

Caltrain Late Night Service White Paper

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Overview of transit network service & network capacity

Rail Service Overview

Caltrain provides inter- and intra-county commuter rail service along the San Francisco Peninsula Corridor, including San Francisco, San Mateo, and Santa Clara counties. The Peninsula Corridor Joint Powers Board (JPB) operates Caltrain 365 days a year with reduced schedules on major U.S. holidays. The current weekday Caltrain operating schedule is comprised of a mix of 92 express (Baby Bullet), limited, and local trains. Scheduled headways, or the time between arrivals of vehicles moving in the same direction at a station, vary by time of day, station, and service type. Overall, service is most frequent during the peak commute periods and is provided every hour in both directions during midday periods. Weekday Northbound service begins at 4:30 a.m. and ends at 12:01 a.m. Weekday Southbound service begins at 4:55 a.m. and ends at 1:32 a.m. Caltrain operates 36 trains on Saturday and 32 on Sunday, with service primarily composed of hourly local trains supplemented by two Baby Bullet trains in each direction per day. Saturday Northbound service begins at 7:00 a.m. and ends at 12:06 a.m., while Southbound service begins at 8:15 a.m. and ends at 1:37 a.m. Sunday's service span is more constrained, with Northbound service beginning at 8:00 a.m. and ending at 10:36 p.m. and Southbound service running from 8:15 a.m. to 10:51 a.m.

Caltrain serves 32 stations along the 77.2-mile route between San Francisco and Gilroy, as illustrated in the system map presented in Figure 1. On weekdays and weekends, the majority of trains operate between San Francisco and San Jose. On weekdays, three trains per weekday start in Gilroy during the morning commute period, and three terminate in Gilroy during the

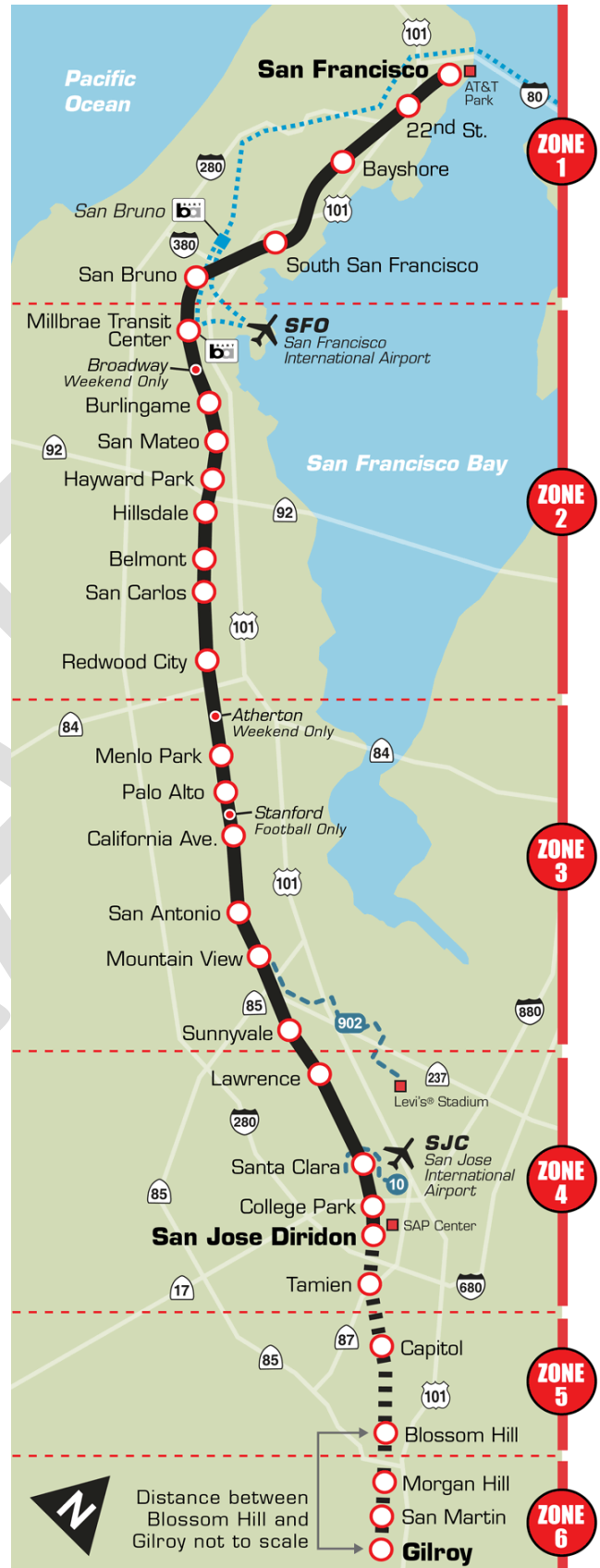


Figure 1: Caltrain System Map

evening commute period. On weekends, trains operate exclusively between San Jose and San Francisco.

Twenty-three stations are served full-time. Weekend-only service is provided to Broadway and Atherton stations while the College Park station is served by only four trains each weekday. The five stations on the Gilroy extension in southern Santa Clara County are served by six weekday trains per weekday during peak hours only. A shuttle bus connects the Tamien station to the San Jose station on weekends. Stanford Stadium station is served approximately eight days per year when the Stanford football team plays home games.

Caltrain currently operates three variants of commuter rail service:

- Express service (Baby Bullet service) provides a 60-minute trip between San Francisco and San Jose, with stops at six to eight stations, including terminal stations. Caltrain operates 22 Baby Bullet trains on weekdays (11 per direction) and 4 on weekend days (2 per direction).
- Limited service includes trains operating a skip-stop or limited local service, stopping at approximately half of the stations between San Francisco and San Jose. Some limited trains operate in an iterative skip stop pattern while others provide local service within a geographic segment of the corridor while operating as express trains in other areas. Run times for limited service are longer than that of Baby Bullets trains, averaging roughly 70 to 80 minutes. Caltrain operates a total of 42 limited service trains on weekdays and none on weekends.
- Local service trains stop at all stations and operate outside the weekday peak period only. Travel times for local trains between San Francisco and San Jose are approximately 90 minutes. Caltrain operates 28 local trains per weekday.

Given Caltrain's blend of services, the individual level of train service experienced by particular stations along the route is variable, especially during weekday peak periods. During the a.m. and p.m. peak periods, all stations receiving express service are served by at least one bullet train per an hour with headways ranging between 15 to 30 minutes. Some higher frequency "bullet stations," and terminals including San Francisco, Palo Alto, and San Jose Diridon, are served by at least two bullet trains per hour. "Non-bullet" stations are served by Limited and Local trains at headways ranging between 30 minutes to 60 minutes during peak periods. During off-peak periods (early morning, midday, and after 7:00 p.m.), headways at all stations are generally about 60 minutes.

Ridership

Caltrain's performance over the past five years has been overwhelmingly shaped by the system's dramatic ridership increase. Since 2009, Caltrain has experienced a 58% increase in average weekday ridership and a 56% increase in annual ridership. This increase has occurred without any major, net service changes on Caltrain's part and has instead been driven by changing demographics and economic conditions in the agency's service area as well as the continued popularity of Caltrain's core commuter service. Increasing ridership has led to

increased revenues and improved Caltrain performance across a range of financial and service metrics including reduced costs per passenger and passenger mile as well as increases in the number of passengers carried per unit of service.

Caltrain’s average weekday ridership has increased enormously since 2010 and the railroad now carries nearly 71% more passengers on a typical weekday than it did five years ago. Increases in ridership are the combined result of economic growth and demographic changes in the Caltrain service area as well as the continued success of Caltrain’s core commuter rail service and ongoing marketing efforts to expand the railroad’s customer base.

Average Weekday Ridership

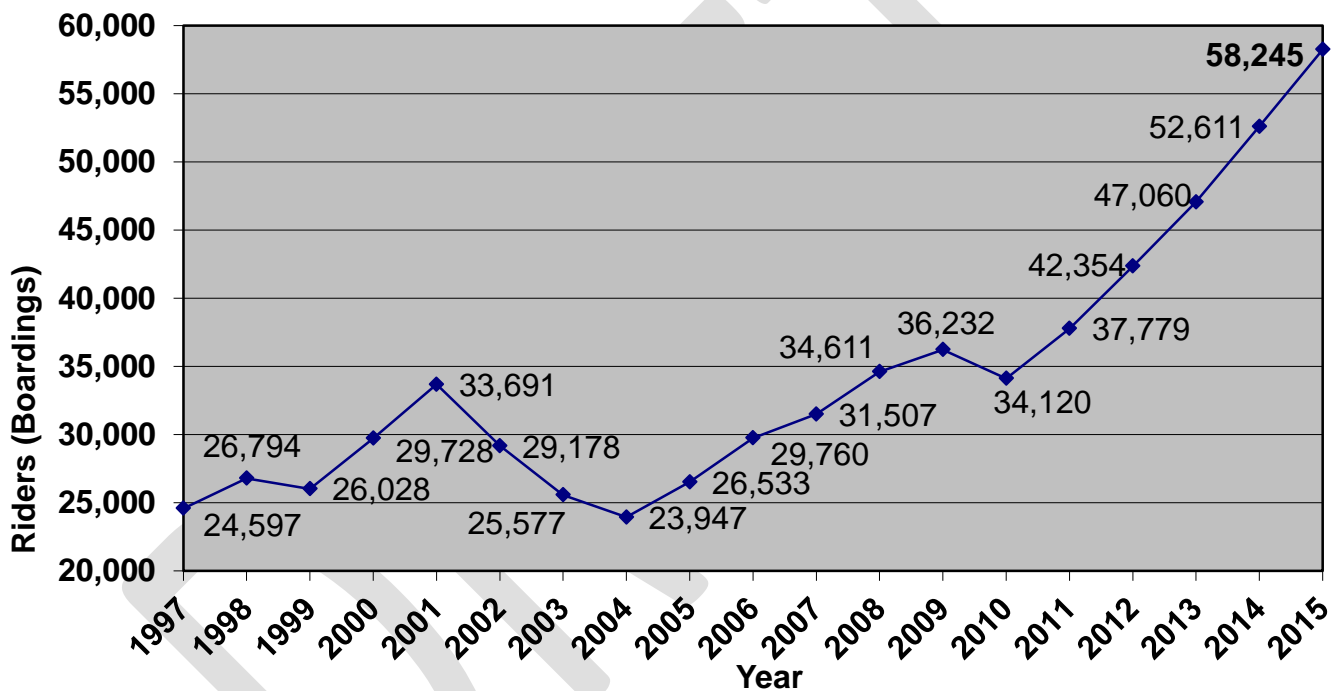


Figure 2: Average Weekday Ridership Since 1997

Late Night Ridership – Weekdays (Source: 2015 Annual Count)

Weekday Ridership is average for the data pulled from 5 weekdays: Monday - Friday

Table 1: Average Weekday Northbound Passengers by Station and Train									
	Train #197 (arrives at San Francisco Station at 11:03 p.m.)			Train #199 (arrives at San Francisco Station at 12:03 a.m.)			TOTAL		
	On	Off	On Board	On	Off	On Board	On	Off	On Board
Bayshore	0	6	122	0	3	42	0	9	164
22nd Street	0	19	103	0	8	34	0	27	137
San Francisco	0	103	0	0	34	0	0	137	0

Table 2: Average Weekday Southbound Passengers by Station and Train												
	SB Train #194 (departs from San Francisco Station at 9:40 p.m.)			SB Train #196 (departs from San Francisco Station at 10:40 p.m.)			SB Train #198 (departs from San Francisco Station at 12:01 a.m.)			TOTAL		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
San Francisco	222	0	222	170	0	170	117	0	117	509	0	509
22nd Street	9	1	231	10	0	180	11	0	128	31	1	539
Bayshore	2	1	232	3	1	182	1	1	128	6	3	542

Late Night Ridership – Saturday (Source: 2015 Annual Count)

Saturday Ridership is taken on one Saturday.

Table 3: Saturday Northbound Passengers by Station and Train									
Saturday Passengers	Train #449 (arrives at San Francisco Station at 10:38 p.m.)			Train #451 (arrives at San Francisco Station at 12:08 p.m.)			TOTAL		
	On	Off	On Board	On	Off	On Board	On	Off	On Board
Bayshore	0	8	114	0	12	83	0	20	197
22nd Street	0	8	106	0	23	60	0	31	166
San Francisco	0	106	0	0	60	0	0	166	0

Table 4: Saturday Southbound Passengers by Station and Train												
Saturday Passengers	Train #448 (departs from San Francisco Station at 9:15 p.m.)			Train #450 (departs from San Francisco Station at 10:15 p.m.)			Train #454 (departs from San Francisco Station at 12:01 a.m.)			TOTAL		
	On	Off	On Board	On	Off	On Board	On	Off	On Board	On	Off	On Board
San Francisco	323	0	323	268	0	268	320	0	320	911	0	911
22nd Street	15	0	338	20	0	288	27	0	347	62	0	973
Bayshore	2	0	340	2	4	286	2	0	349	6	4	975

Late Night Ridership – Sunday (Source: 2015 Annual Count)

Sunday Ridership is taken on one Sunday.

Table 5: Sunday Northbound Passengers by Station			
	Train #449 (arrives at San Francisco Station at 10:38 p.m.)		
	On	Off	On Board
Bayshore	0	7	106
22nd Street	0	13	93
San Francisco	0	93	0

Table 6: Sunday Southbound Passengers by Station			
	Train #448 (departs from San Francisco Station at 9:15 p.m.)		
	On	Off	On Board
San Francisco	139	0	139
22nd Street	11	0	150
Bayshore	3	0	153

Existing constraints on extending hours of rail service

Overview of system constraints

Maintaining the Caltrain right of way and equipment is an important and continual part of the agency’s commitment to safety, reliability and customer service. Routine maintenance is performed every day on the Caltrain system. Much of this maintenance is mandated by the Federal Railroad Administration (FRA) and California Public Utilities Commission (CPUC), but Caltrain’s safety standards exceed minimum requirements and its standards for reliability given its aging fleet require that regular and preventative maintenance programs are rigorous.. Performing the necessary maintenance on the 150-year old rail line allows Caltrain to serve its more than 58,000 daily weekday riders.

On weekdays, Caltrain runs service between San Francisco and San Jose 21 hours of the day. The three hour window when revenue trains are not in service is crucial for maintaining the safety and quality of the system. Providing full access to the tracks allows key maintenance

personnel to efficiently and safely perform daily maintenance tasks that keep the system compliant with FRA and CPUC regulations and safe for passengers and surrounding communities.

Much of the maintenance of equipment is also completed during the three hour window when trains are not in service. Maintaining the equipment is critical to keeping the trains clean and in-service during regular service hours.

Caltrain's capital projects also present constraints to expanding service hours. Many capital projects require uninterrupted access to both tracks in order to perform critical construction tasks such as replacing large sections of rail.

Maintenance of way constraints

Key maintenance activities allow Caltrain to ensure its complex system of rolling stock, equipment, structures and facilities are in a state of good repair and are able to provide safe and reliable service to its customers. Below are some of the key maintenance activities that occur along the Caltrain right-of-way on a regular basis.

Welding: Welding occurs nearly every night along the Caltrain right of way and typically takes four to five hours for a single location. Crews must work continuously once the process has begun. Crews are typically comprised of two to three workers. The welding crew uses air compressors, gas-powered generators, small power tools, electric-arc welders and propane heaters. Crews may also use a grinder to prepare the rail surface before it is welded and to smooth the completed welds.

Resurfacing: Over time, the weight of the train passing over the tracks compresses the ballast under the tracks and between the ties and the tracks can become uneven. Caltrain crews use modern machines to compact the ballast and straighten the track. Caltrain usually uses a five-man crew to operate a tamper, a regulator and track stabilizer. After the tamper has finished, additional ballast may be needed along the tracks. A regulator with a plow, wings and a large rotating broom distributes the ballast and smooths the track bed. Resurfacing typically occurs nightly.



Figure 3: Resurfacing Equipment

Crosstie replacement: A wooden railroad tie, which weighs 200 pounds and is nine feet long, typically lasts 40 to 70 years. Caltrain “spot” replaces ties on the tracks every week, replacing approximately 10 to 20 percent of the ties in a given section of track. Although Caltrain uses concrete ties on all new construction, there are still many wooden ties on the rail line. Caltrain uses several different on-track, self-propelled machines to replace cross ties. In addition, a high-rail crane may be used to replace ties and unload materials for construction and maintenance projects.



Figure 4: Crosstie Replacement Equipment

Track inspection: Three times a week, crews use a “hi-rail” vehicle to perform a visual inspection of the tracks. This is a specially equipped pick-up truck that can be used either on roads or rails, changing from rubber tires to steel wheels according to the need.

Geometry car: Twice a year Caltrain uses a track geometry car to measure deviations in the tracks. This on-track vehicle uses a sophisticated computer system to measure and record the alignment of the track.

Detector car: Three times a year Caltrain uses a “detector” car to find flaws in the rails. This on-track car uses ultrasonic equipment to detect minute flaws in the rails that are not visible to the naked eye. These flaws may be the result of manufacturing defects or simply develop over time. If a critical flaw is found, it must be repaired immediately.

Switch maintenance: Switches “switch” a train from one track to another. Each switch is checked during regular weekly inspections. In addition, every switch is examined once a month by an inspector on foot.

Crossing gates: All crossing gates are tested once a month. The gates must be activated to conduct this test and they may remain down longer than normal.

Weed abatement: Once a year, Caltrain uses an on-track truck to spray weed killer along the right of way. Weed abatement is necessary to prevent brush fires on and around the train tracks.

Rail grinding: Annually, a rail-mounted grinder smooths out defects and restores the shape of the rail. This reduces noise for neighbors next to the right of way and provides a safer, smoother ride for passengers.

Maintenance work using on-track machinery can only be done when there are no trains on the tracks. Although maintenance work is usually done from 7 p.m. to 4:30 a.m., there are times when work will continue around-the-clock. When around-the-clock work is required, north- and southbound trains may operate on one track instead of two, going around or “single tracking” around the work site. In order to limit the impact maintenance and construction work has on revenue service trains, single tracking is used only when necessary. The extension of service hours into the limited maintenance window would negatively impact the ability of the maintenance crews to perform the work they need.

Maintenance of equipment constraints

In addition to the regular maintenance of way mentioned above, Caltrain has a robust maintenance of equipment program that ensures trains are cleaned, fueled, and inspected before being ready for service by 3:30 a.m. each weekday. Extending service hours would reduce the turnaround time available for the critical maintenance of equipment activities listed below.

- Service and Inspection
 - Daily Inspection
 - Exterior Washing
 - Interior Cleaning
 - Brake Pad Replacement
 - Fueling
 - Toilet Servicing
- Unscheduled maintenance work

Capital project constraints

Caltrain has various capital projects planned that would prohibit the expansion of service hours on the system. Many of these projects require construction work to be performed during overnight hours when there are no revenue service trains in operation. Certain construction activities, including the installation of rail bridges or the replacement of large sections of rail, must be done weekends and overnight when there is an extended window of time

uninterrupted by regular service trains. Many of these projects require entire portions of track to be out of service for hours at a time, which during service hours, requires resource intensive bus bridges to ensure continuity of service. Extension of late night service hours would be costly and would negatively impact the ability for construction crews to work efficiently on critical construction activities that necessary to maintain the Caltrain right-of-way.

Below are some major Capital Projects that require work at night and on weekends and would be negatively impacted by the extension of service hours.

Peninsula Corridor Electrification Project (2016 to 2021): The Peninsula Corridor Electrification Project (PCEP) is a key component of the Caltrain Modernization Program and consists of converting Caltrain from diesel-hauled to Electric Multiple Unit (EMU) trains for services between the Fourth and King Street Station in San Francisco and the Tamien Station in San Jose. The project will entail the installation of new electrical infrastructure and the purchase of electrified vehicles. Caltrain will continue Gilroy service and support existing tenants.

Los Gatos Bridge Project (2016 to 2018): The Los Gatos Creek Bridge Project will to replace the existing railroad bridge crossing at Los Gatos Creek in San Jose. The current bridge was built in 1935, and in order to maintain safe rail operations and meet current seismic safety standards, the bridge must be replaced. The project will also include installation of a tail track south of the San Jose Diridon station. The tail track will provide improved operations at the station, minimize system-wide delays, and facilitate Caltrain Modernization, including electrification of the corridor. Construction of the Los Gatos Creek Bridge Project is expected to take two years and will require work to be performed on nights and weekends.

25th Ave Grade Separation Project (2017 to 2020): The 25th Ave Grade Separation Project will provide grade separation between Hillsdale Boulevard and State Route 92, including grade separated crossings at 25th, 28th and 31st avenues. The project also includes a relocation of the Hillsdale Station.

Extension of service hours for special events

Caltrain provides supplemental service to large special events in the form of extra trains. Extra trains are provided for Independence Day, New Year's Eve, and the Bay to Breakers race. Selected regular weekend local trains make stops at the Stanford station before and after Stanford home football games. Extra trains also are provided for certain events at the stadium near the San Francisco Caltrain Station based on demand. The majority of this extra service is to Giants home baseball games. Before Giants home games on weekdays, one extra scheduled train is provided outside of peak hours with additional extra trains provided as needed. After Giants games, Caltrain typically provides two extra trains with additional extra trains provided as needed. Service to special events and Giants games is periodically adjusted to meet passenger demand and operational conditions.

Over the course of the year, approximately 500 special trains are operated in addition to the more than 26,000 regularly scheduled trains. In 2014 Caltrain began providing extra service in and out of the Mountain View Caltrain Station before and after major events at Levi's Stadium

in Santa Clara. Events being held in 2015 at the San Jose Earthquakes stadium in Santa Clara will be monitored with possible additional service added depending on the demand.

Optimizing maintenance efficiencies

The ability to single-track on the Caltrain system is limited by the two main tracks throughout a majority of the corridor. Unlike some public transit agencies, Caltrain does not have additional tracks that allow trains to run while maintenance work is being completed. In addition to the limit of the majority two track system, necessary safety regulations limit the efficiency of single-tracking. FRA rules requires absolute protection be provided on tracks adjacent to work tracks and trains to limit speeds to 40 MPH when passing certain equipment. Single-tracking around work zones increases the costs and time of the maintenance work and negatively impacts the operation of regular services trains. Given these limitations, single-tracking is currently only used when necessary. Utilizing single-tracking to provide extended service hours would be cost prohibitive and would impact the ability of maintenance crews to efficiently and effectively conduct routine maintenance activities.

Conclusion

Extending service hours on the Caltrain system faces many constraints that would significantly impact the system. The limited hours at night when there is no service provides maintenance crews the necessary access to the tracks to perform essential maintenance work. Maintaining the tracks with the current level of crews allows Caltrain to efficiently meet the maintenance needs of the tracks and keep the system in compliance with FRA and CPUC standards. Those few hours also provide a key window for maintenance of equipment to be performed, allowing trains to be maintained and ready for service each and every day. Capital projects along the right of way also require use of the uninterrupted access to the tracks, allowing crews to perform critical construction tasks such as replacing rail bridges or large sections of rail. Caltrain will continue to monitor and evaluate the constraints to expanding service hours, but at this time the agency does not have current or future plans to expand service hours due to the reasons listed above.