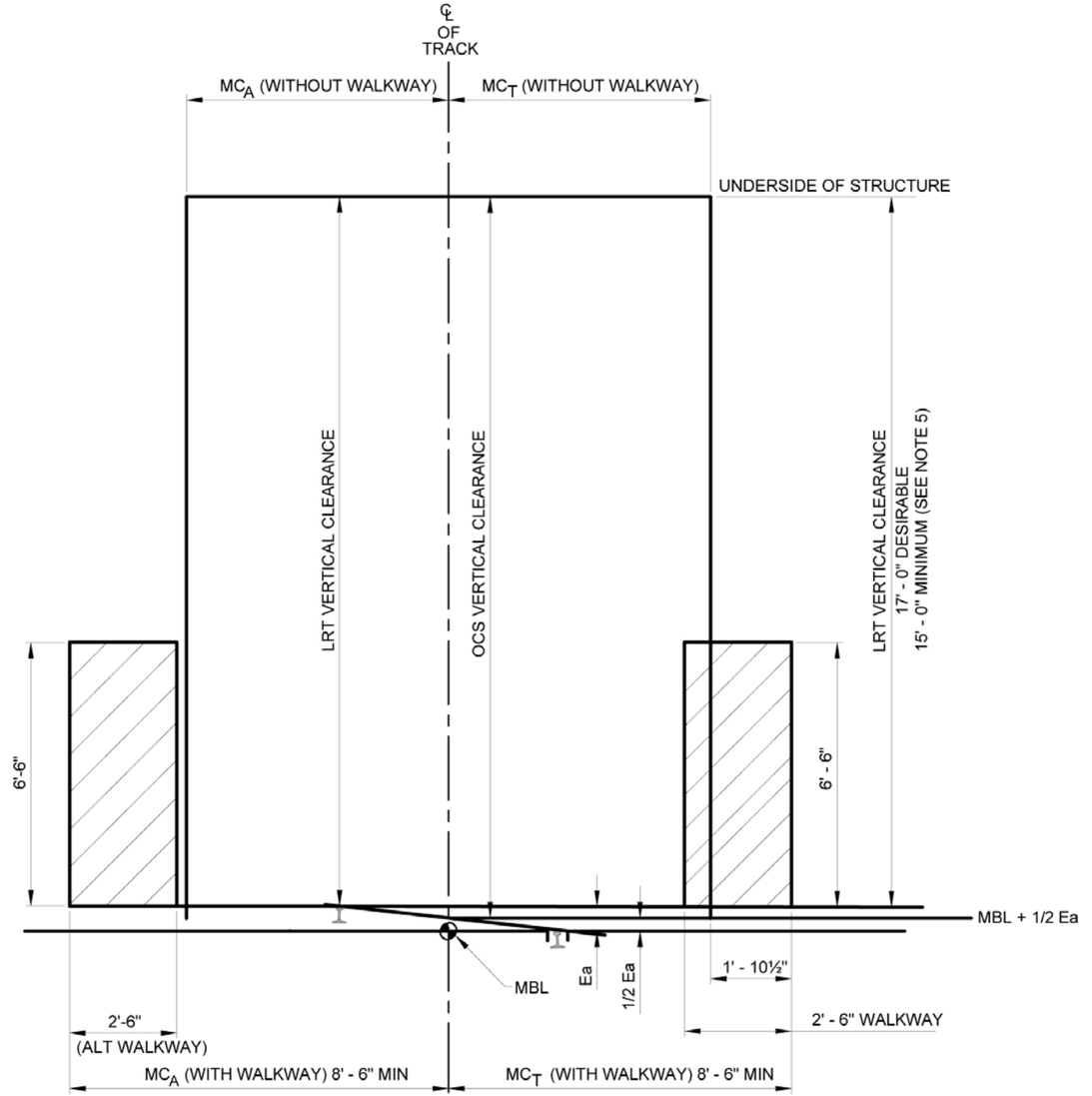


Figure 8-5
Trackwork Vertical Clearance Envelope



A. LRT VERTICAL CLEARANCE TANGENT SECTION



B. LRT VERTICAL CLEARANCE SUPERELEVATED SECTION

NOTES: **For Tangent Sections**

1. LRT vertical clearance measurement points are defined as vertical dimensions from underside of the structure measured to MBL. Along the centerline and at 6'-2" offset (left and right) from the centerline, whichever is smaller.

For Superelevated Section

2. LRT vertical clearance measurement point is from top of the high rail to structure above the LRT.
3. Additional LRV dynamic envelope (Figure 8-6) clearance check shall be performed when any part of overhead structure has less vertical clearance than defined in 2.
4. For LRT vertical clearance at structures, see LRT plan and profile or track chart sheets.
5. Minimum vertical clearance less than 17'-0" desirable.

NOMENCLATURE:
MC$_A$ = Minimum horizontal clearance away from center of curve
MC$_T$ = Minimum horizontal clearance

Figure 8-6
Light Rail Vehicle Dynamic Envelope

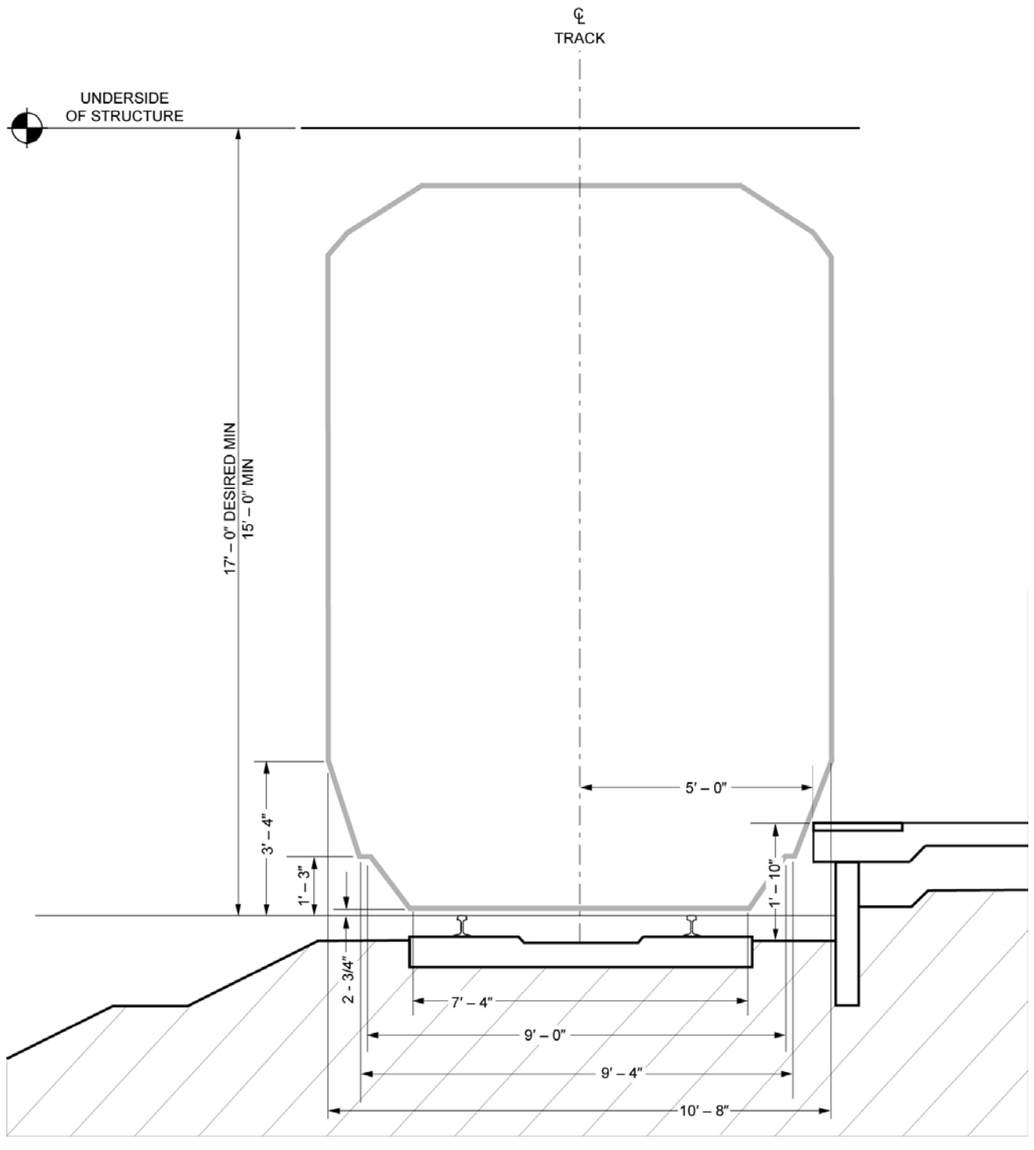
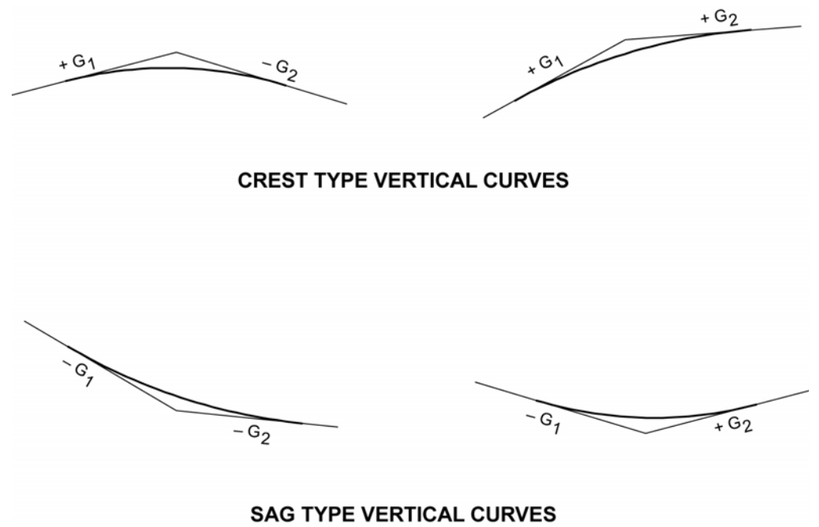
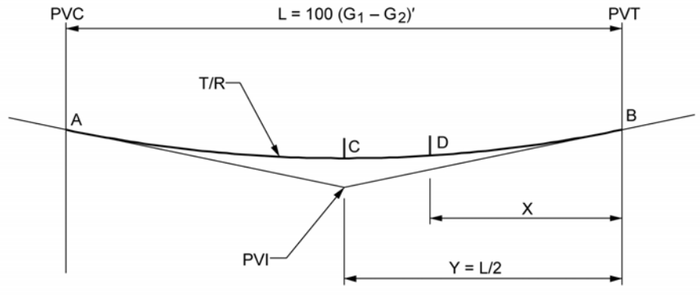


Figure 8-7
Standard Vertical Curves





ELEV C = $\frac{2 \text{ ELEV PVI} + \text{ELEV A} + \text{ELEV B}}{4}$

OFFSET AT D = DIFFERENCE BETWEEN ELEV C AND ELEV PVI

OFFSET AT D = OFFSET AT C$(X/Y)^2$

T/R AT D = OFFSET AT D ± GRADIENT ELEV AT D

STANDARD VERTICAL CURVE

Figure 8-8
Single Track Ballasted Track Section

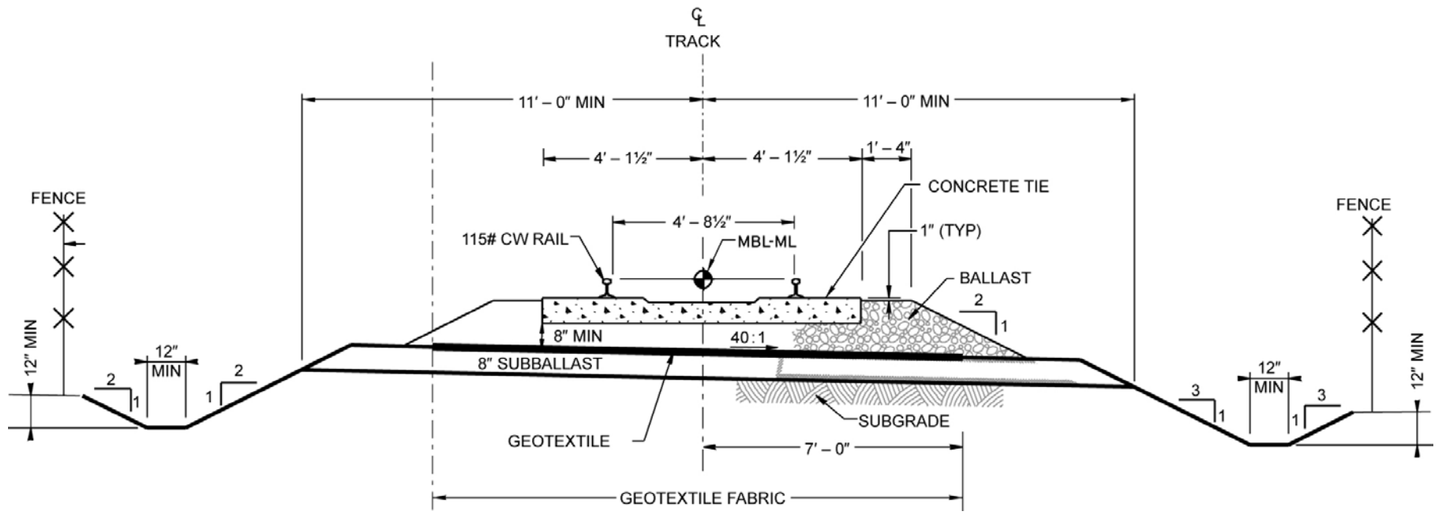


Figure 8-9
Double Track Ballasted Track Section

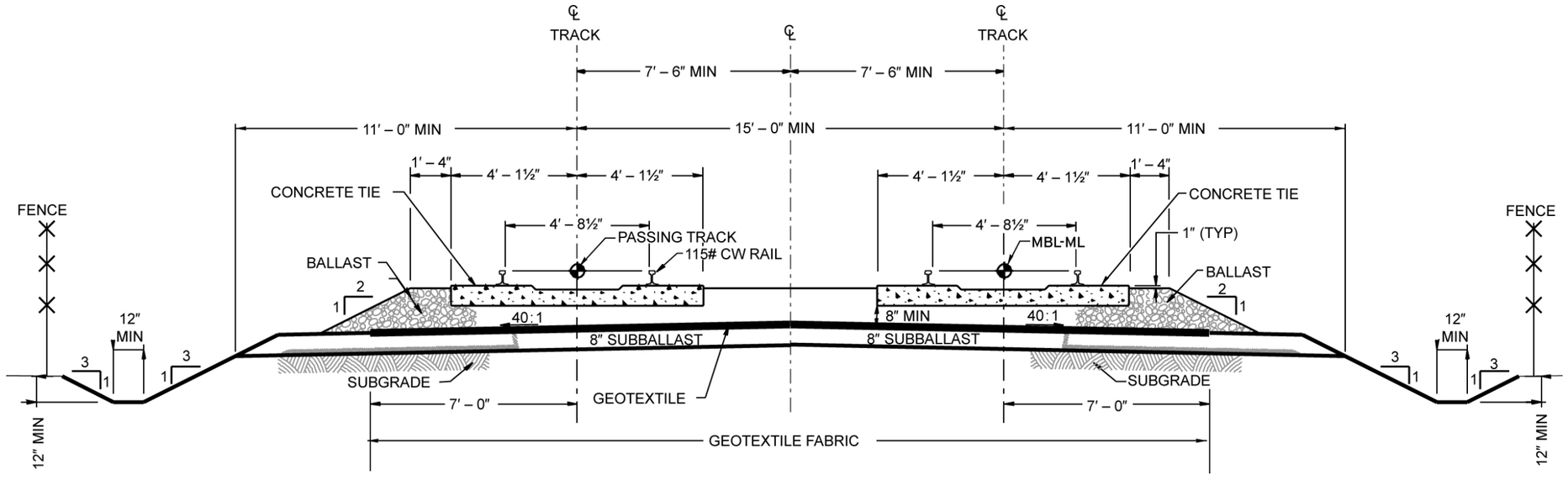


Figure 8-10
Typical Retained Track—Tangent

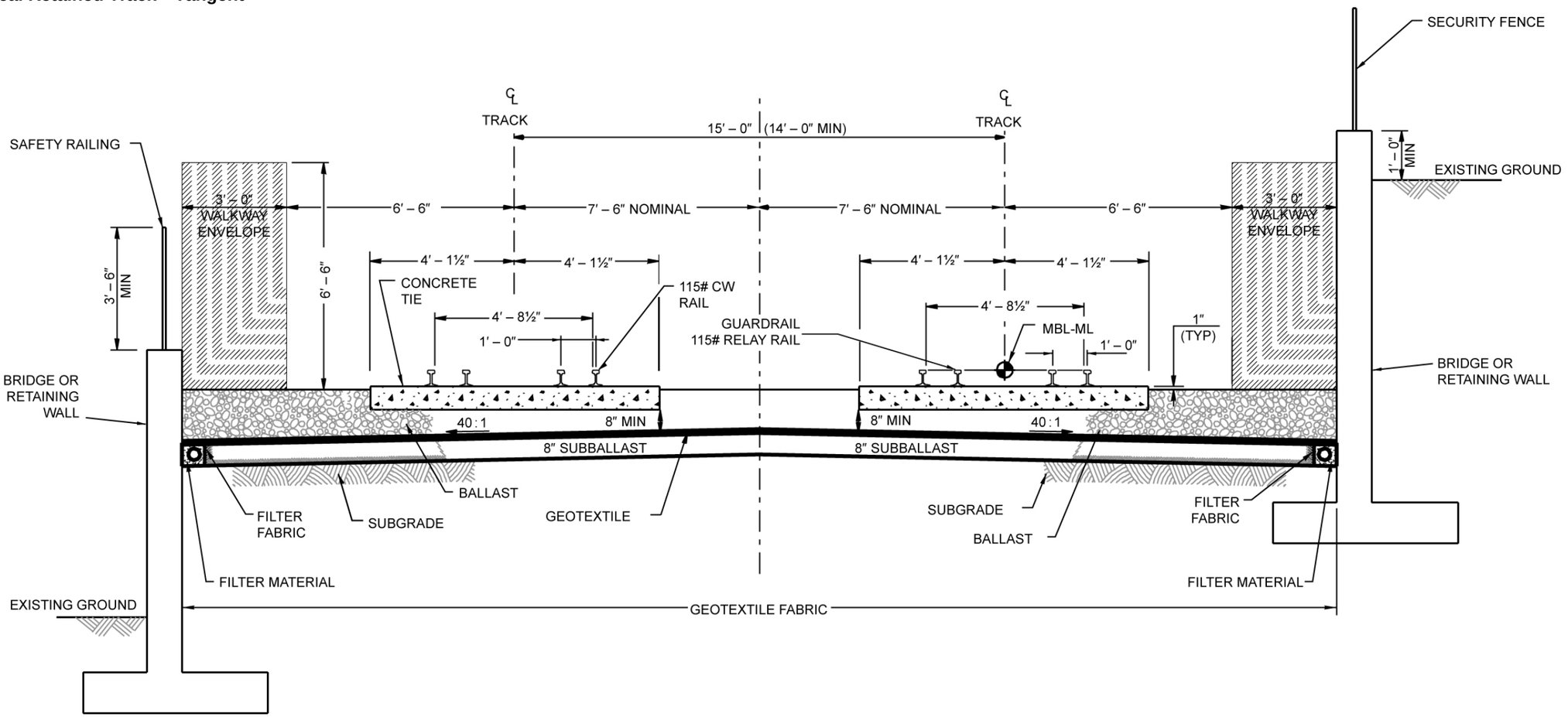


Figure 8-11A
Ballasted Double Track at Underpass

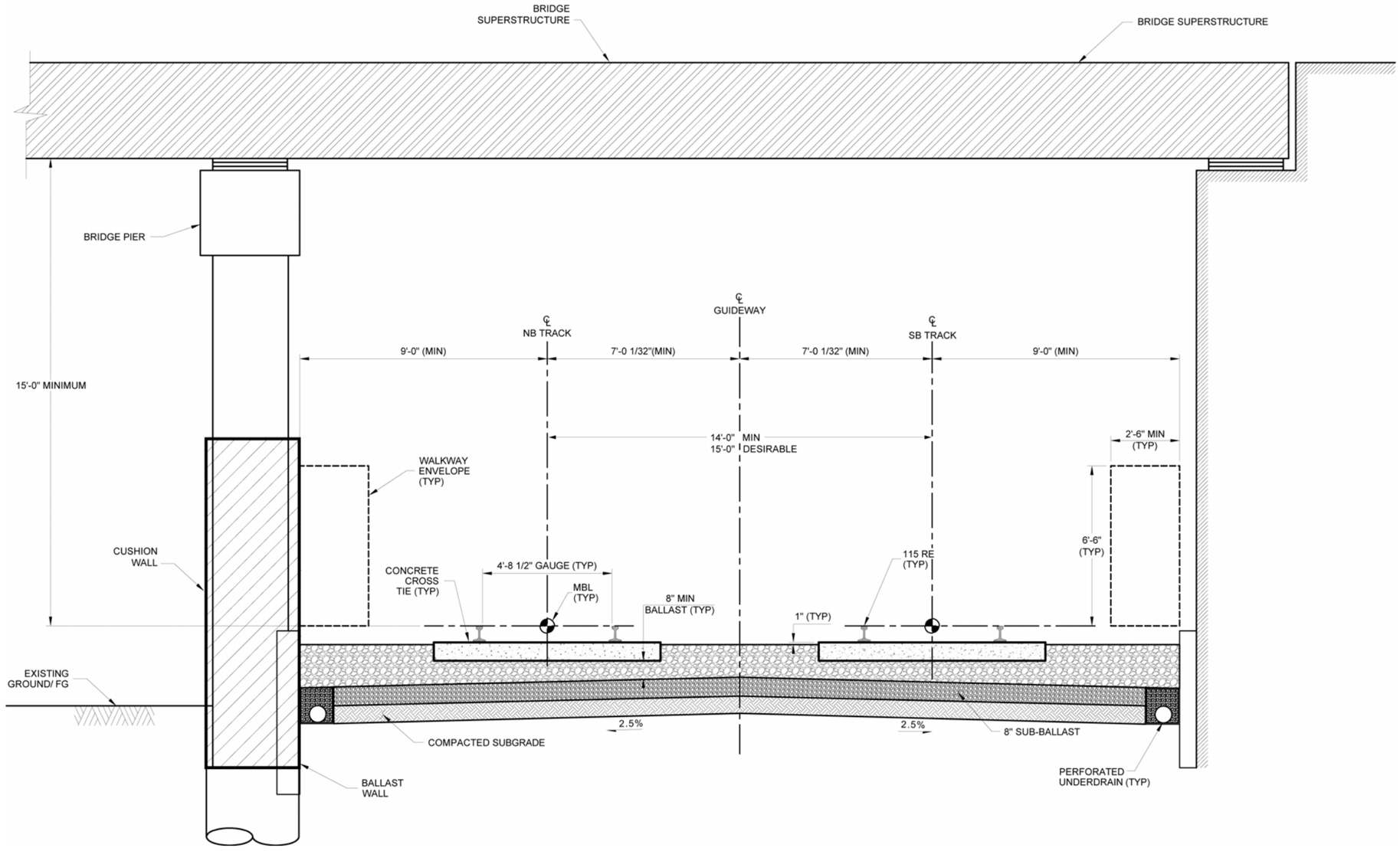


Figure 8-11B
Ballasted Double Track at Underpass with a Pedestrian Trail

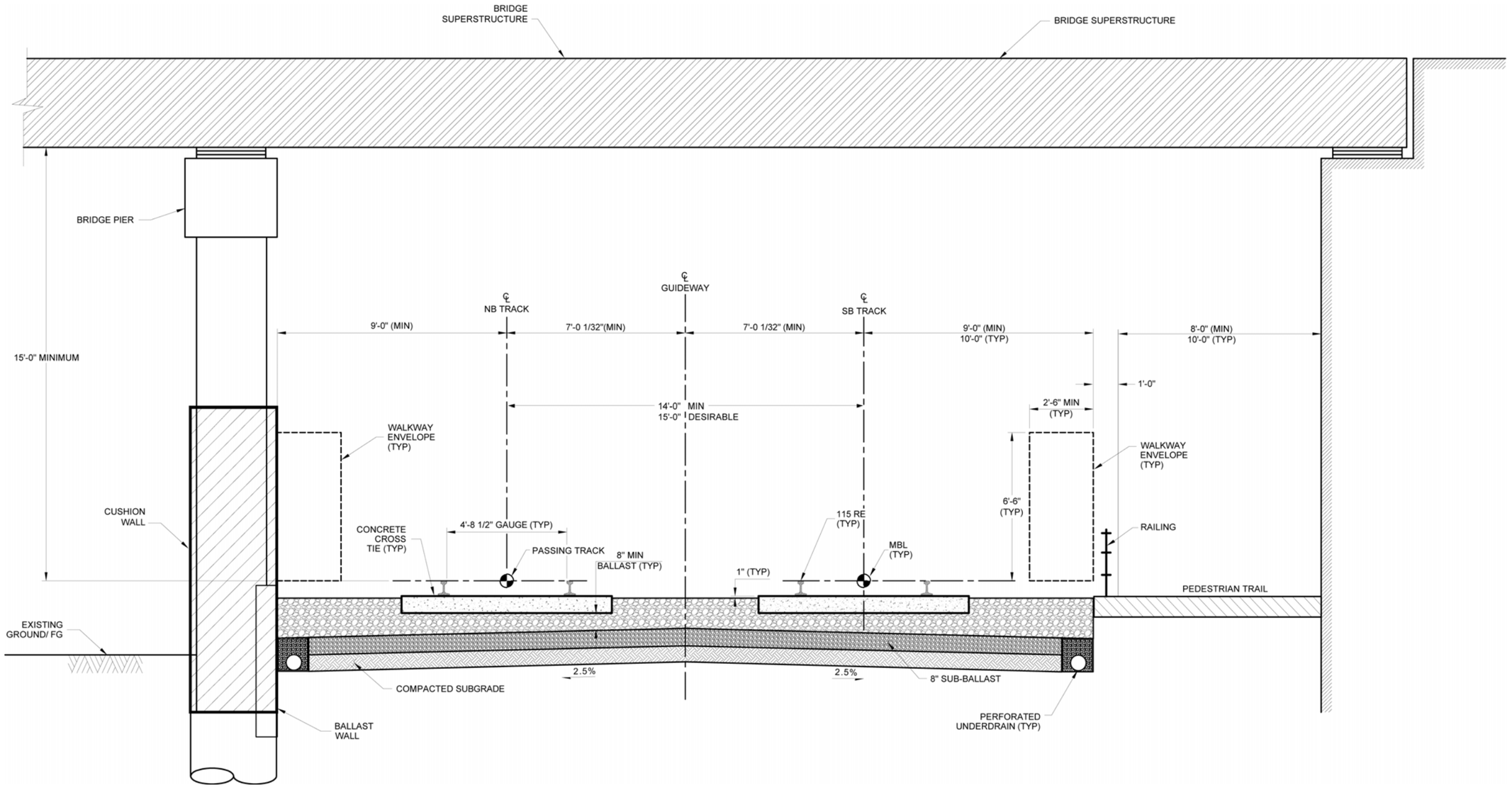
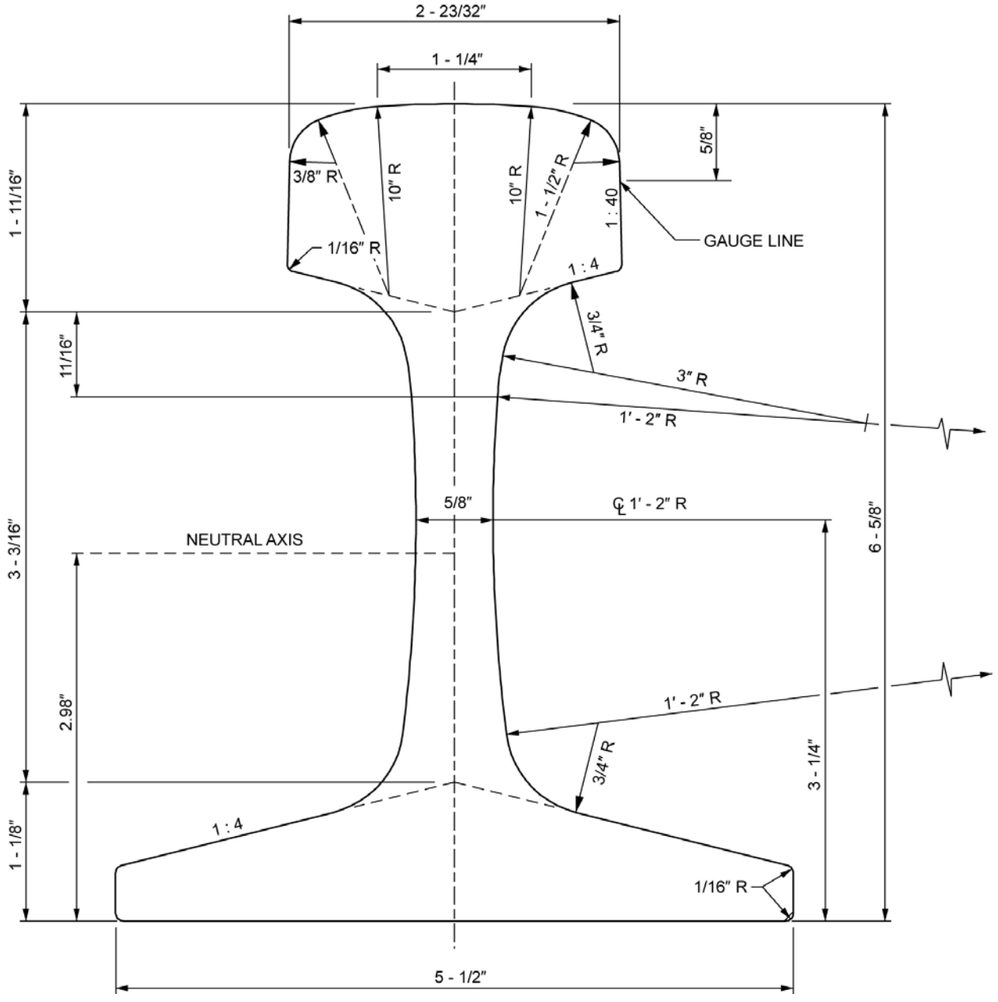
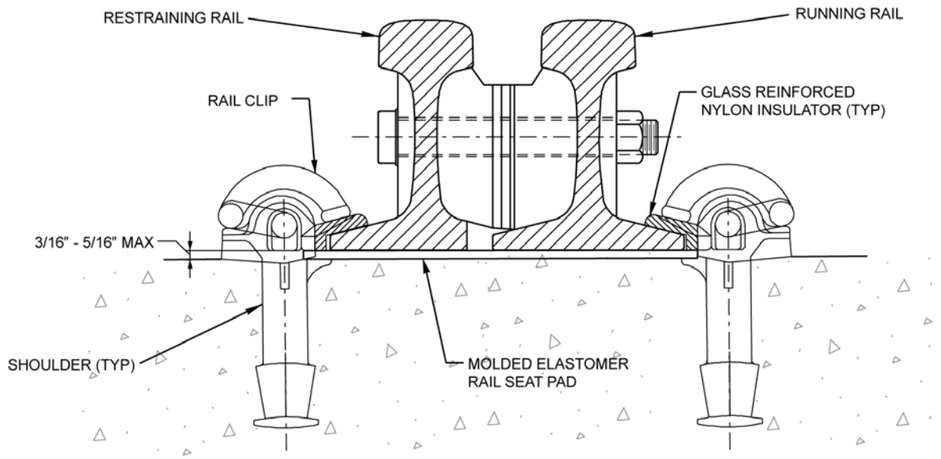


Figure 8-12
115 RE Rail Section

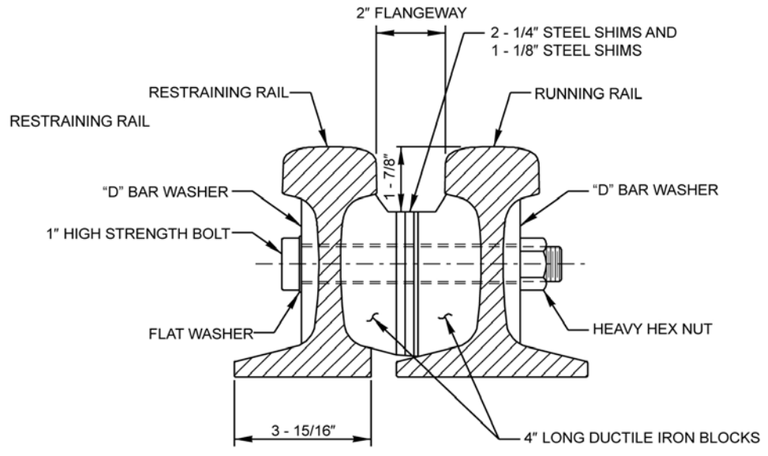


	Area, Sq. In.	Percent		
Head	3.91	34.8	Moment of inertia	65.6
Web	3.05	27.1	Section modulus, head	18.0
Base	4.29	38.1	Section modulus, base	22.0
Total	**11.25**	**100.0**	Calculated weight, lb per yd	114.7

Figure 8-13
Restraining Rail Detail



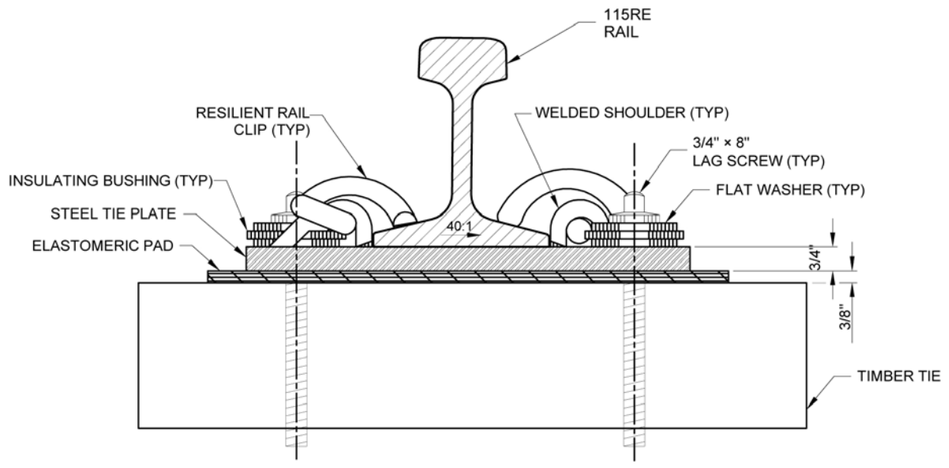
TYPICAL FASTENER DETAIL



SECTION AT SEPARATOR BLOCK

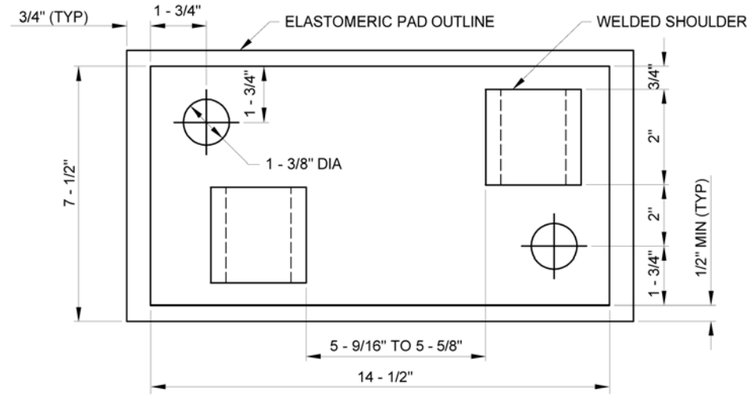
Figure 8-14
Standard Steel Tie Plate

Tie Plate Assembly

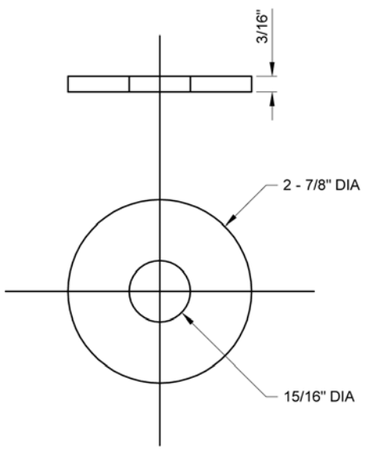


ELEVATION

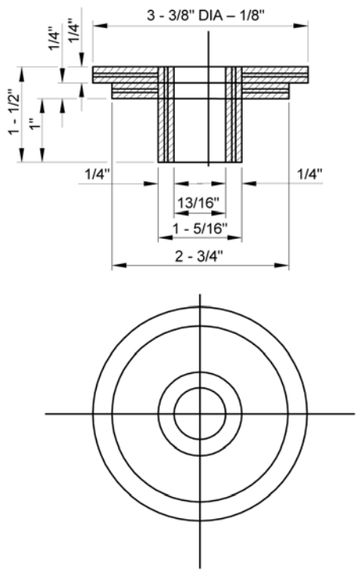
Tie for Lag Screw



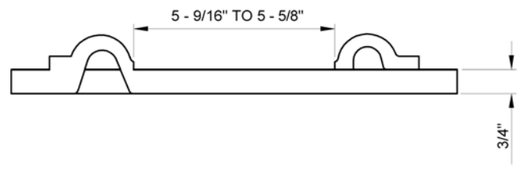
PLAN



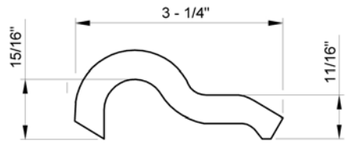
STEEL FLAT WASHER



INSULATING BUSHING

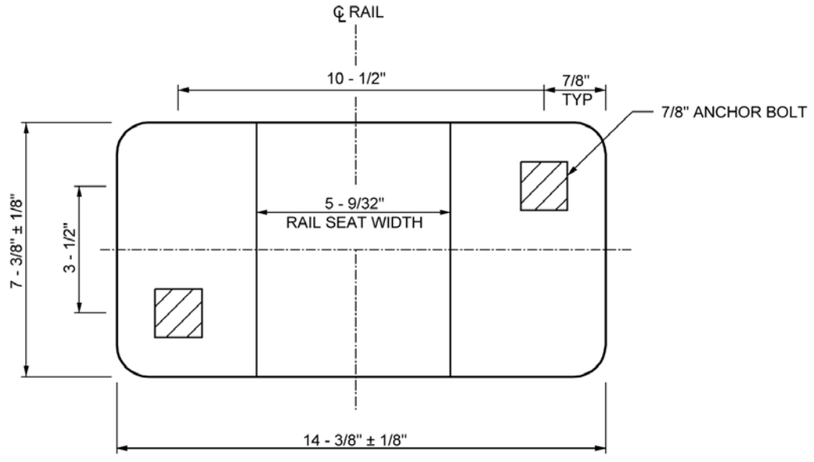


ELEVATION



SHOULDER DETAIL

Figure 8-15
Clearance Envelope for Direct Fixation Track



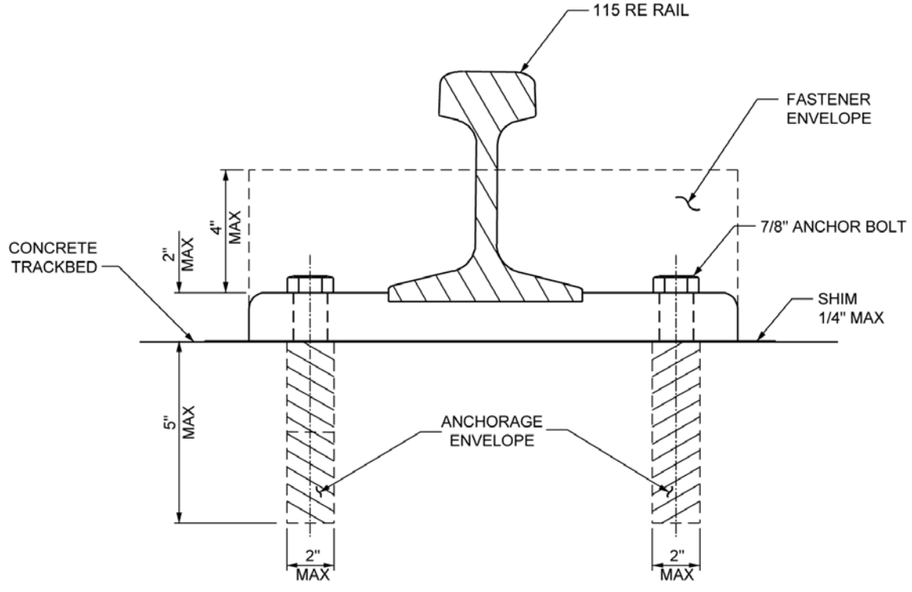
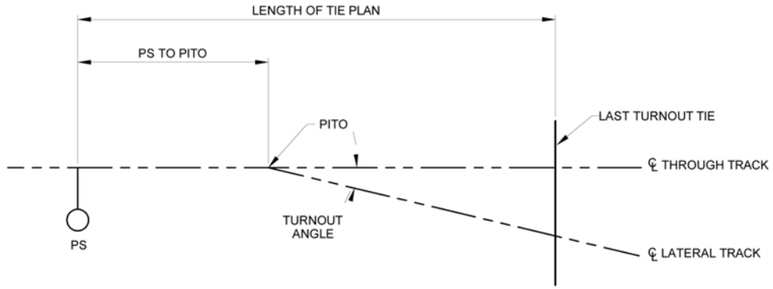
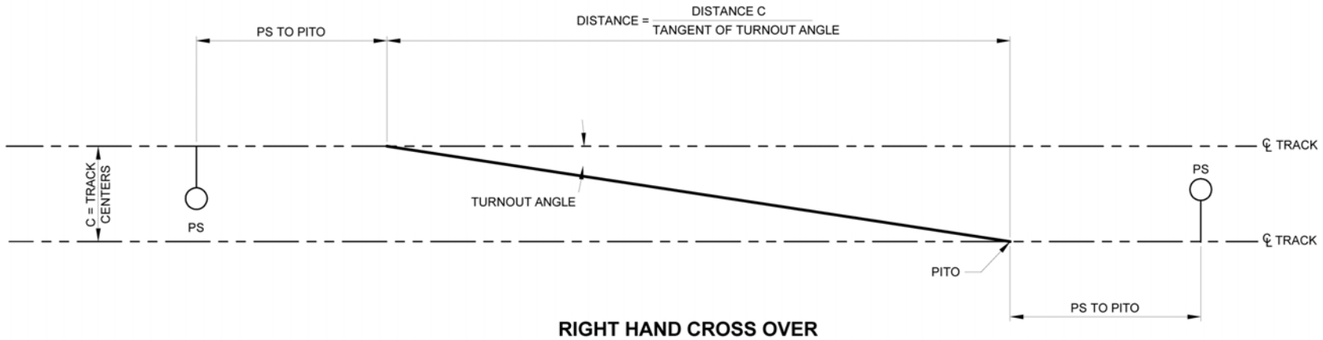


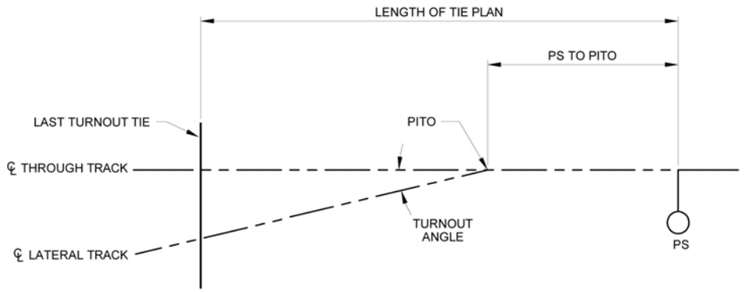
Figure 8-16
Turnout/Crossover Geometry and Speeds



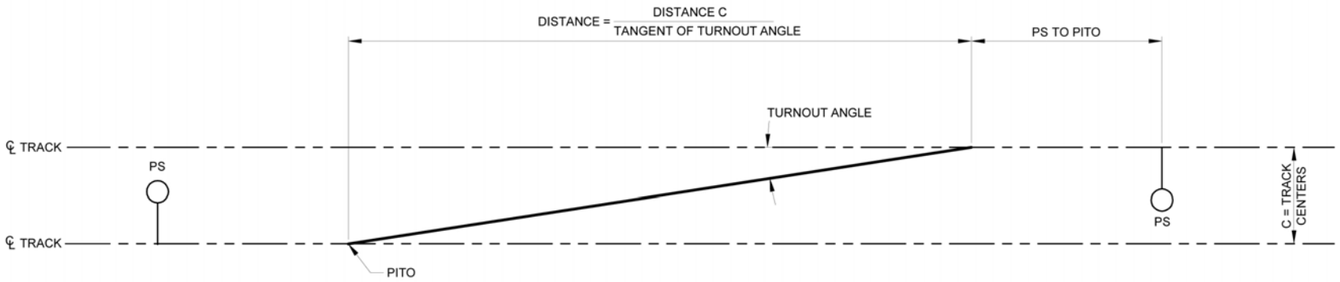
LATERAL TURNOUT, RIGHT HAND



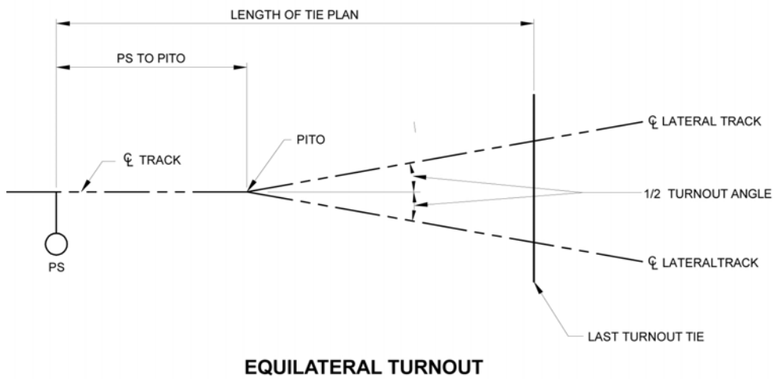
RIGHT HAND CROSS OVER



LATERAL TURNOUT, LEFT HAND



LEFT HAND CROSS OVER



EQUILATERAL TURNOUT

LATERAL TURNOUT NUMBER	TURNOUT ANGLE	DISTANCE, PS TO PITO (IN FEET)	LENGTH OF TIE PLAN (IN FEET)	DISTANCE, PITO TO PITO FOR 14'-0" TRACK CENTERS
6	9°31'38"	21.25	70.84	83.42
8	7°09'10"	31.54	98.48	111.56
9	6°21'35"	31.36	75.56	125.61
10	5°43'29"	31.42	115.57	139.65
16	3°34'47"	42.42	177.89	223.79
20	2°51'51"	61.04	230.62	279.83

EQUILATERAL TURNOUT NUMBER	TURNOUT ANGLE	DISTANCE, PS TO PITO (IN FEET)	LENGTH OF TIE PLAN (IN FEET)
5	11°25'16"	20.80	63.94

TURNOUT NUMBER	SWITCH POINT LENGTH	SWITCH POINT TYPE	OPERATING SPEED (mph) (DIVERGING SIDE OF TURNOUT)
6	13' - 0"	CURVED	10
8	19' - 6"	CURVED	15
10	19' - 6"	CURVED	20
20	39' - 0"	CURVED	45

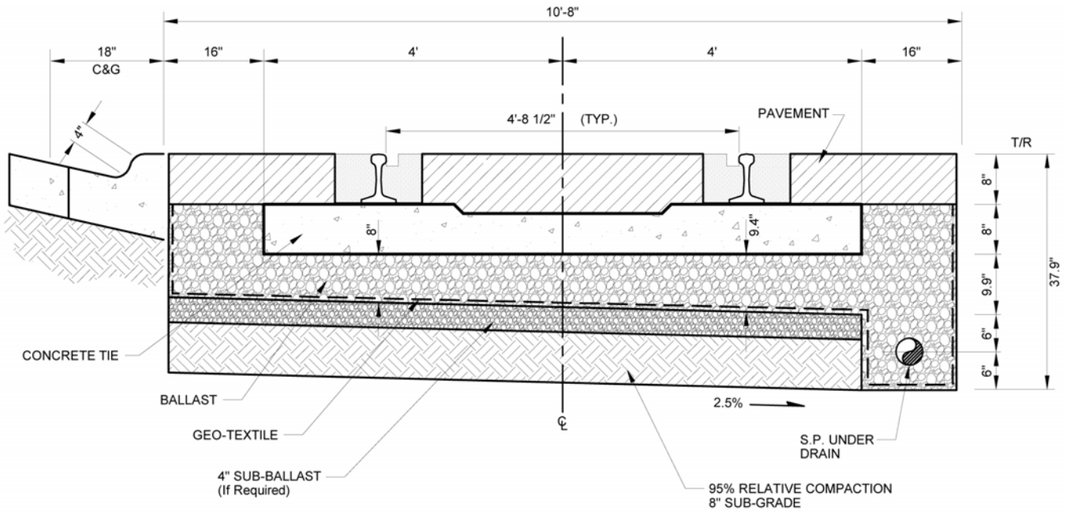
LEGEND:

PS	Point of switch
PITO	Point of intersection of turnout

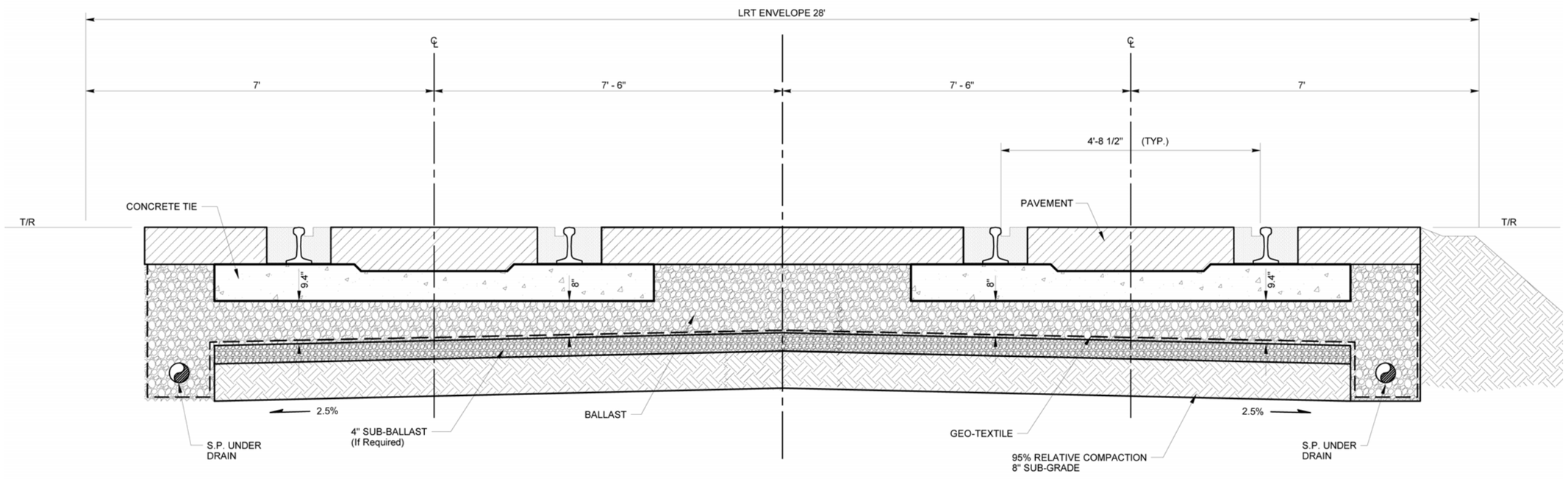
NOTES:
1. Turnouts and crossovers shall not be located in vertical or horizontal curves within the limits of the turnout tie plan length.
2. Within the tie plan, length of turnouts and crossovers, the tops of all rails must be in the same plane.
3. The turnout number is the same as the frog number used in the construction of the turnout and the turnout angle is equal to the frog angle.
4. The number 8 lateral and number 5 equilateral turnouts to be used are not standard turnouts shown in the AREMA portfolio of track plans.

*The speed through the straight side of the turnout is not limited except that it should conform to the speed designated for that specific section of track in which it is located.

Figure 8-17
Paved Track

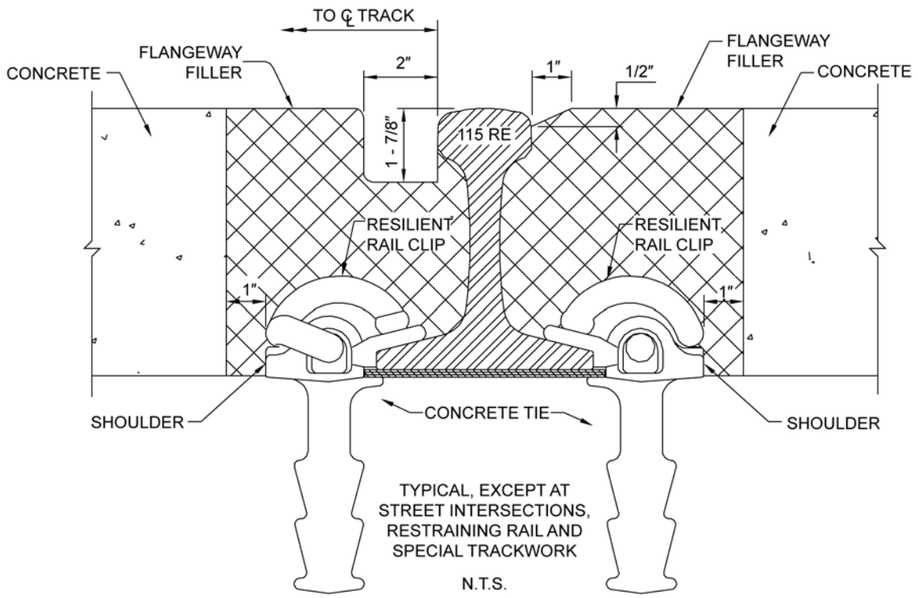


SINGLE TRACK—EMBEDDED



DOUBLE TRACK—EMBEDDED

Figure 8-18
Embedded Rail Detail



Alignment Plans

Three sets of plan sheets follow this page, as follows:

Conceptual Plan Sheets LRT-1 through LRT-30(C) reflect the horizontal definition of the Locally Preferred Alternative (LPA) insofar as track alignment, station locations, bridges, at-grade highway–rail crossings, parking facilities, roadwork, and supporting features such as sidewalks, safety fencing, maintenance facility options, and minor items. These sheets have been updated from January 2010 as indicated in Table 8-6.*

Utility Survey Sheets UT-02(A) through UT-30(A) illustrate topographic elevation contours and the horizontal location and size of utilities. This information is overlaid on the track alignment, station location, bridge, at-grade crossing, and parking definition of the project as of January 2010. **The UT sheets have not been updated in all cases to reflect the Conceptual Plan updates listed in Table 8-6.**

Track Curve Data and Profile Sheets PP-01 through PP-55 illustrate the plan and profile of track restoration and new construction. The maintenance yard track is not included in this plan set. Sheet PP-48 has not been updated to reflect the updated alignment of mainline and passing track illustrated on Sheet LRT-26(A). Sheets PP-51 through PP-53 have not been updated to reflect the relocation of the Naval Postgraduate School station to Sloat Avenue and the elimination of the station at La Playa and Park Avenues, as depicted on Conceptual Plan Sheets LRT-28 and LRT-29.

*At-grade highway–rail crossing detail sheets **do not** reflect current CPUC guidance regarding the placement of pedestrian gate arms on separate masts, as depicted on updated Figures 9-3 and 9-6.

Table 8-6
CONCEPTUAL PLANS FOR TRACK RESTORATION REVISIONS/UPDATES
October 2010 versus January 2010

Sheet	Item	Change
LRT-1	Blackie Road At-Grade Crossing	Four-quadrant gate
LRT-02(B)	Highway 183 At-Grade Crossing	Safety modifications and Del Monte Road left-turn restriction
LRT-05	Nashua Road At-Grade Crossing	Safety modifications
LRT-08(C)	Del Monte Boulevard At-Grade Crossing	Safety modifications
LRT-9	Private Road At-Grade Crossing	Closed
LRT-10	Private Road At-Grade Crossing	Safety modifications
LRT-12	Del Monte Boulevard	Addition of pedestrian midblock crossing; addition of kiss-and-ride spaces on Del Monte Boulevard
LRT-13	Del Monte Boulevard	Install median fencing and addition of kiss-and-ride spaces along Marina Drive and Del Monte Boulevard
LRT-13(B)	Reservation Road	Revise road design to conform with city plans
LRT-14	Palm Avenue At-Grade Crossing	Revise to conform with city plans
LRT-14	Marina Drive	Shift location of kiss-and-ride parking to avoid noise impact
LRT-15	Recreational Trail At-Grade Crossing	Addition of crossing gate protection
LRT-17(B)	Bicycle Trail Connection	Add pathway from coastal side platform to Beach Range Road
LRT-17(J)	Maintenance Facility Alternative 3	Addition of maintenance facility site alternative on Workforce Siding and TOFC load ramp
LRT-22 and LRT-23	Extension of Recreational Trail by Others	From Beach Range Road to California Avenue
LRT-23	Highway 1/Fremont Boulevard Interchange	Addition of local circulation improvements to project description (Alternative E)
LRT-24	Playa Avenue At-Grade Crossing	Addition of traffic signal for California Avenue extension by others
LRT-24	Tioga Avenue At-Grade Crossing	No stop for westbound traffic at California Avenue
LRT-26	Del Monte Avenue and Roberts Avenue Intersection	Addition of crosswalk and traffic signal for pedestrian safety
LRT-26	Alignment of Main Line Passing and Tracks and Passing Track	Revise track alignment (ML) to historic trace. Relocate utility vault
LRT-28	NPS Station	Relocate Naval Postgraduate School station to Sloat Avenue and delete station at La Playa/Park
LRT-28	Del Monte Avenue and Window on the Bay Parking	Revise plans to reflect improvement alternatives by City of Monterey
LRT-29	Window on the Bay/Kayak Parking	Realign driveway entrance, add at-grade crossing protection
LRT-29	Figueroa Street Station Option	Remove reference to unspecified “Water, Flag and Monument Feature”
LRT-30	Lighthouse Avenue Pedestrian	Add clarification that pedestrian bridge would be constructed by

	Bridge	others, not part of project description

9 Utilities, Safety, and Drainage

9. Utilities, Safety and Drainage

Utilities

At this stage of the project, utility agencies that have utilities within the Monterey Branch Line corridor have been identified and a horizontal record of these facilities has been developed by San Benito Engineering & Surveying, Inc. from field investigation and record block maps provided by the respective agencies. No vertical information (*i.e.,* as-built drawings, potholing) have yet been obtained. Public utilities that are present within the Monterey Branch Line corridor include water, wastewater, electricity, natural gas, and telecommunications (telephone, cable television, and fiber optic lines). These utilities are either crossing through or running longitudinally to the corridor. While the water, wastewater, and gas lines are running underground, the electric and telecommunication lines are either overhead or buried underground. The utilities crossing within the Transportation Agency for Monterey County right-of-way are located in easements from the Transportation Agency for Monterey County and the respective utility owner.

Utility Agencies

Utilities owners include public agencies, private owners, and municipal government. Several water agencies control facilities throughout the corridor. In Castroville and unincorporated Monterey County, water is distributed by Monterey County Water Resources Agency. In Marina, the Marina Coast Water District handles water distribution. In Seaside, Sand City, and Monterey, the California American Water Company handles water services. The majority of wastewater services throughout the corridor are handled by Monterey Regional Water Pollution Control Agency. However, for the portion of the corridor within Marina and the Ord District, the Marina Coast Water District also handles wastewater services. Throughout the entire corridor, electric and gas services are owned/provided by Pacific Gas & Electric, telephone facilities are owned/provided by American Telephone & Telegraph, and cable television facilities are owned/provided by Comcast. Fiber optic lines within the corridor are shared by MCI/Verizon, Sprint, and Qwest. For a listing of contact personnel for these agencies, see Table 9-1.

Table 9-1
CONTACT PERSONNEL

Company	Contact	Phone	Ext	E-mail	Address City, State, Zip
AT&T	Hal De Alvarez Sue Barraza	831-728-8641 831-728-6571		hd1392@att.com sb8239@att.com	515 Chappell Road Watsonville, CA 95076
Castroville Water District	Eric Tynan	831-633-2560		cwderic@redshift.com	11499 Gell Street Castroville, CA 95012
City of Monterey	Norman Green	831-646-3924		green@ci.monterey.ca.us	City Hall Monterey, CA 93940
City of Seaside	Kenneth Lewis	831-899-6825		klewis@ci.seaside.ca.us	440 Harcourt Avenue Seaside, CA 93955
Marina Coast Water District	James Derbin	831-384-6131		jdernbin@mcwd.org	2840 Fourth Avenue Marina, 93933
Monterey Regional Water Pollution Control Agency	Jennifer Gonzalez	831-883-6172		jennifer@mrwpca.com	5 Harris Court, Bldg. D Monterey, CA 93940-5756
PG&E	Nick Starkey	831-784-3509		NASc@pge.com	356 East Alisal Salinas, CA 93901

Existing Utilities

The type of construction work with potential to impact utilities for this project includes new track construction, existing track restoration, at-grade street/track crossing improvements, drainage improvements, signal and associated conduit installation, and new station platforms and associated parking areas. The potential for impact includes physical disruption of existing utilities, the need for relocation of utilities prior to construction of new facilities, or unanticipated interruptions in utility services.

For a listing of all known utility facilities within the project limits, including action status (protect in place, abandon, remove/relocate), see Table 9-2.

High Risk Utilities

In the effort to classify the existing utilities in terms of risk to safety, the Peninsula Corridor Joint Powers Board *Policy on High and Low Risk Underground Facilities* has been applied to known existing utilities throughout the Monterey Branch Line corridor. The Peninsula Corridor Joint Powers Board's policy is an adoption of Caltrans policy, with the following modifications: the addition of fiber optic lines and signal related conduit and lines to be considered high risk, as well as the non-exemption of electrical facilities with potential to ground 50 volts or less along with state-owned electrical facilities operating at 300 volts or less.

The following utilities within and or adjacent to the Monterey Branch Line corridor have been determined to be high risk:

- Two fiber optic lines in Castroville parallel to the tracks from Blackie Road continuing to the south
- 16-inch gas within Del Monte Blvd in the City of Marina
- High pressure 10-inch gas in the City of Monterey between approximately 1,000 feet west of Roberts Avenue and approximately 375 feet east of the Monterey Wastewater Treatment Plant driveway

Utilities Within At-Grade Street/Track Crossings

Due to the proposed installation of concrete crossing panels at virtually all of the at-grade track/street crossings, particular attention has been paid to these intersections. For conceptual utility protection/relocation plans for the track/street crossings, see the utility survey drawings (sheet numbers UT-XX) in Section 8.

CASTROVILLE

Blackie Road
Within the track crossing at Blackie Road, the following utilities are present: 8-inch water, 8-inch sanitary sewer, and 4-inch gas.

State Route (SR) 183
At the SR 183 track crossing, the following utilities are present: underground telephone and 4-inch gas.

Nashua Road
Within the Nashua Road track crossing, the following utilities are present: water, 42-inch water, and electrical.

MARINA

Marina Green Drive
The following utilities are present at the track crossing at Marina Green Drive: 3-inch gas and 8-inch water.

Beach Road
The following utilities are within the track crossing at Beach Road: 12-inch water, 8-inch water, 8-inch sanitary, and 3-inch gas.

Reservation Road
Within the track crossing at Reservation Road the following utilities are present: 8-inch sanitary.

Palm Avenue
Within the track crossing at Palm Avenue, the following utilities are present: 3-inch gas and electrical.

SAND CITY

Playa Avenue
The following utilities are present within the track crossing at Playa Avenue: two electric lines, two telephone lines, and 16-inch water.

Tioga Avenue
The following utilities are present within the track crossing at Tioga Avenue: 4-inch gas and a sanitary line that is not in service.

Contra Costa Street
The following utilities are present within the track crossing at Contra Costa Street: overhead telephone and cable television, 6-inch water, 18-inch sanitary, and 4-inch gas.

SEASIDE

Canyon Del Rey (SR 218)
Within the track crossing at canyon Del Rey Boulevard, the following utilities are present: telephone, two electric lines, and 12-inch sanitary.

MONTEREY

Roberts Avenue
The following utilities are present within the track crossing at Roberts Avenue: 12, 16, and 20-inch water, sanitary, telephone, cable television, and gas.

Casa Verde Way
The following utilities are present within the track crossing at Casa Verde Way: 15¼-inch water, gas, three telephone lines, and cable television.

Monterey Wastewater Treatment Plant Driveway
Within the driveway to the Monterey Wastewater Treatment Plant, the following utilities are present: telephone line and two telephone vaults.

Park Avenue
Within the track crossing at Park Avenue, the following utilities are present: 2-inch gas.

Figueroa Street
Acquisition of utility information for this area is currently underway.

Major Utilities Crossing or Adjacent to Guideway

While not considered high risk in terms of life safety, it is important to note the following major utilities (usually 12-inch diameter or larger) that are present within the corridor.

- 18-inch water perpendicular to the tracks approximately 3,450 feet south of SR 183
- 42-inch water slightly diagonal to the tracks adjacent to the Nashua Road crossing
- 27-inch water slightly diagonal to the tracks adjacent to the north Dole track crossing
- 16-inch sanitary diagonal to the tracks adjacent to the Del Monte Boulevard crossing
- 14-inch water diagonal to the tracks adjacent to the Del Monte Boulevard crossing
- 60-inch sanitary force main perpendicular to the tracks near the track split adjacent to Lapis Road
- 42-inch sanitary force main parallel to the tracks at the Marina Green Station, Beach Road Station, Reservation Road Station, Palm Avenue Station, and then diagonal to the tracks near the SR 1 overcrossing
- 15-inch sanitary slightly diagonal to the tracks approximately 550 feet south of Marina Green Drive
- 18-inch sanitary force main perpendicular to the tracks approximately 650 feet south of Beach Road
- 24-inch sanitary inside a 36-inch casing slightly diagonal to the tracks at the Reservation Road crossing
- 18, 27, and 30-inch sanitary lines diagonal and perpendicular to the tracks approximately 850 feet north of Eighth Street
- 18-inch sanitary (not currently in use) slightly diagonal to the tracks just north of Eighth Street
- 12-inch sanitary perpendicular to the tracks near the southwest end of Beach Range Road
- 16-inch water slightly diagonal to the tracks at the Playa Avenue crossing
- 18-inch sanitary diagonal to the tracks at the Contra Costa Street crossing
- 15¼-inch water diagonal to the tracks at Olympia Avenue
- 12-inch sanitary perpendicular to the tracks at the Canyon Del Rey crossing
- 12 and 16-inch water perpendicular to the tracks at the Roberts Avenue crossing
- 20-inch water parallel to the tracks between Roberts Avenue and Casa Verde Way
- Joint trench - power, telephone, and cable television – parallel to tracks between Roberts Avenue and approximately 375 feet east of the WWTP driveway
- 15-inch sanitary perpendicular to the tracks at the Casa Verde Way Station
- 15¼-inch water perpendicular to the tracks at the Casa Verde Way crossing
- 24-inch sanitary force main slightly diagonal to the tracks just west of the Monterey Wastewater Treatment Plant driveway
- 22-inch water parallel to the tracks approaching and adjacent to the Naval Postgraduate School Station
- 16-inch water diagonal to the tracks across Sloat Avenue
- 8-inch fire water line perpendicular to the tracks between Sloat Avenue and Ocean Avenue

Regulations and Standards

Utilities owned and maintained by the Transportation Agency for Monterey County will consist of wires and cables for signal, electrical, communication, and piping for irrigation and drainage. Utilities specifically designed for the Transportation Agency for Monterey County facilities at stations and within the right-of-way shall conform to the standards, codes, and requirements of the California Public Utilities Commission (CPUC) and the local jurisdiction within which the utilities are located, as appropriate. All design work shall be approved by the local jurisdictions and appropriate public utility agencies. Work shall be coordinated with and done in accordance with the standards of the utilities owner. For private utilities, design, relocation, restoration, and construction shall be the responsibility of the facility owner.

The following standards shall be applied to the design of Transportation Agency for Monterey County facilities:

- Applicable standards and criteria established by the utility owners
- CPUC GO Number 95 (Overhead Electric Line Construction)
- CPUC GO Number 128 (Construction of Underground Electric Supply and Communication System)
- Standards and criteria of the jurisdictional agencies, as appropriate

Relocation/Protection Requirements

New construction and the protection, support, restoration, and rearrangement of utilities shall be in conformance with the latest technical specifications and practices of the respective utility owner and Transportation Agency for Monterey County requirements. Utilities encountered or located sufficiently close to be affected by the project construction shall be either:

- Maintained in place and in operation during and after construction
- Temporarily relocated and maintained in operation during and after construction
- Temporarily relocated and maintained, then, upon completion of facilities, replaced by a new utility
- Permanently relocated to a new location beyond the immediate limits of construction
- Abandoned and/or removed

Additionally, utilities abutting Transportation Agency for Monterey County property shall not be interrupted, and if temporarily relocated, shall be restored upon completion of work.

Relocation/Protection Methods

Replacements for any existing utilities, including municipal facilities, shall be designed to provide service equal to that offered by the existing installation. No betterment shall be included, unless specifically directed by the Transportation Agency for Monterey County.

The following general design guidelines shall be followed for utility work:

- *Design Loading:* All underground utilities shall be designed in accordance with Transportation Agency for Monterey County railroad loadings. This also applies to sleeves or encasement pipes.
- *Crossing Angle:* Underground utilities shall cross the railroad right-of-way at a 90 degree angle to the track centerline.
- *Materials:* Utilities shall be constructed with non-conductive materials
- *Sleeves:* Third party utilities that cross tracks shall be sleeved.
- *Future Ducts:* Additional ducts shall be installed for future crossings whenever possible.
- *Horizontal Clearance:* Utilities shall be located outside the zone of influence or at a minimum of 12 feet from the centerline of closest track. At the station area, the utilities shall be located within the designated utility corridor.
- *Vertical Clearance:* Overhead wires and other utilities crossing the tracks are not allowed. They shall be located underground.
- *Vaults:* Reconstruction, abandonment, or other work involving private vaults extending from adjoining buildings into public space shall be in accordance with codes, standards, and practices of the responsible local jurisdiction.
- *Pipelines (water, oil, gas, or other highly flammable, volatile, or pressurized substances):* The pipelines shall be encased in a larger casing pipe or conduit. Casing pipes shall be designed to withstand railroad loadings, and shall be coated with a suitable material to provide cathodic protection, in case of future electrification.
- *Utilities (electric power transmission lines, fiber optic cables, potable water, storm water, etc.):* The utilities owners shall be responsible for the relocation and design of their facilities.
- *Fire Protection Facility:* The relocation design shall be performed by the Transportation Agency for Monterey County's design consultant and require approval of the owner and appropriate fire agency.

Utility Mitigation Measures

Planning and continued coordination with utility providers during the preliminary engineering and final design, and construction stages of the project would be necessary to minimize or eliminate interruption in utility service to customers. The Transportation Agency for Monterey County would coordinate with the affected service provider in each instance to ensure that work is in accordance with the appropriate requirements and criteria. In addition, coordination efforts would lay out utility reroutes, identify potential conflicts, ensure that construction of the proposed project minimizes disruption to utility operations, and formulate strategies for overcoming problems that may arise. If interruptions of utility service are required, they would be restricted in time duration and geographic extent. Careful scheduling of these disruptions and advance notification to occupants of the adjacent properties that would be affected by temporary service interruptions would help to avoid any critical service periods. Where feasible, utility relocations would be undertaken in advance of roadway construction activities.

Also, through close coordination with the various utility agencies and public works departments, accommodations may be made for improvements to existing facilities or inclusion of future projects.

Table 9-2
KNOWN UTILITY FACILITIES WITHIN THE PROJECT LIMITS

Sheet No./Improvement	Owner	Item	Station	Location/Description	High Risk	Action	Quantity (LF)
UT-2							
	MCI and Sprint	Fiber optic	2+00 to 4+00	Diagonal to tracks	Yes		9
	Qwest	Fiber optic	2+00 to 4+00	Diagonal to tracks	Yes		120
		24-inch storm	3+34	Transverse to tracks	No		20
Highway 183 track crossing		Telephone (buried)	8+27	Diagonal to tracks	?		27
	PG&E	4-inch gas	8+49	Diagonal to tracks	No		30
		16-inch storm	15+94	Transverse to tracks	No		20
		Storm drain catch basin	15+94	Right side of tracks	No		
UT-3							
	Monterey County Water Resources Agency	18-inch water	43+95	Transverse to tracks	No		20
UT-4							
UT-5							
Nashua Road track crossing		Water (size unknown)	93+98	Diagonal to tracks	No		41
	Monterey County Water Resources Agency	42-inch water	94+02	Transverse to tracks	No		20
		Electric (size unknown)	94+47	Diagonal to tracks	?		46
UT-6							
UT-7							
	Monterey County Water Resources Agency	27-inch water	165+96	Slight diagonal to tracks	No		21
		Electric (buried)	169+56	Transverse to tracks	?		20
UT-8							
	Monterey Regional Water Pollution Control Agency	16-inch sanitary main	188+65	Diagonal to tracks	No		43
	Monterey County Water Resources Agency	14-inch water	190+55	Diagonal to tracks	No		28
UT-9							
		Sanitary	226+51	Transverse to tracks	No		20
	Monterey Regional Water Pollution Control Agency	60-inch sanitary force main	226+52	Transverse to tracks	No		20
UT-10							
UT-11(A)							
Golf Street improvements		42-inch sanitary force main	269+55 to 270+05	Longitudinal to street	No		48
Marina Green Station	Monterey Regional Water Pollution Control Agency	42-inch sanitary force main	270+05 to 279+44 and 280+05 to 280+26	Longitudinal to site	No		1037
New Marina Green Drive improvements	Monterey Regional Water Pollution Control Agency	42-inch sanitary force main	279+44 to 280+05	Longitudinal to street	No		54

Table 9-2
KNOWN UTILITY FACILITIES WITHIN THE PROJECT LIMITS

Sheet No./Improvement	Owner	Item	Station	Location/Description	High Risk	Action	Quantity (LF)
Old Marina Green Drive track crossing closure	PG&E	3-inch gas	280+53	Transverse to tracks	No		35
	Marina Coast Water District	8-inch water	280+59	Transverse to tracks	No		35
Del Monte Boulevard improvements		16-inch gas	268+62 to 282+07	Longitudinal to site			
		3-inch gas	280+32	Transverse to street	No		69
		8-inch water	280+59	Transverse to street	No		83
		Electric (buried)	280+70 to 282+07	Follows existing curb return, then longitudinal within street	?		90
UT-12(A)							
	Marina Coast Water District	15-inch sanitary	286+81	Slight diagonal to tracks	No		36
Pedestrian/bicycle trail	Marina Coast Water District	15-inch sanitary	286+81	Slight diagonal to tracks	No		10
Beach Road Station	Monterey Regional Water Pollution Control Agency	42-inch sanitary force main	301+96 to 304+74	Longitudinal to station/tracks	No	302+07 to 304+62 part of future station consideration	378
		Telephone	306+91	Slight curve through tracks	?		85
		Telephone	306+93	Slight curve through tracks	?		
Beach Road track crossing		3-inch gas	307+31	Transverse to tracks	No		20
		12-inch water	307+41	Slight diagonal to tracks	No		20
		8-inch water	307+61	Slight diagonal to tracks	No		20
	Marina Coast Water District	8-inch sanitary	307+99	Transverse to tracks	No		20
Beach Road improvements		3-inch gas	307+31	Transverse to tracks	No		218
		2-inch gas	307+33 to 308+39	Longitudinal to tracks	No		107
	Marina Coast Water District	12-inch water	307+41	Slight diagonal to tracks	No		105
	Marina Coast Water District	8-inch water	307+61	Slight diagonal to tracks	No		90
	Marina Coast Water District	8-inch sanitary	307+99	Transverse to tracks	No		247
Del Monte Boulevard improvements	Monterey Regional Water Pollution Control Agency	42-inch sanitary force main	307+20 to 308+48	Longitudinal to tracks	No		120
UT-13(A)							
	Marina Coast Water District	18-inch sanitary force main	314+01	Transverse to tracks	No		20
		Telephone overhead	314+06	Slight diagonal to tracks	?		22
		36-inch storm	329+18	Slight diagonal to tracks	No		21
Del Monte Boulevard improvements		Storm drain manhole	328+75		No		
		24-inch storm	328+75	Diagonal to tracks (does not cross tracks)	No		65
		Storm	329+14	Diagonal to tracks (does not cross tracks)	No		39
		Storm	329+35	Diagonal to tracks (does not cross tracks)	No		49

Table 9-2
KNOWN UTILITY FACILITIES WITHIN THE PROJECT LIMITS

Sheet No./Improvement	Owner	Item	Station	Location/Description	High Risk	Action	Quantity (LF)
Reservation Road track crossing	Marina Coast Water District	24-inch sanitary inside 36-inch casing	331+26	Slight diagonal to tracks	No		20
Reservation Road improvements	Marina Coast Water District	24-inch sanitary inside 36-inch casing	331+26	Slight diagonal to tracks	No		150
		Electric	333+78	Transverse to tracks	?		35
		Electric	333+90	Transverse to tracks	?		35
	Cal-Am Water Co.	10-inch water	333+97	Transverse to tracks	No		35
Reservation Road Station	Monterey Regional Water Pollution Control Agency	42-inch sanitary force main	335+22 to 337+79	Longitudinal to tracks/station	No		302
UT-14(A)							
		Telephone	346+39	Slight diagonal to tracks	?		20
Palm Avenue track crossing	PG&E	3-inch gas	350+54	Transverse to tracks	No		20
		Electric	350+54	Transverse to tracks	?		20
Palm Avenue Station	Monterey Regional Water Pollution Control Agency	42-inch sanitary force main	350+72 to 354+75	Longitudinal to tracks	No		20
Palm Avenue improvements	Monterey Regional Water Pollution Control Agency	42-inch sanitary force main	349+92 to 350+72	Longitudinal to tracks	No		64
	PG&E	3-inch gas	350+54	Transverse to tracks	No		90
		Electric	350+54	Transverse to tracks	?		27
	Comcast	Cable television	350+11	Transverse to track (do not cross tracks)	No		18
		Electric	350+13 to 350+73	Diagonal then longitudinal	?		66
	Marina Coast Water District	8-inch sanitary	357+95	Transverse to tracks	No		20
		12-inch corrugated metal pipe storm	359+14	Transverse to tracks	No		20
	Marina Coast Water District	8-inch water	359+66	Transverse to tracks	No		20
		24-inch storm	361+54	Transverse to tracks	No		20
		Electric	361+82	Transverse to tracks	?		20
		8-inch corrugated metal pipe storm	362+31	Transverse to tracks	No		18
		Telephone	364+21	Transverse to tracks	?		20
UT-15							
	Monterey Regional Water Pollution Control Agency	42-inch sanitary force main	368+83	Diagonal to tracks	No		24
UT-16							
	Marina Coast Water District	8-inch water	403+49	Slight diagonal to tracks	No		20
	Marina Coast Water District	Sanitary (abandoned)	415+72	Diagonal to tracks	No		38
	Marina Coast Water District	12-inch water (not in use)	426+16	Transverse to tracks	No		35
UT-17(A)							
	Marina Coast Water District	27-inch sanitary	431+62	Diagonal to tracks	No		37
	Marina Coast Water District	30-inch sanitary	431+87	Transverse to tracks	No		35

Table 9-2
KNOWN UTILITY FACILITIES WITHIN THE PROJECT LIMITS

Sheet No./Improvement	Owner	Item	Station	Location/Description	High Risk	Action	Quantity (LF)
		36-inch storm	432+09	Diagonal to tracks	No		44
	Marina Coast Water District	18-inch sanitary	432+10	Transverse to tracks	No		35
		Unknown utility (possible telephone)	433+75	Transverse to tracks	?		35
	PG&E	3-inch gas	434+85	Slight diagonal to tracks	No		36
		Storm	436+18	Transverse to tracks	No		35
	Marina Coast Water District	18-inch sanitary (abandoned)	439+65	Diagonal to tracks	No		36
		Telephone	440+17	Transverse to tracks	?		35
		Unknown utility	454+80	Transverse to tracks	?		35
		36-inch storm	455+17	Transverse to tracks	No		35
UT-18							
UT-19							
		Telephone	509+22	Diagonal to tracks	?		29
UT-20							
		12-inch storm (full of dirt)	539+56	Transverse to tracks	No		20
UT-21							
UT-22							
	Marina Coast Water District	8-inch water	572+94	Transverse to tracks	No		20
		Telephone (buried)	579+25	Diagonal to tracks	?		25
	Marina Coast Water District	10-inch sanitary	586+55	Diagonal to tracks	No		27
	Marina Coast Water District	12-inch sanitary	586+85	Transverse to tracks	No		20
		Telephone (buried)	595+63	Transverse to tracks	?		20
	Monterey Regional Water Pollution Control Agency	36-inch sanitary force main	587+00 to 588+13	Longitudinal to tracks	No	Part of future track consideration	112
UT-23(A)							
Monterey Road improvements		Electric box	618+41	Left of tracks			
		Electric and box	607+80 to 608+95	Longitudinal/diagonal to tracks	?		114
		Electric	609+01 to 612+74 and 620+72 to 622+09	Diagonal/transverse to tracks	?		602
	PG&E	4-inch gas	610+95	Transverse to tracks	No		27
Playa Avenue Station	PG&E	Electric	624+65 to 626+00	Diagonal/transverse to tracks	?		169
UT-24(A)							
Playa Avenue Station	PG&E	Electric	626+00 to 627+05	Longitudinal to tracks	?		63
Playa Avenue track crossing		Electric	627+34	Transverse to tracks	?		35
		Telephone	627+35	Transverse to tracks	?		35

Table 9-2
KNOWN UTILITY FACILITIES WITHIN THE PROJECT LIMITS

Sheet No./Improvement	Owner	Item	Station	Location/Description	High Risk	Action	Quantity (LF)
		Electric	627+36	Transverse to tracks	?		35
		Telephone	627+37	Transverse to tracks	?		35
	Cal-Am Water Co.	16-inch water	627+85	Slight diagonal to tracks	No		36
Playa Avenue Improvements		Electric (2)	627+34	Transverse to tracks	?		122
		Electric vault	627+35	Left of tracks	?		
		Electric	627+35	Transverse to tracks	?		69
		Telephone (2)	627+37	Transverse to tracks	?		92
		Telephone line and box	627+34 to 628+06	Longitudinal to tracks	?		
		16-inch water	627+85	Transverse to tracks	No		
Tioga Avenue track crossing	PG&E	4-inch gas	638+68	Transverse to tracks	No		35
		Sanitary (not in use)	638+74	Transverse to tracks	No		35
		Electric	639+60	Diagonal to tracks	?		47
		Electric	639+36 to 644+10	Longitudinal to tracks	?		474
	Cal-Am Water Co.	4-inch water	644+18	Transverse to tracks	No		35
	PG&E	2-inch gas	645+51	Transverse to tracks	No		35
		Power or light pole	647+44	Shown in topo left of tracks	?		
UT-25(A)							
		Sanitary	657+76	Transverse to tracks	No		35
		Storm	657+94	Transverse to tracks	No		35
	Comcast	Cable television	666+47	Transverse	No		23
	Cal-Am Water Co.	2-inch water	667+76	Transverse to tracks	No		35
Contra Costa Street track crossing		Telephone overhead and cable	669+08	Diagonal to tracks	?		42
	Cal-Am Water Co.	6-inch water	669+19	Diagonal to tracks	No		42
		18-inch sanitary	669+37	Diagonal to tracks	No		43
		4-inch gas	669+51	Diagonal to tracks	No		42
		Telephone overhead and cable	669+08	Diagonal to tracks	?		
Contra Costa Street Improvements		Telephone overhead and cable	669+08	Diagonal to tracks	?		
		6-inch water	669+19	Diagonal to tracks	No		
		18-inch sanitary	669+37	Diagonal to tracks	No		90
		Sanitary sewer manhole	669+08	Right of tracks	No		
		4-inch gas	669_51	Diagonal to tracks	No		
		6-inch sanitary	669+08 to 669+57	Longitudinal to tracks	No		
		Cable TV and vault	669+12 to 670+14		No		
	Cal-Am Water Co.	15-1/4-inch water	671+06	Diagonal to tracks	No		59
Olympia Avenue Station	Cal-Am Water Co.	15-1/4-inch water	670+70	Diagonal to tracks	No	Part of future platform consideration	105

Table 9-2
KNOWN UTILITY FACILITIES WITHIN THE PROJECT LIMITS

Sheet No./Improvement	Owner	Item	Station	Location/Description	High Risk	Action	Quantity (LF)
	Comcast	Cable television	670+14 to 673+79	Longitudinal to tracks	No		237
		6-inch sanitary	669+57 to 671+40	Longitudinal to tracks	No		200
		Sanitary sewer manhole	671+40	Right of tracks	No	Part of future soundwall consideration	
		Telephone	682+22	Transverse to tracks	?		20
UT-26(A)							
Canyon Del Rey Boulevard track crossing		Telephone	683+63	Transverse to tracks	?		20
		Electric	683+66	Transverse to tracks	?		20
		Electric	683+67	Transverse to tracks	?		20
		12-inch sanitary	684+17	Diagonal to tracks	No		22
		Electric	684+98 to 691+52	Longitudinal to tracks	?		654
		36-inch storm	686+64	Transverse to tracks	No		20
Pedestrian/bicycle trail	Comcast	Cable television	695+50	Diagonal to trail	No		20
	Comcast	Cable television	695+90	Diagonal to trail	No		32
Roberts Avenue track crossing		20-inch water	696+97 to 697+69	Longitudinal to tracks	No		72
		Sanitary	697+16	Transverse to tracks	No		20
		16-inch water	697+06	Transverse to tracks	No		4
		Telephone	697+39	Transverse to tracks	?		20
	Comcast	Cable television	697+49	Transverse to tracks	No		20
		Gas	697+51	Transverse to tracks	?		20
		12-inch water	697+36	Transverse to tracks	No		20
		Electric	700+61 to 712+00	Diagonal then longitudinal to tracks	?		1034
		8-inch water	701+38	Transverse to tracks	No		23
		20-inch water	697+69 to 712+00	Longitudinal to tracks			
Pedestrian/bicycle trail		Electric	700+26 to 700+58	Diagonal to trail	?		29
		Electric	697+69 to 699+17; 700+26 to 700+58; 700+72 to 701+81; 706+75 to 707+10	Longitudinal to trail	?		787
		Telephone	697+69 to 699+62; 700+76 to 702+35; 707+52 to 712+00	Longitudinal to trail	?		913
	Cal-Am Water Co.	Water	704+79	Transverse to trail	No		12
		Electric vault	706+80	Within trail	?		
		10-inch high pressure gas	707+47 to 712+00	Transverse, then longitudinal to trail	Yes		344
		Telephone	699+62 to 700+26 and 702+35 to 707+52				
		Electric	699+17 to 700+72; 701+81 to 706+75; 707+10 to 708+62	Longitudinal to tracks	?		79
		Electric vault	704+18	Adjacent to tracks	?		
		10-inch high pressure gas	707+47	Transverse to tracks	Yes		27
		Electric	707+50	Transverse to tracks	?		27
		Power pole	707+53	Shown in topo between proposed tracks	?		
		Power pole	708+91	Shown in topo left of tracks	?		
		Power pole	710+34	Shown in topo left of tracks	?		
		Power pole	710+41	Shown in topo left of tracks	?		

Table 9-2
KNOWN UTILITY FACILITIES WITHIN THE PROJECT LIMITS

Sheet No./Improvement	Owner	Item	Station	Location/Description	High Risk	Action	Quantity (LF)
UT-27(A)							
Pedestrian/bicycle trail		Electric	712+00 to 712+06	Longitudinal to trail	?		6
		Telephone	712+00 to 712+06	Longitudinal to trail	?		6
		10-inch high pressure gas	712+00 to 712+06	Longitudinal to trail	Yes		6
		Electric	712+00 to 716+83	Slight diagonal away from tracks	?		
		Power or light pole	712+69	Shown in topo	?		
		Power pole	714+04	Shown in topo	?		
		Light pole	715+34	Shown in topo	?		
		Telephone	712+91	Transverse to tracks	?		25
		Electric	712+95	Transverse to tracks	?		25
		Light pole	715+34	Shown in topo	?		
		Telephone (buried)	715+97	Transverse to tracks	?		12
		20-inch water	712+00 to 712+54	Longitudinal to tracks	No		54
		Power pole	715+40	Shown in topo right of tracks	?		
	Comcast	Cable television	715+98	Transverse to tracks	No		13
		Electric	716+00	Transverse to tracks	?		14
		Storm drain catch basin	715+95	Shown in topo left of tracks	No		
		Light pole	716+15	Shown in topo within tracks	?		
		Power pole	716+28	Shown in topo right of tracks	?		
		Storm drain catch basin	716+78	Shown in topo left of tracks	No		
		Electric cable	718+94	Diagonal, curving, then longitudinal to tracks	?		18
		Cable television	718+94	Diagonal, curving, then longitudinal to tracks	No		17
		Telephone (buried)	718+95	Diagonal, curving, then longitudinal to tracks	?		17
		15-inch sanitary	718+98	Transverse to tracks	No		16
		10-inch high pressure gas	714+79 to 721+05	Longitudinal to tracks	Yes		626
Casa Verde Way Station and parking area		Telephone	714+79 to 721+05	Longitudinal to tracks	?		626
		Electric	714+79 to 721+05	Longitudinal to tracks	?		626
		6-inch water	714+86 to 721+05	Longitudinal to tracks	No		620
		Fire hydrant	714+86	Right of tracks	No		
		Cable television box	714+86	Right of tracks	No		
		Electric vault	714+92	Right of tracks	?		
		Telephone (buried)	715+97	Transverse to tracks	?		25
	Comcast	Cable television	715+98	Transverse to tracks	No		25
		Electric	716+00	Transverse to tracks	?		21
		Telephone vault	715+96	Right of tracks	?		
		Cable television box	716+00	Right of tracks	No		
		Electric	717+63 to 721+05	Longitudinal to tracks	?		343
		Telephone manhole	717+33	Right of tracks	?		
		Electric vault	717+84	Right of tracks	?		
		Electric vault	718+61	Right of tracks	?		
		Telephone box	718+76	Right of tracks	?		
		Telephone vault	719+00	Right of tracks	?		

Table 9-2
KNOWN UTILITY FACILITIES WITHIN THE PROJECT LIMITS

Sheet No./Improvement	Owner	Item	Station	Location/Description	High Risk	Action	Quantity (LF)
		Electric cable	718+94	Diagonal, curving, then longitudinal to tracks	?		17
		Cable television	718+94	Diagonal, curving, then longitudinal to tracks	No		17
		Telephone (buried)	718+95	Diagonal, curving, then longitudinal to tracks	?		17
		15-inch sanitary	718+98	Transverse to tracks	No		15
		Sanitary sewer manhole	718+98	Right of tracks	No		
		20-inch water	717+72 to 721+05	Longitudinal to tracks	No		333
		Power pole	718+07	Shown in topo right of tracks			
		Power pole	720+72	Shown in topo right of tracks			
		Fire hydrant	721+11	Right of tracks			
Casa Verde Way track crossing		Storm	721+13	Slight diagonal to tracks	No		21
	Cal-Am Water Co.	15-1/4-inch water	721+24	Transverse to tracks	No		20
	Cal-Am Water Co.	15-1/4-inch water	721+32	Transverse to tracks	No		20
		Gas	721+44	Slight diagonal to tracks	?		20
		Telephone (buried)	721+66	Slight diagonal to tracks	?		20
		Telephone (buried)	721+68	Slight diagonal to tracks	?		20
		Telephone (buried)	721+69	Slight diagonal to tracks	?		20
	Comcast	Cable television	721+71	Slight diagonal to tracks	No		20
Casa Verde Way improvements		Electric	721+12	Slight diagonal	?		10
		Electric box	721+12		?		
		Storm drain	721+13	Slight diagonal to tracks	No		13
		Storm drain catch basin	721+19	Right of tracks	No		
		20-inch and 15-1/4 inch water (including 8 valves)	721+13 to 721+76	Transverse and longitudinal to tracks	No		170
		Water box	721+16	Right of tracks	No		
		Storm drain catch basin	721+66	Right of tracks	No		
		Electric	721+05 to 721+83	Slight diagonal to tracks	?		62
		Electric	721+05 to 721+74	Longitudinal and transverse to tracks	?		76
		Electric vault	721+69	Right of tracks	?		
		Gas	721+05 to 721+74	Longitudinal to tracks	?		69
		Gas	721+44	Transverse to tracks	?		62
		Telephone	721+05 to 721+73	Longitudinal to tracks	?		69
		Telephone (buried)	721+66	Slight diagonal to tracks	?		78
		Telephone (buried)	721+68	Slight diagonal to tracks	?		78
		Telephone (buried)	721+69	Slight diagonal to tracks	?		78
		Telephone manhole	721+58	Right of tracks	?		
	Comcast	Cable television	721+71	Slight diagonal to tracks	No		52
		Storm drain	722+04	Diagonal to tracks	No		31
		6-inch sanitary	723+29 to 728+19	Longitudinal to tracks	No		491
		Sanitary sewer cleanout	728+17	Right of tracks	No		
		Electric	723+38	Diagonal to tracks	?		27
		Telephone	726+90	Diagonal to tracks	?		26
		Power pole	728+35	Shown in topo right of tracks			

Table 9-2
KNOWN UTILITY FACILITIES WITHIN THE PROJECT LIMITS

Sheet No./Improvement	Owner	Item	Station	Location/Description	High Risk	Action	Quantity (LF)
		Electric	728+58 to 735+17	Diagonal then longitudinal then diagonal to tracks	?		664
		Power pole	729+73	Shown in topo left of tracks			
		Light pole	730+44	Left of tracks			
		Light pole and box	731+15	Left of tracks			
		10-inch high pressure gas	731+78	Transverse to tracks	Yes		20
		Electric (buried)	731+82	Transverse to tracks	?		20
		Telephone (buried)	731+84	Transverse to tracks	?		20
		Power/light pole and box	731+88	shown in topo and left of tracks			
		Light pole and box	732+54	Left of tracks			
		Light pole and box	733+25	Left of tracks			
		Light pole and box	733+99	Left of tracks			
		Light pole	734+70	Left of tracks			
		Joint electric and telephone	730+00 to 731+84	Longitudinal to tracks	?		
Pedestrian/bicycle trail		10-inch high pressure gas	728+42 to 731+78	Longitudinal to tracks	Yes		
		Electric	728+73 to 729+13	Diagonal to tracks	?		
		Telephone	728+81 to 729+27	Diagonal to tracks	?		
Monterey Wastewater Treatment Plant driveway track crossing		Telephone vault	735+41	Within tracks	?		
		12-inch storm	735+51	Transverse to tracks	No		23
		12-inch storm	735+57	Transverse to tracks	No		23
		Telephone vault	735+58	Right of tracks	?		
		Telephone	735+58	Transverse to tracks	?		23
		Telephone (buried)	735+73	Transverse to tracks	?		23
	Monterey Regional Water Pollution Control Agency	24-inch sanitary force main	736+03	Transverse to tracks	No		24
Pedestrian/bicycle trail		Electric	736+64 to 741+00	Slight diagonal, then longitudinal to tracks	?		268
UT-28(A)							
Pedestrian/bicycle trail		Electric	741+00 to 741+83 and 751+24 to 751+48	Slight diagonal, then longitudinal to tracks	?		110
Naval Postgraduate School Station		22-inch water	742+31 to 744+68 and 747+93 to 749+58	Longitudinal to tracks	No		405
		Light pole and box	742+45	Right of proposed tracks	?		
		Electric (buried)	742+06 to 751+13	Diagonal, then longitudinal, then diagonal to tracks	?		929
		Light pole and box	743+94	Right of proposed tracks	?		
		Light pole and box	745+34	Right of proposed tracks	?		
		Light pole	746+04	Between existing and proposed tracks	?		
		Light pole and box	746+63	Between existing and proposed tracks	?		
		Light pole and box	746+73	Between proposed tracks	?		
		Light pole and box	747+43	Between existing and proposed tracks	?		

Table 9-2
KNOWN UTILITY FACILITIES WITHIN THE PROJECT LIMITS

Sheet No./Improvement	Owner	Item	Station	Location/Description	High Risk	Action	Quantity (LF)
		Light pole and box	748+13	Between existing and proposed tracks	?		
		Light pole and box	748+84	Between existing and proposed tracks	?		
		Light pole and box	749+53	Within proposed tracks	?		
		Light pole and box	750+22	Within proposed tracks	?		
		Light pole	750+91	Right of proposed tracks	?		
		2-inch gas	757+03	Longitudinal to tracks	No		35
		Power pole	757+44	Shown in topo right of proposed tracks			
	Cal-Am Water Co.	8-inch water	758+38 to 760+29	Diagonal to tracks	No		192
	Cal-Am Water Co.	16-inch water	758+17 to 759+35	Diagonal to tracks	No		120
		Water and box	758+67	Transverse to tracks	No		12
		Water and box	760+64	Transverse to tracks	No		8
		8-inch fire and box	761+34	Longitudinal to tracks	No		8
		Water	762+65	Transverse to tracks	No		50
	Cal-Am Water Co.	Water cross-connector	763+88	Longitudinal to tracks	No		10
		Water box	765+67	Right of proposed tracks	No		
		Electric (buried)	765+68	Transverse to tracks (right - does not cross)	?		20
La Playa Avenue Station	Cal-Am Water Co.	8-inch water	764+52 to 764+58 and 766+50 to 767+28	Longitudinal to tracks	No		84
	Cal-Am Water Co.	16-inch water	764+52 to 764+58 and 767+22 to 767+28	Longitudinal to tracks	No		12
Park Avenue/La Playa Avenue track crossing		2-inch gas	768+93	Longitudinal to tracks	No		63
Park Avenue/La Playa Street improvements	Cal-Am Water Co.	8-inch water	768+71 to 769+18	Longitudinal to tracks	No		47
	Cal-Am Water Co.	16-inch water	768+71 to 769+06	Longitudinal to tracks	No		35
	Cal-Am Water Co.	8-inch water	768+69	Transverse to tracks	No		15
	Comcast	Cable TV	768+75	Transverse to tracks	No		15
		2-inch gas	768+93	Transverse to tracks	No		75

Safety

Light rail transit vehicles will operate primarily in an exclusive, transit only environment, along the Monterey Branch Line railroad corridor. Where local streets and roads cross the railroad corridor, light rail transit vehicles will operate in mixed traffic (roadway traffic and pedestrians). Safety of the system will facilitate and ensure safe and integrated movement of all traffic. Whenever light rail vehicles, road vehicles and pedestrians share an intersection, the potential for collision exists. History has shown that such collisions represent the single greatest hazard associated with light rail operations. Even with this hazard, light rail transit is a very safe and successful mode of public transport. The mode can be made even safer by using adequate safety equipment and complying with CPUC standards for designing warning device locations.

The light rail transit operating environment pertinent to the Monterey Peninsula Light Rail Transit System is **semiexclusive.**

> ***Semiexclusive:*** *A light rail transit alignment that is in a separate right-of-way or along a street or railroad right-of-way where motor vehicles, pedestrians, and bicycles have limited access and cross at designated locations only.*

Highway-Rail Grade Crossings

Highway-railroad grade crossings have multiple types of traffic: vehicles, trains, and pedestrians which require various special traffic control devices to properly coordinate the movements of the different types of traffic. There are primarily two levels of traffic control devices at highway-rail grade crossings: passive, and active. The most basic of these devices, passive traffic control devices, provide static messages of guidance, warning, and possibly action required by the highway driver such as a “Do Not Stop on Tracks” sign. Passive traffic control devices also include pavement markings. Passive traffic control devices are not activated by trains. Passive traffic control devices are commonly referred to as “passive warning devices.”

For more advanced traffic control, active traffic control devices are needed. Active traffic control devices give warning of the approach or presence of a train and are activated by the passage of a train over a detection circuit in the track. The predominant active traffic control device is the use of automatic gates, which physically block the travel lanes at the crossing and are used in conjunction with flashing lights. Active traffic control devices are supplemented by the same signs and pavement markings used in passive warning devices. Active traffic control devices are commonly referred to as “active warning devices.”

The California Public Utility Commission (CPUC) has jurisdiction over the installation of **all public** highway-rail crossings, including pedestrian crossings. CPUC General Order No. 75-D, “Regulations Governing Standards for Warning Devices for At-Grade Highway-Rail Crossings in the State of California,” establishes the appropriate warning devices for the safety of both pedestrians and roadway vehicles. In addition, the California Manual on Uniform Traffic Control Devices (CAMUTCD) provides standards for active and passive warning devices. Both the CPUC General Order No. 75-D and the CAMUTCD was used to determine the appropriate warning devices for the safety of pedestrians and roadway vehicles.

Authorization is also needed from CPUC to install or modify **all highway-rail crossings, including grade separated crossings, publicly used private crossings, and pedestrian crossings.** As per General Order No. 164-D, “Rules and Regulations Governing State Safety Oversight of Rail Fixed Guideway Systems,” Section 10:

- In the initial phase, the Rail Transit Agency shall consult with staff during the process of developing a Draft Environmental Impact Report for the projects that require such document to be prepared. The purpose of this consultation is for the Rail Transit Agency to provide its reasons and supporting evidence, why at-grade crossing is not a good candidate for closure or grade separation. The following information is to be provided to Staff as part of the consultation:

1. Current and projected railroad operations. If the crossing is planned to be used by other types of trains such as freight trains, the number, type and speed**(**s) of trains shall be provided;
2. Current and projected highway usage – number, type and speed of vehicles
3. Existing and projected facilities that generate traffic in the area, such as shopping centers, major industries, schools, entertainment venues, or emergency services.
4. Preliminary drawings and/or aerial photographs, or site maps of the crossing and vicinity-include information on nearby roads to determine if they can accommodate additional vehicular traffic if existing intersections are eliminated.

For the purpose of CPUC approval and to aid safe operation of the light rail transit and roadway traffic, passive and active warning devices are employed at the appropriate locations as per their standards. This chapter as well as Chapter 8 of this report includes intersection layouts illustrating the location of proposed grade crossing active and passive warning devices. At-grade crossing warning devices that will be required for this project are summarized in Table 4-5 and a detailed description is also summarized in Table 9-3.

Private At-Grade Rail Crossings

At-grade crossings can be either a public at-grade crossing (or a publically used private at-grade crossing as determined by the CPUC or a court of competent jurisdiction), or a private at-grade crossing depending on predominate use. All private at-grade crossings require the installation of the CPUC Standard No. 1-X sign (Figure **9-1A**). The railroad has the option to include the language contained in the lower portion of the sign, commencing with and including the words “No Trespassing.” At all approaches to private at-grade crossings there shall be installed either a STOP sign (defined as a Standard R1-1 in the CAMUTCD) or a CPUC Standard automatic active warning device (described below). For this project, the proposed passive warning devices for all private at-grade crossings, with the exception of the north and south Dole entrances, are the STOP sign and 1-X sign. For the north and south Dole entrances, the CPUC Standard No. 9 (Figure 9-2) automatic active warning device with the necessary passive warning devices are proposed due to accident history and perceived high potential for semi-truck/train collisions. The private at-grade crossings are summarized in Table 9-3.

Public At-Grade Rail Crossings

Railroad crossing automatic active warning devices are used to provide warning at public at-grade rail crossings, where high volumes, limited sight distance or other hazardous conditions exist. These intersections are summarized in Table 9-3. Special attention has been given to locations where the potential interference in the operation of roadway vehicular traffic and the light rail transit vehicle can occur when determining the proposed active control devices at that location. Although an at-grade warning device can be a Standard **1-R** sign (Figure **9-1B**), there are three basic types of automatic active warning devices that are proposed for this project that are CPUC Standards (per GO No. 75-D).

- Automatic flashing lights, bell, and vehicular gate arm mounted on a pole adjacent to the roadway in one or both approach directions, and in the median when necessary (Figure 9-2, CPUC Standard No. 9).
- Automatic flashing lights, bells, and vehicular gate arm mounted on a pole adjacent to the roadway in one or both approach directions, with **a separate mast for the** pedestrian gate arm protecting the pedestrian sidewalk at-grade crossing path (Figure 9-3, CPUC Standard No. 9 with **a Separate Mast for the** Pedestrian Gate Arm).
- Automatic flashing lights, bells, and vehicular gate arm mounted on a pole adjacent to the roadway in one or both approach directions, and in the median when necessary (CPUC Standard No. 9), with additional light signals over the roadway on a cantilever arm (Figure 9-4, CPUC Standard No. 9-A). At some locations**, a separate mast for** the pedestrian gate arm protecting the pedestrian sidewalk at-grade crossing path is included where needed.

Figure 9-1
CPUC Standard No. 1

A. CPUC Standard No. 1-X

B. CPUC Standard No. 1-R

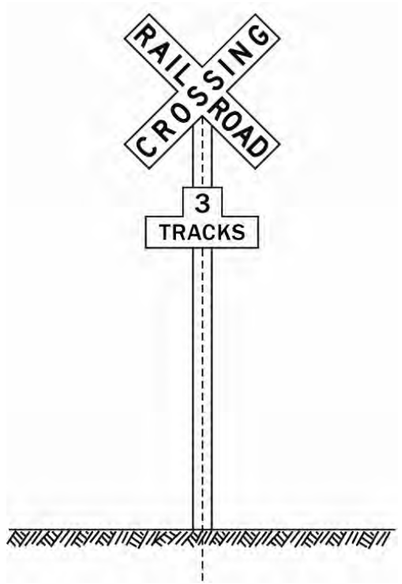


Figure 9-2
CPUC Standard No. 9

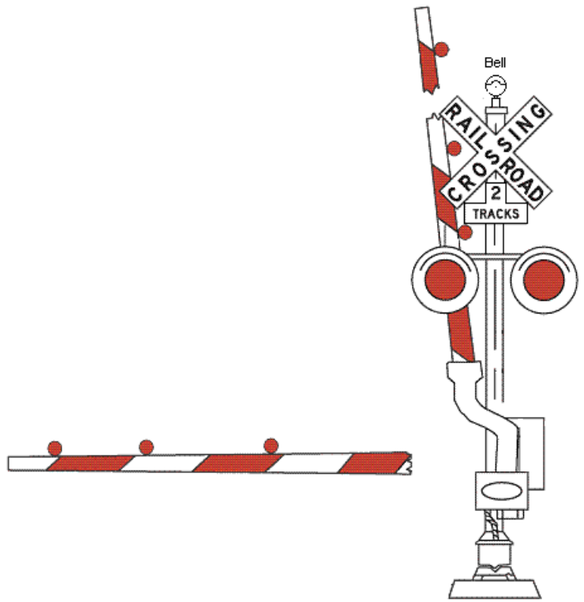


Figure 9-3
CPUC Standard No. 9 with a Separate Mast for the Pedestrian Gate Arm

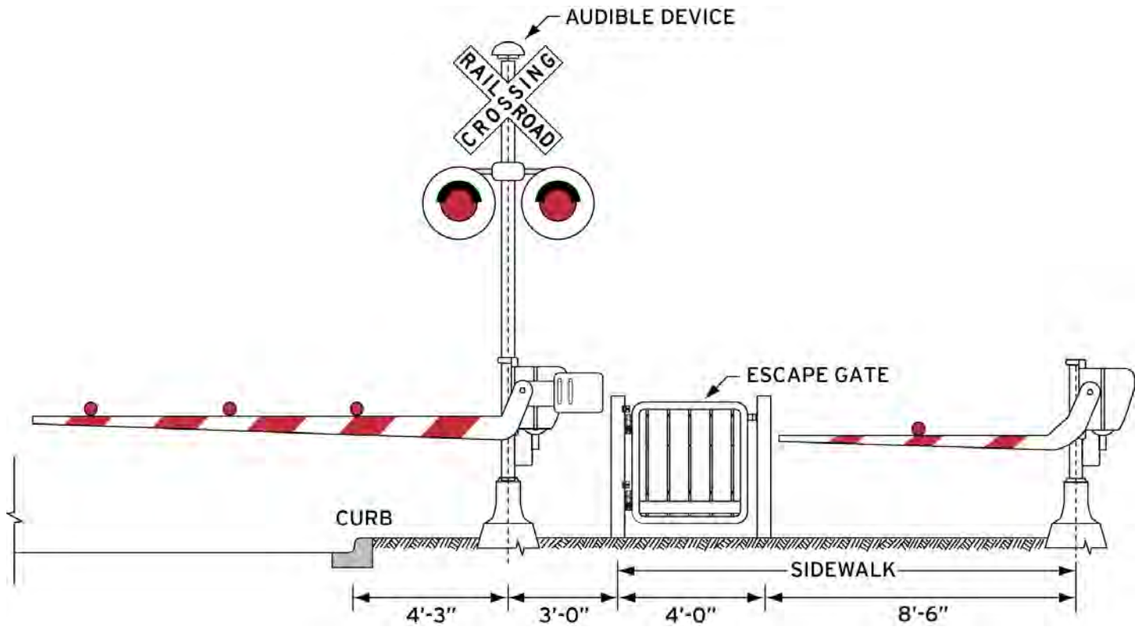
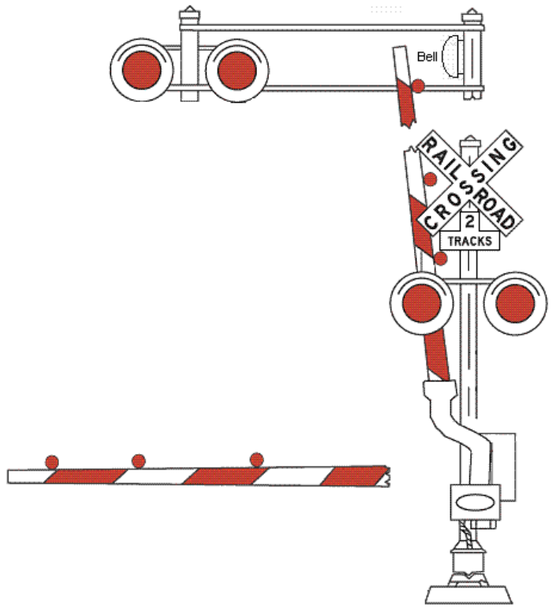


Figure 9-4
CPUC Standard No. 9-A



Pedestrian At-Grade Rail Crossings

Pedestrian access to stations is critical for a successful light rail transit system. Pedestrian crossings must be controlled for the safe operation of both the light rail transit vehicles and pedestrians. Station platforms are typically located adjacent to intersections controlled by traffic signals, where pedestrians can cross in designated crosswalks.

Appropriate pedestrian at-grade crossing design is only effective if pedestrians actually cross at the designated point and take a path that allows them clear observation of the active and passive warning devices. Pedestrians tend to take the shortest route to their destination. Therefore, in an effort to ensure proper channelization of pedestrians at designated crossings and prohibit pedestrian access to tracks at non-designated locations, fencing is recommended and railroad crossing automatic active pedestrian gates are proposed to provide safe access across the tracks and to prevent pedestrians from crossing while a train is passing. When channelization treatments are employed with automatic gate arms, there is always the possibility of trapping a pedestrian between the tracks and the gate arm; therefore an exit path using an “escape swing gate” that swings away from the tracks is added where pedestrian gates are proposed. In addition, a “safe refuge” area has been provided to allow refuge adjacent to the escape swing gate on the track side for any trapped pedestrian or handicapped individual that fails to exit through the escape swing gate prior to the arrival of a train.

All pedestrian at-grade crossings also require the installation of the CPUC Standard No. 1-D sign (Figure 9-5) passive warning device.

Two different pedestrian-rail automatic active warning devices are proposed depending on whether the device is on the approach or departure side (from a vehicular perspective) of the pedestrian crossing. If the device is on the approach side, then **a separate mast with a** pedestrian gate arm and escape gate is added **along with the** CPUC Standard No. 9, as shown on Figure 9-3. If a pedestrian railroad automatic active warning device is on the departure side of the crossing, then the proposed warning device is similar to CPUC Standard No. 9 (Figure 9-3) **to** protect the pedestrian sidewalk. The gate arm is 8 feet in length, and a 4-foot escape swing gate should be added for safety. Figure 9-6 shows an example of the pedestrian gate placement with the pedestrian gate arm, but without the escape swing gate shown. Figure 9-7 shows an example of active warning device placement, including pedestrian gate arm and escape swing gate orientation.

As a guideline for the design of the proposed safety equipment to ensure pedestrian crossing safety, a report entitled *Pedestrian-Rail Crossing in California, A Report Compiling the Designs and Devices Currently Utilized at Pedestrian-Rail Crossings within the State of California* (dated May 2008) by the California Public Utilities Commission has been used.

The location of the proposed safety equipment is shown on plan sheets included in Chapter 8 of this document. The applicable CPUC and California Manual on Uniform Traffic Control Devices (CA MUTCD) clearance requirements have been followed for the design of the proposed automatic active and passive warning devices.

Traffic Control Signals at or Near At-Grade Rail Crossings

If an at-grade rail crossing is equipped with automatic active warning devices and is located within 200 feet of a signalized intersection or mid-block signalized location, then the traffic signal for the intersection should be provided with preemption, in accordance with CA MUTCD Section 4D.13. All of the highway-rail at-grade crossings for this project are within 200 feet of an adjacent intersection, and therefore, will require preemption of the traffic signal with the exception of the traffic signals at Washington Street (Lighthouse).

There are two types of preemption: simultaneous and advanced. Simultaneous preemption is the notification of an approaching train which is forwarded to the intersection traffic signal controller unit or assembly and railroad automatic active warning devices at the same time. Advanced preemption is the notification of an approaching train that is forwarded to the intersection traffic signal controller unit or assembly by the railroad warning signal equipment in advance of the activation of the railroad automatic active warning devices. Preemption allows for the interruption of the normal sequence of traffic control signal indications upon the approach of the train to avoid entrapment of vehicles on the highway-rail grade crossing by conflicting aspects of the traffic control signals and the highway-rail grade crossing flashing-light signals. Advance preemption time is the difference in time between the maximum highway traffic signal preemption time and the activation of the railroad warning devices, and varies depending on location.

All of the highway-rail at-grade crossings except the crossing at Washington Street (Lighthouse Avenue) will require advance preemption of the nearby intersection traffic signals. The locations of highway-rail at-grade crossings near signalized intersections where advance preemption is proposed are listed in Table 9-3.

Figure 9-5
CPUC Standard #1-D

Figure 9-6
Example of Pedestrian Gate Placement With Pedestrian Gate Arm
(gate support Between sidewalk And roadway)

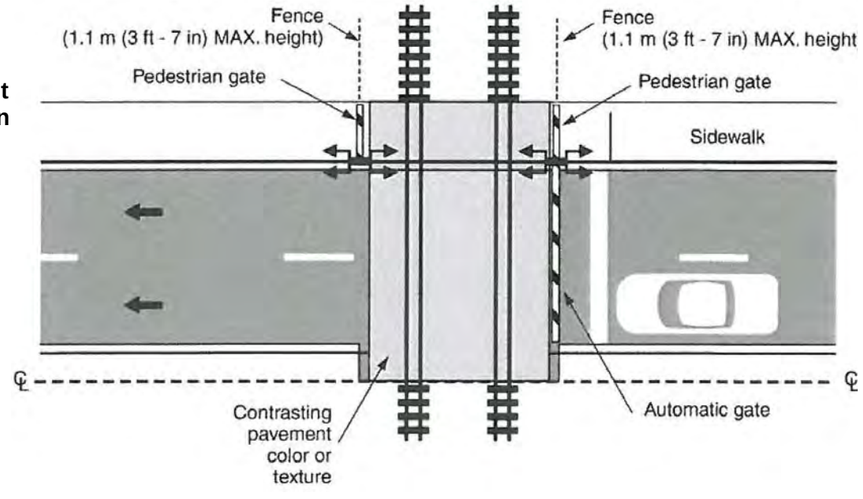
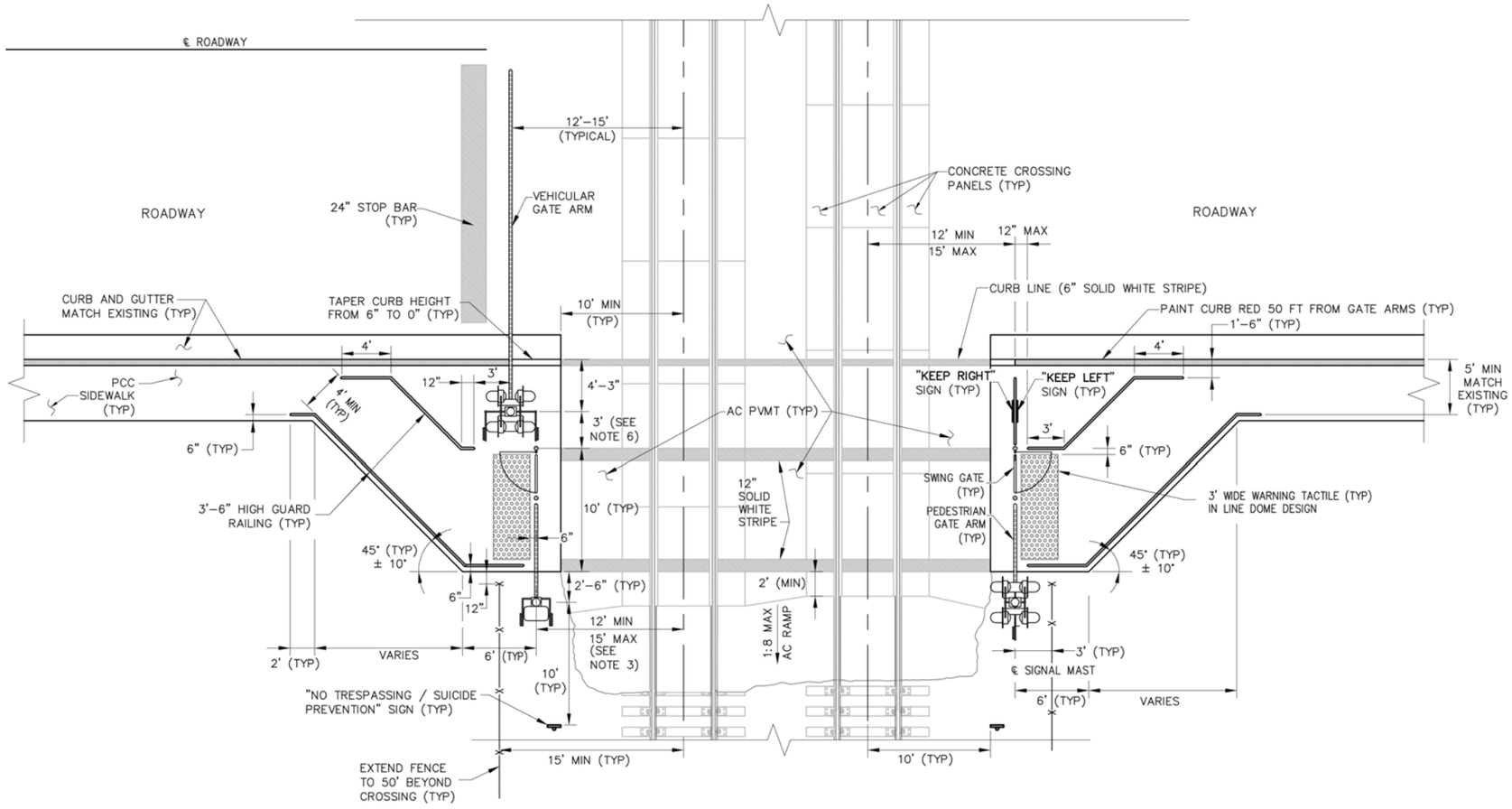


Figure 9-7
Example of Warning Device Placement



(OPPOSITE END IDENTICAL)

NOTES:

1. THE STANDARDS ARE FOR GUIDANCE AND TO INDICATE INTENT. SINCE THE ACTUAL DESIGN WILL TYPICALLY BE SITE SPECIFIC, A CLOSE COLLABORATION WITH CPUC WILL BE REQUIRED.
2. FOLLOW CALIFORNIA MUTCD FOR STRIPING, MARKING, AND OTHER WARNING DEVICES.
3. TO MINIMIZE CROSSING DISTANCE, THE PEDESTRIAN GATE SHALL BE PARALLEL TO TRACKS. ALIGN WITH EITHER SIDE OF THE VEHICULAR GATE COUNTER WEIGHT THAT PROVIDES 12' MIN (TRACK CENTER TO PED SIGNAL MAST).
4. FENCE:
   - EXTEND TO EXISTING ADJACENT STRUCTURES (BUILDINGS, ETC.) TO CLOSE ANY GAPS.
   - IN ABSENCE OF EXISTING ROW FENCE, EXTEND 50 FT ONTO THE ROW. MATCH EXISTING ON FENCE TYPE, HEIGHT, AND ALIGNMENT.
5. USE 4 FT WHEN THE COUNTER WEIGHTS ARE OBLONG TYPE (AS OPPOSED TO SQUARE). THIS TYPICALLY OCCURS WHEN THE ROADWAY IS OF 2 LANES OR MORE IN EACH DIRECTION. FIELD VERIFY.

Table 9-3
HIGHWAY-RAIL AT-GRADE CROSSINGS

Public Crossings	Private Crossings	Sheet Nos.	Crossing Street/Name	Mile Post (MP)	Existing CPUC No.	DOT No.	No. of Tracks	No. of Traffic Lanes	Existing Warning Device	Proposed Warning Device	Parallel Street	Adjacent Signalized Intersection?	Distance between Edge of Track and Edge of Parallel Roadway (ft)	Proposed Signage and Pavement Delineation on Crossing Approaches (if not exisitng)	Proposed Signage and Pavement Delineation on Parallel Roadway	Replace Crossing Surface?	Pedestrian Improvements	Other Proposed Improvements?
1			Blackie Road	110.69	EE-110.6	752253J	3	2 EB, 2 WB	#9-A, with #9 in median on both approaches	Train detection for EE track	Del Monte Ave.	No	25	Crossbuck (R15-1) and Number of Tracks (R15-2) on #9-A, Advance Warning (W10-1), Number of Tracks (W48(CA)) 3 tracks adjacent to RR Crossing Symbol pavement markings. Consider placing LOOK (R15-8) for pedestrian safety.	W10-2 (tracks left) for SB Del Monte approach, W10-2 (tracks right) for NB Del Monte approach	no	Automatic Pedestrian Sidewalk Warning Device with arm and escape gate protecting the crosswalk (both sides) opposite the #9 and #9-A.	I-13 or I-13a (Emergency Notification Sign)
1		LRT-02(B) SD-02	**Merrit Street (SR 183)**	110.87	EE-110.80	752258T	1	1 SB, 1 NB, 1 NB Right Turn	#9-A on both approaches	Replace with new equipment	Merrit Street (Del Monte Ave.)	No	55	Crossbuck (R15-1) on #9-A, Advance Warning (W10-1) adjacent to RR Crossing Symbol Pavement Markings.	W10-4 (tracks left) for SB Del Monte Ave. approach	yes with concrete panels	None	I-13 or I-13a (Emergency Notification Sign)
1		LRT-05(B) SD-05	**Nashua Road**	112.56	EE-112.5	752261B	1	1 SB, 1 NB	#9 (missing arm) on both approaches	Replace with new equipment	Monte Road	No	55	Crossbuck (R15-1) on #9, RR Crossing Symbol Pavement Markings with Advance Warning (W10-1) adjacent to the RR Crossing Symbol Pavement Markings.	W10-4 (tracks right) for EB Monte Road approach, R1-1 (Stop) at EB Monte Road approach.	yes with concrete panels	None	I-13 or I-13a (Emergency Notification Sign)
	1	LRT-07(B) SD-07	**North Dole (Private)**	113.83	EE-113.83	752264W	1	1 NB, 1 SB	None	On both approaches #9 on right side with half round guardrailing per Caltrain Std Drawing SD-5407.	Private road	No	15	None	None	yes with concrete panels	None	None
	1		**South Dole (Private)**	114.07	EE-114.07	752265D	1	1 NB, 1 SB	STOP (R1-1)	STOP (R1-1) with PRIVATE CROSSING (CPUC Standard 1-X) mounted below stop sign.	Private road	No	60	None	None	yes with concrete panels	None	None
1		LRT-08(C) SD-08	**Del Monte Boulevard**	114.27	EE-114.30	752266K	1	2 SB, 2 NB	#9-A	Replace with new equipment	Lapis Road	No	95	Crossbuck (R15-1) on #9-A, RR Crossing Symbol Pavement Markings with adjacent Advance Warning (W10-1). Additional RR Crossing Symbol Pavement Marking between track and Lapis Road (for traffic toward crossing).	W10-4 (tracks left) for EB Lapis Road approach	yes with concrete panels	None	I-13 or I-13a (Emergency Notification Sign)
	1		**Private Crossing**	114.64	EE-114.64	752267S	1	1	STOP (R1--1)	STOP (R1-1) with PRIVATE CROSSING (CPUC Standard 1-X) mounted below stop sign.	Lapis Road	No	50	None	None	yes with asphalt concrete (AC)	None	None
	1		**Private Crossing** (Opened 1/1/70 per FRA records)	115.01	EE-115.01C	752268Y	1	1	STOP (R1-1)	STOP (R1-1) with PRIVATE CROSSING (CPUC Standard 1-X) mounted below stop sign.	Lapis Road	No	45	None, see Proposed Warning Device	NA	yes with asphalt concrete (AC)	None	None
	1		**RMC Pacific Materials** (private crossing)	115.04	EE-115.04X	752269F	1	1	STOP (R1-1)	STOP (R1-1) with PRIVATE CROSSING (CPUC Standard 1-X) mounted below stop sign	Lapis Road	No	50	None	None	yes with concrete panels	None	None
	1		**Private Crossing** (Open per FRA records)	115.70	EE-115.70	752270A	1	1	None	STOP (R1-1) with PRIVATE CROSSING (CPUC Standard 1-X) mounted below stop sign.	Del Monte Blvd	No	105	None, see Proposed Warning Device	NA	No	None	Can this crossing be closed?
1		LRT-11(C) SD-11C	**New Golf Drive Public Crossing**	115.82 (New)	TBD	TBD	1	1 NB, 2 SB	None	On NB approach #9 on right side. On SB approach #9 on right side and #9 in median.	Del Monte Blvd	No	66	Crossbuck (R15-1) and Number of Tracks (R15-2) on #9, RR Crossing Symbol Pavement Markings with adjacent Advance Warning (W10-1). Additional RR Crossing Symbol Pavement Marking between track and Del Monte Boulevard (for traffic toward crossing). Consider placing Do Not Stop On Tracks (R8-8) on the right side, or both sides, either on the near side or the far side to provide sufficient visibility for motorists approaching or stopped on the crossing.	Signalize Del Monte Blvd intersection that includes preemption. Install R3-1 (Activated Blank Out, No RT Turn) at both the stop line on Del Monte Boulevard for the right turn lane toward the crossing and on the upstream signal mast on Del Monte Blvd. W10-2 (tracks right) for WB Del Monte approach. W10-2 (tracks left) for EB Del Monte approach.	yes with concrete panels	#9 with back sidewalk arm protecting the crosswalk (east side), #9 with back sidewalk arm protecting the crosswalk (west side), extend concrete panels for striped crosswalks (both sides). Automatic Pedestrian Sidewalk Warning Device with arm and escape gate protecting the crosswalk (both sides) opposite the #9's.	I-13 or I-13a (Emergency Notification Sign)

Table 9-3
HIGHWAY-RAIL AT-GRADE CROSSINGS

Public Crossings	Private Crossings	Sheet Nos.	Crossing Street/Name	Mile Post (MP)	Existing CPUC No.	DOT No.	No. of Tracks	No. of Traffic Lanes	Existing Warning Device	Proposed Warning Device	Parallel Street	Adjacent Signalized Intersection?	Distance between Edge of Track and Edge of Parallel Roadway (ft)	Proposed Signage and Pavement Delineation on Crossing Approaches (if not exisitng)	Proposed Signage and Pavement Delineation on Parallel Roadway	Replace Crossing Surface?	Pedestrian Improvements	Other Proposed Improvements?
1		LRT-11(E) SD-11	**Relocated Marina Green Drive**	115.98 (New) 116.00 (E)	EE-116.00	748347D	2 (1 existing)	2 NB, 2 SB	#9	Replace with new equipment. On NB approach #9 on right side and #9 in median. On SB approach #9 on right side and #9 in median.	Del Monte Blvd	No	21 (to Stop Bar)	Crossbuck (R15-1) and Number of Tracks (R15-2) on #9, RR Crossing Symbol Pavement Markings with adjacent Advance Warning (W10-1), Number of Tracks (W48(CA)) 2 tracks. Stop Here on Red (R10-6) and No Turn on Red (R10-11) adjacent to Stop Bar on SB approach. Consider placing Do Not Stop On Tracks (R8-8) on the right side, or both sides, either on the near side or the far side to provide sufficient visibility for motorists approaching or stopped on the crossing.	Signalize Del Monte Blvd. intersection that includes preemption. Install R3-1 (Activated Blank Out, No RT Turn) at both the stop line on Del Monte Boulevard for the right turn lane toward the crossing and on the upstream signal mast on Del Monte Blvd. W10-2 (tracks right) for WB Del Monte approach. W10-2 (tracks left) for EB Del Monte approach.	yes with concrete panels	#9 with back sidewalk arm protecting the crosswalk (east side), #9 with back sidewalk arm protecting the crosswalk (west side), extend concrete panels for striped crosswalks (both sides). Automatic Pedestrian Sidewalk Warning Device with arm and escape gate protecting the crosswalk (both sides) opposite the #9's.	I-13 or I-13a (Emergency Notification Sign)
1		LRT-12(B) SD-12	**Beach Road**	116.50	EE-116.5	752271G	1	4 SB (3 lanes now, 1 future LT lane), 2 NB	#9	Replace with new equipment. On NB approach, #9 on right side and #9 in median. On SB approach #9-A on right side and #9-A in median.	Del Monte Blvd.	Yes	39 (to edge of crosswalk) **within 50', should consider pre-signals on SB approach.**	Crossbuck (R15-1) on #9 and #9-A, RR Crossing Symbol Pavement Markings with adjacent Advance Warning (W10-1) on both approaches. Stop Here on Red (R10-6) and No Turn on Red (R10-11) adjacent to Stop Bar on SB approach. Consider placing Do Not Stop On Tracks (R8-8) on the right side, or both sides, either on the near side or the far side to provide sufficient visibility for motorists approaching or stopped on the crossing.	Signalize Del Monte Blvd intersection that includes preemption. Install R3-1 (Activated Blank Out, No RT Turn) at both the stop line on Del Monte Boulevard for the right turn lane toward the crossing and on the upstream signal mast on Del Monte Blvd. W10-2 (tracks right) for WB Del Monte approach. W10-2 (tracks left) for EB Del Monte approach.	yes with concrete panels	#9 with sidewalk arm protecting the sidewalk (east side), #9-A Cantilever with adjacent Model 10 Signal with 3590 Series Gate Mechanism with vehicular arm and back sidewalk arm protecting the sidewalk (west side), extend concrete panels for striped crosswalks (both sides). Automatic Pedestrian Sidewalk Warning Device with arm and escape gate protecting the crosswalk (both sides) opposite the #9 and #9-A.	I-13 or I-13a (Emergency Notification Sign)
1		LRT-13(B) SD-13	**Reservation Road**	116.92	EE-116.9	750227M	1	2 SB, 2 NB	#9	Replace with new equipment. On NB approach, #9 on right side and #9 in median. On SB approach #9 on right side and #9 in median.	Del Monte Blvd.	Yes	37 (to Del Monte Blvd.) **within 50', should consider pre-signal on SB approach. SB: Install pre-signal traffic signal faces on additional upstream traffic signal mast.**	Crossbuck (R15-1) on #9, RR Crossing Symbol Pavement Markings with adjacent Advance Warning (W10-1) on both approaches. Stop Here on Red (R10-6) and No Turn on Red (R10-11) adjacent to Stop Bar on SB approach. Consider placing Do Not Stop On Tracks (R8-8) on the right side, or both sides, either on the near side or the far side to provide sufficient visibility for motorists approaching or stopped on the crossing.	Signalize Del Monte Blvd. intersection that includes preemption. Install R3-1 (Activated Blank Out, No RT Turn) at both the stop line on Del Monte Boulevard for the right turn lane toward the crossing and on the upstream signal mast on Del Monte Blvd. W10-2 (tracks right) for WB Del Monte approach. W10-2 (tracks left) for EB Del Monte approach.	yes with concrete panels	#9 with sidewalk arm protecting the sidewalk (east side), #9 with back sidewalk arm protecting the sidewalk (west side), extend concrete panels for striped cross-walks (both sides). Automatic Pedestrian Sidewalk Warning Device with arm and escape gate protecting the crosswalk (both sides) opposite the #9's.	I-13 or I-13a (Emergency Notification Sign)
1		LRT-14(B) SD-14	**Palm Avenue**	117.31	EE-117.3	752273V	1	2 SB, 1 NB	#9	Replace with new equipment. On NB approach, #9 on right side with back sidewalk arm. On SB approach #9-A on right side with back sidewalk arm.	Del Monte Blvd.	Yes	30 (to Del Monte Blvd.) 39 (to Marina Drive) **within 50', should consider pre-signal on SB approach. SB: Install pre-signal traffic signal faces on cantilever arm of #9-A.**	Crossbuck (R15-1) on #9, RR Cross-ing Symbol Pavement Markings with adjacent Advance Warning (W10-1) on both approaches. Stop Here on Red (R10-6) and No Turn on Red (R10-11) adjacent to Stop Bar on both approaches. Consider placing Do Not Stop On Tracks (R8-8) on the right side, or both sides, either on the near side or the far side to provide sufficient visibility for motorists approaching or stopped on the crossing.	Signalize Del Monte Blvd intersection that includes preemption. Install R3-1 (Activated Blank Out, No RT Turn) at both the stop line on Del Monte Boulevard for the right turn lane toward the crossing and on the upstream signal mast on Del Monte Blvd. W10-2 (tracks right) for WB Del Monte approach. W10-2 (tracks left) for EB Del Monte approach.	yes with concrete panels	#9 with sidewalk arm protecting the sidewalk (east side), #9 with back sidewalk arm protecting the sidewalk (west side), extend concrete panels for striped crosswalks (both sides). Automatic Pedestrian Sidewalk Warning Device with arm and escape gate protecting the crosswalk (both sides) opposite the #9's.	I-13 or I-13a (Emergency Notification Sign)
1		LRT-18(C) SD-18	**SR-1 Bike Path**	119.62	EE-119.62C	752275J	1	1 ped/bike lane	Stop lines and RR Crossing Symbol Pavement Markings on each approach.	New Stop lines and RR Crossing Symbol Pavement Markings on each approach. STOP (R1-1) with RAILROAD CROSSING (CPUC Standard 1-D) mounted below stop sign on both approaches.	NA	No	NA	New Stop lines and RR Crossing Symbol Pavement Markings on each approach.	NA	No	None	None
	1		**Private Crossing**	119.87	EE-119.87	752277X	1	1	None	STOP (R1-1) with PRIVATE CROSSING (CPUC Standard 1-X) mounted below stop sign.	NA	No	NA	None, see Proposed Warning Device	NA	No	None	None

Table 9-3
HIGHWAY-RAIL AT-GRADE CROSSINGS

Public Crossings	Private Crossings	Sheet Nos.	Crossing Street/Name	Mile Post (MP)	Existing CPUC No.	DOT No.	No. of Tracks	No. of Traffic Lanes	Existing Warning Device	Proposed Warning Device	Parallel Street	Adjacent Signalized Intersection?	Distance between Edge of Track and Edge of Parallel Roadway (ft)	Proposed Signage and Pavement Delineation on Crossing Approaches (if not exisitng)	Proposed Signage and Pavement Delineation on Parallel Roadway	Replace Crossing Surface?	Pedestrian Improvements	Other Proposed Improvements?
	1		**Private Crossing**	120.14	EE-120.14X	752278E	1	1	None	STOP (R1-1) with RAILROAD CROSSING (CPUC Standard 1-D for pedestrian crossing) mounted below stop sign.	NA	No	NA	None, see Proposed Warning Device	NA	No	None	None
	1		**Private Crossing**	120.27	EE-120.27X	752279L	1	1	None	STOP (R1-1) with PRIVATE CROSSING (CPUC Standard 1-X) mounted below stop sign.	NA	No	NA	None, see Proposed Warning Device	NA	No	None	None
	1		**Private Crossing**	120.51	EE-120.51X	752280F	1	1	None	STOP (R1-1) with PRIVATE CROSSING (CPUC Standard 1-X) mounted below stop sign.	Beach Range Road	No	NA	None, see Proposed Warning Device	NA	No	None	None
	1		**Private Crossing**	120.58	EE-120.58X	752281M	1	1	None	STOP (R1-1) with PRIVATE CROSSING (CPUC Standard 1-X) mounted below stop sign.	Beach Range Road	No	NA	None, see Proposed Warning Device	NA	No	None	None
	1		**Private Crossing**	120.62	EE-120.62X	752282U	1	1	None	STOP (R1-1) with PRIVATE CROSSING (CPUC Standard 1-X) mounted below stop sign.	Beach Range Road	No	NA	None, see Proposed Warning Device	NA	No	None	None
1		LRT-23(B) SD-23	**Ord Ave./Monterey Road**	122.20	EE-122.2	752286W	1	3 EB, 2 WB	None, #9 removed	Replace with new equipment. On EB approach, #9-A on right side and #9 in median. On WB approach #9 on right side and #9 in median.	Fremont Blvd/State Hwy 1 SB Off-Ramp & California Avenue/State Hwy 1 SB On-Ramp	Yes	28 (EB to Fremont Blvd.) 40 (WB to Hwy 1 On-Ramp) **within 50', should consider pre-signals on both approaches. EB: Install pre-signal traffic signal faces on cantilever arm of #9-A. WB: Install pre-signal traffic signal faces on additional traffic signal mast.**	Crossbuck (R15-1) on #9 and #9-A, RR Crossing Symbol Pavement Markings with adjacent Advance Warning (W10-1) EB Monterey Road approach. Stop Here on Red (R10-6) and No Turn on Red (R10-11) adjacent to Stop Bar on EB and WB approaches. Consider placing Do Not Stop On Tracks (R8-8) on the right side, or both sides, either on the near side or the far side to provide sufficient visibility for motorists approaching or stopped on the crossing.	Signalize intersection that includes preemption. Install R3-1 (Activated Blank Out, No RT Turn) at both the stop line on SB State Hwy 1 Off-Ramp approach and the upstream signal mast on Fremont Blvd and the NB California Avenue approach for both the right turn lane toward the crossing and on the upstream signal mast on SB State Hwy 1 On-Ramp. Install R3-2 (Activated Blank Out, No LT Turn) at both the stop line on SB State Hwy 1 On-Ramp approach and the upstream signal mast on California Ave. W10-2 (tracks right) for NB California Avenue and State Hwy 1 SB Off-Ramp approaches. W10-2 (tracks left) for SB California Avenue and NB Fremont Blvd approaches. W10-2 (tracks right) for State Hwy 1 SB Off-Ramp and NB California Avenue approaches.	yes with concrete panels	#9 with sidewalk arm protecting the sidewalk (north side), #9-A with sidewalk arm protecting the sidewalk (south side), extend concrete panels for striped crosswalks (both sides). Automatic Pedestrian Sidewalk Warning Device with arm and escape gate protecting the crosswalk (both sides) opposite the #9 and #9-A.	I-13 or I-13a (Emergency Notification Sign)
1		LRT-24(B) SD-24(B)	**Playa Avenue**	122.57	EE- 122.6?	**Not on FRA list**	2	3 EB (2 @ approach), 2 WB	Stop lines and RR Crossing Symbol Pavement Marking on each approach. Can't tell from Google Earth or the topo if there are #9-A's on both approaches or if they are #9's?? Assume #9's.	On EB approach, #9 on right side and #9 in median. On WB approach #9 on right side and #9 in median.	California Avenue & Del Monte Blvd.	Yes	118 (EB to Del Monte Blvd) 40 (WB to California Ave.) **within 50', but no signal on Cal Ave. on WB approach.**	Crossbuck (R15-1) on #9, RR Crossing Symbol Pavement Markings with adjacent Advance Warning (W10-1), Number of Tracks 2 tracks on EB approach. RR Crossing Symbol Pavement Marking on WB approach between Del Monte Blvd and the tracks. Stop Here on Red (R10-6) and No Turn on Red (R10-11) adjacent to Stop Bar on WB approach. Consider placing Do Not Stop On Tracks (R8-8) on the right side, or both sides, either on the near side or the far side to provide sufficient visibility for motorists approaching or stopped on the crossing. Construct medians to discourage driving around gate arms.	Signalize intersection @ Del Monte Blvd. that includes preemption. Install R3-1 (Activated Blank Out, No RT Turn) at both the stop line on SB Del Monte Blvd. approach for the right turn lane toward the crossing and the upstream signal mast on Del Monte Blvd.	yes with concrete panels	#9 with sidewalk arm protecting the sidewalk (north side), #9 with sidewalk arm protecting the sidewalk (south side), extend concrete panels for striped crosswalks (both sides). Automatic Pedestrian Sidewalk Warning Device with arm and escape gate protecting the crosswalk (both sides) opposite the #9's.	I-13 or I-13a (Emergency Notification Sign)

Table 9-3
HIGHWAY-RAIL AT-GRADE CROSSINGS

Public Crossings	Private Crossings	Sheet Nos.	Crossing Street/Name	Mile Post (MP)	Existing CPUC No.	DOT No.	No. of Tracks	No. of Traffic Lanes	Existing Warning Device	Proposed Warning Device	Parallel Street	Adjacent Signalized Intersection?	Distance between Edge of Track and Edge of Parallel Roadway (ft)	Proposed Signage and Pavement Delineation on Crossing Approaches (if not exisitng)	Proposed Signage and Pavement Delineation on Parallel Roadway	Replace Crossing Surface?	Pedestrian Improvements	Other Proposed Improvements?
1		LRT-24(D) SD-24(D)	**Tioga Ave.**	122.78	EE-122.8	752287D	2	2 EB, 2 WB	Stop lines and RR Crossing Symbol Pavement Marking on WB approach. #9 on both approaches.	Replace with new equipment. On EB approach, #9-A on right side (no median). On WB approach #9-A on right side (no median).	Del Monte Blvd.	Yes	120 (EB to Del Monte Blvd.) approx. 45 (WB to California Ave.) **within 50', but no signal on Cal Ave. on WB approach.**	Crossbuck (R15-1) on #9-A, RR Crossing Symbol Pavement Markings with adjacent Advance Warning (W10-1), Number of Tracks (W48(CA)) 2 tracks on EB approach. Additional RR Crossing Symbol Pavement Marking between the track and Del Monte Blvd (for WB traffic toward the crossing. Stop Here on Red (R10-6) and No Turn on Red (R10-11) adjacent to Stop Bar on WB approach. Consider placing Do Not Stop On Tracks (R8-8) on the right side, or both sides, either on the near side or the far side to provide sufficient visibility for motorists approaching or stopped on the crossing. Construct medians to discourage driving around gate arms.	Signalize Del Monte Blvd intersection that includes preemption. Install R3-1 (Activated Blank Out, No RT Turn) at both the stop line on SB Del Monte Boulevard for the right turn lane toward the crossing and the upstream signal mast on Del Monte Blvd.	yes with concrete panels	#9-A with sidewalk arm protecting the sidewalk (north side), #9-A with sidewalk arm protecting the sidewalk (south side), extend concrete panels for striped crosswalks (both sides). Automatic Pedestrian Sidewalk Warning Device with arm and escape gate protecting the crosswalk (both sides) opposite the #9's.	I-13 or I-13a (Emergency Notification Sign)
	1		**Private Crossing (Granite Rock) Crossing closed 5/11/79**	122.92	EE-122.92X	752288K	2	None	None	None, crossing closed.	Del Monte Blvd.	No	NA	None, crossing closed and to stay closed.	None	No	None	None
1		LRT-25(C) SD-25	**Contra Costa Street Crossing closed, need to reopen at-grade crossing closed 3/26/79**	123.37	EE-123.35	752289S	2	1 SB, 1 NB	None	On NB approach, #9 on right side. On SB approach, #9 on right side.	Del Monte Blvd.	Yes	80 (to Del Monte Blvd.)	Crossbuck (R15-1) on #9, RR Crossing Symbol Pavement Markings with adjacent Advance Warning (W10-1), Number of Tracks (W48(CA)) 2 tracks on SB approach. RR Crossing Symbol Pavement Marking on NB approach between Del Monte Blvd and the tracks. Consider placing Do Not Stop On Tracks (R8-8) on the right side, or both sides, either on the near side or the far side to provide sufficient visibility for motorists approaching or stopped on the crossing.	Signalize Del Monte intersection that includes preemption. Install R3-1 (Activated Blank Out, No RT Turn) at both the stop line for WB Del Monte Boulevard traffic for the right turn lane toward the crossing and the upstream signal mast on Del Monte Blvd.	yes with concrete panels	#9 with sidewalk arm protecting the sidewalk (east side), #9 with sidewalk arm protecting the sidewalk (west side), extend concrete panels for striped crosswalks (both sides). Automatic Pedestrian Sidewalk Warning Device with arm and escape gate protecting the crosswalk (both sides) opposite the #9's.	I-13 or I-13a (Emergency Notification Sign)
1		LRT-26(B) SD-26	**Canyon Del Rey Blvd (formally Humboldt Street?) Crossing closed, need to reopen at-grade crossing closed 3/26/79**	123.64	EE-123.60	752292A	1	4 SB, 2 NB	None	On NB approach, #9 on right side and #9 in median. On SB approach #9-A on right side and #9 in existing median (need min. median width of 8'-6" for clearance).	Del Monte Blvd.	Yes	70	Crossbuck (R15-1) on #9 and #9-A, RR Crossing Symbol Pavement Markings with adjacent Advance Warning (W10-1) on both approaches. Additional RR Crossing Symbol Pavement Marking on NB approach between Del Monte Blvd and the tracks. Consider placing Do Not Stop On Tracks (R8-8) on the right side, or both sides, either on the near side or the far side to provide sufficient visibility for motorists approaching or stopped on the crossing. Extend medians, if necessary to discourage driving around gate arms on NB approach.	Signalize Del Monte Blvd intersection that includes preemption. Install R3-1 (Activated Blank Out, No RT Turn) at both the stop line for WB Del Monte Boulevard traffic for the right turn lane toward the crossing and the upstream signal mast on Del Monte Blvd. W10-2 (tracks right) for WB Del Monte approach. W10-2 (tracks left) for EB Del Monte approach.	yes with concrete panels	#9 on NB approach with sidewalk arm and escape gate protecting the sidewalk on east side of crossing. #9-A on SB approach with sidewalk arm and escape gate protecting the sidewalk on west side of crossing, extend concrete panels for striped crosswalks (both sides). Automatic Pedestrian Sidewalk Warning Device with arm and escape gate protecting the sidewalk on the west and east sides of crossing opposite to the #9 and #9-A.	I-13 or I-13a (Emergency Notification Sign)
1		LRT-26(C) SD-26(C)	**Roberts Avenue Crossing closed, need to reopen at-grade crossing closed 3/26/79**	123.84	EE-123.8	752293G	1	1 SB, 1 NB	None	On NB approach, #9 on right side. On SB approach #9 on right side.	Del Monte Blvd.	No	34 (SB to Del Monte Blvd.) **within 50', should consider pre-signals on SB approach.**	Crossbuck (R15-1) on #9, RR Crossing Symbol Pavement Markings with adjacent Advance Warning (W10-1) on SB approach. Stop Here on Red (R10-6) and No Turn on Red (R10-11) adjacent to Stop Bar on NB approach Consider placing Do Not Stop On Tracks (R8-8) on the right side, or both sides, either on the near side or the far side to provide sufficient visibility for motorists approaching or stopped on the crossing.	Signalize Del Monte Blvd intersection that includes preemption. Install R3-1 (Activated Blank Out, No RT Turn) at both the stop line for WB Del Monte Boulevard traffic for the right turn lane toward the crossing and the upstream signal mast on Del Monte Blvd. W10-3 (tracks right) for WB Del Monte approach. W10-3 (tracks left) for EB Del Monte approach.	yes with concrete panels	#9 on NB approach with sidewalk arm and escape gate protecting the sidewalk on east side of crossing. #9 on SB approach without the sidewalk arm and escape gate since there is no sidewalk on west side of crossing, extend concrete panels for striped crosswalk (east side). Automatic Pedestrian Sidewalk Warning Device with arm and escape gate protecting the sidewalk on the east side of crossing opposite the #9.	I-13 or I-13a (Emergency Notification Sign)
	1		**Private Crossing (Maris Driveway)**	124.21	EE-124.21X	752296C	1	1 SB, 1 NB	None	PURCHASE MARIS PROPERTY AND CLOSE CROSSING	Del Monte Ave.	No	NA	STOP (R1-1) with PRIVATE CROSSING (CPUC Standard 1-X) mounted below stop sign.	NA	No	None	None

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Public Crossings	Private Crossings	Sheet Nos.	Crossing Street/Name	Mile Post (MP)	Existing CPUC No.	DOT No.	No. of Tracks	No. of Traffic Lanes	Existing Warning Device	Proposed Warning Device	Parallel Street	Adjacent Signalized Intersection?	Distance between Edge of Track and Edge of Parallel Roadway (ft)	Proposed Signage and Pavement Delineation on Crossing Approaches (if not exisitng)	Proposed Signage and Pavement Delineation on Parallel Roadway	Replace Crossing Surface?	Pedestrian Improvements	Other Proposed Improvements?
	1		**Private Crossing**	124.23	EE-124.23X	752297J	1	1 SB, 1 NB	None	STOP (R1-1) with PRIVATE CROSSING (CPUC Standard 1-X) mounted below stop sign.	Del Monte Ave.	No	NA	None, see Proposed Warning Device	NA	No	None	None
1		LRT-27(C) SD-27	**Casa Verde Way (Roberts Ave.) Crossing closed, need to reopen at-grade crossing closed 1/03/87**	124.35	EE.124.4	752298R	1	3 SB, 1 NB	None	On NB approach, #9 on right side with back sidewalk arm. On SB approach #9-A on right side with back sidewalk arm and #9 in median.	Del Monte Ave.	Yes	1 (SB to Del Monte Blvd) **within 50', should consider pre-signal on SB approach. SB: Install pre-signal traffic signal faces on cantilever arm of #9-A.**	Crossbuck (R15-1) on #9 and 9-A, RR Crossing Symbol Pavement Markings with adjacent Advance Warning (W10-1) on NB Casa Verde Way approach. Additional RR Crossing Symbol Pavement Marking between the tracks and Roberts Ave. for SB traffic approaching the crossing. Stop Here on Red (R10-6) and No Turn on Red (R10-11) adjacent to Stop Bar on SB approach. Consider placing Do Not Stop On Tracks (R8-8) on the right side, or both sides, either on the near side or the far side to provide sufficient visibility for motorists ap-proaching or stopped on the crossing.	Signalize Del Monte Ave. intersection that includes preemption. Install R3-1 (Activated Blank Out, No RT Turn) at both the stop line for WB Del Monte Ave. traffic for the right turn lane toward the crossing and the upstream signal mast on Del Monte Ave. W10-2 (tracks right) for WB Del Monte Ave. approach. W10-2 (tracks left) for EB Del Monte Ave. approach. W10-3 (tracks right) on Roberts Ave for traffic toward the crossing. W10-3 (tracks left) on Surf Way for traffic toward the crossing.	yes with concrete panels	#9 on NB approach with the sidewalk arm and escape gate. #9-A on SB approach with sidewalk arm and escape gate protecting the sidewalk on west side of crossing, extend concrete panels for striped crosswalk (both sides). Automatic Pedestrian Sidewalk Warning Device with arm and escape gate protecting the sidewalk on the west side of crossing opposite to the #9 warning device.	I-13 or I-13a (Emergency Notification Sign)
	1		**Private Crossing (Treatment Plant Driveway)**	124.60	EE-124.60X	752299X	1	1 SB, 1 NB	None	STOP (R1-1) with PRIVATE CROSSING (CPUC Standard 1-X) mounted below stop sign.	Del Monte Ave.	No	NA	STOP (R1-1) with PRIVATE CROSSING (CPUC Standard 1-X) mounted below stop sign.	NA	No	None	None
1		LRT-28(D) SD-28	**Park Avenue (La Playa) Crossing closed, need to reopen at-grade crossing closed 1/03/87**	125.24	EE-125.2	752300P	2	1 SB, 1 NB	None	On NB approach, #9 on right side. On SB approach #9 on right side.	Del Monte Ave.	No	12 **within 50', should consider pre-signals on SB approach.**	Crossbuck (R15-1) on #9, RR Crossing Symbol Pavement Markings with adjacent Advance Warning (W10-1), Number of Tracks (W48(CA)) 2 tracks on both approaches. Stop Here on Red (R10-6) and No Turn on Red (R10-11) adjacent to Stop Bar on SB approach. Consider placing Do Not Stop On Tracks (R8-8) on the right side, or both sides, either on the near side or the far side to provide sufficient visibility for motorists approaching or stopped on the crossing.	Signalize Del Monte Avenue intersection that includes preemption. Install R3-1 (Activated Blank Out, No RT Turn) at both the stop line on Del Monte Ave. for the right turn lane toward the crossing and the upstream signal mast on Del Monte Ave. W10-2 (tracks right) for WB Del Monte Ave. approach. W10-2 (tracks left) for EB Del Monte Ave. approach. W10-2 (tracks right) for WB La Playa approach. W10-2 (tracks left) for EB La Playa approach.	yes with concrete panels	#9 on NB approach. #9 on SB approach with sidewalk arm and escape gate protecting the sidewalk on west side of crossing, extend concrete panels for striped crosswalk (west side). Automatic Pedestrian Sidewalk Warning Device with arm and escape gate protecting the sidewalk on the west side of crossing, opposite to the #9 warning device.	I-13 or I-13a (Emergency Notification Sign)
1		LRT-29(B) SD-29	**Figueroa Street**	125.69	EE-125.6	752301W	1	2 SB, 3 NB	None	On NB approach, #9-A on right side with back sidewalk arm and escape gate and #9 in the median. On SB approach #9 on right side with back sidewalk arm and escape gate and #9 in median (need min. median width of 8'-6" for clearance).	Del Monte Ave.	Yes	3 (to Del Monte Blvd.) **within 50', should consider pre-signal on NB approach. NB: Install pre-signal traffic signal faces on cantilever arm of #9-A.**	Crossbuck (R15-1) on #9 and #9-A, RR Crossing Symbol Pavement Markings with adjacent Advance Warning (W10-1) on both approaches. Consider placing Do Not Stop On Tracks (R8-8) on the right side, or both sides, either on the near side or the far side to provide sufficient visibility for motorists approaching or stopped on the crossing.	Signalize intersection that includes preemption. Install R3-1 (Activated Blank Out, No RT Turn) at both the stop line on Del Monte Ave. for the right turn lane toward the crossing and the upstream signal mast on Del Monte Ave. W10-2 (tracks right) for WB Del Monte Ave. approach. W10-2 (tracks left) for EB Del Monte Ave. approach.	yes with concrete panels	#9-A on SB approach with sidewalk arm and escape gate protecting the sidewalk on west side of crossing. Extend concrete panels for striped crosswalk on both sides of the crossing. Auto-matic Pedestrian Sidewalk Warning Device with arm and escape gate protecting the sidewalk on the west side of the crossing opposite to the #9 and #9-A warning devices on the west and east sides of the crossing.	I-13 or I-13a (Emergency Notification Sign)
1		LRT-30(C) SD-30(C)	**Washington Street (Lighthouse) crossing closed, need to reopen at-grade crossing closed 1/01/87**	125.80	EE-125.8	752302D	1	Del Monte Blvd: 4 WB, 3 EB Lighthouse Ave.: 3 SB, 2 NB Washington Street: 2 NB, 1 SB	None	On SB Lighthouse approach to the parking lot entrance, #9 on left side, separate #9 on sidewalk with arm and escape gate on right side on both sides of tracks.	Del Monte Ave. and Lighthouse	Yes	20'	None at upstream approach. For downstream (away from tracks, into the parking lot) install Do Not Enter (R5-1) and Wrong Way (R5-1a) signs to prevent vehicles from trying to exit through the parking lot entrance.	Signalize intersection that includes preemption. Install R10-6 (Stop Here On Red) and R3-1 (Activated Blank Out, No RT Turn) at the stop line on Del Monte Ave. for the right turn lane toward the crossing. R3-1 (Activated Blank Out, No RT Turn) on the upstream signal mast on Del Monte Ave. W10-2 (tracks right) for EB Del Monte Ave. approach.		Automatic Pedestrian Sidewalk Warning Device with arm and escape gate protecting the sidewalk on the west side of crossing, on both sides of the tracks.	I-13 or I-13a (Emergency Notification Sign)
20	**16**																	

Drainage

Overall Hydrologic Conditions

Regional and local hydrologic conditions are described in the following paragraphs.

SOILS

The Salinas Valley Ground Water Basin is a deep alluvial basin that was formed as the Salinas River meandered across the valley toward the Pacific Ocean. The Salinas River deposited fluvial sediments, and tributary streams that originate in the surrounding mountain ranges deposited alluvial fan sediments. The Pliocene to Holocene water-bearing sediments comprise a sequence of interbedded sands, gravels and clays of at least 650 meters thick (Durbin, *et al*, 1978). The Monterey County Soil Survey identifies the soils in this area with soil permeability ranges from 6 to 20 inches per hour. The estimated 100-year, 24-hour rainfall depth for the area within the Monterey Branch Line footprint is 5.5 inches based on the Monterey County Department of Public Works Plate 25, Rainfall Intensities Chart shown at the end of this section. It can be shown that even under saturated conditions and given enough pervious area, all runoff generated within the Monterey Branch Line guideway and station platforms may be easily percolated back into the ground within the Monterey Branch Line right-of-way.

SURFACE HYDROLOGY

To help increase the utilization of Salinas River flows for groundwater recharge and to provide flood control benefits, Nacimiento and San Antonio Reservoirs began operations in 1957 and 1967, respectively. These reservoirs have been operated to optimize Salinas River recharge by storing winter runoff and making releases in a timely manner during the irrigation season, when the potential for recharge is highest.

The area is divided among numerous watersheds, or basins, that eventually consolidate at the Salinas River, Pajaro River, and Elkhorn Slough for release into Monterey Bay. The Monterey Branch Line lies within Salinas River Watershed as shown in Figure 9-8. The Salinas drainage basin is bounded on the south by the La Panza Range, on the southwest by the Santa Lucia Range, on the northwest by the Sierra de Salinas; and on the northeast by the Diablo Range and the Gabilan Range as shown in Figure 9-9. The mountains that form the northeastern, northwestern, and southwestern margins of the basin slope steeply and are dissected by streams that have carved steep canyons into the valley walls. The southeastern margin is characterized by gently rolling hills and broad valleys.

From Monterey northerly to Marina, runoff drains from east to west into Monterey Bay. Within the Salinas River watershed, the direction of flow is generally to the northwest. North of the Salinas River watershed, the project alignment sits on the ridge between Tembladero and Castroville Sloughs, which is the tributary of Moro Cojo Slough, which discharges to the Monterey Bay via Elkhorn Slough. The area south of Blackie Road drains into the Tembladero Slough. The area north of Blackie Road drains to either the Tembladero or Castroville Slough. The Tembladero Slough borders the southeast side of the Castroville boundary and is the primary drainage for the Gabilan Creek watershed. The Castroville Slough begins at a retention pond located on the east side of Castroville near the overpass of Highway 156 and railroad tracks. Both the Tembladero and Castroville Sloughs are influenced by tides, which in turn impact the storm drain system of Castroville (County of Monterey, 2004).

The project site is located within the jurisdiction of the Central Coast Regional Water Quality Control Board, Region 3. From north to south, the proposed alignment traverses the following hydrologic units and planning areas: the Bolsa Nueva hydrologic unit, the Salinas hydrological unit Lower Salinas Valley hydrologic area 309.10, and the Salinas hydrologic unit Monterey Peninsula hydrologic area 309.50 (Monterey County, 1994).

GROUNDWATER

The Salinas Valley is an important agricultural area growing a variety of row crops, making it a multi-billion dollar industry. The area is strongly dependent on groundwater, as it accounts for more than 95 percent of the water used for irrigated agriculture, industrial and municipal purposes. Recharge to the groundwater basin occurs primarily from precipitation, return flows from irrigated lands, and stream recharge from the Arroyo Seco and Salinas River. It is estimated that stream recharge accounts for approximately half of the total basin recharge (Monterey County Water Resources Agency, 1997).

The Salinas Valley overlies a single common aquifer that is divided into four hydrologically interconnected subareas known as the Pressure Area, the East Side Area, the Forebay Area, and the Upper Valley Area. The Pressure Area is located near the coast and covers an estimated surface area of 342 square kilometers. In the Pressure Area, three stratified aquifers exist under confined conditions. These aquifers are known as the Pressure 180-Foot, the Pressure 400-Foot, and the Deep Zone and are comprised of permeable sands and gravels separated by confining clay layers. Recharge to the Pressure subarea occurs from the unconfined units surrounding the Pressure subarea (DWR, 2003).

Groundwater subareas for the Monterey Bay vicinity are shown on Figure 9-9. The project site crosses Subbasin 3-4.01 (180/400 foot aquifer subbasin) and Subbasin 3-4.0801 (Seaside subbasin). Surface and groundwater basin boundaries are shown in Figure 9-10.

Existing Drainage System

At this stage of the project, the drainage system within the Monterey Branch Line corridor has been identified by San Benito Engineering & Surveying, Inc. from field investigations and record block maps provided by the respective agencies. A horizontal record of these facilities has been developed as well. No

Figure 9-8
Salinas River Watershed

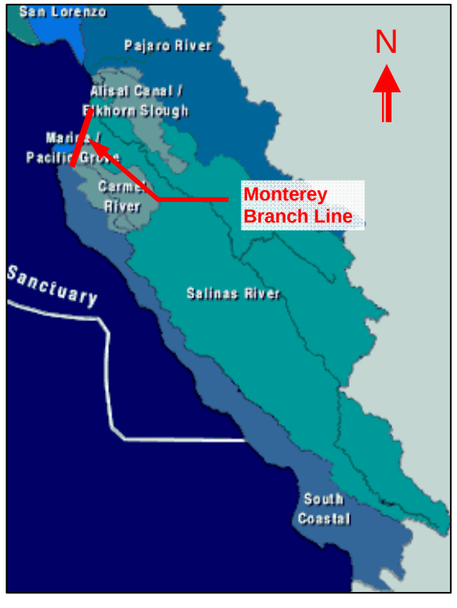
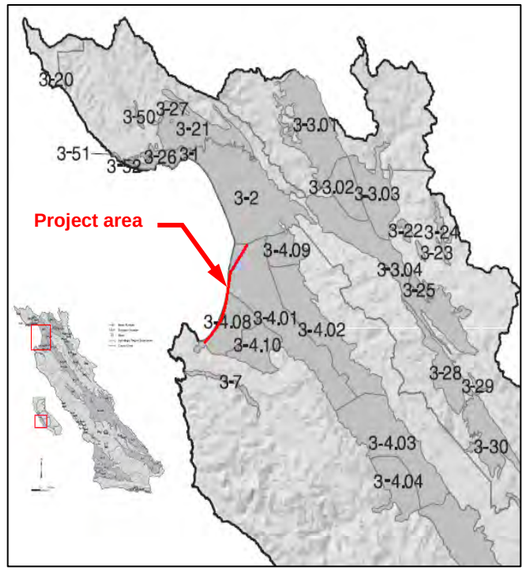


Figure 9-9
Groundwater Subareas for Salinas Valley Basin



vertical information (*i.e.*, as-built drawings, potholing) have yet been obtained. The list of existing known drainage facilities within the corridor is shown in Table 9-4. The drainage sheets at the end of this section show the storm drain systems.

Existing drainage facilities within the regional system either cross perpendicular to, or run longitudinally along, the rail corridor. The drainage systems crossing within the Transportation Agency for Monterey County right-of-way are located in easements from the Transportation Agency for Monterey County with the respective utility owner.

Figure 9-10
Salinas Drainage Basin

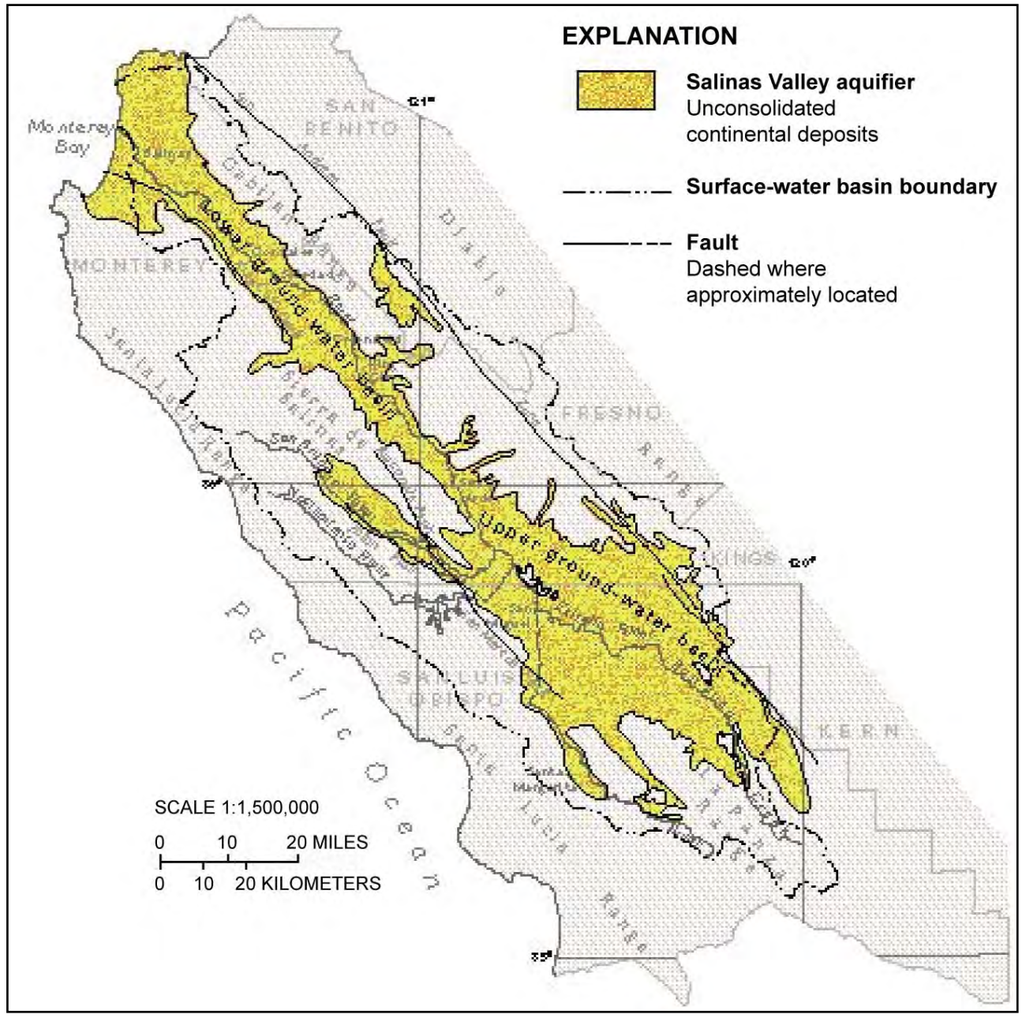


Table 9-4
KNOWN UTILITY FACILITIES WITHIN THE PROJECT LIMITS

Sheet No./ Improvement	Item	Station	Location/Description	Quantity (LF)
UT-2				
	24-inch storm	3+34	Transverse to tracks	20
	16-inch storm	15+94	Transverse to tracks	20
	Storm drain catch basin	15+94	Right side of tracks	N/A
UT-7				
	36-in storm	153+10 to 166+75	Parallel to tracks	21
UT-13(A)				
	36-inch storm	329+18	Slight diagonal to tracks	21
Del Monte Boulevard improvements	Storm drain manhole	328+75		N/A
	24-inch storm	328+75	Diagonal to tracks (not cross)	65
	Storm	329+14	Diagonal to tracks (not cross)	39
	Storm	329+35	Diagonal to tracks (not cross)	49
UT-14(A)				
	12-inch CMP	359+14	Transverse to tracks	20
	8-inch water	359+66	Transverse to tracks	20
	24-inch storm	361+54	Transverse to tracks	20
	36-inch storm	432+09	Diagonal to tracks	44
	Storm	436+18	Transverse to tracks	35
	36-inch storm	455+17	Transverse to tracks	35
UT-20(A)				
	12-inch storm (not in use)	539+56	Transverse to tracks	20
	Storm	657+94	Transverse to tracks	35
UT-26(A)				
	24-inch storm	683+70 to 686+64	Diagonal to parallel to tracks	TBD
	36-inch storm	686+64	Transverse to tracks	20
	storm	683+15 to 684+90	Diagonal to tracks (not cross)	TBD
UT-27(A)				
	Storm drain catch basin	715+95	Shown in topo left of tracks	N/A
	Storm drain catch basin	716+78	Shown in topo left of tracks	N/A
	Fire hydrant	714+86	Right of tracks	N/A
	Fire hydrant	721+11	Right of tracks	N/A
Casa Verde Way track crossing	Storm	721+13	Slight diagonal to tracks	21
	Storm drain	721+13	Slight diagonal to tracks	13
	Storm drain catch basin	721+19	Right of tracks	N/A
	Storm drain catch basin	721+66	Right of tracks	N/A
	Storm drain	722+04	Diagonal to tracks	31
Monterey Wastewater Treatment Plant driveway track crossing	12-inch storm	735+51	Transverse to tracks	23
	12-inch storm	735+57	Transverse to tracks	23

Source: San Benito Engineering & Surveying, Inc., 2009

Proposed Drainage System

The typical single ballasted track cross-section is shown on Figure 9-11, while a typical double track ballasted track cross-section is shown on Figure 9-12. Since the center of the track is the high point, runoff percolates into the ballast to the compacted sub-ballast, where it flows longitudinally toward the swales on both sides of the tracks.

The typical retained track cross-section is shown in Figure 9-13, while Figure 9-14 shows a typical ballasted double-track section at an underpass. For these track types, an underdrain is proposed to be installed at bothbe installed at both ends of the retained track. Since the center of the track is the high point, runoff percolates into the ballast to the compacted sub-ballast, where it flows longitudinally toward the far end and into the underdrain. The underdrain is connected to the outside drainage system to a runoff discharge point.

Figure 9-11
Single Track Ballasted Track Cross-section

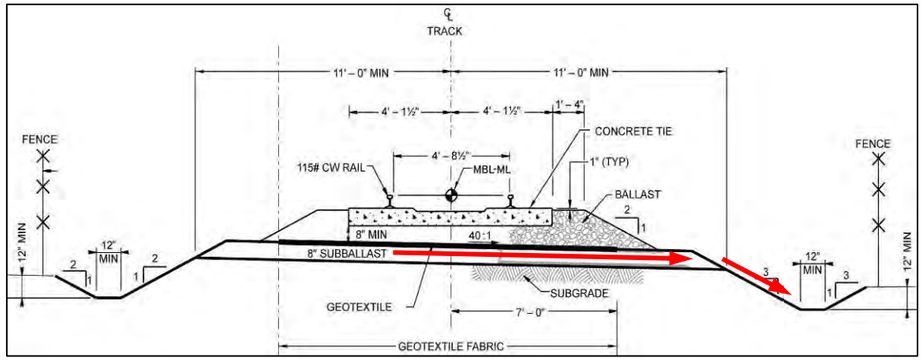


Figure 9-12
Double Track Ballasted Track Cross-section

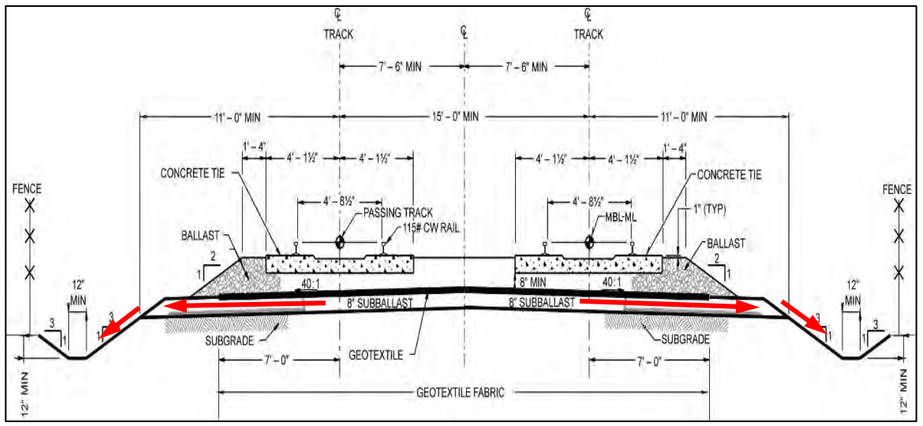


Figure 9-13
Typical Retained Track Section—Tangent

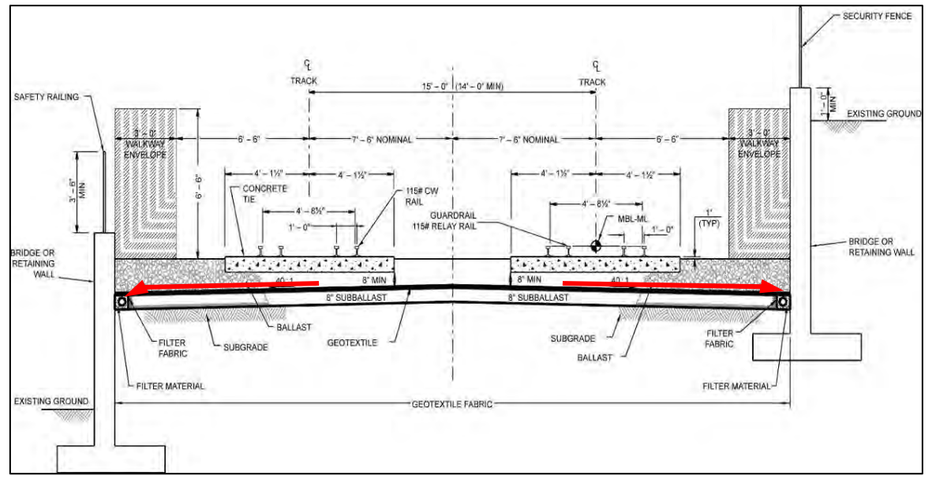
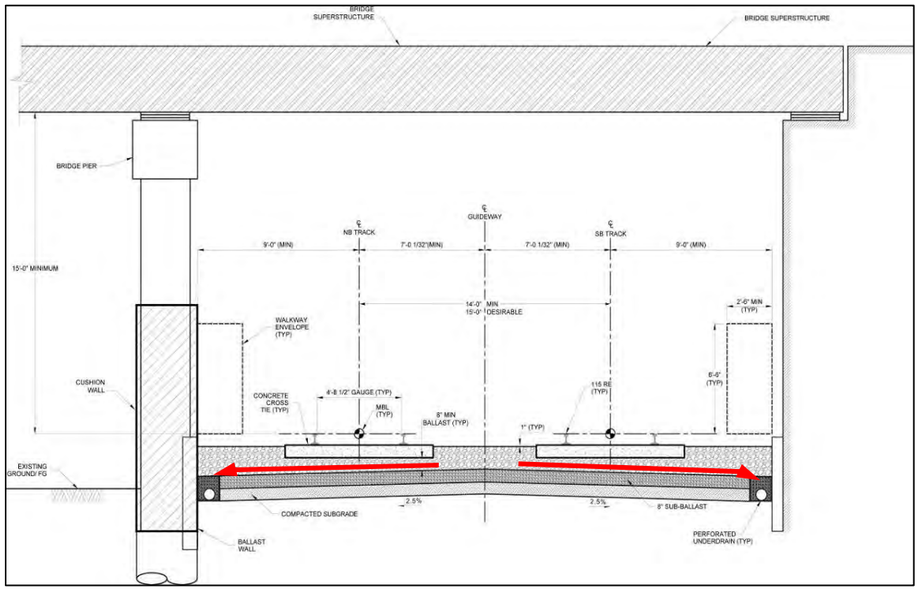


Figure 9-14
Ballasted Double Track Section at Underpass



Impacts on Existing Drainage System

The vast majority of improvements within the 16-mile-long project site would involve only minor increases in impervious surfaces. Since the project entails upgrading of the existing Monterey Branch Line line, pre- and post-project drainage conditions would be similar. It is anticipated that existing drainage flow patterns would be only slightly modified with the project. There would be increases in impervious surfaces at the proposed 13 stations along the alignment. Best management practices will be included in the project for station waiting platforms (*e.g.,* trash receptacles) and parking lots (*e.g.,* landscaped swales). The project will be designed so that runoff from the station sites would not exceed pre-project conditions. Given these considerations, there would be no permanent hydraulic impact to the drainage network associated with the proposed project.

Salinas River Floodplain

PRE-PROJECT CONDITIONS

Two ordinances regulate floodplain development in Monterey County. Countywide floodplain ordinance No. 3272 includes the minimum Federal Emergency Management Agency (FEMA) requirements for participation in the regular phase of the National Flood Insurance Program and has been codified in Chapter 16.16 of the County Code. Development within the 100-year floodplain or within 200 feet of the riverbank requires a Use Permit from the Monterey County Planning and Building Inspection Department. As defined in County Code, development means any man-made change to improved or unimproved real estate including, but not limited to, buildings or other structures, mining, dredging, filling, grading, paving, excavation, or drilling operations (Monterey County, 2003).

Flood insurance rate maps prepared by the FEMA were reviewed to identify the locations of 100-year floodplains within the area. Flood insurance rate maps for the project site, with proposed alignment shown in red, are provided as Figures 4-15 through 4-24. Several miles of the 16-mile project corridor are located within or adjacent to 100-year floodplains. The most substantial encroachments into the 100-year floodplain occur at the following locations: on both sides of Tembladero Slough and the Salinas River, south of Roberts Lake, north of Del Monte Lake, and north of El Estero Lake.

As shown on Figure 9-15, the segment from the beginning of the Monterey Branch Line near Blackie Road southerly to the Salinas River traverses land designated as both Zone X and Zone AE. The corridor crosses Tembladero Slough just south of the State Route 183 crossing. Further south, as shown on Figure 9-16, the alignment traverses the Zone AE floodplain associated with both Tembladero Slough (north of Nashua Road) and the Salinas River (south of Nashua Road).

Moving south and traversing the city of Marina and adjacent unincorporated land, there are isolated patches of flood-prone land designated as both Zone AE and Zone X. As shown on Figure 9-17, however, most of the existing Monterey Branch Line appears to be elevated above these scattered, flood-prone areas. Near Reindollar Avenue, about 300 feet of the Monterey Branch Line is in the vicinity of Flood Zone AE, as shown on Figure 9-18.

From First Street to Olympia Avenue, in and adjacent to the cities of Seaside and Sand City, the Monterey Branch Line represents the western boundary of Flood Zone X, as shown on Figures 9-19 through 9-21. From Olympia Avenue to the east end of Roberts Lake, the Monterey Branch Line is located within Flood Zone X, as shown on Figure 9-21. The rail corridor, both in the vicinity of Roberts Lake and across Canyon Del Rey Boulevard, is designated as Flood Zone AE.

Figures 9-23 and 9-24 show the alignment from Casa Verde Way in the city of Monterey westerly to the project terminus at Fisherman's Wharf, which is predominantly located within Flood Zone X. The area where the corridor traverses north of El Estero Lake from Park Avenue to Cortes Street is within Flood Zone AE as shown in Figure 9-24.

Figure 9-15
Flood Map 06053C0088G

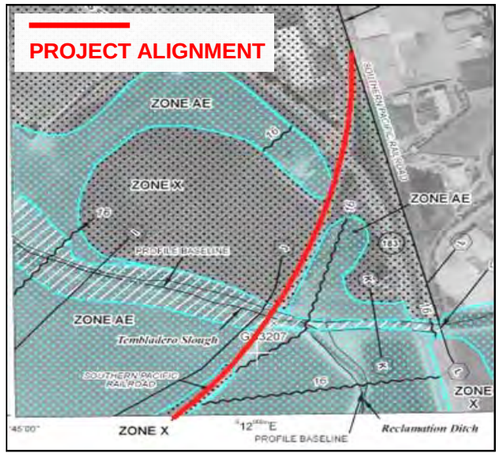


Figure 9-16
Flood Map 06053C0185G

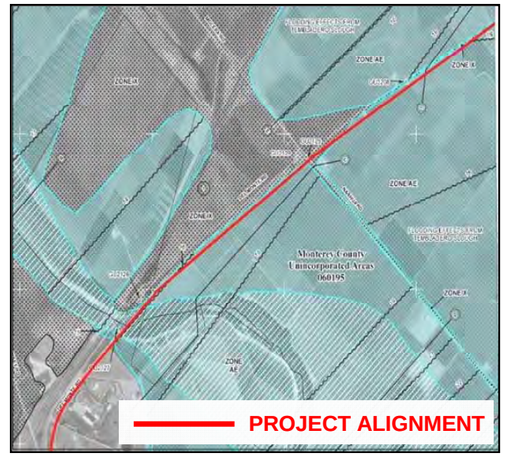


Figure 9-17
Flood Map 0653C0185G

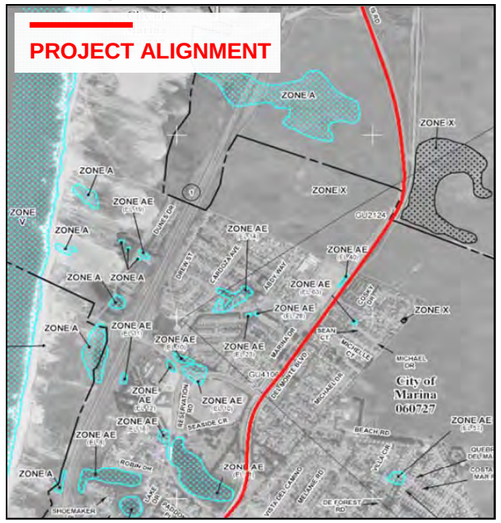


Figure 9-18
Flood Map 06053C0195G

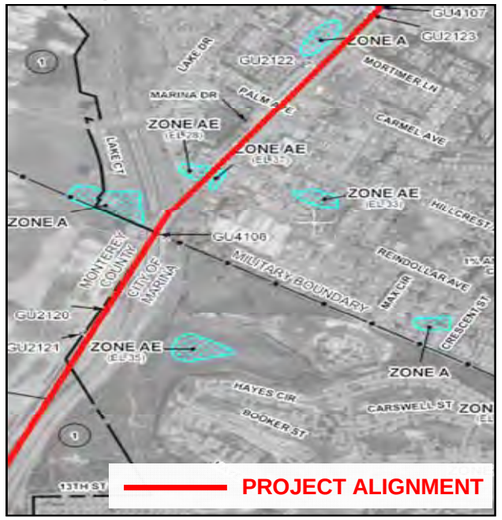


Figure 9-19
Flood Map 06053C0190G-1

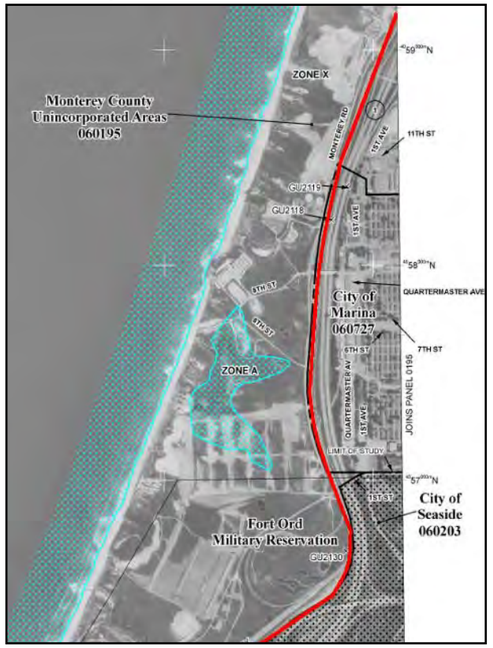


Figure 9-20
Flood Map 06053C0190G-2

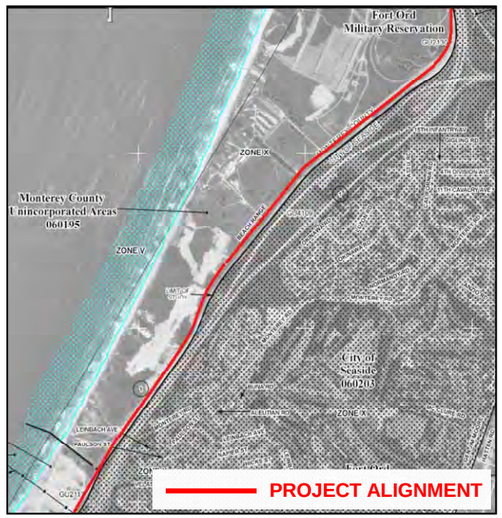


Figure 9-21
Flood Map 06053C0326G

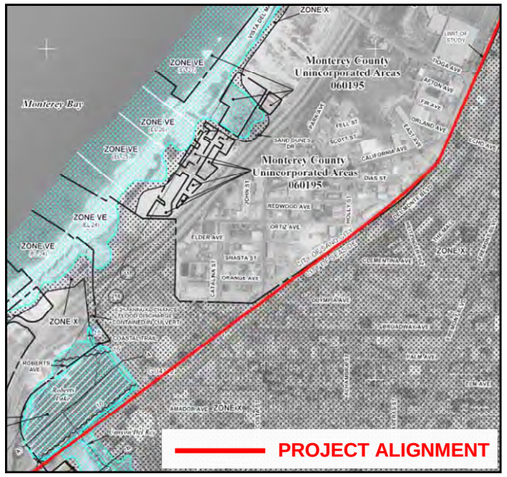


Figure 9-22
Flood Map 06053C03270G

Figure 9-23
Flood Map 06053C0326G

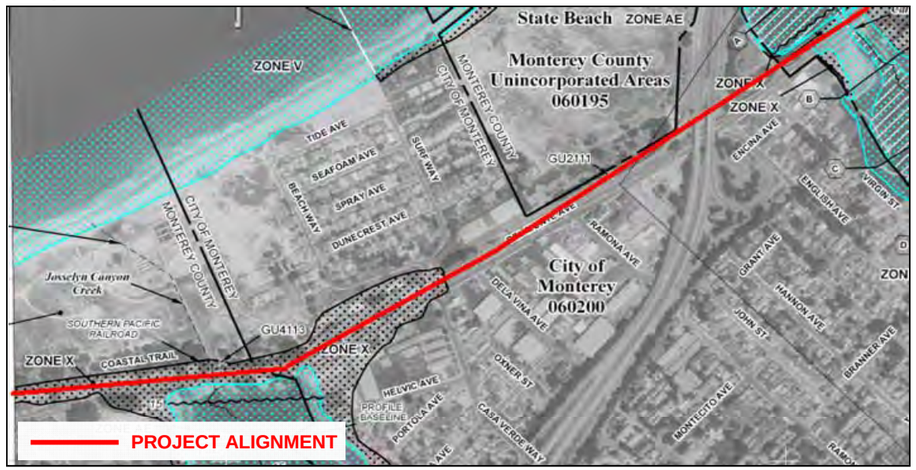
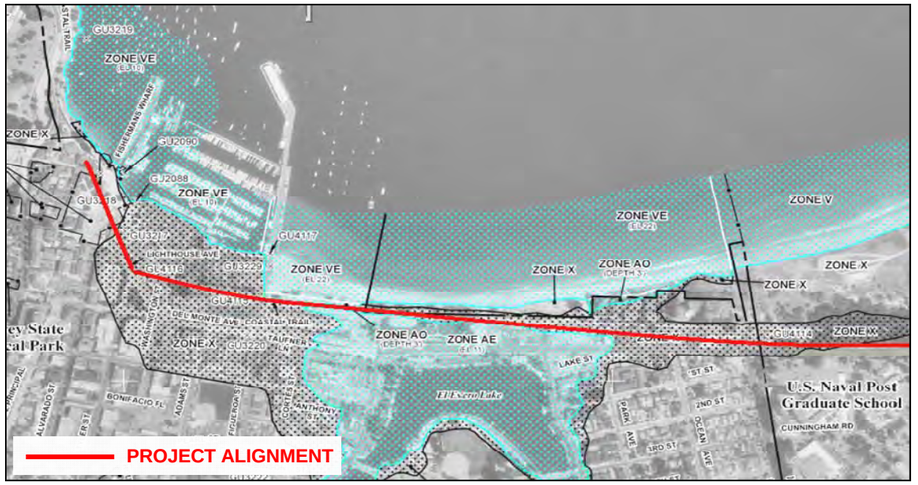


Figure 4-9-24
Flood Map 06053C0307G



POST-PROJECT CONDITIONS

Regulations governing the National Flood Insurance Program (23 CFR 650, Subpart 6A Section 650) were used as guidance for the evaluation of floodway impacts, which focuses on FEMA-defined floodways. Section 650.111 calls for location hydraulic studies to be performed with detailed engineering design drawings, and lists five location considerations to be examined for floodplain encroachments:

- Risks associated with implementation of the action.
- Impacts on the natural and beneficial floodplain values.
- Support of incompatible floodplain development.
- Measures to minimize impacts associated with the action.
- Measures to restore and preserve the natural and beneficial floodplain values impacted by the action.

Impacts of the project with respect to the five location considerations are considered in the following discussion. The No-Build Alternative would have no impact on floodplains, because it would involve continuation of existing bus services.

- **The risks associated with implementation of the action.** The risks associated with the project are very low. The floodplain areas affected by the project are already occupied by a railroad facility.
- **The impacts on natural and beneficial floodplain values.** No long-term impact on natural beauty, outdoor recreation, aquaculture, natural moderation of floods, or water quality is anticipated. Short-term construction impacts can be mitigated by scheduling activities in the floodplain during the dry season and by implementing erosion and other pollution control practices.
- **The support of probable floodplain development.** The proposed project would restore passenger rail service along an existing rail line, which passes through or adjacent to several areas of 100-year floodplain. While the proposed project could induce development within the vicinity of the 13 planned stations, most of these are located in an urban environment and outside of designated floodplain area. Although the project passes through floodplains, it is unlikely to induce any development in those floodplains.
- **The measures to minimize floodplain impacts associated with the action.** At some locations where the project corridor passes through narrow or isolated floodplains, the Transportation Agency for Monterey County will determine whether it is possible to avoid floodplain encroachment. In areas where groundwater is shallow and there is potential to affect riparian habitat or encounter hazardous wastes, platform shelter foundation siting and/or modification of construction techniques (including steel casing and other methods) will be explored to minimize the potential for impacts. Within designated floodplain areas, there should be minimal need for additional impervious surfaces; however, new pavement required for rail station access and/or parking will be improved using either gravel or a permeable paving product to minimize runoff.
- **The measures to restore and preserve the natural and beneficial floodplain values impacted by the action.** The goal of hydraulic design for bridges and culverts is to convey surface and stream waters originating upstream of the drainage facility to the downstream side without causing objectionable backwater, excessive flow velocities, excessive scour, or unduly affecting traffic safety. The hydraulic drainage design criteria reported at the end of this section have been developed to accomplish this goal.[1]

Culverts will be sized to accommodate the 100-year storm event with a time of concentration equal to the watershed time of concentration. The 100-year storm event should not overtop the embankment or headwall of the culvert. To the extent feasible, construction within designated floodplain areas will be scheduled to occur during the dry season. Erosion and sediment control practices will be implemented during construction, as discussed below.

[1] State-of-the-art methods and procedures for the hydrologic analysis required to determine the severity and probability of occurrence of flood events are inherently ambiguous. Therefore, the drainage design criteria reported at the end of this section are provided for guidance only and is not intended to establish legal or design standards, which must be strictly adhered to.

Stormwater Quality

This section addresses existing water quality issues within the project region, as well as projected water quality impacts associated with the proposed project. Where appropriate, mitigation measures to offset potentially adverse impacts are recommended.

BENEFICIAL USES AND WATER QUALITY OBJECTIVES

Surface Water Quality

Through the California Porter Cologne Water Quality Control Act, each Regional Water Quality Control Board is required to formulate and adopt water quality control plans, or basin plans, for all areas within the region. In addition, each Regional Water Quality Control Board needs to establish water quality objectives to ensure the reasonable protection of beneficial uses and a program of implementation for achieving the water quality objectives within the basin. In California, the beneficial uses and water quality objectives are the State's water quality standards. Beneficial uses identified by the Central Coast Regional Water Quality Control Board for water bodies within the study area are identified on Table 9-5.

Water quality objectives are the limits or levels of water quality constituents or the characteristics of a waterbody that are established for the protection of the aforementioned beneficial uses. Water quality objectives are either numeric limits or narrative objectives designed to ensure that bodies of water can support their designated beneficial uses. At concentrations equal to or greater than numeric objectives, constituents (or pollutants) are considered to have impaired the beneficial uses of the state's water.

Section 303(d) of the Clean Water Act mandates that states identify waters that do not meet, or are not expected to meet during the next listing cycle, applicable water quality standards after application of certain technology-based controls. Table 5-2 lists fresh water receiving bodies in the vicinity of the subject project that are listed by the State Water Resources Control Board under Section 303(d) of the Clean Water Act. Pollutants identified (bacteria, nitrates, pesticides, sedimentation) reflect the agricultural nature of the Castroville region.

Table 9-5
BENEFICIAL USES OF POTENTIALLY-AFFECTED WATER BODIES

	Basin Plan Uses*															
Waterbody	**MUN**	**GWR**	**REC1**	**REC2**	**WILD**	**COLD**	**WARM**	**MIGR**	**SPWN**	**BIOL**	**RARE**	**EST**	**NAV**	**COMM**	**AQUA**	**SHELL**
Elkhorn Slough			X	X	X	X	X	X	X	X	X	X	X	X	X	X
Moro Cojo Slough		X	X	X	X	X	X		X	X	X	X		X		X
Old Salinas River Estuary			X	X	X	X	X	X	X	X	X	X		X		X
Tembladero Slough			X	X	X		X		X		X	X		X		X
Robert's Lake	X		X	X	X	X	X							X		
Del Monte Lake	X		X	X	X		X							X		
El Estero Lake	X	X	X	X	X	X	X		X					X		
Salinas River Lagoon (N)			X	X	X	X	X	X	X	X	X	X		X		X

*MUN = Municipal; GWR = Groundwater Recharge; REC1 = Water Contact Recreation; REC2 = Non-contact Water Recreation; WILD = Wildlife Habitat; COLD = Cold Freshwater Habitat; WARM = Warm Freshwater Habitat; MIGR = Migration of Aquatic Organisms; SPWN = Spawning, Reproduction and/or Early Development; BIOL = Preservation of Biological Habitats; RARE = Rare, Threatened or Endangered Species; EST = Estuarine Habitat; NAV = Navigation; COMM = Commercial and Sport Fishing; AQUA = Aquaculture; SHELL = Shellfish Harvesting

Source: Regional Water Quality Control Board 1994.

Total maximum daily loads denote the quantity of a pollutant that can be assimilated by a water body and still meet water quality objectives. Total maximum daily loads are also referred to as the loading capacity or assimilative capacity of the water body. Table 9-6 also shows the schedule for development of total maximum daily loads (TDML).

Table 9-6
SECTION 303(d) LISTED WATER BODIES

Name	Calwater Watershed	Pollutant/ Stressor	Potential Sources	Estimated Size Affected	Proposed TMDL Completion
Alisal Creek (Salinas)	30970093	Fecal coliform	Agriculture Urban runoff/storm sewers Natural sources Nonpoint sources	7.4 miles	2007
		Nitrate	Source unknown	7.4 miles	2007
Elkhorn Slough	30600014	Pathogens	Natural sources Nonpoint source	2034 acres	2015
		Pesticides	Agriculture Irrigated crop production Agricultural-storm runoff Agricultural return flows Erosion/siltation Contaminated sediments Nonpoint source	2034 acres	2008
		Sedimentation/siltation	Agriculture Irrigated crop production Agriculture-storm runoff Channel erosion Nonpoint source	2034 acres	2015
Lower Salinas River	30917000	Fecal coliform	Source unknown	31 miles	2007
		Nitrate as Nitrate (NO_3)	Source unknown	31 miles	2019
		Nutrients	Agriculture	31 miles	2007
Tembladero Slough	30911010	Ammonia (unionized)	Source unknown	5 miles	2019
		Fecal coliform	Agriculture Pasture grazing-riparian and/or upland Urban runoff/storm sewers Natural sources	5 miles	2007
		Nutrients	Agriculture Irrigated crop production Agriculture-storm runoff Agriculture-irrigation tailwater Agricultural return flows Nonpoint source	5 miles	2006

Groundwater Quality

The water quality in the Salinas Valley basin is generally acceptable for most uses with dissolved solids generally less than 800 mg/liter (Planert and Williams, 1995). However, due to intensive agricultural practices and urban growth, the water needs of the northern Salinas Valley currently exceed the natural recharge of the underlying aquifer. In particular, pumping in excess of replenishment has gradually lowered the groundwater table decreasing the pressure gradient in the confined portion of the aquifer near the coast. The decreased pressure gradient has resulted in a landward hydraulic gradient, thus inducing seawater intrusion. This effect has degraded the ground waters of the Pressure 180-Foot, and 400-Foot aquifers along the coastal areas of the valley. High chloride levels have rendered the seawater-intruded ground waters too salty for municipal and agricultural use.

Efforts to halt the advancement of seawater intrusion have been implemented by the local water resources agency charged with management of the groundwater resources. Some of the measures in place designed to help with the seawater intrusion problem include, for example, the implementation during the summer months of scheduled flow releases from two reservoirs located upstream on the Salinas River. The water releases are designed to augment the natural groundwater recharge to the aquifers. Also, in lieu of groundwater, growers are now using recycled water to irrigate crops farmed near the coastal areas of the valley. The purpose of using recycled water is to reduce or cease groundwater pumping near the coast. The reduction in pumping is expected to raise the groundwater levels of the aquifer, and thus stop and/or reverse the movement of seawater intrusion by maintaining the groundwater hydraulic gradient seaward.

Seawater intrusion into the Pressure subarea was occurring at an annual rate of approximately 14,000 acre feet per year prior to initiation of operations of the Monterey County Water Recycling Projects. The Monterey County Water Recycling Projects delivers recycled water as irrigation water for the Castroville Seawater Intrusion Project. As the Monterey County Water Recycling Projects becomes fully operational, delivering approximately 13,300 acre feet per year of recycled water, the annual rate of seawater intrusion is projected to decrease to approximately 8,800 acre feet per year.

Water Quality Impacts and Mitigation

Anticipated pollutants generated from access and parking facilities associated with the project include heavy metals, organic compounds (including petroleum hydrocarbons), sediments, trash and debris, and oil and grease. Treatment best management practices (BMPs) shall be selected for removal of such pollutants and will mitigate any stormwater pollution that could be attributed to the proposed project.

The total disturbed area is estimated at approximately 75 acres, of which approximately 60 acres is expected to flow to ballasted track. The ballasted track acts as an infiltration trench. The ballast is rock underlain by a sub-base that in some sections drains to perforated plastic pipes located on the outer sides of the tracks. The perforated plastic pipes are surrounded by permeable material, making the system act as an infiltration trench. Water from the underdrains enters the local storm drain system that flows to the Pacific Ocean either directly or via the aforementioned water bodies.

Because of the nature of the light rail, there will be very few pollutants of concern. There is little potential for hydrocarbon contamination and trash/debris will be caught in the ballast. Placement of ballast and underdrains along the track actually reduces the impervious surface and would generally improve water quality since it acts as a 60-acre infiltration trench, approximately one foot deep (60 acre-foot of volume).

The parking facilities will be equipped with bio-swales or other BMPs depending upon site limitations. Locations for these facilities will be determined during the design stage of the project. Media filters in the storm drain system will also be considered. Other BMPs to be evaluated would include infiltration basins or infiltration trenches; however, these may not be practical depending on site-specific soil and groundwater considerations, or may require too much space for treatment in developed areas.

Evaluation of Best Management Practices

BMP REMOVAL EFFICIENCIES

BMPs are designed and implemented to reduce the discharge of pollutants from the storm drain system to the maximum extent practicable. Since this project comprises more than 5,000 square feet of paved surface, it falls into projects categorized as requiring BMPs to be used in the project. Permanent treatment BMPs evalu-

ated for the locally preferred alternative are mentioned previously with a primary focus for this project on biofiltration swales. Landscaped swales are generally considered to have medium pollutant removal efficiency for sediment, metals, oil and grease, and organic compounds. For trash, biofiltration swales have low removal efficiency unless they are equipped with a grate or trash rack at the outlet. They have low removal efficiency for bacteria. Removal efficiencies are categorized as low (20 to 50 percent), medium (50 to 80 percent), and high (80 to 100 percent).

Biofiltration swales, the primary BMPs for the subject project, are described in greater detail below.

BIOFILTRATION SWALES

Biofiltration swales are open, shallow channels with vegetation covering the side slopes and bottom that collect and slowly convey runoff flow to downstream discharge points. They are designed to treat runoff through filtering by the vegetation in the channel, filtering through a subsoil matrix, and/or infiltration into the underlying soils. Swales can be natural or manmade. They trap particulate pollutants (suspended solids and trace metals), promote infiltration, and reduce the flow velocity of stormwater runoff. Biofiltration swales can serve as part of a stormwater drainage system and can replace curbs, gutters, and storm sewer systems. Table 9-7 presents detailed descriptions of design concerns, while Figure 9-25 displays a bio-swale schematic.

Temporary Construction Best Management Practices

While the project involves construction of an above-grade facility along an existing railroad corridor, there would be extensive grading and excavation required to develop the new track, construct stations and parking lots, install or move utilities, etc. This work would require exposure and stockpiling of soil, development of fill slopes, and minor alterations of drainage patterns. There would also be a reduction in impervious surfaces at some station locations. Exposed soil and slopes could result in erosion and concentrated flow conveyance during storm events, resulting in on-and off-site erosion and downstream sedimentation into surface waters.

The water quality of the surface water courses could be degraded due to additional pollutant concentrations in runoff from the disturbed areas. Other potential sources of stormwater pollution during construction include delivery, handling and storage of construction materials and waste, spills and leaks from heavy vehicle equipment, staging areas for the use of paints, solvents, cleaning agents, metals, and other materials during construction, hazardous materials from demolition of existing structures, spilled concrete rinsate, and vegetation requiring irrigation with fertilizers and pesticides.

To minimize impacts associated with construction activities, temporary stormwater pollution prevention practices are required in accordance with the State of California NPDES General Permit for Storm Water Discharges associated with Construction Activities. The BMPs must be incorporated into a Stormwater Pollution Prevention Plan, which details the placement, staging, and monitoring of BMPs required for project construction. These include BMPs designed to control discharges of pollutants from regulated construction projects and include pollutants from stormwater and non-stormwater discharges.

Because the proposed project will be constructed over the Salinas River and other water courses, special construction BMPs are required to minimize debris deposition into these waterways. These temporary control measures are also required pursuant to the State of California NPDES General Permit for Storm Water Discharges associated with Construction Activities. Potential BMPs for such activities include the following:

- Demolition and construction activities either within or over waterways should be limited to the dry season (April 1 to October 31).
- Demolition should be accomplished using non-shattering methods that would normally scatter debris (*e.g.*, wrecking balls will not be acceptable).
- Place platforms under/adjacent to bridges to collect debris.
- Provide watertight curbs or toe-boards on bridges to contain spills and prevent materials, tools, and debris from falling from the bridge.
- Secure all materials on the bridge to prevent discharges into the channel via wind.
- Use attachments on equipment, such as backhoes, to catch debris from small demolition operations.
- Stockpile accumulated debris and waste generated from demolition away from channels.
- Work areas within channels are to be isolated from the river or stream flows using sheet piling, K-rail, or other methods of isolation.
- Drip pans are to be used during equipment operation, maintenance, cleaning, fueling, and storage for spill prevention. Drip pans are to be placed under all vehicles and equipment on the bridge when expected to be idle for more than 1 hour.
- Keep equipment used in the channel leak-free.
- Direct water from concrete curing and finishing operations away from inlets and water courses to collection areas for dewatering.
- Convey groundwater discharge from dewatering operations for pile installation into an acceptable sediment containment bin or basin. Test and treat the contained water prior to discharge as per requirements set forth by the Central Coast Regional Water Quality Control Board.

Other general protection measures will be applied to the proposed project in accordance with the aforementioned General Construction Permit and the project-specific Stormwater Pollution Prevention Program. These are typically required for soil stabilization and sediment control, non-stormwater management, and waste management. With application, monitoring, and maintenance of these BMPs, water quality impacts associated with the project are not expected to be adverse.

Table 9-7
BIOFILTRATION SWALE DESIGN DETAILS

Description	Issues	Preliminary Design Factors
• Bio-swales are vegetated channels that receive and convey stormwater. • Treatment Mechanisms: – Filtration through the grass – Sedimentation – Adsorption to soil particles – Infiltration • Pollutants removed: – Debris and solid particles – Some dissolved constituents	• Site conditions and climate must allow vegetation to be established. • Flow velocities must be low enough to avoid scour. • Maintenance required to prevent excess vegetative growth.	• Bio-swales sized as a conveyance system (per Caltrans flood routing and scour procedures). • Bio-swale water depth as shallow as the site will permit. • No minimum dimensions or slope restrictions for treatment purposes with the exception of velocity constraints. • Vegetation mix should be appropriate for climate, aesthetic, and flow requirements.

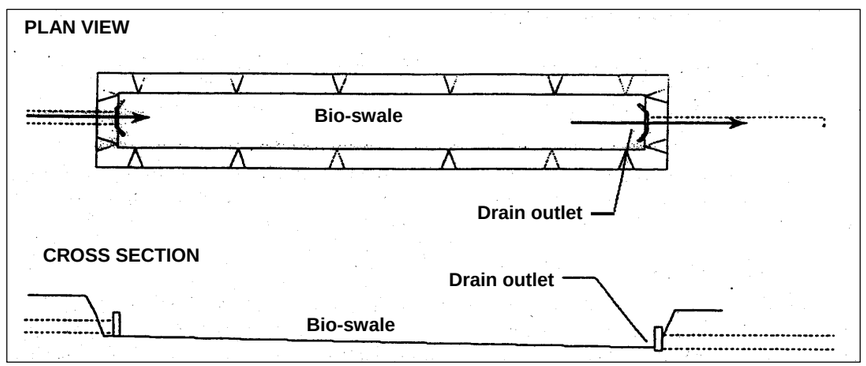


Figure 9-25 Schematic of a Biofiltration Swale

Site Drainage Characteristics

The following narrative describes the land use, floodplain terrain, and other drainage characteristics observed from a ground reconnaissance of the Monterey Branch Line.

FROM NORTH TERMINUS TO STATE ROUTE 183

The project begins/ends just north of Blackie Road and runs parallel to a local street, Del Monte Road. The runoff from the street drains to the two storm drains at track station 3+34 as shown on sheet DR-01 at the end of this section.

Figure 9-26
Rail East of State Route 183 Looking South

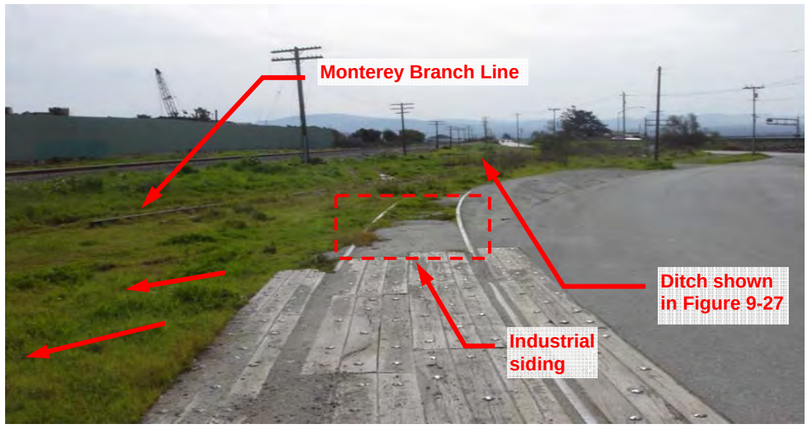


Figure 9-27
Ditch at the Southeast Corner of State Route 183 and Light Rail Looking North

Away from the street, the runoff from Del Monte Road drains east to the grassland and south to the culvert as shown in Figure 9-26. The culverts drain to the ditch shown on Figure 9-27 at the southeast corner of State Route 183.

The runoff near the track just north of State Route 183 drains east to the grassland and north to the culvert as shown in Figure 9-28. There is ponding at the southeast corner of State Route 183 and the rail right-of-way as shown in Figure 9-29.

Figure 9-28
Drainage at Southeast Corner of State Route 183 and Rail Looking South

Figure 9-29
Ponding at the Northwest Corner of State Route 183 and Rail

STATE ROUTE 183 TO TEMBLADERO SLOUGH

The grade crossing at Merritt Street (State Route 183) is shown in Figure 9-30. The track will be embedded and the drainage at the grade crossing will be accommodated by the drainage of the roadway.

Figure 9-30
Grade Crossing at State Route 183 Looking South

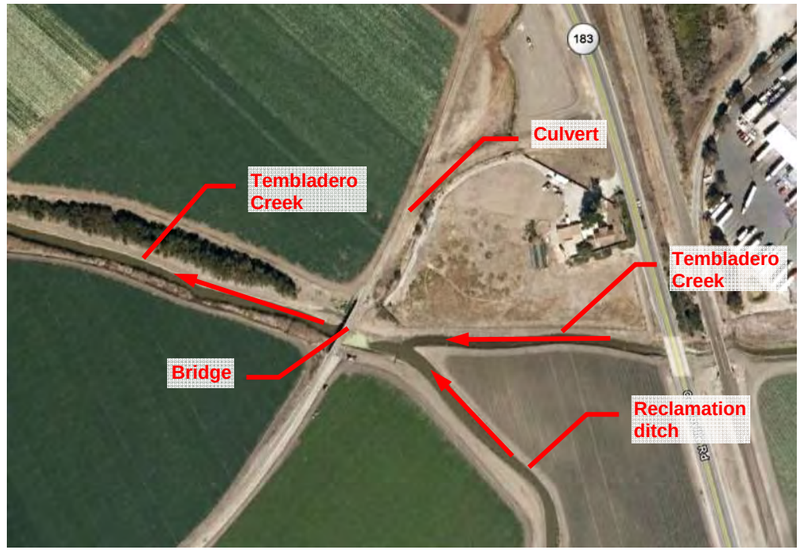
The runoff discharges to the ditch on the southeast as shown in Figure 9-31. The ditch on the east drains south to the Tembladero Creek. West of the track is the agricultural field, and east of the ditch on the east side is a small ranch.

Figure 9-31
Rail South of Merritt Street Looking South

The culvert at station 15+94 is shown in Figure 9-32. The location of this culvert is shown in Figure 9-33. Half of the culvert has been filled up and needs to be cleaned. The culvert carries runoff west to the ditch on the east, as shown in Figure 9-33, and then discharges to Tembladero Creek.

Figure 9-32
Culvert at Tembladero Slough

Figure 9-33
Drainage Features near Tembladero Slough



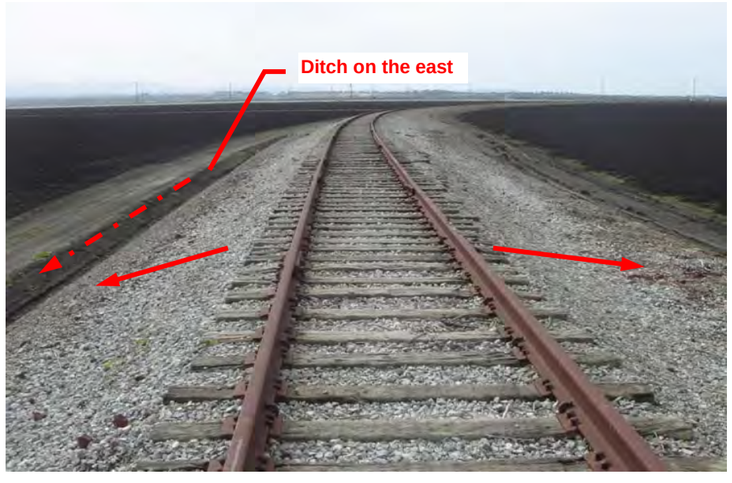
The bridge over the Tembladero Slough at MP 111.05 is a 150-foot-long pile trestle, ballast deck timber bridge and is on a one degree curve as shown in Figure 9-34. The bridge will be replaced with pre-stressed concrete girders on driven concrete piles with an increased length of 180 feet. The replacement will not affect the encroachment of the floodplain. At the rail bridge, the reclamation ditch flows westerly and joins the Tembladero Slough, which flows west as shown in Figure 9-33.

TEMBLADERO SLOUGH TO ALISAL SLOUGH

South of Tembladero Creek, the east side of the track is lower than the west side, and the east side has a naturally formed ditch along the edge of the subballast as shown in Figure 9-35. The track runoff flows off the center of the track, and flows north to the Tembladero Creek.

Figure 9-34
Bridge at Tembladero Creek

Figure 9-35
South of Tembladero Slough Looking South



There are ponding spots, especially when there is heavy farm equipment traffic as shown in Figure 9-36. From Tembladero Creek to Alisal Slough, the track runoff drains off the center of the track and south to the Alisal Slough.

At MP 112.54, as shown in Figure 9-37, a timber trestle bridge crosses over the Alisal Slough. The overcrossing has been backfilled to remedy a mosquito abatement problem caused by the adjacent agricultural pump station. A culvert crosses under the embankment to convey water pumped from south of the track to the north into the Alisal Slough. Figure 9-38 shows the cross-section at the embankment, and Figure 9-39 shows the north side of the track, and the location of the pump station.

Figure 9-36
Ponding along the Edge of Rail Looking South

Figure 9-37
Alisal Earth Embankment at MP 111.93

Figure 9-38
Alisal Slough Looking East

Figure 9-39
Alisal Slough North of the Track

ALISAL SLOUGH TO NASHUA ROAD

From Alisal Slough to Nashua Road, the track runoff drains off the center of the track and south to Alisal Slough. Figure 9-40 shows the track looking east at Alisal Slough from Nashua Road. There is ponding on the north side of the track. The runoff travels off the center of the track and into the side ditches which have been filled by the adjacent land owners to create farm access unpaved roads. The elevation on the north side is much lower than that on the south side of the track. From Alisal Slough to Nashua Road, the track runoff drains off the center to the adjacent agricultural fields.

Figure 9-40
Looking East from Nashua Road

NASHUA ROAD TO BRIDGE AT MP 112.54

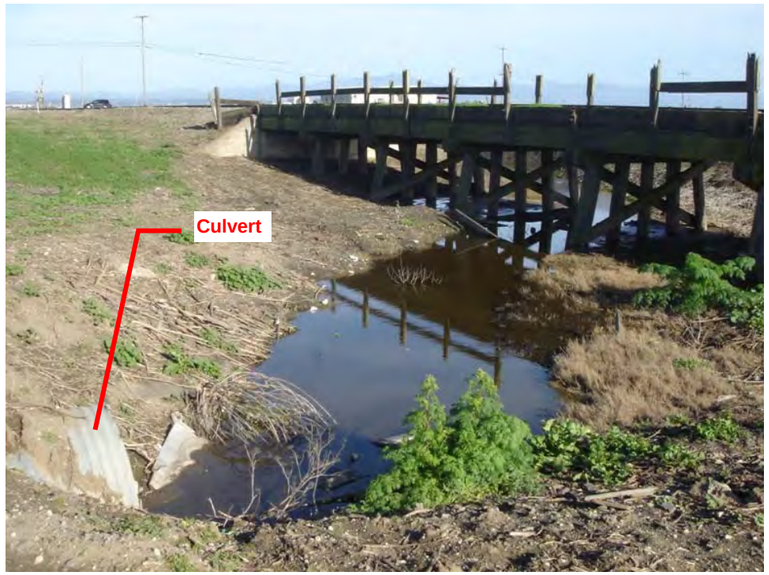
Figure 9-41 shows the grade crossing at the Nashua Road. The runoff travels to the floodplain located south of Nashua Road. As shown in Figure 9-42, south of Nashua Road, the elevation south west of the track is lower than that of the east side. Runoff drains away from the center of the track into the ditches on the sides, and drains south to the floodplain at MP 112.54.

The existing bridge at MP 112.54 is a 120 feet long 8-span timber ballast deck trestle bridge over a drainage channel as shown in Figure 9-43.

Figure 9-41
Crossing at Nashua Road Looking South

Figure 9-42
Rail Looking Southwest from Nashua Road

Figure 9-43
Bridge at MP 112.54



From Nashua Road to track station 98+00, and from track station 98+00 to 111+23.29, the track runoff drains off the center and into the ditches on both sides, and to the low area around track station 98+00 (MP 112.54) as shown in Figure 9-43. A culvert drains the runoff west to the ditch on the northwest side of Monte Road as shown in Figures 9-44 and A-45. The ditch then connects to the Salinas River via a ditch along the Cabrillo Highway (State Route 1) as shown in Figure 9-46. The existing bridge at MP 112.54 will be replaced with an earth embankment and a concrete culvert.

Figure 9-44
Track at MP 112.54 Looking North

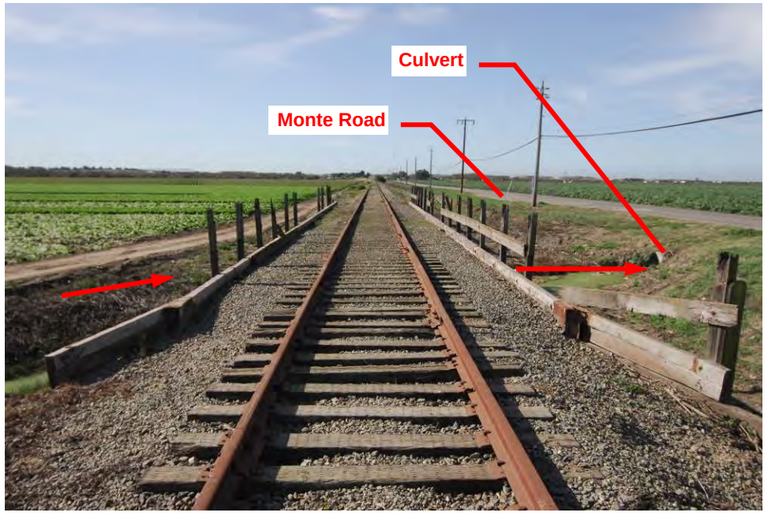
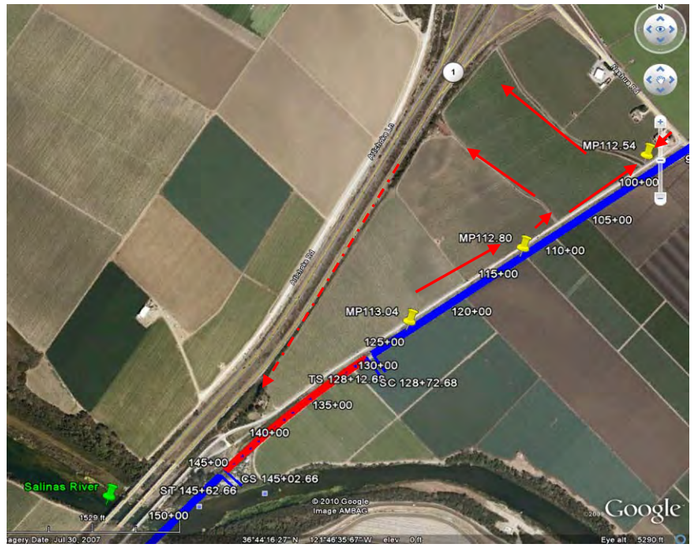


Figure 9-45
Culvert at MP 112.54

Figure 9-46
Drainage at MP 112.54



BRIDGE AT MP 112.80

The existing floodplain equalizer at MP 112.80 is a 225-foot-long, 15-span timber ballast deck trestle bridge over the low area as shown in Figures 9-47 and 9-48. From track station 114+00 to track station 124+00 (MP 113.04), the track runoff drains off the center of the tracks and drains to the low area at track station 124+00 (MP 113.04); the low area then drains north to the ditch north of Monte Road via the culvert at Monte Road as shown in Figure 9-49. The runoff drains north along the swale to the ditches around track station 108+00, and track 98 (MP 112.80) as shown in Figure 9-46.

Figure 9-47
Floodplain Equalizer Trestle Bridge at MP 112.8

Figure 9-48
Ponding at Equalizer Trestle Bridge at MP 112.8

The existing bridge will be replaced with an earth embankment and a concrete culvert. The low area will be filled and be graded sloped north so that there will be no standing water and runoff will drain north to the two ditches.

Figure 9-49
Culvert at Monte Road

BRIDGE AT 113.04

The floodplain equalizer at MP 113.04 is a 90-foot, 6-span timber ballast deck trestle bridge as shown in Figures 9-50 and 9-51. From track station 125+00 to track station 146+00 (Salinas River), the track runoff drains off the center and to the ditch between the track and Monte Road. The runoff that does not percolate into the ground eventually drains to the two ditches on the north. The bridge will be replaced with an earth embankment with a concrete culvert. The low area will be filled to eliminate the standing water.

Figure 9-50
Floodplain Equalizer Timber Trestle Bridge at MP 113.04

Figure 9-51
Ponding at the Floodplain Equalizer at MP 113.04

There is ponding just north of the Salinas River as shown in Figure 9-52. Proper grading will improve the overall drainage condition and eliminate the standing water at this location.

SALINAS RIVER BRIDGE

The Salinas River Bridge is shown in Figure 9-52. Typical land use in the vicinity of the bridge is shown in Figure 9-54.

Figure 9-52
Ponding at Low Area North of the Salinas River

Figure 9-53
Salinas River Bridge

Figure 9-54
Land Use at the Salinas River

NORTH AND SOUTH DOLE ENTRANCES

From 153+00 to track station 168+00 (North Dole entrance), the track runoff drains off the center of the track and drains to the grass swales along the track on both sides. Figure 9-55 shows a picture of the North Dole entrance grade crossing. Ponding between the North Dole and South Dole entrances, as can be seen in Figure 9-56, is caused by the low elevation of the land. Proper grading will address the drainage issue and eliminate the standing water at this location.

Figure 9-55
North Dole Grade Crossing

Figure 9-56
Ponding between South Dole and North Dole Entrances

From track station 168+00 (North Dole entrance) to Del Monte Boulevard, the track runoff drains off the center and into the two swales on both sides. The runoff that does not percolate into the ground drains north along the swales. Figure 9-57 shows the grade crossing at South Dole. A typical cross-section is shown in Figure 9-58.

Figure 9-57
South Dole Grade Crossing

Figure 9-58
Drainage South of Lapis Road

The grade crossing at Lapis Road is shown in Figure 9-59. From Lapis Road to track station 246+00, the track runoff drains off the center into the side ditches along the track. The runoff that does not percolate into the ground drains north along the swales on both sides. The typical cross-sections around Lapis Road and Del Monte Boulevard are shown in Figures 9-60 and 9-61.

Figure 9-59
Lapis Road Grade Crossing

Figure 9-60
Drainage Looking South around Lapis Road

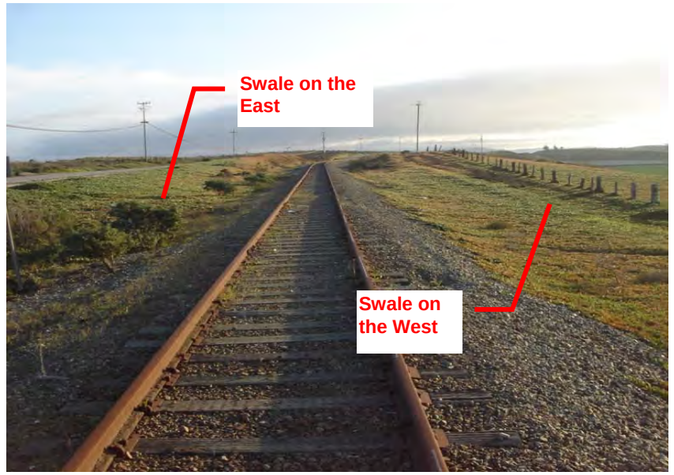
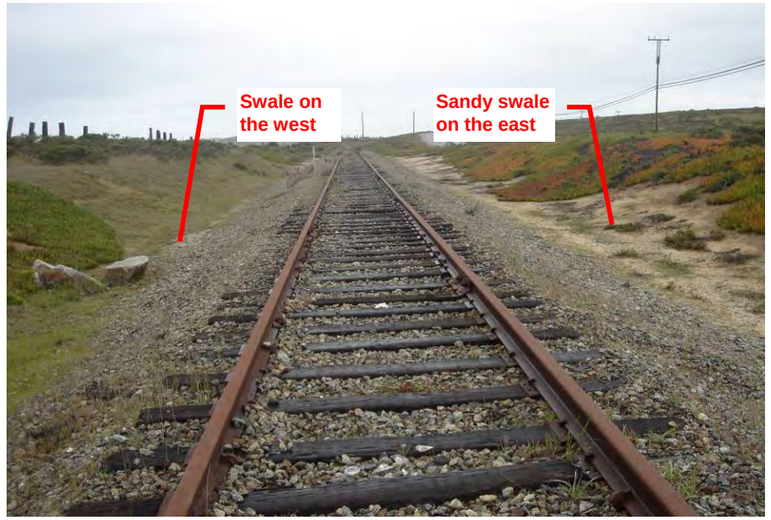


Figure 9-61
Land Use Looking North at Del Monte Boulevard



North of track station 246+30.80, the track runoff drains north. South of track station 246+30.80, the track runoff drains south. Around track station 265+00, there is a low elevation in Lapis Road as shown in Figure 9-62. There may be drainage issues at this location for Lapis Road, but this will not affect the track drainage. From track station 246+30.80 to track station 272+47.02 the track runoff drains off the center and into the low point at track station 260+56.83.

Figure 9-62
Low Elevation Area on Lapis Road around Station 256+00

MARINA GREEN DRIVE

From track station 272+47.02 to track station 306+21.55, the track runoff drains off the center and to the swales on both sides. The runoff that does not percolate into the ground drains into the low point at track station 283+61.28. Figure 9-63 shows the Marina Green Drive grade crossing around track station 280+00. The runoff drains south before 283+61.28, and into the ditch around 283+61.28 as shown in Figure 9-64. A culvert directs the runoff from north to south to the ditch in the south east corner of Marina Green Drive and the track as shown in Figure 9-64.

Figure 9-63
Marina Green Drive Grade Crossing Looking South

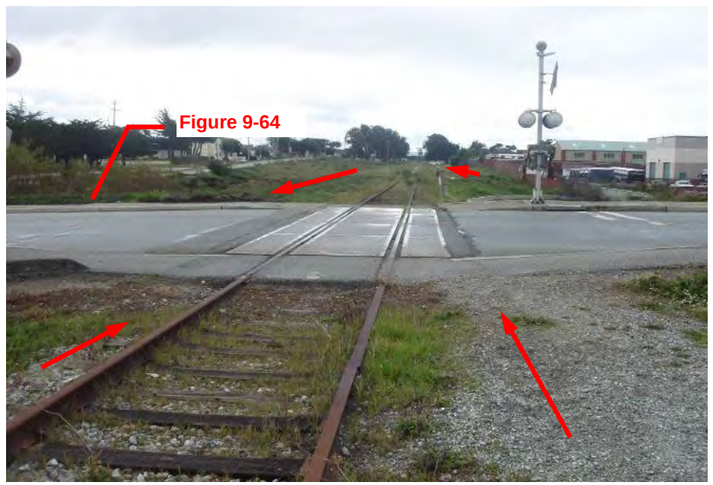


Figure 9-64
Swale at the Southeast of Marina Green and Rail with a Culvert

BEACH ROAD TO PALM AVENUE

From Marina Green Drive to Beach Road, the land use around the track is residential and light industrial. From track station 306+21.55 (Beach Road) to 350+85.90 (Palm Avenue) the track runoff drains off the center and into the grass swales on both sides. The runoff that does not percolate into the ground drains off to the lake at Locke-Paddon Park at Reservation Road near track station 330+28.58. Figure 9-65 shows the grade crossing at Beach Road. Figure 9-66 shows the track north of Reservation Road, while Figure 9-67 shows the track south of Reservation Road.

Figure 9-65
Northerly View at Beach Road Grade Crossing

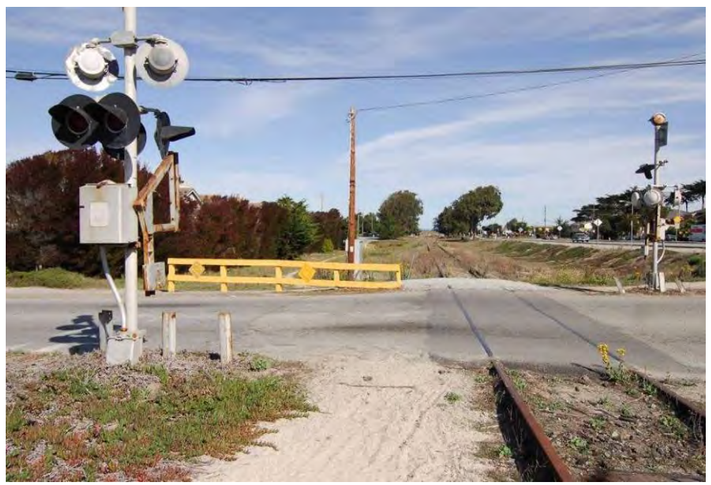


Figure 9-66
Track at Reservation Road Looking North

Figure 9-67
Reservation Road Looking South

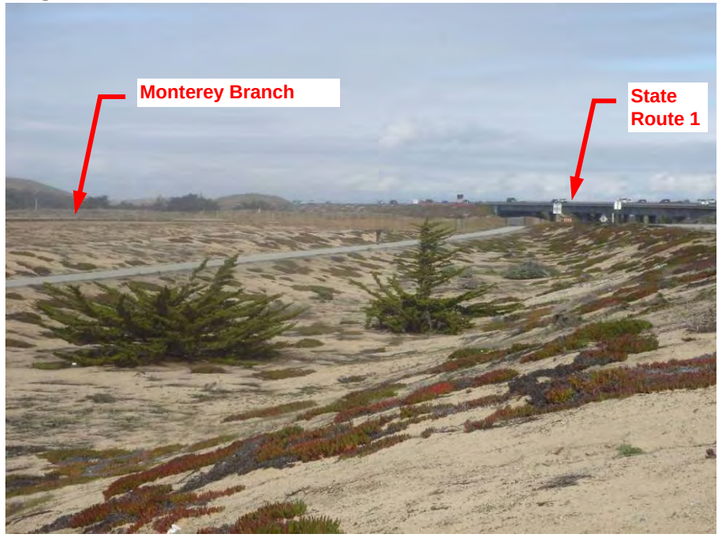
PALM AVENUE TO STATE ROUTE 1 OVERPASS

Figure 9-68 shows the grade crossing at Palm Avenue. From 350+85.90 (Palm Avenue) to 381+20.72 (south of State Route 1 overpass), the track runoff drains off the center of the track, draining to the ditches on both sides. The runoff that does not percolate into the ground drains to the low point at track station 360+52.86 as shown on Figure 9-69. Figure 9-70 is a photograph looking north toward the State Route 1 overpass.

Figure 9-68
Westerly View at Palm Avenue Grade Crossing

Figure 9-69
Looking North from the Northern State Route 1 Overpass

Figure 9-70
Land Use Looking North toward State Route 1



IMJIN PARKWAY TO LIGHT FIGHTER DRIVE

From track station 381+20.72 to track station 488+94.10, the track runoff drains off the center and into the low point at 389+92.07. The land use in this segment is rural grassland. Figure 9-71 shows a typical cross-section along with land use in the area.

Figure 9-71
Land Use between Imjin Parkway and Light Fighter Drive

U.S. 1 slopes from south to north. East of U.S. 1 and west of the parking lot on the west lies a swamp where runoff is intercepted and contained within the ditch. The parking lot east of the ditch drains north to south and eventually sheet flows to the swamp from the south side of the ditch. The newly built street east of U.S. 1 slopes from north to south.

The topography at the park-and-ride lot around station 440+00 north of Eighth Street generally slopes from the south to north away from Eighth Street and drains to the low lying area north of Eighth Street east of U.S. 1.

South of Eighth Street, the topography slopes from northeast to southwest and drains to the storm drain inlets, which intercept runoff and direct the runoff to the south via the 18 inch storm drains. The runoff south of the storm inlets drains to the two low areas just south of the storm inlet around track station 444+50 to 447+00.

The area south of the two low lying areas drains south. The runoff is intercepted by the drain inlets around track station 455+00. The area north of track station 457+00 drains north to the drain inlets which intercept runoff and drain west to the 36-inch storm drains. The area south of the storm inlets drains north and sheet flows to the landscaping area.

LIGHT FIGHTER DRIVE TO STATE ROUTE 1

Figures 9-72, 9-73 and 9-74 show typical track environments along this section of the Monterey Branch Line right-of-way.

Figure 9-72
Land Use between Light Fighter Drive and State Route 1

Figure 9-73
Land Use between Light Fighter Drive and State Route 1

Figure 9-74
Rail at State Route 1 Overpass

From track station 489+00 to 540+79.53, the track runoff drains off the center and south into the low point at 540+79.53. From track station 560+90 to 540+79.53 the track runoff drains off the center and north to the low point area at 540+79.53.

MONTEREY ROAD

From track station 560+90 to 592+47.90, the track runoff drains off the center and south into the low point area at 592+47.92. From track station 592+47.92 to 604+71.82, the track runoff drains off the center and north into the low area at 592+47.92. Figure 9-75 and 9-76 show the grade crossing and the typical cross-section around Monterey Road.

Figure 9-75
Monterey Road Grade Crossing (610+00)

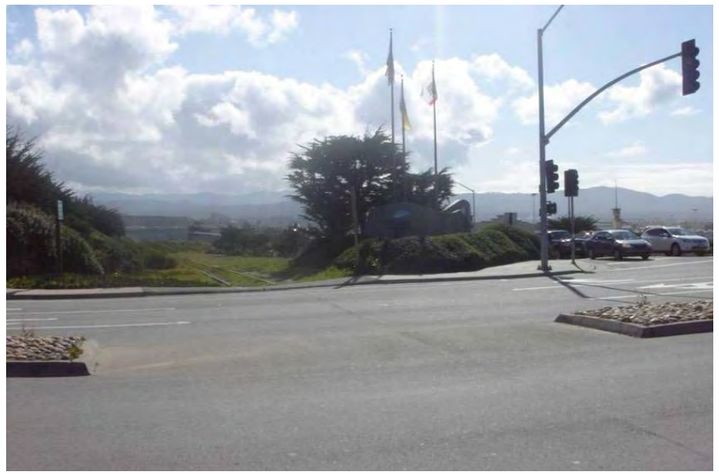


Figure 9-76
Land Use around Monterey Road

STATE ROUTE 1 OVERPASS TO PLAYA AVENUE AND TIOGA AVENUE

From the State Route 1 overpass at track station 607+00 to track station 684+00 (Canyon Del Rey Boulevard), the land use is light industrial. From track station 604+71.82 to 632.28+79, the track runoff drains off the center and south to the low point area at track station 632.28.79. Figure 9-77 shows the grade crossing at Playa Avenue. Figure 9-78 shows the typical cross-section from Playa Avenue to just south of Tioga Avenue. From track station 632.28.79 to 643+52.34, the track runoff drains off the center and north to the low point area at track station 632.28.79. Figure 9-79 shows the grade crossing at Tioga Avenue.

Figure 9-77
Playa Avenue Grade Crossing

Figure 9-78
South of Tioga Looking North toward Tioga Avenue Grade Crossing

Figure 9-79
Grade Crossing at Tioga Avenue

TIOGA AVENUE TO CONTRA COSTA STREET

From track station 643+52.34 to 657+53.28, the track runoff drains off the center and south to the low point area at track station 657+53.28. From track station 657+53.28 to 671+88.94, the track runoff drains off the center and north to the low point area at track station 657+53.28. Figures 9-80 and 9-81 illustrate typical right-of-way conditions in this area. Figure 9-81 illustrates that there is a ponding spot north of the intersection. The ponding could be eliminated with proper grading during the construction of the project.

Figure 9-80
North of Contra Costa Street and South of Tioga Avenue

Figure 9-81
Ponding North of Contra Costa Street Crossing

CONTRA COSTA STREET TO STATE ROUTE 1 OVERPASS

From track station 671+88.94, the track runoff drains off the center and south to the low point area at track station 688+52.27 around the Roberts Lake. From track station 688+52.27 to 706+97.47, the track runoff drains off the center and north to the low point area at track station 688+52.27 around the Roberts Lake. There is a low area with an inlet at the northeast corner of the track and Canyon Del Rey Boulevard as shown in Figure 9-82.

The track and drainage environment around Roberts Lake is shown in Figure 9-83. Figure 9-84 shows the grade crossing at Roberts Avenue, which is south of Roberts Lake, while Figures 9-85 and 9-86 show the Monterey Branch Line right-of-way extending south toward the State Route 1 overcrossing.

Figure 9-82
North of Monterey Branch Line Crossing at Canyon Del Rey Boulevard

Figure 9-83
Rail at Roberts Lake

Figure 9-84
Grade Crossing at Roberts Avenue

Figure 9-85
Swales around Roberts Avenue

Figure 9-86
Swale North of State Route 1 Overpass (around Station 698+00)

STATE ROUTE 1 OVERPASS TO LA PLAYA STREET

From track station 706+97.47 to Casa Verde Way, the track runoff drains off the center and drains to the swales on both sides, and south to the low point area near Casa Verde Way, around track station 722+00. From Casa Verde Way to the track station 747+52.36, the track is relatively flat, sloping slightly west. From track station 747+52.36 to La Playa Street, the track drains off the center and west to the low point at track station 777+52.13.

FIGUEROA STREET TO END OF PROJECT

From track station 790+46.08, around Figueroa Street, to the end of the project, the track runoff drains off the center and north to the low point at track station 790+46.08 around Figueroa Street. Figures 9-87, 9-88, and 9-89 illustrate typical sections along this portion of the project area.

Figure 9-87
Cross-section at Naval Postgraduate School (Station 730+00)

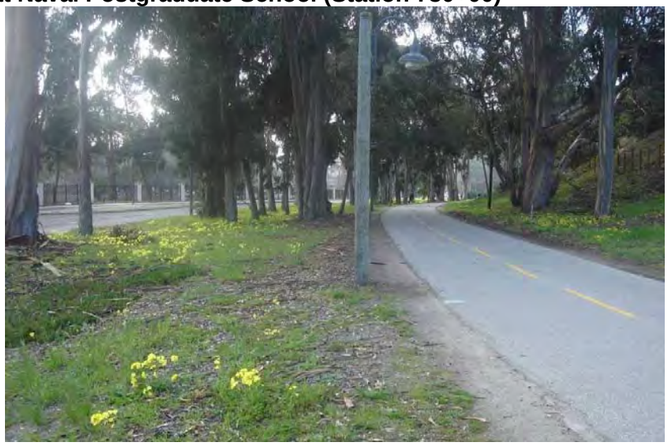


Figure 9-88
Grade Crossing at Naval Postgraduate School Waste Water Treatment Plant Driveway (Station 735+00)

Figure 9-89
North of La Playa Street/Park Avenue Looking South

Figure 9-90 shows a photograph of Window on the Bay waterfront park around station 770. The runoff along the park area drains to the street.

Figure 9-90
Window on the Bay (around Station 770)

Hydraulic Calculations

DESIGN STANDARD

The goal of track drainage design for the Monterey Peninsula Light Rail Project is to facilitate rapid removal of runoff from the track bed to drainage facilities. The objective is to convey surface and stream waters originating upstream of the drainage facility to the downstream side without causing objectionable backwater, excessive flow velocities, or excessive scour, and without unduly affecting traffic safety. The hydraulic drainage design criteria contained or referenced in this manual have been developed to accomplish this goal. However, state-of-the-art methods and procedures for the hydrologic analysis required to determine the severity and probability of occurrence of flood events are inherently ambiguous. Therefore, the drainage design criteria contained in this section is provided for guidance only and is not intended to establish legal or design standards, which must be strictly adhered to.

The culverts/swale are usually sized to accommodate the 100-year storm event with a time of concentration equal to the watershed time of concentration. Usually, the 100-year storm event should not overtop the embankment or headwall of the culvert.

An exception to the above discussion is the evaluation of encroachments on the base flood plain. Federal regulations (23 CFR 650.115) state that all such encroachments shall be evaluated to assess the costs and risks associated with the base flood (Q100) or overtopping flood, whichever is greater.

PRELIMINARY CULVERT DESIGN

Bridge at MP 112.54

For the segment from Nashua Road to MP 112.80, the flow runs north to the bridge at MP 120.54 through the earth swales on both sides.

Time of Concentration

Time of concentration, Tc, for all undeveloped area from Merritt Street to Marina Green Drive was determined using the Soil Conservation Service (SCS) Upland Method, where Tc equals the flow path length divided by a velocity taken from Figure 9-91. Using cultivated pasture (overland flow), for a slope of 0.01 percent, the velocity is assumed to be 0.65 feet/second. The flow path length is calculated to be 1,251 feet.

Tc = flow path length ÷ velocity = 1,251 ÷ 0.65 ÷ 60 = 32.08 (s), as shown in column 7 in Table 9-8

Rainfall Intensity–Duration–Frequency (IDF) Relationships

From the Monterey County Public Works Plate 25, Figure 9-92,

Rainfall intensity I_t = conversion factor × 7.75 × (i)/$t^{1/2}$

Where:

I_t = maximum intensity of storm of t minutes duration, where I_t is the conversion of the county's two-year, one-hour rainfall intensity "i,"
10-year conversion factor = 1.48,
25-year conversion factor = 1.73,
100-year conversion factor = 2.22,

i = 0.55 inches per hour for the project, from the county's chart,

t = estimated "time of concentration" in minutes (32.08 minutes)

I_t = 2.22 × 7.75 × 0.55 ÷ $30.8^{1/2}$ = 1.67 in/hour, as shown in column 8 in Table 9-8

Peak Discharge Calculation

The storm water discharge will be calculated by the Rational Method equation as follows:

Q = C × I × A

Where:

Q = peak discharge in cubic feet per second (cfs)

C = runoff coefficient = 0.9 for ballasted area and 0.15 for the earth swale. A composite runoff coefficient is calculated as shown in column 14 in Table 9-8

I = average rainfall intensity in inches per hour (in./hr) for the selected rainfall return period (I = 1.67 in./hr)

A = contributing drainage area in acres, 3.9 acres.

Q = 0.40 × 1.67 × 3.9 = 2.60 cfs, as shown in column 15 in Table 9-8

Hydraulic Capacity Check

$$Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$$

Where:

Q = flow rate, cfs, TBD based on the drainage system. For the segment from Nashua Road to MP 112.80, the flow runs north to the bridge at MP 120.54 through the earth swales on both sides. A typical swale cross-section is chosen at MP 109+43.44. The depth of swale on the north side is 56 feet with a depth of 1.3 feet; the depth on the south side is 0 feet. The Q is shown in column 17 in Table 9-8.

n = Manning's coefficient (n = 0.15 for earth swale)

S = slope (the flow path is from station 111 to station 99, the slope is 0.01%)

A = flow area of the two swales on both sides, in this case only one swale on the north side.
A =1/2 × (depth) × width=36.4 ft^2

R = hydraulic radius = (area ÷ wet perimeter)

$$Q = \frac{1.49}{0.15} AR^{2/3} S^{1/2}$$ = 2.71 cfs, greater than peak discharge of 2.60 calculated previously

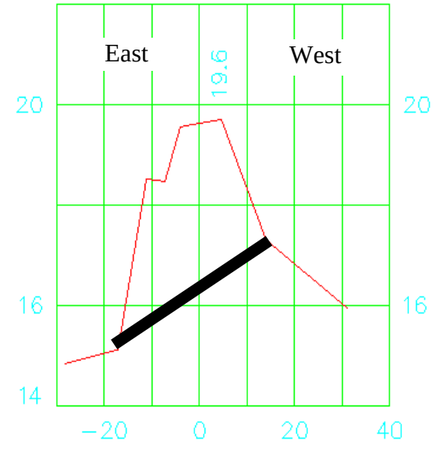
Hydraulic Capacity Check for Culvert at MP 120.54 Bridge

As calculated previously under Peak Discharge Calculation, the peak discharge from Nashua Road to MP 120.80 and to the culvert is 2.60 cfs. The closest cross-section survey is at track station 99+23.19. The culvert is proposed to be placed from toe to toe of the track. The upstream invert elevation is 17.32 feet, the downstream invert elevation is at 15.13 feet, and the culvert length is 32 feet. The slope of the culvert is 7 percent, with a Manning's n of 0.012.

The full capacity of the culvert is calculated using Manning's n,

$$Q = \frac{1.49}{0.15} AR^{2/3} S^{1/2}$$ = 65 cfs, as shown in column 12 in Table 9-9

The full capacity of the culvert is larger than the peak discharge, as shown in column 11 in Table 9-9, so the culvert design is sufficient.



Cross-section at 99+23.19

Bridge at MP 112.80

The peak discharge from MP 113.04 (track station 124) to MP 128.00 (track station 114) is calculated to be 1.37 cfs, as shown in column 17 in Table 9-8.

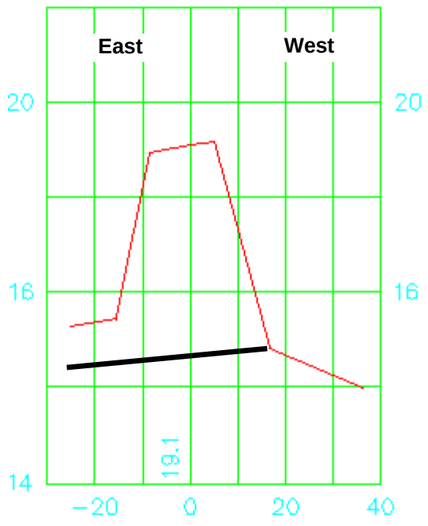
The cross-section at track station 111+47.90 is used as the cross-section at the bridge at MP 112.80.

The culvert upstream invert elevation is 14.81 feet, the downstream invert elevation is 14.21 feet, and the culvert length is 51 feet. The slope is calculated to be 1.2 percent.

The full capacity of the culvert is calculated using Manning's, n

$$Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$$ = 26.91 cfs, as shown in column 12 in Table 9-9

The full capacity of the culvert is larger than the peak discharge, as shown in column 11 in Table 9-9, so the culvert design is sufficient.



Cross-section at 111+47.90

Bridge at MP 113.04

The peak discharge from Salinas River (track station 146) to MP 113.04 (track station 124) is calculated to be 2.66 cfs as shown in column 15 in Table 9-8.

The cross-section at track station 125+08.90 is used as the cross-section at the bridge at MP 113.04.

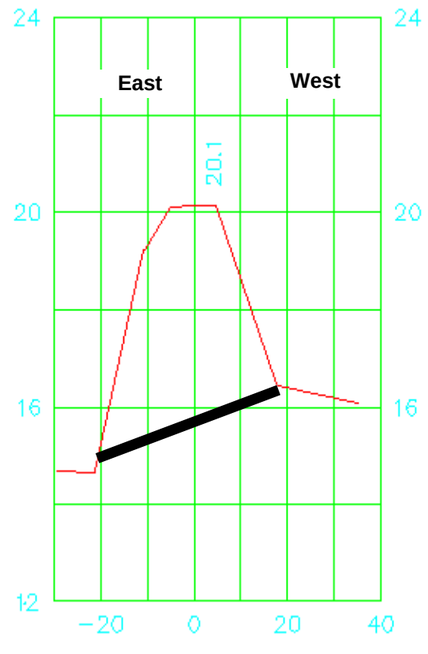
The culvert upstream invert is at 16.42 feet, the downstream invert elevation is 14.63 feet, and the culvert length is 39 feet. The slope is calculated to be 4.6 percent.

The full capacity of the culvert is calculated using Manning's n,

$$Q = \frac{1.49}{n} AR^{2/3} S^{1/2}$$ = 52.68 cfs, as shown in column 12 in Table 9-9

The full capacity of the culvert is larger than the peak discharge, as shown in column 11 in Table 9-9, so the culvert design is sufficient.

Based on the previous discussion, it is determined that the existing drainage system is sufficient to intercept and convey the 100-year storm event for this restoration project. No additional drainage design is necessary.



Cross-section at 125+08.90

The proposed culvert design is shown below:

Bridge Location	Track Station	Upstream Invert (ft)	Downstream Invert (ft)	Culvert Length (ft)
MP 120.54	99+23.19	17.32	15.13	32
MP 120.80	111+47.90	14.81	14.21	51
MP 113.04	125+08.90	16.42	14.63	39

Conclusion

As stated in the hydraulic design standard, the goal of track drainage design for the Monterey Peninsula Light Rail Project is to facilitate rapid removal of runoff from the track bed to drainage facilities. The objective is to convey surface and stream waters originating upstream of the drainage facility to the downstream side without causing objectionable backwater, excessive flow velocities, or excessive scour, and without unduly affecting traffic safety. The hydraulic drainage design criteria contained or referenced in this section have been developed to accomplish this goal. However, state-of-the-art methods and procedures for hydrologic analysis required to determine the severity and probability of occurrence of flood events are inherently ambiguous. Therefore, the drainage design criteria contained in this section are provided for guidance only and are not intended to establish legal or design standards, which must be strictly adhered to.

This is a restoration project. All of the calculations above are based on the assumption that surface drainage and drainage systems will be restored to as good or better condition than the previous condition. Restoration includes, but is not limited to, grading the surface to drain away from the tracks, replanting surface vegetation, cleaning outgrown ditches, clearing clogged storm drains, and replacing damaged culverts in kind. The drainage calculation is based on restoring the surface to a moderate fair state of condition.

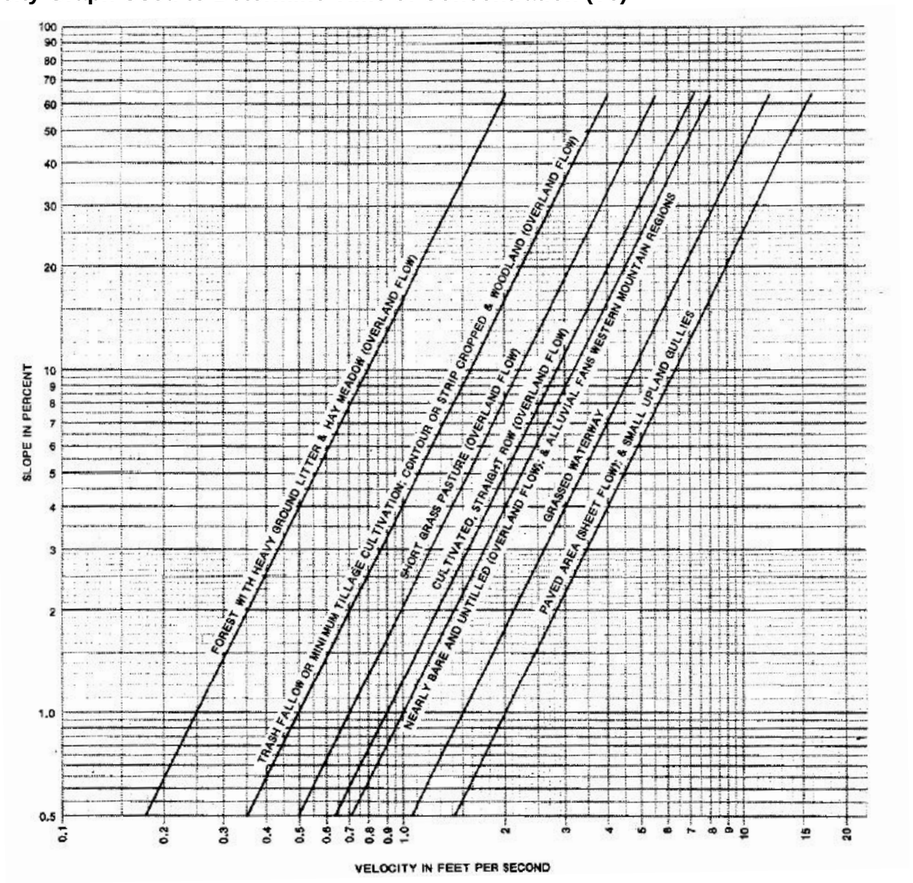
Based on the information provided in the Hydraulic Calculations section of this document, it was determined that the existing drainage system is sufficient to intercept and convey the runoff from a 100-year storm event for this restoration project. No additional drainage design is necessary.

The proposed culvert design is shown in the table above.

The embankment of the side slopes and other standards will be based on the recommendations from the *Geotechnical Evaluation Report*, April 23, 2010, by Kleinfelder.

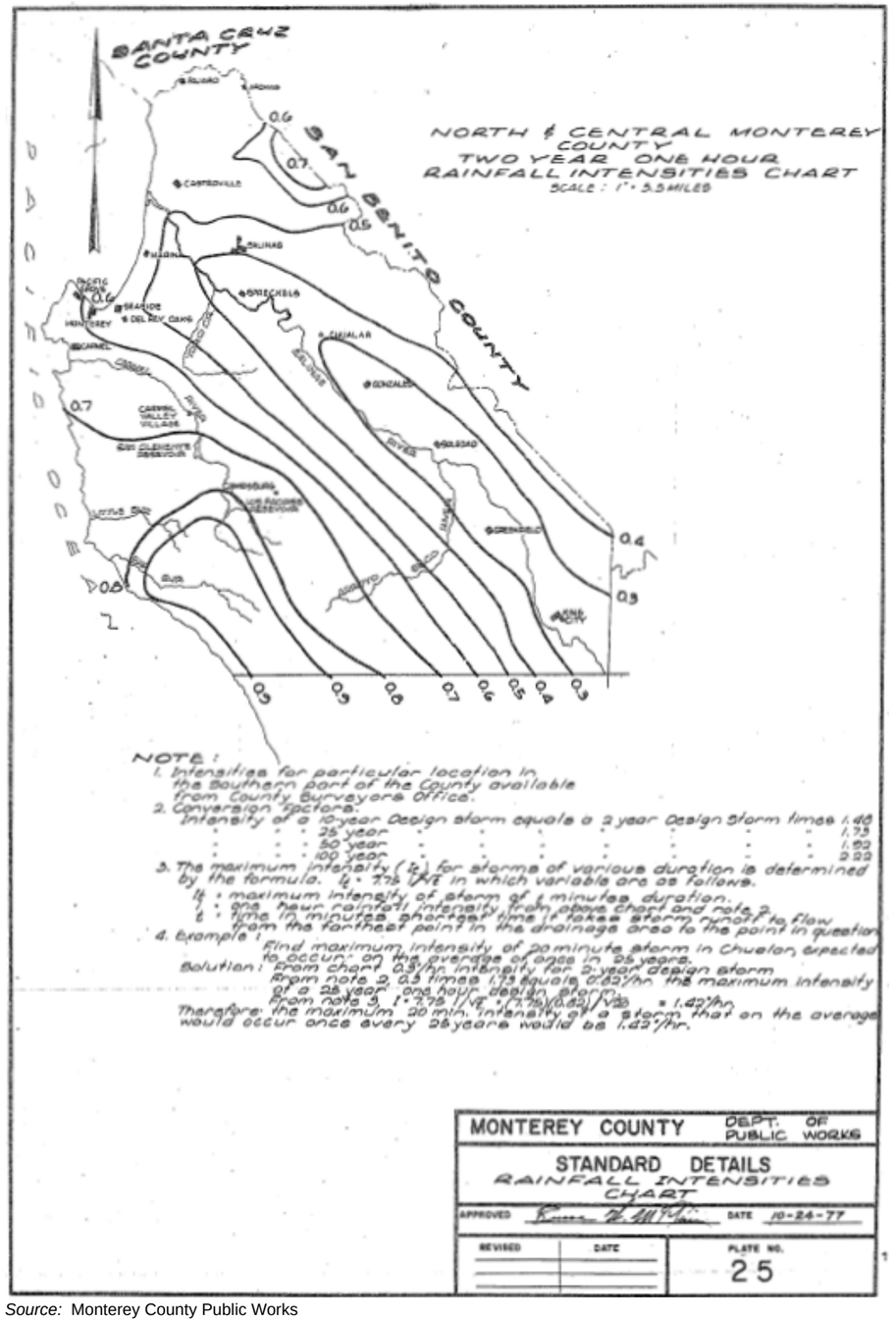
During construction, grading adjacent to the track will be performed in such a way that no ponding will accumulate after major storm events.

Figure 9-91
Velocity Graph Used to Determine Time of Concentration (Tc)



Source: SCS National Engineering Handbook, Section 4, 1972

Figure 9-92
Plate No. 25: Rainfall Intensities Chart



Source: Monterey County Public Works

Table 9-8
DRAINAGE SYSTEM HYDRAULIC CAPACITY CALCULATIONS

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
Area Name	Location from Station to Station	Tributary Area (ft²)	Area (acres)	Slope (%)	Velocity (ft/s)	Flow Length (ft)	Tc (min)	100-Year Rainfall Intensity (in./hr)	Swale Width (ft)		Depth (ft)		Track Width (ft)	Runoff Coefficient (C)	Peak Discharge Q = CIA (cfs)	Typical Cross-Section Used	Drainage Capacity	Meet the Requirement
									On the North	On the South	On the North	On the South						
DA1	Beginning to Merritt Street	76228	1.7	1.34	0.65		13.21	2.60	Ditch on side					0.62	7.09	24" culvert	28.43	Yes
DA2	Merritt Street to Tembladero Slough (10-65)	557,095	12.8	0.07	0.65	4400	112.82	0.89	20.00	17.00	1.45	1.11	14.00	0.35	2.57	40+93.27	2.81	Yes
DA3	Tembladero Slough to Alisal Slough (65-94)	292,539	6.7	0.02	0.65	2900	74.36	1.10	40.00	38.00	1.00	1.00	20.00	0.35	2.26	77+05.11	2.44	Yes
DA4	Nashua Road to MP 112.80 (98-111)	168,863	3.9	0.01	0.65	1251	32.08	1.67	56.00	0.00	1.30		28.00	0.40	2.59	109+43.44	2.71	Yes
DA5	MP 112.80 to MP 113.04 (114-124)	128,317	2.9	0.09	0.65	1182	30.31	1.72	42.00	21.00	0.50	0.50	12.00	0.27	1.37	117+60.68	1.86	Yes
DA6	MP 113.04 to Salinas River (124 to 146)	321,626	7.4	0.42	0.65	2272	58.26	1.24	38.00	36.00	6.50	5.20	17.00	0.29	2.66	129+98.49	316.85	Yes
DA7	Salinas River (153) to 246+37.88	1,002,150	23.0	0.93	0.87	7847	150.33	0.77	18.00	14.00	1.54	0.50	17.50	0.42	7.37	194+08.65	15.25	Yes
DA8	246+37.88 to south of Golf Road 272.47	251,267	5.8	0.75	0.8	1190	24.79	1.90	26.00	20.00	3.30	4.00	19.00	0.37	4.05	266+87.24	96.60	Yes
DA9	South of Golf Road (272.48) to Beach Road (306.21)	347,106	8.0	0.34	0.65	2261	57.97	1.24	26.00	20.00	1.43	0.91	17.00	0.32	3.17	291+11.59	13.51	Yes
DA10	Beach Road (306.21) to Palm Avenue (350+85.90)	445,598	10.2	0.32	0.65	2058	52.77	1.30	18.00	18.00	1.10	1.10	13.00	0.28	3.74	335+15.60	7.47	Yes
DA11	Palm Avenue (350+85.90) to south of U.S. 1 overpass (381.21)	307,579	7.1	1.39	1.2	2068	28.72	1.77	10.00	19.00	0.91	0.22	17.00	0.30	3.69	363+09.98	5.48	Yes
DA12	South of U.S. 1 overpass (381.22) to south of overpass bridge (488.94)	1,163,704	26.7	0.28	0.65	9902	253.90	0.59	20.00	17.00	1.32	0.90	20.00	0.31	4.88	409+25.72	8.72	Yes
DA12A	Northeast of U.S. 1 and 8th Street	146,129	3.4	0.28	2.75	406	2.46	6.03	/	/	/	/	/	0.57	11.60	/	87.14	Yes
DA12B	Southeast of U.S. 1 and 8th Street far east part	433,660	10.0	1.78	2.75	354	2.15	6.46	/	/	/	/	/	0.90	57.88	/	515.87	Yes
DA12C	Small patch around low area within DA12B	53,623	1.2	1.78	2.75	91	0.55	12.74	/	/	/	/	/	0.90	14.12	/	17.23	Yes
DA12D	Southeast of U.S. 1 and 8th Street far west part with the parking lot	432,919	9.9	1.78	2.42	144	0.99	9.50	/	/	/	/	/	0.53	50.21	/	72.89	Yes
DA12E	Southeast of U.S. 1 and 8th Street far south part	294,573	6.8	1.78	2.42	557	3.84	4.83	/	/	/	/	/	0.44	14.45	/	515.87	Yes
DA13	South of overpass bridge (488.95 to 560.90)	1,015,605	23.3	0.77	0.8	5186	108.04	0.91	36.00	13.00	1.11	0.42	15.00	0.33	6.91	538+86.30	13.98	Yes
DA14	560.91 to U.S. 1 overpass 604+71.82	439,195	10.1	1.85	1.25	3158	42.11	1.46	40.00	40.00	0.60	0.10	20.00	0.30	4.41	586+61.96	9.47	Yes
DA15	Overpass 604+71.83 to Tioga Avenue (643+52.34)	404,230	9.3	2.16	1.32	2757	34.81	1.60	16.00	14.00	0.67	0.58	12.00	0.28	4.22	626+10.94	6.77	Yes
DA16	Tioga Avenue (643+52.34) to Contra Costa Street (671+88.94)	281,125	6.5	0.17	1.4	1436	17.10	2.29	16.00	14.00	0.67	2.10	1.20	0.15	2.23	661	3.04	Yes
DA17	Contra Costa Street (671+88.94) to U.S. 1 overpass 706+97.47	349,577	8.0	0.24	1.4	1845	21.96	2.02	10.00	7.50	3.70	1.68	8.00	0.18	2.91	690+99.77	19.58	Yes
DA18	U.S. 1 overpass 706+97.48 to La Playa Street (777+52.13)	757,151	17.4	0.03	1.4	8349	99.39	0.95	43.00	40.00	1.50	1.11	17.00	0.25	4.20	765	8.07	Yes
DA19	La Playa Street (777+52.13) to the end	184,347	4.2	0.03	1.4	8349	99.39	0.95	43.00	40.00	1.50	1.11	17.00	0.18	0.73	766	8.07	Yes

Table 9-9
DRAINAGE SYSTEM HYDRAULIC CAPACITY CALCULATIONS

1	2	3	4	5	6	7	8	9	10	11	12	13
Culvert Location	Tributary Area (ft²)	Area (acres)	Location from Station to Station	Slope (%)	Flow Length (ft)	Velocity (ft/s)	Tc (min)	100-Year Rainfall Intensity (in./hr)	Runoff Coefficient (C)	Peak Discharge Q=CIA (cfs)	Culvert Capacity (cfs)	Meet the Requirement
MP 112.54	168,863	3.9	Nashua Road to MP 112.80 (94-111)	7	1251	0.65	32.08	1.67	0.40	2.59	64.98	Yes
MP 112.80	128,317	2.9	MP 112.80 to MP 113.04 (114-124)	1.2	1182	0.65	30.31	1.72	0.27	1.37	26.91	Yes
MP 113.04	321,626	7.4	MP 113.04 to Salinas River (124 to 146)	4.6	2272	0.65	58.26	1.24	0.29	2.66	52.68	Yes

10 Bridge Type Selection

10. Bridge Type Selection

The *Bridge Strategy Report for the Monterey Peninsula Light Rail Project*, May 2010 Update, accompanies this *Conceptual Plan for Track Restoration* document as a separately bound report.

As indicated in Table 10-1, the Monterey Branch Line traverses eight bridge structures. Retention, repair, or replacement of seven of these bridges will require modest capital expenditures. The Salinas River Bridge will require major repairs as discussed below.

Table 10-1
MONTEREY BRANCH LINE BRIDGE STRUCTURES

MP	Structure	Description	Recommendation
111.05	Trembladero Slough	150-foot 10-span timber trestle	Retain or replace
111.93	Alisal Slough	45-foot 3-span timber trestle	Replace with embankment and culvert undercrossing
112.54	Drainage channel	120-foot 8-span timber trestle	Replace with embankment and culvert undercrossing
112.80	Floodplain equalizer	225-foot 15-span timber trestle	Replace with embankment and culvert undercrossing
113.04	Floodplain equalizer	90-foot 6-span timber trestle	Replace with embankment and culvert undercrossing
113.50	Salinas River	715-foot 5-span steel through truss	Retain. Extensive repairs and replacement of members is required
119.64	First Street	2-lane pre-stressed concrete undercrossing	Caltrans bridge. Retain vehicular undercrossing. Close adjacent pedestrian tunnel
123.65	Roberts Lake (Lake George)	45-foot 2-span prestressed concrete trestle	Retain for rail use. Construct new bridge for recreational trail users

Salinas River Bridge

The Salinas River Bridge is a 715-foot long, 5-span (143 feet each), truss bridge carrying a single track across the Salinas River. The structure consists of warren type, steel through trusses with concrete piers and abutments. The piers and the abutments are supported on 50-foot timber piles. The bridge was constructed in 1904 with a new first span added to the north end of the bridge in 1914. Abutments 1 and 2 and piers 2 and 3 are accessible by land and piers 4 and 5 are located in the river. The bridge has extensive corrosion causing loss of structural section through the bridge members. Generally the primary load carrying members have a moderate loss; however, some of the secondary members have extensive corrosion and need replacement.

During the 2010 re-inspection and re-evaluation, the bridge was found to have extensively advanced corrosion causing from 5 to 40 percent additional loss of structural section throughout the bridge members. While increased, the primary load carrying members still have a moderate loss except in Span 1 where up to a 40 percent increase was found. With the re-inspection, a majority of the secondary members in Spans 2 through 5 now have extensive corrosion and need replacement. The re-inspection also revealed that the open timber deck must also be replaced.

Alternatives Analysis

REHABILITATION

Rehabilitation repairs including realigning the two shifted trusses, replacing the bearings, replacing the identified bracing, lattice and the connection members, replacing some chord cover plates, repairing the crack at abutment 1, and painting the bridge are required. Painting of the bridge would entail cleaning by water blasting and painting. These above-described repairs do not include seismic retrofitting and therefore to protect the public in the case of an earthquake, it is recommended that a site seismic monitoring system be installed and train operating rules be enacted in the case of a seismic event.

In addition to the replacements listed above, the 2010 re-inspection and re-evaluation found that there was a significant increase in the amount of bracing requiring replacement, including virtually all of the top lateral and sway bracing in Spans 2 through 5. A much higher percentage of lacing bars or lattice bracing and lateral bracing connection members (gusset plates) throughout the bridge now require replacing. Nearly all the chord member cover plates now require replacement and, to extend the life-span of the repairs to a minimum of 30 years, the significant increase in top flange deterioration in the Span 1 bottom chords and diagonals requires that the channel top flanges be cut off and replaced with new flange angles bolted to the webs of the existing members before other new replacement material can be attached.

The 2010 re-inspection and re-evaluation also found that deterioration of the open deck timber ties had also increased since an earlier inspection performed by Modjeski and Masters in 2001, and that the ties were now in fair to poor condition such that the entire deck required replacement. With all of the additional steel repairs, the timber deck replacement, and cleaning and painting, the cost of the existing bridge rehabilitation in 2010 dollars is now estimated to be $6.3 million.

In addition to the above, the service life of a high quality bridge paint system and an open timber deck is 15 to 20 years, maybe much less for a paint system in a salt-air environment that does not receive annual paint life extension maintenance. Annual paint life extension maintenance includes keeping trees trimmed and well

M.P. 113.46—Salinas River Bridge, 715-foot Steel Through Truss Bridge

clear of the bridge; and washing the bridge to remove bird dung, leaves, dirt, ballast, and other debris that promotes corrosion. It has been found that tree trimming and washing on at least an annual basis will even double the life of an unpainted older non-weathering steel bridge, even possibly in a salt-air environment.

It is therefore recommended that tree trimming and washing be budgeted and performed on an annual basis and that timber deck replacement and cleaning, minor steel repairs, and repainting be budgeted and performed on a regular 15 year maintenance cycle. Performing these tasks on a regular maintenance cycle will easily prolong the life of the bridge to over 30 years or even indefinitely.

With the significant increase in deterioration found in the 2010 re-inspection and re-evaluation, even the relatively light weight DMU equipment proposed for providing LRT service cannot be operated over the bridge without performing the recommended steel repairs and replacing the open timber deck, particularly if a minimum 30-year service life is to be provided.

We also anticipate the need for a restriction on work trains with ballast hoppers traveling across the bridge. Ballast for track restoration or maintenance may have to be trucked to the south of the bridge and then loaded on the work trains. Since work train operations will be infrequent, however, maximum rated capacity of members could be used. Even so, further evaluation of the bridge capacity will be required to establish the type of locomotive that can be used for work trains and the level of ballast which can be transported if a loaded work train is to travel across the bridge.

Potential scour impact is a critical issue for the existing bridge, as the existing foundations have relatively shallow (50-foot) pile foundations. Scour is the erosion and deepening of the riverbed due to increased flows during a high water event. Significant scour could undermine the foundations leading to a catastrophic failure of the bridge. A 2001 report prepared by Shannon & Wilson estimated 30 foot of scour based on the hydraulic studies at the adjacent downstream Monte Road and Highway 1 bridges. Because all four bridges constrict the floodway, and because the upstream floodplain is considerably wider than the channel at the bridges, it can be assumed that contraction scour could add another 10 feet of scour. Therefore, a total scour of 40 plus feet may be expected at the railroad bridge during high water events. Placement of rip rap around the piers would mitigate potential scour but the cost of rip rap could be prohibitively high considering the amount of rip rap required.

In lieu of rip rap protection, another monitoring system could be installed to monitor the water level during high water events. Based on the structure vulnerability, an acceptable scour depth can be established which would determine the critical water surface elevation beyond which it would not be advisable to run the trains across the bridge. The monitoring system could be connected to a signal warning system, which would stop the trains before they cross the bridge when the critical water level is reached. We understand that FHWA has such a “Plan of action for scour critical bridges” which is similar to the above-described system.

The operation of the monitoring and signaling system for both seismic and scour would have to be inspected and maintained as necessary. Bay Area Rapid Transit (BART) has a similar system in place for seismic events.

It is also recommended that the riverbed profile be measured at least once a year to detect any erosion and scour problems that may impact the bridge’s stability. Shannon and Wilson cited a 20 mph limit on the train speed to provide a sufficient warning to a moving train before it reaches the bridge. This limit should be revisited by TAMC since the speed limit is a risk management issue.

The cost of the monitoring and signaling system for both seismic and scour is included in Parsons’ estimate. Parsons recommends further hydrological and scour investigation before deciding on the bridge rehabilitation option. Based on the results of such an investigation, the stability of the foundations can be more accurately determined. The ground profile assumed to support our current recommendations is based on Union Pacific Railroad’s 1997 inspection and report.

During the preliminary engineering/design phase, topographic and bathymetric surveys need to be carried out and the bridge should be re- evaluated if conditions are different than currently assumed.

It is important to note that a new bridge would be able to resist the anticipated seismic demands as well as withstand the anticipated erosion due to potential scour without the need for riprap. A new bridge would also not need a seismic or high water monitoring and signal warning system.

RETROFIT (WITH REHABILITATION)

Rehabilitating the superstructure together with seismically retrofitting the substructure, as suggested by the Shannon & Wilson geotechnical report was evaluated. However, the life span of superstructure would only be approximately 15 years compared to over 75 years for a replacement bridge. In 15 years, the trusses would have to be replaced and would be placed on the retrofitted substructure. Since the cost of rehabilitation and retrofitting is comparative to the replacement cost (and would be likely greater when you add in the cost of future superstructure replacement), and comparing the life cycle cost for both alternatives, this option does not appear to be economically prudent.

Rehabilitating the superstructure as described in the updated recommendations above, together with seismically retrofitting the substructure, as suggested by the Shannon & Wilson geotechnical report is now estimated to cost approximately $14.4 million in 2010 dollars. In spite of the life span of the rehabilitated superstructure being more than 15 years with a regular deck and paint maintenance cycle eliminating the need for replacement of the truss spans, this option still does not appear to be economically prudent.

REHABILITATION AND SPAN 1 REPLACEMENT

With the significant increase in deterioration found in Span 1 necessitating a significant increase in repairs to primary bottom chord and diagonal members, replacing Span 1 with a new deck girder span and rehabilitating the remainder of the existing bridge appeared to be a viable alternative. A Span 1 replacement using a steel deck plate girder span of the same type as investigated for the on-line alternative described below was assumed. This alternative, however, was estimated to cost approximately $8.0 million in 2010 dollars revealing that repair of the existing bridge without substructure retrofit still has a lower initial cost than replacement.

REPLACEMENT

Parsons examined two alignment design options which included keeping the replacement bridge on the same existing alignment, or moving it down stream. An upstream alignment option was not considered prudent as it would have negatively impacted the track alignments approaching the bridge. A replacement structure on a new downstream alignment is proposed to be located approximately 40 feet from the existing structure to clear the concrete piers and most of the supporting timber piles. Note that the proposed location would be within existing TAMC right-of-way. The new alignment would maintain the same top of rail elevation. Bent locations would be kept at the same alignment relative to the channel as the existing bridges in order to minimize an increase in anticipated scour.

Both steel plate deck girder and the prestressed box girder design options were considered. The steel plate girder superstructure would consist of 11-foot deep twin plate girders with a cast-in-place concrete deck supporting the track structure. The girders would be supported on cast-in-place concrete caps. The substructure consisting of two 6-foot diameter cast-in-steel shell concrete piles is proposed at this location similar to the downstream Monte Road Bridge and the Highway 1 bridges. The pile spacing would be kept at approximately18 feet to achieve needed lateral capacity to resist seismic loads. The 6-foot diameter steel shells would be 1-inch thick, which includes ¼ inch corrosion allowance. The pile shells would be filled with concrete and reinforcing steel to resist vertical and lateral loads.

Per Shannon and Wilson's geotechnical report, the soils at the site are liquefiable and the substructure would be unsupported for approximately 30 feet below the existing ground during a seismic event. Hence, the large diameter steel shells filled with concrete would offer adequate lateral and vertical support. The proposed piles would be approximately 130 feet long as recommended in the Shannon & Wilson's geotechnical report. The updated construction cost in 2010 dollars is now estimated to be approximately $9.6 million which includes the recent significant drop in steel costs. Even though an increase in steel costs in the near future has been rumored, this increase should be covered by the contingency amount included in the cost estimate.

A prestressed concrete box girder design was also considered. This option would consist of 12-foot deep box girders supported on cast-in-place concrete caps and two 7-foot diameter cast in steel shell concrete piles. The 7-foot diameter piles are assumed to be 130 feet long and 1-1/8 inches thick, which includes ¼ inch corrosion allowance. The updated construction cost in 2010 dollars is now estimated to be approximately $10.9 million which is now more than the steel option.

Of these alternatives, in addition to lower 2010 overall costs, the steel plate girder option on a new alignment would offer ease of construction, lighter weight, and reduced substructure cost. A plate girder alternative would also avoid extensive false work construction. Partial length girders could be brought to the site and spliced during erection. The superstructure would require periodic inspection and maintenance, including annual tree trimming and bridge washing and cleaning and painting on approximately a 15 year cycle. The concrete option, however, would require only routine inspection and minimal maintenance.

A superstructure replacement option consisting of steel plate girders on the existing alignment was also considered. The existing structure would have to be removed to the bottom of the concrete piers. Partial abutment removal would also be necessary. The existing timber piles supporting the concrete piers would be very difficult to pull out and if pulled, soil would be disturbed which in turn would reduce the lateral capacity of the new piles. Therefore, Parsons would propose to leave the timber piles in place and construct new piles and pile caps to clear the existing piles. This would make the pier cap considerably longer and deeper than rebuilding the bridge on a new alignment. Seven-foot diameter, cast-in-steel shell concrete piles are proposed for this alternative due to heavier superstructure loads.

For the existing alignment option, the updated construction cost in 2010 dollars is now estimated to be approximately $11.7 million which reflects the recent significant drop in steel costs. The superstructure of this option would also require periodic inspection and maintenance, including annual tree trimming and bridge washing and cleaning and painting on approximately a 15 year cycle.

ADDITIONAL COST CONSIDERATIONS

Note the above construction cost estimates for all the options include a 25 percent contingency allowance. Approximately 25 to 30 percent should be added to the above cost for the design/construction management/agency soft costs.

Recommendation

Parsons recommends replacement of the bridge on a new downstream alignment within the existing railroad right of way. Although there is a higher initial cost for a new bridge the overall life cycle cost spread over the 75 plus year life would be lower. A new bridge will also provide less risk as it will be designed to current codes in regards to seismic and high water events. This also provides for assurance that substantial interruption (1 to 2 years) caused by a seismic or high water event to passenger services would be minimized or eliminated.

Updated costs of a new bridge in 2010 dollars ranges between approximately $9.6 and $10.9 million for steel and concrete superstructure alternatives respectively. At this time it appears the steel superstructure may now provide the preferred alternative but this also must be confirmed during the next phase of engineering development and the added maintenance of a steel structure must be considered.

If the funds are not available to replace the bridge, Parsons recommends rehabilitating the bridge, including installing the monitoring and signaling system for both seismic and scour events. The possibility of an extended interruption in service to a large number of patrons in the case of significant damage caused by an earthquake or high water event must, however, be considered. Note also that a concrete bridge replacement would have a lower life cycle cost since the existing bridge will need replacement in 15 to 20 years or need to have annual tree trimming and bridge washing maintenance and have the timber deck replaced and cleaning, minor steel repairs, and painting performed on a 15 year cycle.

Table 10-2 lists the bridge alternatives considered along with the estimated construction and design costs. Life cycle costs are not included in the estimate.

Table 10-2
SALINAS BRIDGE REPAIR/REPLACEMENT ALTERNATIVES

Alternative	Construction Cost (millions)	Soft Cost (millions)	Total Cost (millions)
Rehabilitation	$ 6.3	$1.9	$ 8.2
Rehabilitation with seismic retrofit	14.4	4.3	18.7
Rehabilitation with span 1 replacement	8.0	2.4	10.4
Replacement on new alignment			
• Steel plate girder	9.6	2.9	12.5
• Prestressed concrete box	10.9	3.3	14.2
Replacement on existing alignment			
• Steel plate girder	11.7	3.5	15.2