

The Caltrain CTX Projects

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ABSTRACT

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In the spring of 2002, the Peninsula Corridor Joint Powers Board (PCJPB) in San Carlos, CA, embarked upon a construction program along the Caltrain Peninsula Corridor unprecedented in this area for the past 5 decades. The plan was to complete the installation of CTC and to construct the third and fourth mainlines in several areas to facilitate the implementation of express train (known locally as the “Baby Bullet) service between San Francisco and San Jose. The goal was to reduce the commute time between these two major cities from the then current 90 minutes to less than one hour.

The unique approach to this project was to essentially implement a series of small construction “blitzes” intended to maximize the contractors available work windows and minimize the impact to the commuter service. Essentially the railroad was totally shut down between Santa Clara and San Francisco from after the last train at 1:00 am Saturday morning until just before the first train at 4:00 am on Monday morning. This also required a huge Public Relations effort and the establishment of a “bus bridge” during the shutdown times.

The focus of this paper will be the usage of these work windows to complete this major construction project in less than two years.

Key Words: Caltrain, JPB, shutdowns, construction

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INTRODUCTION

In the spring of 2002, following over three years of intense planning, the Peninsula Corridor Joint Powers Board (PCJPB) in San Carlos, CA, embarked upon a construction program along the Caltrain Peninsula Corridor unprecedented in this area for the past five decades. The plan was to complete the installation of CTC and to construct the third and fourth mainlines in several areas to facilitate the implementation of express train (known locally as the “Baby Bullet”) service between San Francisco and San Jose. The goal was to reduce the commute time between these two major cities from the then current 90 minutes to less than one hour.

The program unfolded in March 2002, with the opening of bids and the ultimate award of a contract to the joint venture of Herzog Contracting Corp. and Stacey & Witbeck, Inc (HCC/S&WI) for the construction of the northern portion, termed NCTX of the overall program. Notice to proceed was granted on June 1st and the actual work was begun over the 4th of July weekend. A similar contract was let for bid for the southern portion of the work, called the SCTX. In January 2003 this contract was also awarded to the Joint Venture HCC/S&WI. The work under these two contracts consisted of bridge structures, express tracks, high-speed crossovers and station platforms and access, as well as the upgrading and reconstruction of timber tied, jointed rail trackage. The focus of the program was the Centralized Traffic Control system that would replace the Automatic Block System between Bayshore, and Santa Clara.

The focus of this paper will be the extensive scope of work involved with this program and the unique approach to completing this work in less than two years while continuing to operate a commuter railroad upon which the San Francisco Peninsula commuters have become somewhat dependent.

HISTORY

Passenger service on the Peninsula Corridor began on Oct. 18, 1863 under the authority of the San Francisco and San Jose Railroad Company. Prophetically, some \$600,000 of the original \$2 million capital stock was owned by the voters of San Francisco, San Mateo and Santa Clara counties following a three-county election in 1861. In 1870, the San Francisco and San Jose Railroad Company was acquired by the firm that was consolidated eventually 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.

CALTRAIN MAP



Changing commute patterns impacted Southern Pacific along with private carriers all over the county, and after protracted struggles with the state Public Utilities Commission on fares and service levels, Southern Pacific petitioned to abandon passenger service in 1977. Once more, the three Peninsula counties stepped into the breach with a temporary Fare Stabilization Plan -- that reversed a long pattern of declining ridership and set the stage for state sponsorship of the Peninsula Commute in 1980. From 1980 until mid-year 1992 the California DOT (Caltrans) contracted with Southern Pacific to provide passenger service in the corridor, sharing operating subsidies with San Francisco, San Mateo and Santa Clara counties. The state assumed sole responsibility for station acquisitions and other capital improvements until the service resulted in formation of the Peninsula Corridor Joint Powers Board (PCJPB) in 1987. The PCJPB agreed to assume operating responsibilities for Caltrain effective July 1, 1992, and to shoulder 100 percent of the operating subsidy a year later.

In December 1991, the PCJPB purchased the rail right of way from San Francisco to San Jose. The PCJPB secured trackage rights to Gilroy for another \$4 million, with an option to acquire half the right of way in the future. Union Pacific Railroad, which merged with Southern Pacific in 1996, retains rights to operate freight service along the corridor. To replace Southern Pacific as the commute operator, the PCJPB signed Amtrak, the National Rail Corporation, to a three-year agreement with two one-year options beginning July 1, 1992. In November of 2001, Amtrak was awarded a 5-year contract to continue commute service for the PCJPB. Contract oversight is provided by the San Mateo County Transit District (Samtrans), as the administrative arm of PCJPB. As its legacy to the PCJPB, Caltrans deeded 26 stations, 20 diesel locomotives and 73 bi-level passenger cars to the local agency. Many of the locomotives and gallery cars have been rebuilt or replaced over the last five years.

Some Statistics regarding the Caltrain commuter service are as follows:

- 86, miles of mainline track between San Francisco and Gilroy.
- 86, scheduled weekday trains.
- 34 stations most with parking.
- 84 vehicular grade crossings between San Francisco and Gilroy (36 between San Jose and Gilroy are the responsibility of UPRR).
- 11 pedestrian crossings with active warning devices.
- Push/pull operation.
- Top speed of train 79 miles per hour.
- Each train consist can handle 32 bicycles.
- Average daily ridership in 2001 was over 32,000 passengers, dropped to about 25,000 during construction, and is now rebounding nicely.
- 29 locomotives, and 90 cars, including 26 cab cars.

The PCJPB has a progressive plan to upgrade and improve the physical plant. The plan will systematically upgrade the route to a modern facility with continuous welded rail, upgraded ties, CTC signaling, a step towards the migration to future Cab Signaling or Communication Based Train Control, and many other improvements to the stations, bridges and right of way. The plan calls for major capacity expansion with additional main tracks, improved station and terminal facilities, a new equipment maintenance facility and potential extensions. Caltrain is also planning for electrification of the route. The CTX or Caltrain Express Program was the second installment in this overall plan. The first phase, the Ponderosa Project was completed about three and one-half years ago.

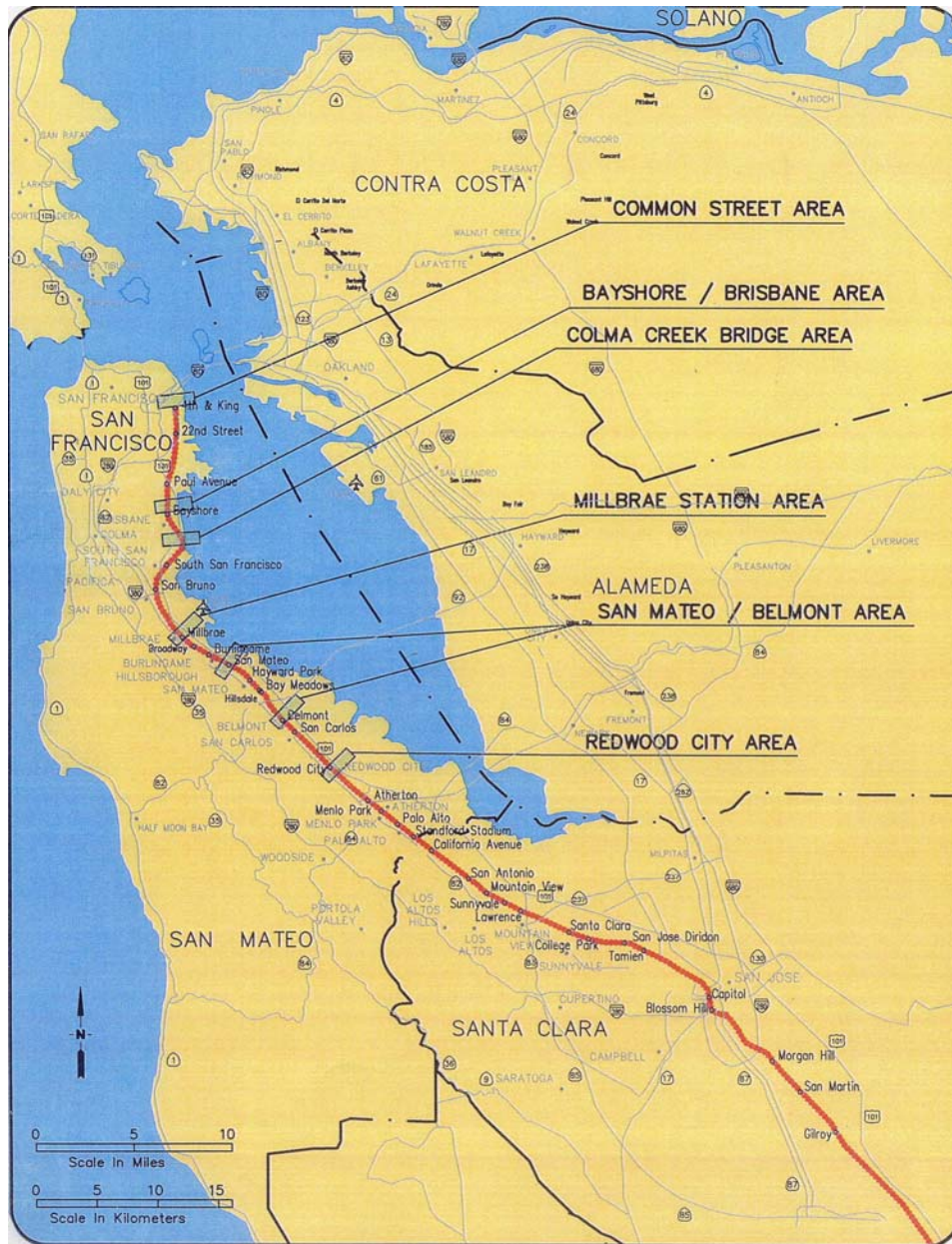
THE CTX PROGRAM

The CTX Program was intended to provide increased capacity and efficiency of operation between San Francisco 4th St. Terminal and San Jose Diridon Station. Capacity was to be increased by the addition of long sidings operated essentially as mainlines and high speed (50 mph) turnouts and crossovers. Greater efficiency of operation could be achieved by replacing the outdated ABS signals with a microprocessor controlled CTC system.

NCTX

The NCTX project was separated into six individual Project Segments, each having a geographic limit identified by railroad mileposts. Each Project Segment had its' own respective items in the Schedule of Bid Prices and each Project Segment had an individually defined completion time. The Project Segments were identified as follows: the Common Street Area, Bayshore / Brisbane Area, Colma Creek Bridge Area, Millbrae Station Area, San Mateo / Belmont Area, and the Redwood City Area.

NORTH CTX MAP



NCTX Track & Civil Work

The work in the Common Street Area consisted mainly of rebuilding the Mainlines MT1 and MT2 as well as the “Pullman Lead”. These tracks were rebuilt from the sub grade up with new 136# RE CWR on concrete ties. The trackage between MP 0.6 & 0.8 is on a 10° curve and new head-hardened rail was used. The existing track was salvaged. New No. 10 turnouts were installed as well as a new power operated #20 turnout to the “Pullman Lead” and a new #20 power operated crossover between MT1 and MT2. All mainline turnouts were constructed on concrete ties. Two freight transfer tracks were rebuilt using relay 136# jointed rail on timber ties as was the relocate Potrero Wye track and the Inside Yard Lead.

Additional trackwork included the closing of the King Street grade crossing and a new grade crossing installation at Common Street. The 16th Street grade crossing was reconstructed and widened to accommodate new development in the area.

Trackwork in the Bayshore/Brisbane Area was made up of new construction as well as reconstruction. Main Tracks 1 and 2 were completely rebuilt on a newly established grade from the south portal of Tunnel 4 to the Control Point at Brisbane utilizing new 136# CWR. Additionally two new Main Tracks, MT3 and MT4 were added on new grade on the east and west sides of the rebuilt Mainlines. Power Operated #20 Turnouts were constructed on each end for higher speed access to the new mains. A new universal #20 crossover was constructed at the new CP Geneva. New connections to the existing Lumber Yard Spur, a Siding on the east side of MT3 and the Visitacion Lead off MT4 were also rebuilt using 136#RE CWR and jointed rail. About a mile of track was rehabilitated with a tie renewal program and joint elimination by cutting, sliding and flash-butt welding. The original plan was also to rebuild the Bayshore Lead, but a late agreement with the UPRR allowed that work to be avoided. Portions of the track associated with the Visitacion Lead not originally in the Contract were rebuilt as well. This was done to accommodate the Circus Train which ties up here during the annual show at the Cow Palace. A short timber decked bridge at MP 6.68 was also replaced



with a concrete structure as part of the work of this segment. About half way through the North CTX job, the final design for a new Station at Bayshore was made available, the construction of which became a major (\$5M) change order to the Contractor on that project. Prior to the addition of the new main lines between Bayshore and Brisbane, only a small station existed here which consisted basically of

old wooden bus shelters and asphalt platforms. The new Station would span four brand-new tracks and be of modern architecture. A broader pedestrian structural steel overpass was constructed between two similarly constructed elevator towers also accessed by staircases. While standard bus stop type shelters were employed the number was doubled and the platforms were widened to greatly improve the appearance and functionality of the station. The overall improvement was astounding.

Moving on the Colma Creek Bridge Area, the major element of work here was the replacement of the existing bridge over Colma Creek at MP 9.72 and the removal of an existing aqueduct at MP 9.68. This was a significant task and one that was long overdue. Additionally, all trackwork in this area was subject to construction, reconstruction and relocation to provide temporary and permanent track alignments necessary to facilitate construction phasing and final alignment. The mainlines were rebuilt using new 136# RE CWR on concrete ties which was the standard for the program. The permanent alignment required the installation of #10 turnouts either salvaged or supplied new by the Contractor.

The bridgework itself was also restricted at this location by the Corps of Engineers to avoid the winter rainy season. Even then the work required the construction, maintenance and subsequent removal of a temporary cofferdam and temporary water diversion system. A temporary work pad was required in the creek bottom. Removal of the existing timber deck, portions of existing pile supported concrete abutments, piers and wing walls and an abandoned 24" VCP sanitary sewer with a partial concrete encasement was required before reconstruction could begin. The reconstruction consisted of the installation of new pile supported abutments, piers and wing walls as well as new prestressed concrete solid slab girders. This was especially challenging since railroad traffic had to be maintained throughout construction. This was accomplished by implementing a two-stage construction plan, and building the structure essentially one half at a time.

The aqueduct work was pretty straightforward with the removal of an existing timber deck and the existing metal aqueduct pipe. This could only be accomplished in conjunction with the installation of a temporary support structure and ballast retainer. The aqueduct undercrossing was then backfilled with earthen material.

The work in Millbrae was associated with a new joint facility shared with BART. The BART Project provided the major part of the Station itself, but the CTX Contractor had to build a new platform 4S and complete the work started on Platforms 4 and 5 adjacent to MT1 and MT2 within the intermodal station. The functional and aesthetic value of the station was enhanced with the installation of shelters, lighting, Visual Messaging System (VMS), PA systems and other amenities. Additional drainage was provided and new wire mesh fencing was erected. The station was able to remain in service during the entire course of construction due to an elaborate five-stage construction plan designed to allow the work to continue while patrons were directed to alternate facilities.

Tracks MT1 and MT2 were shifted and reconstructed on new concrete ties using new and relay 136# RE CWR. The reconstruction started just north of the Center Street Crossing and extended approximately two miles to the south. A new signaled siding about 3000 feet in length was constructed to the east of MT1 with a new power operated #20 turnout at the south end (new CP Trousdale) and a new power operated #10 turnout on the north end (new CP BART). A new Left Hand #20 crossover was installed at the north end of the segment (new CP Center) and a new right-hand #20 crossover was installed at the new CP Trousdale near the south limit. The grade crossing at Center Street and the pedestrian crossing at Santa Paula Ave. were both reconstructed with concrete crossing panels, underdrains and fences. Pedestrian gates were installed at Center Street and active warning devices were installed at Santa Paula. Also provided for was the rehabilitation of most of the track between MP 11.0 and 15.9 with a new timber tie program and more joint elimination between MP 11.4 and 11.65 as well as the removal of existing #10 hand-throw facilities.

San Mateo / Belmont Area trackwork was more or less limited to the installation of two new #20 power-operated universal crossovers: one at CP Ralston, north of the Belmont Station and one at CP Palm between 5th and 9th Avenues in San Mateo. Both Mainlines 1 and 2 were rebuilt in this area with new concrete ties and rail on shifted alignments. The grade crossing at 9th Ave. in San Mateo was also reconstructed to accommodate the revised track alignment. Additional trackwork in this segment consisted of tie renewal between 15.9 and 17.5, removal of existing hand-throw #10 turnouts and crossovers.

Redwood City Area Trackwork was quite extensive. MT1 and MT2 were totally rebuilt between Redwood City and Atherton. A new #20 left-hand power operated crossover was installed on concrete ties at the north end (CP Dumbarton) and a new right-hand #20 crossover was installed at the south limit (CP Junction). A new siding (MT4) was built on a new grade to the west of MT2 with new #14 power-operated turnouts at each end. A new Signaled Siding was also constructed on the east side next to MT1 with, again, #14 power-operated turnouts on either end. Several other tracks, designated as freight tracks were either reconstructed or shifted as required. This work was with 132# and 136# rail on wood ties. Additionally rail was re-laid with second-hand 136#RE between MP 27.3 and 27.7. All hand-throw crossovers were removed at Redwood City.

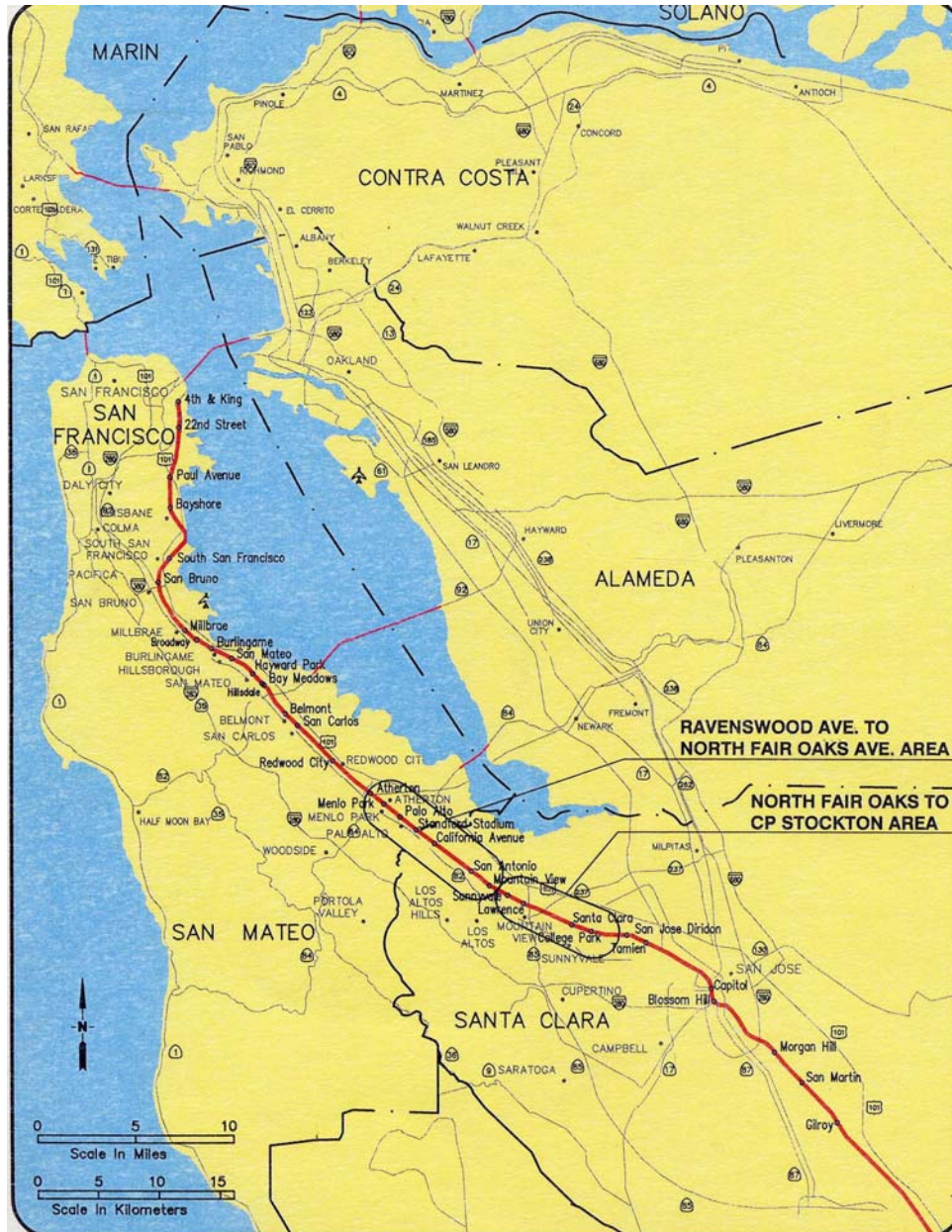
Civil work here consisted of providing a structural base for the new trackwork while reinforcing the support around two existing 66" and 60" Hetch-Hetchy water mains. The new installation required secant type piles around the existing pipes, a new invert slab, new pipe saddle supports and a heavily reinforced top slab. Demolition and reconstruction of existing security fencing along the property lines on both sides of the Right of Way was also undertaken.

SCTX

The SCTX project, like the North job was separated into individual Project Segments, in this case three, each having a geographic limit identified by railroad mileposts. The

Project Segments were identified as follows: Ravenswood to North Fair Oaks, North Fair Oaks to CP Stockton, and the Track Rehabilitation Bid Option.

SOUTH CTX MAP



SCTX Track & Civil Work

The trackwork construction between Ravenswood Ave. in Menlo Park and the North Fair Oaks Overcrossing involved mostly the construction of new universal #20 power-operated crossovers at CP Alma, CP Mayfield and CP Mary. At Alma, 3000 track feet of existing track was upgraded to 136# CWR / concrete tie track on both mainlines.

Similarly in the CP Mayfield area, 2800 track feet of both existing mainlines was rebuilt to the new 136# / concrete tie standard. Slightly more was rebuilt near CP Mary; 4900 feet of MT1 and MT2 were improved. In several places the newly rehabilitated track was tied into track previously improved by the Ponderosa Project.

A set-out track at MP 32.2 was reconstructed as was the Grumman Industry Lead at MP 39.3. This track was also lined over to allow for wider track centers on the mainlines. An agreement with the UPRR after the project was underway allowed this industrial lead to be retired and converted to a set-out track only. Several stretches of abandoned and out-of-service track were also retired under the contract as were numerous #10 hand-throw crossovers.

Work between North Fair Oaks and CP Stockton in Santa Clara was more extensive. A total of 4.3 track miles of mainline track was completely rebuilt from the grade up on a slightly new alignment from the new CP Hendy to CP Bowers. Also 4.3 miles of completely new railroad was built on either side of MT1 and MT2 which would become the new MT3 and MT4. Access to the new tracks was via four new #20 higher speed turnouts on concrete ties. Other main track work included the realignment and renewal of ties for approximately 3,000 feet of both mains north of the Bowers Avenue underpass. A #10 hand-throw crossover at MP 41.2 was originally scheduled for salvage, but objections by the UPRR led to leaving it in place, but shifted to accommodate the new alignment and track centers.

Track work with regard to industrial and set-out tracks was at three locations: Pine Cone Lumber Spur at MP 39.8, Peninsula Materials Spur, MP 40.9, and The UPRR Industrial Lead Connection at MP 41.3, known at the "Butter House Lead". Work at these locations consisted of replacement of the existing turnouts with concrete tied ones and the reconstruction of associated tracks to accommodate any changes in alignment of the mainlines.

The Track Rehabilitation work under an Optional Bid Item was implemented and included the replacement of approximately 12.7 track miles of jointed rail and CWR (all 132# or less) with 136# CWR. Locations were also selected for 100% tie renewal within five platform areas. Materials were furnished, delivered and later installed for the rehabilitation of Curves #7 and #11 within the project limits of the NCTX Project. The fastening system on both of these curves was upgraded with new Pandrol tie plates, 'e' clips and screw spikes. Final surfacing of 10 ½ miles of railroad between as well as around both of the north end curves was also accomplished.

The Civil work in this segment was also quite significant. The Station at the Lawrence Expressway near the Sunnyvale / Santa Clara border was completely rebuilt to accommodate the new track alignments and to make it totally ADA compliant. The entire station was completely demolished. The new station was centered around a pedestrian tunnel connecting the east and west platforms which themselves were totally new. This new underpass replaced an outdated metal overpass stairway. The tunnel was constructed by temporarily placing the two mainline tracks on precast bridges. Then, a

secant pile shoring system was installed for the tunnel and ramps. This allowed the tunnel and ramps to be excavated for the concrete cast in place structure. Once the structure was formed, the temporary rail bridge could be removed and the track placed across the new



tunnel. New station platforms, canopies, platform furnishings and signage as well as landscaping and irrigation systems were installed. Improvements included new lighting, poles, VMS boards, PA speakers and Ticket Vending Machines (TVMs). New vehicular entrances, parking areas, driveways, pullouts for shuttle buses and short term parking and pedestrian boarding areas were also constructed along both San

Zeno Way and French Street on both sides of the station. All in all the new Lawrence Station was the landmark structure of the South CTX Project.

SIGNAL WORK CONSTRUCTION

To the casual observer, the work that has just been described would seem to be the focus of the effort, but to those more in the “know” it was merely the most visible portion of the work. This was the work that required the majority of track shutdowns and single tracking, the work that delayed the late night trains and shook the neighborhood in the middle of the night. In reality this program was all about signals. With the completion of the signal work the operating department is able to move trains down the corridor more efficiently

The signal work was divided between the two CTX Contracts and was, therefore divided into the same segments as the civil and track work. This work was subcontracted by the prime. Because the railroad signal system is a system of train operation and associated rules as well as the physical construction, the limits of the signal system work did not always align themselves perfectly with the limits of track and civil work. By far the biggest challenge was to interface the new signal system with the existing signal system as work progressed. Incorporated into the CTX projects was the upgrade of vehicular grade crossings with more up-to-date crossing controls that would allow train movement in either direction at a maximum speed of 79 mph. A previous project had already upgraded about 70% of the JPB crossings. Upgrades in areas with multiple crossings proved a special challenge. Coordination between all crossings had to be planned and detailed work plans provided so that the work that had to be done was recognized and

accounted for. Numerous meetings and field inspections were conducted before the actual conversion to the new program was started. Upgrades to the pre-emption of the city traffic signal system was also required in several areas.

The Contractor was required to furnish, install and place in service new conduits, pull boxes, cables, track wires, track connections, foundations AC meter service and other apparatus required to provide a functional CTC signal system and fully functional grade crossing warning system within that framework. The Owner provided much of the larger equipment required to make the finished system functional. Signal Bungalows, major signal cantilevers and bridges, many of the signal masts, heads and items such as relays were furnished by Caltrain and installed by the Contractor. Some of the existing equipment, having been recently installed was also scheduled for re-use on the project. The Contractor was required to make modifications as necessary in order to make such relocation possible. The Contractor was required to follow JPB Engineering and Signal Standards when installing the new system. After installation and cutover of the new systems, all overhead signal cables and poles were to be removed. Retired signal equipment that was in useable condition was delivered to Caltrain. Old signal foundations were removed and the ground restored to final grade. Insulated joints eliminated by the new systems were replaced by track welds.

The Contractor was also required to design, furnish and install a complete radio based Advanced Train Control System (ATCS) including base stations on San Bruno Mountain and Monument Peak. Data radios and associated hardware was installed at the 17 new Control Points.

If all of this doesn't sound daunting enough, consider the fact that the work was being accomplished in an operating railroad environment; not quite under traffic, but almost. The work of the project required the contractor to maintain an active working signal and highway warning system at all times. Tracks were allowed to be taken out of service for planned activities through a comprehensive Site Specific Work Plan (SSWP) process. No red or other restrictive signals or signal related train bulletins were allowed outside of the approved work windows. Additionally other projects and modifications were anticipated to take place to portions of the Signal System during the course of the contract. It was the responsibility of the contractor to verify that the drawings being used were current with the configuration of each location before beginning work on active signal circuits. At the end of the work window, the contractor was required to return the system to operation with little or no delay to commuter traffic.

EXECUTION

How does a Public Agency running approximately 80 trains per weekday and hourly service on the weekends implement a construction project of this magnitude? In our case, we suspended weekend service for the duration of the project. Following the last train which departed the Caltrain Station at 12:07 am on Saturday morning, July 6th, 2002, weekend service via rail was not seen again on the peninsula until 6:00 am Saturday morning, June 5th, 2004. To replace the train service on weekends during this

time period, Caltrain instituted a “RRX Bus Service” with limited stops. These buses ran hourly, but only stopped at San Jose Diridon, Palo Alto, Hillsdale, Millbrae, and San Francisco 4th & King stations. Approximately 25 buses were utilized at a total cost of \$6,000,000.00. Also impacted was the service that is often added for special events, most notably the Giants Baseball Specials which run before and after every home game. For these events thirty additional busses were added in an effort to continue the special service on the weekends.

Additionally, an agreement was reached with the Union Pacific Railroad to curtail their operations during these shutdown periods. Such operations consist only of local freight deliveries between the San Jose Newhall Yard and the Ports of Redwood City and San Francisco as well as a limited number of local shippers. Initially their work was only impacted north of Redwood City. Trains on the south end were not impacted until April of 2003 when the SCTX project started shutting down both mainlines. Throughout the entire project every attempt was made to coordinate special moves required by the UP and in no instance where proper notification was made was the local freight traffic delayed more than three hours.

The bulk of the heavy work as well as the crossover installation and signal cut-overs were completed during these Weekend Shutdowns. Since this was anticipated and arranged for in advance the Contractor’s work week was compressed to four days, basically 6:00 am Thursday until 6:00 am Monday. On Thursday and Friday evenings (9:00 pm – 1:00 am) and on Friday and Monday mornings (1:00 am – 4:00 am) single-track operations were effected to allow construction to proceed on one track where required. During the daytime hours on Thursdays and Friday’s limited work could occur along the Right-of-Way under Form B protection utilizing Amtrak flagmen and watchmen, but the form B’s were only permitted between the hours of 8:00 am and 5:00 pm so as to avoid impacting the morning and evening commuter fleets. Occasionally exceptions to these restrictions were permitted to accommodate extenuating circumstances, but such occurrences were few and very far between. As the project progressed and schedule slippage became an area of concern (as is too often the case for projects of this nature) the Contractor was permitted to work along the Right-of-Way outside of the fouling limit (15 feet for the JPB) using Train Approach Warning (TAW) protection.

The Contract for the North job required that the Contractor start his work in the Common Street Segment and the Millbrae Segment. Only after completing the work in these two areas could he move on to work in the remaining segments, with the work winding up in the Redwood City area. By the fourth month of work, it was the request of the Contractor to move into the Bayshore/Brisbane segment to keep the grading and other advance work gangs ahead of the trackwork construction crews. We had already allowed work to begin in this segment for a small bridge replacement that needed to be started before the waterway curfew came into play at the middle of October, 2002. After much deliberation it was decided to allow this and the advance of work from one segment to another on the North job continued for the duration of the project. It was not long before Construction activities spread over 29 miles on the north end alone. Adding to that was the start-up of the south project on the weekend of January 29th, 2003. Work here first

began at the Lawrence Station. Keeping track of all of the gangs and all of the work became a major undertaking for Caltrain Construction Managers.

The SSWP program had been in place previously on the Caltrain property and utilized extensively on the Ponderosa Project preceding the CTX Program. Robert Nagel was instrumental in the application of the Ponderosa program and had some definite ideas on how to improve on it for the CTX work. Previously the Contractor had made their requests in a large SSWP meeting and the JPB Staff had formalized it and forwarded the requests to the Operating Department. Robert made changes to require the Contractor to prepare the initial paperwork which was discussed, modified and approved in this meeting. This was very effective and worked as follows.



At least two weeks prior to the start of any work activity, the Contractor was required to submit a Work Plan for the individual tasks of work that they intended to undertake. These Work Plans were somewhat generic for the Track and Civil Work but somewhat more specific for the signal work especially as we neared the pre-testing and final cutovers. On Sunday afternoons the Contractor met with Caltrain and Amtrak staff to discuss the work upcoming for the next weekend. At this time it was determined just what individual Work Plans would be implemented and whether or not these Work Plans had been properly approved. More importantly the form of protection was finalized for each gang and the appropriate flagman or watchman was assigned from the Amtrak resource pool. It was also determined just how many Amtrak signal maintainers would be required to support the signal activities for the weekend. This was quite a task for the Contractor in the beginning, but as the project moved forward, it actually became a tool for him to schedule his own work and ensure that he could support his own activities. When the south job came aboard, another Sunday afternoon meeting was added and the determinations made there were incorporated into an overall plan for the week. Soon it became apparent that we were not the only ones vying for the track and/or the Amtrak resources and another meeting was established on Thursdays to coordinate all of the projects in progress along the corridor. This included Third-Party projects as well as other JPB Construction work and Amtrak maintenance activities. As a result of this process very little work was denied any entity.

Therein lay another problem; as the work progressed over a larger and larger area and the number of gangs increased their track time demands, the number of Amtrak people available to support the work became insufficient. Luckily, or perhaps by design, the

number of people made available to the Contractor was spelled out in the Contract with a cost associated for requests for additional resources. Nevertheless, we did not have enough people to fill the additional requests. In the spring of 2003 we started a program by which after completion of an intern or apprentice program, the contractor could supply his own watchmen. The program required that the Contractor's Watchman/Coordinators (W/C) complete an 8 hour training course hosted by the JPB Safety Department and the Amtrak Rules Trainer followed by 40 hours of "OJT" with an Amtrak Flagman in the field. The program was very successful in that the Contractor could work in still more areas than previously permitted with no additional costs being levied by the JPB. At the Sunday afternoon SSWP meeting the Contractor was required to identify where he intended to use his Watchman/Coordinators to support his work and to identify who the person filling that position would be. Watchman/Coordinators were permitted to perform the duties of a Watchman and coordinate the activities of their assigned gang with the Flagman assigned to their overall work.

Follow-up coordination was also necessary to ensure that everyone was where they were supposed to be and that only approved work was being undertaken. Thursday morning meetings were held with the appropriate project staff, on all sides; Caltrain, Amtrak and Contractor to review what had been approved what protection was in place, who was responsible for that protection and what changes were now necessary. Very often problems were identified at this meeting and adjustments were made to the field support and work locations. As we neared the end of the jobs this was an on-going issue. Additionally on Saturday and Sunday mornings, when crews often reported directly to the work location in the field the Amtrak EIC, or senior flagman met with all his Amtrak Watchmen and Contractor's Watchman/Coordinators to effect an over-all job briefing and to determine that the right person was headed for the right job and that the appropriate protection was being provided for the work anticipated to be done that day. Again, problems were often identified here and adjustments made to the assignments.

QUALITY CONTROL AND QUALITY ASURANCE

As the job progressed and the work spread across the property, control of the worker protection was the first priority. Next on the priority list was quality. Keeping track of the work that was being undertaken was a major issue. We, of course, had the SSWPs to tell us where the gangs were and what they were doing, but ensuring that the work accomplished was of acceptable quality was not so straight-forward. Due to budget constraints, inspection staff was maintained at a minimal level. Unfortunately the complexity of the project scope and the geographical area covered by each contract kept the Resident Engineers busy reviewing Submittals, RFIs, CORs, and potential claim issues as well as the remainder of the broad spectrum of administrative tasks associated with such projects.

On the Civil side we employed three full-time civil inspectors and one electrical inspector working under the direction of an overall Manager of Civil Construction. We required that these inspectors be prepared to oversee a wide range of activities, which included grading, installation of secant and driven steel piles, construction of an underpass

structure, bridge construction, station platforms and shelters, utilities, and the relocation of existing stations to temporary locations during construction. The Bridge over Colma Creek was of a precast concrete girder design replacing the old timber deck on concrete piers. Construction lasted from the first of April to the end of October and continuous civil inspection was required. The extensive scope of the two new major station rebuilds was addressed earlier. Work often continued around the clock on both projects in order to maximize the available double-track windows. As stated earlier, all of this work was covered by a very few inspectors who were called upon to witness general grading, drainage and other civil-type construction activities. They were also often called upon to witness construction on other smaller projects within the JPB Right of Way.

The grading was no sooner underway when the track crews were hot on the heels of the dirt moving equipment. Actually the work started in the Common Street Segment near downtown San Francisco where the original track had to be removed before the grading could even begin. The areas of active track construction had to be demolished, regarded, compacted, bedded with new concrete ties, strung with new rail, de-stressed and brought to final surface and alignment. Many areas were totally new track construction to provide the new third and fourth main lines. In order that the magnitude of the work can be fully realized, a Material Summary Chart has been provided at the end of this paper. This work was witnessed by eight track inspectors reporting to our Manager of Track Construction, Robert Nagel. These inspectors were basically split four for the north and four for the south, two on each at night and two each during the day. For the most part, the Trackwork Inspection Team worked around the clock from 6:00 am on Thursday Mornings to well after 7:00 am on Monday mornings. Shifts were nominally twelve hours, but usually lasted 13 to 14 hours as an overlap was required in order to insure a complete and safe turnover. Every Friday and every Monday morning the entire area of disturbed track was walked, both before running the first train and then again in daylight to ensure that nothing was overlooked in the turnover process and return to service. The first trains out of San Jose and San Francisco every Monday made their entire run at track speed with only minor slow-orders to accommodate temporary alignment or "conformed" situations. Major train delays were not an issue during this construction project. The fact that the Contractor quickly became active in multiple areas kept the track people moving constantly from one location to another in an effort to adequately cover the various activities.

The Signal Inspection Team came to be even more stretched; although not until we started the major cutovers and the incorporation of the Speed Signaling and ATCS Systems did they work in the dark with any regularity. The Signal Sub-Contractor got a



late start and had not anticipated that the Trackwork side would move forward so quickly. They were behind from the beginning. Adding to that situation is that fact that the PCJPB has rather stringent Class I requirements regarding the qualifications of Signal Managers and Signal Engineers. The Signal Sub-Contractor assumed that the people that they were using on Bart and Light-Rail Projects would have no problem becoming qualified to work on

the Caltrain Property. Such was not the case as candidate after candidate was not prepared to construct and cutover a new CTC System over the existing ABS System and still run trains at track speed on Monday morning. Eventually a qualified staff was assembled, but the remainder of the project was a game of fast-paced catch-up on the signal side. Signal Inspectors were supplied by the Signal Consultant, Southwest Engineering and were brought in from all over the country. At the peak of the project, ten inspectors were working seven twelve to fourteen hour days. Not only did they have to insure that the new system was installed safely and in accordance with the intended design, but there was a never ending chain of RFIs regarding the existing system the physical characteristics of which often did not conform to the situation depicted in the design drawings. In the end the delay to the final completion date was not as severe as it could have been without their expertise and the new system has operated with only minor sputters since the day that it was first put into service.

SAFETY

The truly outstanding accomplishment that is attributable to the Inspection Staff as a whole in the field is that this project was closed out with only twelve minor injuries over the two years of work. There were a number of incidents. At the start, the utilization of crews more experienced with commuter train operations than work trains took its' toll in work train incidents and the flurry of signal activity resulted in an occasional red that was not desired or anticipated, but no one was hurt and there were no commuter train incidents.

There was a heightened awareness regarding safety on this project due to several major factors. First is the fact that the Contractor, who has enjoyed a rather solid safety reputation, was not going to allow any exceptions here. Second the FRA inspection staff

found this project an easy commute from Sacramento, especially when traveling to points south. Before the project was even underway the local and regional FRA inspectors made regular visits to the project, making it clear that CFR 49 Part 214 would be strictly enforced. The Caltrain Construction Management Staff reacted by enforcing the existing Caltrain Zero Tolerance Policy regarding PPE and actually extending it to include all aspects of Part 214. As the projects progressed and incidents occurred, the work was halted to hold appropriate “Safety Stand Downs” to make sure that all employees understood the nature of the incident, the potential for disaster associated with such an incident and the means by which reoccurrence of the incident could be avoided. Such Stand Downs were hosted by Senior Contractor and CM Management.

With the advent of the Watchman/Coordinator program a new area of concern arose. The program itself worked very well, but now we had more “Employees in Charge” (EIC) who had to be monitored for compliance. The entire list of associated documentation was assembled in a Roadway Worker Protection Manual which every EIC, foreman, inspector and manager was required to maintain and have readily available. The Inspection Staff was tasked with ensuring compliance with this guideline and proper use of the RWP Manual by the responsible parties.



Another problem was that a large percentage of the workforce did not speak English. A small book was prepared by the Contractor, similar to that used by major railroads, in which all employees could record the pertinent information regarding the protection that they were being afforded on each particular day. During each job briefing all employees were required to record this information and have it readily available for reference. The Job Briefings were always translated for the Spanish speaking workers so that they could record the information and understand what it meant. Later in the project Caltrain developed its’ own book which provided more detail regarding the protection and limits of the work.

About ten months prior to the completion of the job, an increased number of incidents was experienced and unsafe acts were being noted on a more frequent basis. To keep this from getting out of hand and to preclude the obvious potential ramifications, the Chief Development Officer instituted a program in which an audit team made up of senior Safety, CM and Engineering managers patrolled the projects each weekend, interviewing flagmen, watchmen, watchman/coordinators, foremen, machine operators, inspectors and managers as well as individual workers to ensure that the Safety measures adopted to date

were being properly implemented. These audit teams were out for one day and one night shift each weekend during the time that the most activity was being seen. The audit teams were given the authority to write up any individual found to be deficient in his or her compliance. These individuals were issued a “ticket” for the offense and the deficiency was noted and logged so that we would know when someone was experiencing their second or third violation. It was not long before all personnel on the property became aware of the long-range effects of the program and non-compliance quickly became a thing of the past.

THE RESULTS

Caltrain’s approach to a project of this size and complexity worked very well. Cooperation with the operating department allowed the weekend shut-downs and continuing single tracking that made room for the Contractor(s). The CTX Contract work was completed in late March of this year and after completion of punchlist work, cut-over and implementation of the Speed Signaling and ATCS systems as well as a couple of weekends of “dry runs” by the operating department, weekend service was re-established on June 5th and the new “Baby Bullet” Service was placed into effect on the Monday the 7th. Closeout of both CTX contracts was completed in late summer of this year. Several other improvements had been identified during the course of the CTX Program and associated contracts were awarded to bring the Diridon Station in San Jose into ADA compliance, fabricate and install mini-high platforms at the express stops for wheel-chair dependent riders, and up-grades to the SF Service and Inspection facilities. These projects were completed either prior to or just after Express train service was implemented. The CTX program was completed safely, essentially on time and within budget. One-way from San Jose to San Francisco is now completed in 57 minutes. The commuters love it and ridership is growing, even on weekends and already, the addition of more trains is being seriously considered.



CTX Trackwork Quantities

	<u>NCTX</u>	<u>SCTX</u>	<u>TOTAL</u>
Active Track Const.	23,838 tf	46,245 tf	70,083 tf
Non-Active Track Const.	19,127 tf	22,771 tf	41,898 tf
Timber Active Track	4,160 tf	1,373 tf	5,533 tf
Ballast	162,620 T	132,738 T	295,358 T
New Rail	2,579 T	6,375 T	8,954 T
Field welds	2,385 ea	1,196 ea	3,581 ea
In-Track Flash Butt	375 ea	N/A	375 ea
Production tie	7,576 ea	19,198 ea	26,774 ea
Spot tie	1,945 ea	3,649 ea	5,594 ea
Concrete ties	49,815 ea	37,590 ea	87,405 ea
#9 Timber Turnouts	22	7	29
#10 Timber Turnouts	22	7	29
#10 Concrete Turnouts	12	4	16
#14 Concrete Turnouts	4	0	4
#20 Concrete Turnouts	6	4	10
#20 Concrete Crossovers	11	6	17
Split Point Derails	9	7	16
Turnouts Removed	75	27	102