APPENDIX E

CALTRAIN HISTORY AND BACKGROUND

A. PENINSULA CORRIDOR

1.0 HISTORY OF PASSENGER SERVICE

San Francisco and San Jose Railroad Company began passenger service in the peninsula corridor from San Francisco to San Jose on October 18, 1863. In 1870, the Company was acquired by the firm that was eventually consolidated into the Southern Pacific Railway. Southern Pacific double-tracked the line in 1904, and operated passenger service in the corridor successfully until after World War II. In 1977, citing declined ridership, Southern Pacific petitioned the State of California Public Utilities Commission (CPUC) to abandon the passenger service.

From 1980 until 1992, California Department of Transportation (or Caltrans), sharing operating subsidies with the San Francisco, San Mateo and Santa Clara counties, contracted with Southern Pacific to continue the service. Caltrans assumed sole responsibility for station acquisitions and other capital improvements until the formation of the Peninsula Corridor Joint Powers Board (PCJPB) in 1987.

2.0 CALTRAIN COMMUTER RAIL SERVICE

PCJPB assumed the operating responsibilities for the commuter rail service or *Caltrain* effective July 1, 1992, and began to shoulder 100 percent of the operating subsidy a year later.

In December 1991, PCJPB purchased Caltrain right-of-way between San Francisco and San Jose (51.5 miles), and trackage rights further south to Gilroy (26 miles). Caltrans deeded 26 stations, 20 diesel locomotives and 73 bi-level passenger cars to the PCJPB in 1993. The Union Pacific Railroad (UP) acquired Southern Pacific in 1996, and retains rights to operate freight service along the corridor. PCJPB contracted with Amtrak to operate/maintain Caltrain until late 2011 when Transit America Service, Inc. (TASI) took over.

B. DUMBARTON RAIL CORRIDOR

In 1994, SamTrans purchased the Dumbarton Rail Corridor between Redwood Junction and Newark Junction for future commuter rail service. The Dumbarton Rail Corridor (DRC) will extend commuter rail service across the bay between the Peninsula and the East Bay.

C. CALTRAIN DESIGN DOCUMENTS AND GUIDELINES

1.0 CALTRAIN DESIGN STANDARDS

In 1994, Caltrain developed its first design standards and guidelines (*PCJPB Standards, Volumes 1 and 2*). These documents, drawn largely from former Southern Pacific's standards, provided general guidelines to the construction and encroachment activities within the corridor. They were used for several projects (stations and grade separations) sponsored and managed by the Cities.

In 1999, Caltrain developed its first design criteria and standard technical drawings for signals (*Communication/ Signal Engineering Standards*, and *Communication/ Signal Design Standards*), and for track (*Track Standard Drawings*).

In 2007, the above documents (including all others as except those listed in APPENDIX B) were superseded by Caltrain Engineering Standards. These Standards, consisting of Design Criteria, Standard Drawings, and Standard Specifications were the first Caltrain comprehensive Engineering Standards. Together with '*Standards for Maintenance and Construction of Structures*" (2003), "*Engineering Standards for Excavation Support System*" (2003), and '*CADD Manual'* (2003), they formed complete Caltrain Engineering Standards.

This 2011 documents are the first revision of the above 2007 Standards.

2.0 CALTRAIN CONSTRUCTION DOCUMENTS

In 1999, Caltrain completed its first comprehensive construction documents for use on the 1998/99 Facility Upgrade Project (Ponderosa). The construction documents included General Conditions (Division 0) and Special Provisions (Division 1) and Standard Specifications (Divisions 2 through 16 and 18). These documents, including the construction drawings, have since been used as a basis for design and construction of subsequent capital and maintenance projects. They were also the basis for the development of the Caltrain Engineering Standards 2007.

3.0 CALTRAIN SIGNAL SYSTEM MIGRATION

3.1 Migration of Caltrain Signal System Defined as Bidirectional

The Migration of the Caltrain Signal System was defined as follows:

1. Replacement of Relay Based Systems with Microprocessor based ones: All areas outside the San Francisco and San Jose Terminals completed in 2006.

2. Replacement of telephone leased lines with Advanced Train Control System (ATCS) Radio: ATCS Radio is the primary medium of train control communication with Telco back up at 80% of the Control Points completed in 2003.

3. Replacement of dc track circuits and line circuits with Electronic Coded Track circuits: OS (On Station) tracks remain dc and there are some dc track circuits in locations where the coded track is on line circuits completed in 2003.

4. Replacement of system of single direction running ABS (Automatic Block System) with double direction running CTC: Completed in 2003 with the completion of the construction of Caltrain CTX projects.

5. Installation of a Positive Train Control System

6. Implementation of a signal system that will also function in an electrified environment

By defining the path of migration, projects today will lay the groundwork for future projects. Since the railroad was originally defined as single direction running, many highway grade crossings were designed for greatly reduced speeds in the reverse direction. In times where one track is removed from service due to construction, or operational difficulties, the service disruption was magnified by the reduced speed required over these crossings.

Once the path of migration was defined as a bidirectional running railroad on both tracks, grade crossings were designed to accommodate the ultimate 79 MPH (miles per hour) operation on both tracks. Non-signaled moves are limited by Federal regulation to 59 MPH. The crossings were designed to allow for 79 MPH operation when the track became signaled in both directions. This approach avoided costly retrofit or replacement when the implementation of the signal migration for the whole corridor took place.

3.2 Migration to Centralized Traffic Control (CTC)

Caltrain has successfully migrated to Centralized Traffic Control (CTC). With the construction of express tracks and a track structure of numbers 20 (Limited Speed), 14 (Medium Speed) and 10 (Slow Speed) powered turnouts, it became apparent that the Route Signal Aspects would not support the optimal operation. Speed Signaling was placed in service north of CP Coast. Speed Signaling alerts the train operator when the train is approaching a higher speed turnout. Different aspects are displayed for moves through number 20 turnouts, number 14 turnouts, and number 10 turnouts. In a Route Signal System, a train only knows it is to take a diverging route and must approach a control point with different sized turnouts prepared to take the turnout at the lowest speed of any turnout, which can be reached, from that signal.

Control Points have been designed to accommodate the presently funded projects, and as much as possible, facilities were sized to allow for future projects. Currently trains are governed by wayside signals. In the future, there will be some on board enforcement of signal indications. With increased rail traffic, this important safety feature will be necessary. Express train operation may call for trains to operate at greater than 79 MPH. This too will require on board control of locomotives by the signal system. Whether it is a form of intermittent automatic train stop, or a form of automatic train control, the present system has been designed to allow for the addition of the new equipment.

3.3 Signal System and Future Electrification

Caltrain Board of Directors have mandated future electrification of the Caltrain corridor. Equipment installed today must be sized to allow for the addition of necessary filtering and other equipment required for operation in a high noise traction power environment. Funding guidelines prohibit purchasing equipment for projects other than that funded. However, an intelligent design with a defined path of migration, allows for the future projects to build upon the present projects, and for newly installed equipment to be reused as much as possible.

The migration path has been defined as moving the Caltrain signal system from a single-direction running automatic block between Control Points, to one of bidirectional CTC with express tracks. This has been accomplished. Relay logic is being replaced with programmable solid state microprocessor based logic. Leased telephone lines are being replaced with ATCS radios. Caltrain's new criteria on signal system uses Electrode 4+ Code Rates. While this is a system manufactured by GETS, the code rate structure is an open architecture and can be emulated by competitive vendors. This equipment can be augmented to operate in an electrified environment, and it can support on board train control equipment.

3.4 Signal System at Pedestrian Crossings

In addition to the high number of motor vehicles, which cross the railroad, there are a large number of pedestrians who cross the Caltrain tracks. The safest crossing for both pedestrians and motorists is one which is at a separate grade, either over or under the tracks. The ideal scenario is to have no at grade crossings. In the meantime, necessary crossing points for pedestrians are to be treated in the same manner as necessary crossings for motorists. These will have microprocessor based Constant Warning Time systems, and pedestrian gates. At stations, and on sidewalks where major work is taking place, auxiliary sidewalk gate arms will be added to the roadway gate, and a new gate assembly will be installed in the off quadrant on the sidewalk for pedestrians.

This Caltrain Design Criteria incorporates many lessons learned from recent projects, a commitment to the judicious use of public funds by defining the migration path, and recognizing the risk inherent to pedestrians and vehicles crossing the railroad at grade.

4.0 CALTRAIN GRADE CROSSINGS

The Caltrain line is the oldest passenger line west of the Mississippi. As such, it has been a double track operation through the city centers of a major west coast metropolitan area for over 100 years. Grade crossing control systems have evolved to enhance public safety and to provide more efficient train operations.

4.1 Vehicular Crossings

The former Southern Pacific Railroad (SP) developed several innovative treatments for the grade crossing control systems. Among these treatments was a series of calibrated track circuits where speed measurements were used to determine whether a train approaching a grade crossing was going to stop short of the crossing, or go through the crossing. These applications were costly in terms of relays, insulated joints and cabling.

In the 1960's, in order to enhance the operation through grade crossing, the SP, in partnership with Stanford University sponsored the development of Constant Warning Time devices, known as predictors.

In 1990, as part of the rehabilitation of the property as a condition of sale to the State of California, the SP upgraded 10 vehicular crossings with "next generation" microprocessor based Constant Warning Time devices. These crossings were Broadway Avenue (Burlingame), Holly Street, Watkins Avenue, Rengstorff Avenue, Castro Avenue, Sunnyvale Avenue, Stockton Avenue, Lenzen Avenue, Auzerais Avenue, and Virginia Street. The benefits of the upgrade are enhancement to both vehicular and train operations through the crossings.

As part of the 1998/1999 Facility Upgrade project (Ponderosa), Caltrain began an extensive vehicular grade crossing rehabilitation. The three most important components of the rehabilitation are installation of new signal control equipment, removable concrete panels, and drainage system. There have since been several projects of rehabilitating the grade crossings.

4.2 Pedestrian Crossings at Stations

In 1998, during the construction of BART extension to the San Francisco Airport (BART SFO Extension), it became necessary to relocate the San Bruno station to just north of I-380 Overpass. Since this area was just north of a 3 degree track curve, it was observed that a person crossing the tracks would have only about 5 seconds to visually detect an approaching northbound train. To complicate the matter further, the area was also a high noise environment with both the freeway and the flight paths to San Francisco Airport (SFO) being directly overhead.

The permanent San Bruno station is now just south of the I-380 overpass.

4.3 Caltrain Grade Crossing Standards

The need was clear to reevaluate the pedestrian at-grade crossings. There are, however, no nationally or state recognized standards for the design of pedestrian crossing warning systems on railroads. This was the catalyst for the development of the Caltrain Pedestrian crossing at stations. At its own initiative, Caltrain, in collaboration with Signal and other Consultants developed its own recommended practices of pedestrian grade crossing configuration at stations.

These resulting standards utilize active warning devices similar to those of vehicular crossings, signal equipment modified from that of vehicular crossing, crossing gate arm, and a crossing configuration. These standards are an example of the integrated effort required from the various disciplines to provide a safe and effective means for pedestrians to cross the tracks. This prototype was first used at the relocated San Bruno station, and during the Ponderosa project at the San Mateo, Hayward Park, Redwood City, Menlo Park and Mountain View stations. In 2004, the then new San Bruno Station was built to this standard, and the Sunnyvale station was brought into conformance with this standard.

D. CALTRAIN TODAY

1.0 CALTRAIN SERVICES

Currently Caltrain's service includes Express ("*Baby Bullet*") service on top of a blend of local, skip stop, and limited express services. Caltrain is a diesel push-pull system operating over a mostly double track line, with a small amount of three and four track sections of bypass tracks. All trains operate at the maximum authorized speed (MAS) of 79 miles per hour. Average ridership is over 32,000 passengers (2006).

The Baby Bullet service (or Express service) began in June 2004. The current service includes 11 morning and 11 afternoon/evening weekday trains, shortening the commute time between San Francisco and San Jose to just under one hour. Baby Bullet trains make up time by stopping at fewer stations and by bypassing other trains.

Caltrain's current commuter service includes (2011), which is reduced from a high of 96 trains on weekday.

a. 86 scheduled weekday trains (including 22 express service, and 28 limited express service)
b. 36 (Saturday) and 32 (Sunday) scheduled trains including 4 express service each weekend day
c. 34 Stations, most with parking
d. About 40 bicycle spaces per train consist
e. Transfer to San Francisco MUNI system at 4th and King Station
f. Transfer to BART system at Millbrae Station
g. Transfer to VTA system at Mountain View Station
h. Transfer to VTA, Capitol Corridor, and Amtrak at San Jose Diridon Station
i. Transfer to Altamont Corridor Express (ACE) at Santa Clara Station and San Jose Diridon Station

2.0 CALTRAIN CORRIDOR ASSETS

Caltrain corridor assets include the following.

a. 77 route miles
b. 105 miles of main tracks and controlled sidings

c. 34 passenger stations (67 boarding platforms)
d. 31 locomotives, 112 cars, including 34 cab cars
e. 106 support buildings and station buildings
f. 65 railroad bridges, 13 pedestrian underpasses, and 4 tunnels
g. 31 control points
h. 48 grade crossings between San Francisco and San Jose
i. 38 grade crossings between San Jose and Gilroy
j. 612 acres fee owned operating rail corridor
k. 79 acres of easement operating rail corridor

For more details, see *Caltrain Track Charts, Right-of-Way and Rail Corridor Infrastructure Assets*.