CHAPTER I

DESIGN GUIDELINES

A. PURPOSE

The Design Criteria (Document) establishes the uniform and minimum standards for planning, design, and construction as well as maintenance of Peninsula Corridor Joint Powers Board (PCJPB or JPB) facilities. This document is developed based on best industry standards and accepted practices for Commuter/Class 1 railroads and equals or exceeds applicable regulatory requirements.

PCJPB and JPB are used interchangeably to mean agency. The name of the commuter service, Caltrain is often used in this document in the capacity as the agency because of the familiarity of the public with the name and associating it as the agency.

The Design Criteria (Criteria) is intended to cover the majority of Caltrain’s current and future improvements. The Criteria does not attempt nor is it practical or feasible to cover all situations that might be encountered or requested throughout a project’s life. Future large projects such as Electrification, and Dumbarton Rail Corridor (DRC) will develop their own Criteria and Standards on an as-needed basis.

Other projects by other various such as the Downtown Extension (DTX) and the Transbay Terminal Center (TTC) by the Transbay Joint Powers Authority (TJPA), and the California High Speed Train (HST) by the California High Speed Rail Authority (CHSRA) will have their own Criteria and Standards. The DTX project includes sharing of underground multi-modal stations, tunneling, etc. Part of the CHSR is planned to share Caltrain corridor, which will involve shared use of some stations and facilities.

1.0 CALTRAIN STANDARDS

This document, together with two other documents, namely Standard Drawings, and Standard Specifications supersedes the first issue (April 2007). The other three (3) other documents listed below issued separately which collectively form Caltrain Engineering Standards, or Caltrain Standards.


c. CADD Manual (“Drafting Standard”)
All these documents, including any changes made to them are available online on the Caltrain website (caltrain.com).

References on regulatory bodies and industry standards are included in the APPENDIX.

In the event of conflict between the Criteria, Specifications and Standard Drawings, and the industry standards such as AREMA, Federal Railroad Administration (FRA), California Public Utilities Commission (CPUC), and other State and Local Agencies, the most stringent requirements shall take precedence. Caltrain’s determinations regarding conflicts shall be final.

1.1 UPDATES AND REVISIONS

As with any Standards, this is a life and controlled document. Users may forward any proposed changes or suggestions for consideration through the website. The criteria in this document will be updated on a continual basis to reflect regulatory changes and changes in Caltrain and industry practices. These updates will be posted on the website. Periodically, Caltrain will issue revised documents to replace the existing documents.

It is the responsibility of the designers and other users to use the latest applicable updates and revisions.

1.2 DESIGN VARIANCES

In this Document and all other Caltrain Standard Documents, standard (‘shall’) means required, no exception. Guidance (‘should’) means recommended, involving engineering judgment. Option (‘may’) means permission. Support is informational statement. Any deviations from all these criteria shall receive prior approval by the Caltrain Deputy Director of Engineering.

It shall be noted that variances or deviations are not for convenience. They shall be very rare, and only as a last resource and only after exhaustive analysis. Designers or other Project personnel shall not request a variance based on precedence. To request a variance, designers shall prepare written justifications documenting the reasons and justifications. If approved, the variance is only valid for the specific location of the project. This variance can not be used for future variance request. Any design variances shall never be less than the regulatory standards, and shall not introduce unacceptable safety and functionality of the railroad.

2.0 DESIGNER ROLES AND RESPONSIBILITIES

The Criteria contained in this document is intended to provide the designer with flexibility while ensuring that the functionality, goals and objectives of Caltrain are met. The Design Criteria shall be used in conjunction with sound engineering judgment, experience and standard industry practices. This document in no way replaces the individual designer’s adherence to the profession’s “standard of care” in design.
Review of the design by Caltrain is part of the Owner’s Quality Assurance (QA) process to provide some level of independent verification. The designers are ultimately responsible for every aspect and the overall integrity of the design.

B. PENINSULA CORRIDOR JOINT POWERS BOARD (PCJPB)

Caltrain is a commuter rail service operating on a 77-mile corridor between the cities of San Francisco and Gilroy. Caltrain is owned and governed by the Peninsula Corridor Joint Powers Board (PCJPB or JPB).

The Peninsula Corridor Joint Powers Board is a state-authorized joint powers authority comprised of the three counties where Caltrain operates: San Francisco, San Mateo, and Santa Clara Counties. PCJPB owns approximately 52-route miles of rail corridor between San Francisco and San Jose, and an additional approximately 25 miles of trackage rights from San Jose to Gilroy. San Mateo County Transit District (SamTrans) provides administrative and staff support for PCJPB. See FIGURE 1-1 CALTRAIN SYSTEM MAP.

After about 20 years as Caltrain’s Contract Operator, Amtrak (National Railroad Passenger Corporation) is being replaced by TASI (Transit American Services, Incorporated), a subsidiary of Herzog in 2011. Being the Operating Railroad of Record (ORR) the Contract Operator operates the trains and performs the State of Good Repair (SOGR) maintenance of the infrastructure (track, signal, stations, structures and other facilities as well as ROW maintenance), and inspections of bridge structures.

Additionally, the Contract Operator also on an as-needed basis provides supports of construction activities (capital, maintenance, and third-party work) in the form of Roadway Worker Protection (RWP) as well as signal maintainers, track inspectors, and communications system technicians. The Contract Operator performs the services of certifying the conditions of track and signaling and communications systems for return to safe and functional train revenue service following the completion of construction work.

1.0 CALTRAIN MISSION

Caltrain strives to provide a safe, convenient, reliable and economical rail transportation system offering minimum travel times to commuters within the San Francisco Bay area. Caltrain is constantly seeking to provide new and improved services to meet the needs of the commuters, as well as increased operational efficiency.

The principal objectives of Caltrain commuter system are:

a. A safe, reliable and cost effective service

b. Contribution and support of regional air quality goals
SAN FRANCISCO BAY AREA

FIGURE 1-1 CALTRAIN SYSTEM MAP
c. Working in partnership with regional plans and policies, and communities and other stakeholders for a balanced transportation system and potential economic enhancement.

d. Integration with other transit modes

e. An infrastructure that will sustain future regional growth

2.0 CALTRAIN CORRIDOR ASSETS

Current Caltrain corridor assets can be found in Caltrain Track Charts, Right-of-Way and Rail Corridor Infrastructure Assets.

3.0 UNION PACIFIC RAILROAD

The Union Pacific Railroad (UPRR or UP) has the trackage right to operate local freight service on the Caltrain corridor. Majority of the cargo is typically lumber, rock aggregates and some scrap metal. Freight traffic, about 3 or 4 trains daily, is typically moved at night.

The UPRR owns, maintains and controls Track No. 1 from CP Coast (Santa Clara) to CP Lick (San Jose), and all tracks from CP Lick to Gilroy. PCJPB has trackage rights from CP Lick to Gilroy.

The UPRR and the PCJPB have joint facility arrangements in a number of locations. The PCJPB has the responsibility of maintaining a freight yard in South San Francisco and all industrial tracks that are within the Caltrain right-of-way (ROW) from San Francisco to CP Lick.

4.0 PROJECT DELIVERY METHODS

Caltrain generally develops and manages its own capital and maintenance projects entirely from conception to completion through all typical major project delivery phases such as planning, design and construction. Some projects are sponsored and managed by other PCJPB partners, this typically being VTA (Santa Clara Valley Transportation Authority) for improvements within the Santa Clara County. Some Cities have sponsored and managed for improvements through their cities.

Construction contracts are typically DBB (Design Bid Build) on the basis of a competitive bid similar to any public works contracts. Other project delivery methods may be by the procurement process, for long delivery items, and for other supply contracts for materials such as ballast. Caltrain will consider, on a case by case basis, Design-build delivery method if the projects are relatively large (dollar and duration) and complex. Caltrain has not implemented this delivery method.

C. PLANNING AND DESIGN CONSIDERATIONS

For a successful implementation of a project, especially during the conceptual and preliminary design stages, the designers must have a good understanding of the
current and future needs of the system and the design parameters that may impact the design. The purpose of this section is to outline the considerations that require analysis and review in the planning process.

Caltrain capital projects fall into the categories of safety improvements; state of good repair; operational enhancements and new initiatives. Safety improvements are developed through state and federal mandates and/or conditional assessments. State of good repair projects are to sustain the current system and operation taking into consideration of current conditions and remaining useful life of the asset. Operational enhancements are projects which improve throughput and reliability while new initiatives address long range planning efforts and future needs.

Mission critical components are defined as those that have a direct impact on the system safety, security and operations. For the mission critical components, the designer shall provide in-depth technical analysis and develop alternatives for Caltrain review. Operationally, the performance of each alternative should be measured in throughput, reliability, capacity, and functionality.

Each design level needs to be thoroughly reviewed prior to the beginning of next design level. Each level shall be accompanied by an updated schedule, cost estimate, specifications, constructibility analysis, and Caltrain’s Safety and Security Certification.

During planning phase, considerations include Operations planning and Environmental planning. This will involve identifying stakeholders, such as the local agencies (cities, counties), communities (residents and businesses), PCJPB partners, Caltrain riders, etc. Designers shall closely collaborate with Caltrain to solicit and evaluate inputs from the stakeholders, and set and manage expectations.

1.0 OPERATIONAL PLANNING

Early in the planning phase, inputs from the Operations are essential. Examples of such inputs include the following:

a. Capacity and throughput improvements
b. Electrification (Future)
c. Infrastructure changes to enhance train performance
d. Track speed increase to accommodate future operations
e. Train service levels increase
f. Trip/travel time reduction
g. Safe and timely interchange of passengers and information among various local and regional modes of transportation.
2.0 ENVIRONMENTAL PLANNING

For projects that require environmental clearance and subject to permitting requirements, the environmental process will be conducted during the project planning phase in accordance with the guidelines and requirements of state and federal agencies below.

a. CEQA (California Environmental Quality Act) guidelines

b. NEPA (National Environmental Policy Act) requirements

Project sites with historical resources such as station buildings (depots) and historical districts listed on the National Register of Historic Places (NRHP) are under the purview of the State Historical Preservation Officer (SHPO). The South Bay Historical Railroad Society (SBHRS) has an agreement with SHPO as the custodian of all historical depot buildings owned by Caltrain. Additionally, local historical resources designated by the cities and local governments, such as station building at Atherton Station, shall be given proper consideration.

The environmental studies are normally conducted and engineering design and analysis progress in concert to support the studies. The studies involve identifying, verifying any potential impacts and if any, the corresponding proposed mitigations. Examples of these activities include impacts to adjacent properties, historic preservation need, visual interest, noise mitigation, and aesthetic improvements, traffic analysis, etc.

The planning process also includes identifying any possible ROW acquisitions, either permanent acquisitions or as temporary construction easements (TCE).

3.0 DESIGN LIFE

The design life for both permanent and temporary facilities are described below. While this determination is typical for railroad environment the Designers shall use it as a guidance subject to site specific conditions and circumstances, as well as time.

3.1 Permanent System Wide Facilities

Permanent facilities shall generally be designed for a minimum life as follows:

a. Track System: 50 years

   This system commonly referred to as track structure for both track and special trackwork includes the following components:
   i. Rail
   ii. Fastening System
   iii. Ties
   iv. Ballast
   v. Subballast
   vi. Subgrade
b. Signaling System: 25 years, except noted otherwise

Signaling system is a most mission critical component of a commuter operations. The system, in concert with track system and train control communication system governs the operations of railroad. It includes the following:

i. Signal houses
ii. Signal equipment/computers: 10 years
iii. Signal software system: updated as provided by the manufacturer

c. Train Control Communication System: 20 years, except noted otherwise

The system, working in concert with the signaling system is part of communication for train operations:

i. Communication tower
ii. Data or Radio system, including fiber optic

d. Stations and Facilities: 50 years, except noted otherwise

The facilities are typically station related and generally contained within the limits of the stations:

i. Station platforms
ii. Station amenities (shelters, benches, bike racks, bike lockers): 15 years
iii. Electrical system
iv. Station buildings
v. Parking structures and surface parking

e. Station Communications: 10 years

These are technology based system subject to dynamic and continuous enhancement in technology. Including in these are:

i. VMS (Variable Message Sign)
ii. PA (Public Address) system
iii. TVM (Ticket Vending Machine)
iv. CCTV (Closed Circuit Television) cameras

f. Major Civil Structures: 100 years

Major civil structures are part of the railroad infrastructure as follows:

i. Bridges
ii. Grade separation structures (vehicular)
iii. Grade separation structures (pedestrian underpasses and overpasses)
iv. Retaining walls

g. Others:

Other civil engineering components include the following:

i. Grade Crossings (non-signal): 25 years
ii. Drainage System:
   1. Storm Water lift station: 50 years
   2. Culverts (large, crossing tracks): 50 years
   3. Track side ditches: 10 years

iii. Landscaping and irrigation system: 15 years

3.2 Temporary System Wide Facilities

These facilities accommodate construction of permanent systems and shall be designed for a period up to five (5) years. They are typically required to facilitate construction, or for interim improvement prior to construction of permanent facilities. Examples of these facilities include the following:

a. Shoofly (temporary tracks)

b. Temporary station and related facilities during construction

4.0 STANDARDIZATION OF EQUIPMENT AND MATERIALS

Design must include the use of standardized equipment and materials wherever possible. Standardization ensures ease of procurement, and inventory management; minimizes staff training; optimizes maintenance; and avoids long lead time for materials, equipment and components.

Major equipment and materials shall meet industry standards, be available off the shelf, and supplied by established manufacturers that have a well documented quality product and history of furnishing to Commuter or Class 1 railroads that have the service experience and operating conditions similar to those of the Caltrain system. Selection of equipment and materials shall consider long term costs, ease of construction and maintenance, and readily technical support availability.

D. GENERAL DESIGN CONSIDERATIONS

In the early phase of the design, designers shall prepare a Design Basis Memorandum (DBM) summarizing the project description and its limits, scope, technical criteria, any design variances, key specifications, etc., which have been reviewed and approved by Caltrain Deputy Director of Engineering. The DBM shall include all assumptions, Records of all Requests for design exceptions, a thorough analysis for justifications and their subsequent rejection or approval by Caltrain Deputy Director of Engineering. The DBM shall then be used as a basis for the detailed design and design review.

Prior to each design submittal to Caltrain, the designers shall check all design documents to ensure that the project deliverables are complete and accurate, conform to Caltrain design criteria and standards, and consistent to the best and accepted industry standards and practices. The designers are responsible and shall perform a thorough quality control review in accordance with the established procedures on all project deliverables before their release.
As part of the early project delivery, the designers shall develop a specific design checklist to meet the needs and objectives, in order to facilitate the quality control process. The objective shall include establishing sustainability goals in general accordance with the State Building Code, in particular Green Building Standards Code (or CalGreen). Below are examples of design considerations that the checklists should incorporate for various design disciplines.

1.0 CONSTRUCTION IMPACTS

It is imperative that during design that construction phasing or staging for any project which intrudes on or has the potential to intrude on rail operations shall be planned in such a way as to mitigate any impact on Caltrain train operations. Further, the design review process shall clearly identify the resources required from Caltrain, and all impacts to operations, including when and for how long as well all mitigation measures. All must be collaborated and approved in advance by Caltrain Rail Operations.

The following may be used as a guidance for planning construction phasing and staging:

a. Double track closure is not permitted during regular scheduled services. Double track closure may be permitted but limited to the short off-peak service hours and only on weekends.

b. Single track closure may be allowed during weekends.

c. Speed of temporary tracks shall typically be maintained at existing speed, but in general not less than 65 MPH.

d. Caltrain operates additional services for special events that are not in the passenger time table.

e. Station closure shall not be contemplated.

2.0 OPERATING SAFETY CLEARANCES

a. Locomotives and Rail Cars (dimensions, weight, clearance envelope, capacity, etc.).

b. Horizontal and vertical clearances for permanent and temporary features and structures.

c. Horizontal and vertical clearances for construction and maintenance equipment.

d. CPUC Requirements.

e. Sight lines of train engineers.
3.0 TRACK SYSTEM

Track design drawings shall be checked with full track element “footprints” for special trackwork elements to check and assure that switch machines, headblocks, insulated joints (temporary and permanent), walkways, drainage channels or side ditches, and signal foundations and all related appurtenances can be constructed without interference. Embankment and drainage design shall include footprints for signals, signal enclosures, and signal and communications vaults, manholes, pull boxes, and conduit runs.

a. Constructability
b. CPUC requirements
c. Safety of freight operations
d. Drainage and grading of trackway
e. Horizontal track alignment and vertical track profile requirements
f. Locations of special trackwork includes signal components
g. Locations of related track and signal components
h. Sections typical to trackway
i. Spacing and clearances of track
j. Design speed and maximum authorized speed

4.0 STATIONS AND FACILITIES

Stations shall be designed to provide safety, and accessibility to all users, including bicyclists and mobility impaired persons. The resulting stations shall be convenient, functional and attractive. Safety is paramount of all. The station design shall include platforms, access to platforms, platform crossings, station furniture and amenities and parking. The stations shall be functional for passengers, integrating other existing modes of local and regional transportation systems. To the extent possible, the stations shall be as attractive as possible, incorporating local elements.

5.0 STATION COMMUNICATIONS SYSTEM

This communications system include three (3) components, namely passenger information system (Visual Message signs or VMS, and Public Announcements or PA), fare collection (TVM or Ticket Vending Machine, and Clipper or regional pay system), and safety and security system.

Passenger information system is controlled from the CCF (Central Control Facility) at CEMOF (Centralized Equipment Maintenance and Operations Facility). The other two systems are controlled at Caltrain headquarters in San Carlos, except that
Clipper is managed by the San Francisco Bay Area Metropolitan Transportation Commission or MTA.

6.0 SIGNALS

This is a mission critical component of the Caltrain commuter system. Design of signaling system shall incorporate the following checklist:

a. Aspect strings
b. Cable, conduits and pull boxes including schedules
c. Electrical and communication services requirements
d. FRA/CPUC requirements
e. Frequency compatibility
f. Grade Crossing Warning System Controls
g. Grade Crossing Warning System Devices (including pedestrian)
h. Grade Crossing Warning System Time
i. Locking times
j. Power switch machines
k. Signal clearances
l. Signal headways
m. Signal houses, signals and insulation joints locations
n. Signal sight distance requirements
o. Signal stopping distance requirements
p. Signal types and sizes
q. Station stop locations (present and future)

7.0 TRAIN CONTROL SYSTEM

As with Signaling system, this is a mission critical component of the Caltrain commuter system, among others providing interaction among the train dispatchers and field personnel. The system is integrated to the train signals system. Train control communication consists of the following components:

a. Base stations and antenna towers
b. Data radio system
c. Voice radio system

8.0 AT-GRADE CROSSINGS

Design of grade crossing shall result in a safe, convenient, and functional passage for trains and all users, including motorists, and non-motorists (pedestrians, mobility impaired persons, bicyclists). The vehicular crossings where there are adjacent roadway intersections shall be thoroughly analyzed using a “Diagnostic Team” approach involving the Local Agency (cities, counties) as well as the CPUC. Additionally, a risk analysis shall be performed on vehicular crossings with a high pedestrian traffic.

The design shall meet the requirements of the ADA accessibility, Federal Railroad Administration (FRA), Federal Highway Administration (FHWA), the CPUC and local agencies where applicable.

9.0 GENERAL CIVIL DESIGN

Civil design includes drainage, utilities, structures and bridges, walkways, and fencing and railing. Landscape and irrigation improve the aesthetic aspects of the stations.

9.1 General Civil Work

General civil work includes grading and drainage, fencing, railing, walkways, landscape and irrigation.

Drainage is a critical component in the corridor in order to effectively maintain Caltrain infrastructure. During design and construction, the considerations shall include impacts to adjacent properties to Caltrain, impacts to operations and maintenance, including site access. The drainage shall improve the existing conditions and proposed improvements.

Fencing, railing and walkways are a critical safety component used to promote crossing at designated locations as well as to discourage general access to the Caltrain ROW.

9.2 Structures and Bridges

Design of structures and bridges shall conform to Caltrain’s standards as contained in the “PCJPB Standards for Design and Maintenance of Structures”, and “PCJPB Engineering Standards for Excavation Support Systems”.

9.3 Utilities

Close coordination is required with all utility owners. It is most important to perform utility survey consisting of a records survey to identify and verify the utilities, potholing and other field survey. Coordinate with the owners for adequacy of
protection, and design of replacement, or relocation of impacted utilities. Consider impacts during construction to the utility owners and users. All utilities shall be underground.

10.0 MECHANICAL, ELECTRICAL AND PLUMBING

The mechanical, electrical and plumbing (MEP) consists of the following components:

a. Conduit and cable schedules
b. Electrical service
c. Emergency back up systems
d. Fire protection
e. Lighting
f. Mechanical systems
g. Plumbing

E. SYSTEMS INTEGRATION

System integration is an essential function in the planning and design process. The goal of system integration is to resolve all interdisciplinary design conflicts during the planning and design process so conflicts can be minimized to the greatest extent possible during construction. This in turn will lead to a smoother system commissioning and cutover and transition to operations.

The designers of each design discipline shall identify all relevant interface issues and potential design conflicts, and communicate with each other to ensure all design solutions are compatible with each other. The designers shall communicate to Caltrain and other stakeholders of proposed resolution to each design interface issues.

The optimum design of a complete facility must often reconcile the competing design elements from various disciplines participating in a project. During concept development and preliminary engineering, the design and construction impacts of each discipline on the others must be checked, discussed, and adjusted to avoid a final design that fails to achieve the project goals.

F. SAFETY AND SECURITY CERTIFICATION

Caltrain implements a Safety and Security Certification Program. The purpose of the Safety and Security Certification is to ensure that new infrastructure, facilities,
equipment, rules, procedures, manuals, and training and their operation, including interface with the existing rail system, are viewed as, and are actually determined to be safe and secure.

The Safety and Security Certification process is generally applied to projects with a construction/acquisition budget of $1 Million or greater, or, will be applied as determined by the Caltrain Safety and Security Certification Policy Committee. The designers shall refer to the Safety and Security Certification Program Plan for their roles and responsibilities.

G. VALUE ENGINEERING

Value engineering involves detailed identification of alternatives and evaluation of each for the purpose of improving the performance, ease of maintenance and economy and safety. Value engineering shall typically be performed during the design phase on projects with construction value over $25 million. Timeline for value engineering shall be determined in the Design Basis Memorandum. In summary, the Value engineering shall:

a. Identify and develop alternatives to improve construction, operation, and maintenance of the system wide facilities.

b. Evaluate implementation costs to maximize cost savings for construction, operations, and maintenance.

c. Design for safety, operating efficiency, and ease of maintenance.

d. Design with consideration for future access to facilities for maintenance and repair.

e. Study the long range use of the improved facilities.

When alternatives derived from value engineering are implemented, they shall not compromise life cycle cost of the project.

END OF CHAPTER