

Perris Valley Commuter Rail Extension; Riverside County, CA

The Perris Valley Line (PVL) Commuter Rail Project is a 24-mile extension of the existing Metrolink 91 Line with four new stations operating between Downtown Riverside and South Perris following the Interstate 215 corridor. In 2004, Riverside County had grown to a population of 1.7 million residents, with a majority concentrated in the western portion of the county. By 2040, Riverside County was projected to grow to a population of more than 3.1 million residents. Attempting to mitigate the resulting traffic growth, Riverside County Transportation Commission (RCTC) sponsored the San Jacinto Branchline (SBJL)/I-215 Corridor Study to examine potential alternatives to automobile use in the corridor. The rail service option that emerged from this study was a 24-mile extension south from Downtown Riverside to Moreno Valley and Perris.

The Perris Valley Commuter Rail Extension entered FTA Project Development (PD) in December 2007 and received the Project Construction Grant Agreement (PCGA) with FTA in December 2013. The project opened for service in June 2016.

RCTC was the project sponsor who constructed and funded the project as FTA's recipient of the PCGA. Metrolink, the commuter rail operator for the Los Angeles Metropolitan area, operates the PVL extension service. The Riverside Transit Agency (RTA) is responsible for bus service provided along the PVL corridor. Figure 1 shows a map of the Metrolink commuter rail system and highlights the location of the Perris Valley Extension project.



Figure 1. Metrolink Commuter Rail System and Perris Valley Line

Physical scope

The Perris Valley Extension project is a 24.0-mile commuter rail extension from Metrolink’s Riverside-Downtown Station and a new terminus at Perris-South station. The project alignment traverses three distinct sections of railroad operating environments along the project. For 3.2 miles from Riverside-Downtown Station to just east of Iowa Avenue, PVL trains operate north on the existing three-track BNSF Railway San Bernardino Subdivision. This segment has extensive freight operations as this is BNSF’s connection to the Ports of Los Angeles and Long Beach.

A new 2,000-foot connection called the Citrus Connection was constructed just north of Citrus Street to connect the BNSF San Bernardino Subdivision to the San Jacinto Branchline. The remaining 20.4 miles operates on the reconstructed San Jacinto Branchline. The operations on the Citrus Connection and the San Jacinto Branchline operates as a single-track, at-grade railroad, with limited freight sidings.

Four new project stations were constructed along the San Jacinto Branchline as part of the project: Riverside-Hunter Park/UCR, Moreno Valley/March Field, Perris-Downtown and Perris-

South Stations. Each station has a 510-foot side platform sized to accommodate trains with up to six passenger cars (all can be extended to 680 feet). Stations provide canopies for weather protection, fare collection equipment, schedule information, dynamic train arrival displays and monitored cable television security. The four new stations include 2,250 new park-and-ride spaces, new bus plazas, pedestrian and bicycle amenities. Eight traffic signals were added in station areas to facilitate connections to the local roadway network.

The project constructed a new layover facility in South Perris just beyond the terminus station to provide for overnight storage and servicing of PVL trains. The facility includes a modular operations building, parking facilities, fencing, trash enclosures, pollution control equipment, storage containers and supporting utilities.

The project built or modified 20 at-grade railroad crossings. This included two new pedestrian crossings at stations, 15 reconstructed roadway crossings to meet Metrolink and California Public Utilities Commission standards, one emergency vehicle crossing and two crossing closures. All roadway crossings feature quad gates and/or medians. All crossings provide full pre-emption of traffic when trains approach.

Utilities along the project were relocated and/or encased to support passenger rail service. These include drainage structures, telephone, power, cable, sewer, storm drain, water and gas. The project added environmental mitigation focused on three areas: noise insulation and sound walls, habitat monitoring in biologically sensitive areas and cultural resource mitigation.

The San Jacinto Branchline was formerly an un-signalized low-speed freight railroad. Extensive systems construction was required to implement passenger rail service. The project installed a full Positive Train Control (PTC) train control system, 18 new at-grade crossings required crossing protection devices and interconnection to eight traffic signals to allow for signal preemption. Fiber optic and microwave communication links were provided to all control points, stations and the layover facility.

The project required purchasing of 67 acres of right-of-way. Seventeen of these acres were for the construction of the Citrus Connection, nine acres for the Riverside-Hunter Park Station and 40 acres in South Perris for the station and layover facility. Small property takes were required at several crossings to install safety equipment. The Moreno Valley/March Field station location was donated by the surrounding business park. RCTC purchased the San Jacinto Branchline from the predecessor of the BNSF Railway in the early 1990s.

No vehicles were purchased as part of the project. Instead the existing Metrolink fleet was used to provide service on the PVL.

The anticipated project scope at entry to PD was significantly different from the as-built project. First, the project development project scope assumed that the Union Pacific Railroad (UP) Riverside Industrial Lead (RIL) line would be used to access downtown Riverside. Instead of using the UP RIL, the project utilizes the BNSF San Bernardino Subdivision to access downtown Riverside. The change from the UP alignment to the as-built BNSF alignment lowered the project costs and had fewer environmental impacts. Second, the predicted PD scope assumed that the project would mostly rehabilitate the San Jacinto Branch Line. Instead during entry to PD, RCTC and Metrolink decided to utilize new track for the project. Third, at PD, the project planned six stations, instead of the four constructed. The changes to the number of stations were in response to residential disapproval at public meetings for one station and a settlement of an

environmental lawsuit settlement at a second station. Fourth, at PD the planned layover facility in Perris-South was significantly undersized for the level of service maintenance that needed to be accommodated at this facility. In addition, the location of this layover facility did not account for its location within a floodplain, which required buildings to be raised and electrical subsystems to be designed for water immersion. Fifth, the supporting site-work was underestimated, including the sound wall lengths and utility relocations. Lastly, the project did not include PTC implementation. Shortly after entry into PD in 2007, Congress enacted the Rail Safety Improvement Act which mandated the installation of PTC.

All the major scope differences between the planned scope and the actual scope of the project had been resolved at the time of the PCGA execution. There were only very minor project scope differences between the PCGA and the as-built project.

Capital cost

The actual cost of the project was \$248.3 million in year-of-expenditure (YOE) dollars – 61 percent for construction, 6 percent for land acquisition and 33 percent for professional services. Total YOE cost per mile was \$10.2 million and the average station construction cost was \$4.7 million.

At PD-entry, the predicted cost was \$168.3 million in YOE dollars, an underprediction of \$80.0 million in YOE dollars or 32 percent less than the actual cost. Of that underestimate, \$45.5 million in YOE dollars (57 percent of the underprediction) is attributable to scope differences identified in the physical scope section above. \$31.7 million in YOE dollars is attributable to schedule differences, as the Entry to PD milestone predicted the project would open in 2011, instead of the actual opening of 2016. The schedule delay was attributed to the state environmental process – an initial less intensive environmental document had to be supplemented with a more extensive document that was litigated and settled. The remaining small differences were attributed to inflation forecasts, which tracked closely to actual inflation rates.

At the PCGA, the predicted \$248.2 million cost estimate in YOE dollars matched the actual as-built cost in YOE dollars. While the predicted and actual cost estimates matched overall, there were slight offsetting differences in the components of capital costs. There was an \$8.6 million cost overestimate attributed to scope differences and a \$2.8 million cost overestimate of inflation rate differences. These were overestimates entirely offset by a \$11.4 million cost estimate underprediction of costs due to the schedule delays. The PCGA anticipated that the project would open in 2015 and it instead opened in 2016.

Transit service

The PVL schedule was designed to support travel from residences in the Perris Valley Corridor to job centers in Riverside, Orange County and Los Angeles County. In October 2018, two years after project opening, the westbound (inbound) service included a total of six trains daily. The first three of the six trains operate from South Perris to Los Angeles Union Station. These trains depart South Perris between 4:43am and 5:48am and arrive at Los Angeles Union Station between 7:05 and 8:10am. The end-to-end-travel time on these trains is 142 minutes.

The remaining three inbound trains serve as shuttle trains which operate on the PVL as a shuttle between Perris-South and Riverside-Downtown. The travel time on these shuttle trains is 44

minutes. Customers traveling further west to Orange County or Los Angeles County must transfer to connecting service at Riverside-Downtown. Due to track availability limitations, there is about a 30-minute wait for Riverside Line trains for these connections. Passenger connections to the Inland Empire – Orange County Line are not feasible because these trains leave several minutes before the PVL trains arrive. These shuttle trains depart South Perris at 6:51am, 10:36am and 1:51pm.

The eastbound (outbound) service provides a similar operating philosophy to the inbound service plan. Three of the six trains depart Los Angeles Union Station between 3:35pm and 5:30pm. The end-to-end travel time on these trains is 140 minutes. The remaining three trains operate as shuttle trains between Riverside-Downtown and Perris-South. The travel time on these trains is 45 minutes. These shuttle trains depart Riverside-Downtown at 8:10am, 12:00pm and 2:53pm.

Riverside County has three Metrolink lines and nine stations. The five non-project Metrolink stations continue to be attractive travel options for Perris Valley corridor residents. These existing Riverside County stations offer both 1) more train frequency to/from Los Angeles Union Station (via Riverside Line/91 Line) versus the PVL and 2) offer connections to the large job centers in Orange County (via Inland Empire – Orange County Lines). The Metrolink schedules are oriented to support typical workday starting times at the large job centers in Los Angeles metropolitan area - meaning residents traveling from Riverside County need to start their commutes very early in the morning. An analysis by FTA and RCTC showed that during these early morning hours, riders can save 15-25 minutes of time by driving longer distances to a non-project Metrolink station versus driving shorter distances to ride the PVL.

The smaller reverse commute eastbound market is populated by residents outside the Perris Valley corridor who want to travel east in the morning to jobs and schools and west in the evening. There is only one train and it operates only from Riverside-Downtown at 8:10am. There is no reverse-peak service in the evening, with the last westbound train departing Perris-South at 1:51pm. The lack of service makes the Perris Valley service impossible to use for reverse commuters.

At both the Entry into PD and PCGA milestones, the number of trains planned to operate on the PVL extension matched the actual service – 12 trains daily, six in each direction. However, the service plan at both milestones assumed all 12 trains would operate between Perris-South and Los Angeles Union Station. Due to limited track slot availability with the BNSF Railway west of Riverside, only three of the six trains in both directions operate the full length between Perris-South and Los Angeles Union Station. The remaining trains operate only between Perris-South and Riverside-Downtown, with connections requiring a 30-minute wait at Riverside-Downtown. The travel times along the PVL were predicted to be 38 minutes, which was six to seven minutes faster than the actual travel times.

RCTC has continued to expand service on the PVL since 2018. In October 2019, weekend service and a fourth daily PVL round-trip from Perris-South to Los Angeles was implemented. In addition, several capital projects are underway in Riverside County to allow for more effective reverse-commute and off-peak service. Additional PVL service is planned over the next few years following service recovery from the COVID-19 pandemic.

O&M costs

Metrolink O&M costs are not reported for the PVL. RCTC estimated the actual PVL O&M costs by comparing Metrolink O&M costs before and after project opening. The year 2018 O&M costs were estimated at \$11.4 million for the PVL. RCTC predicted year 2018 O&M costs of \$6.8 million at both the entry to PD and PCGA milestone, an underprediction of 40 percent. RCTC identified inflation in fuel costs, labor (train operations and administration) and risk management. Fuel costs have grown over 300 percent in the last 10 years, with volatility in diesel prices posing a risk to future cost increases. Insurance costs for Metrolink increased dramatically following the Chatsworth incident that led to implementation of PTC on the Metrolink system.

Ridership

In 2018, two years after the PVL opened to service, weekday ridership on the project averaged 550 trips. Of these project trips, 86 percent, were produced by residents of the Perris Valley corridor traveling to/from jobs throughout the Los Angeles metropolitan area. While the Los Angeles Central Business District (CBD) was found to be the largest of the job centers served by the project, only 20 percent were destined there. The remaining 80 percent were attracted to locations throughout many destinations in Los Angeles and Orange Counties. These project trips are predominantly for commutes to/from work, relied on automobile access (park-and-ride and drop-off) between residences and project stations.

Another key feature of the actual ridership on the project is that only 25 percent of Metrolink riders from the PVL corridor used the project; most traveled to a pre-existing Metrolink station to board their train. As discussed, in the service section, this is likely because residents of the PVL corridor can save significant travel time by boarding at other Metrolink stations outside the corridor, notably Riverside-Downtown. The southern half of the corridor (furthest away from Riverside-Downtown) carried 38 percent of Metrolink trips produced in the corridor but only 17 percent of trips produced in the northern part. This is likely because the northern half of the corridor is closer to these options that compete with the PVL and has relatively fast automobile access to these Metrolink stations. The southern half of the corridor requires a longer drive to other Metrolink stations and the project attracts a larger share of PVL corridor riders.

Approximately 50 trips per average weekday were “reverse” market riders produced outside the Perris Valley corridor who are attracted to activities in the Perris Valley corridor. This small “reverse” market has notably different characteristics: these riders tended to not have a car available for the trip, to be less work-trip oriented, and to be dropped off at their home-end Metrolink station.

The PVL project forecasts reported to FTA were 3,430 trips per weekday at Entry to PD and 4,300 trips at the Small Starts Grant Agreement. In fact, however, RCTC and FTA determined that the entry into PD forecasts were 5,800 project trips and the PCGA forecast predicted 7,400 project trips, even higher than reported. This incorrect reporting of the forecasts was the result of confusion over terminology used in the FTA form that project sponsors used to report the forecast. The form used the term “boardings” instead of “trips.” This confusion led to the submittal using predicted boardings – per the term used in the FTA form – rather than predicted trips.

RCTC and FTA have identified four reasons for the over-prediction in project ridership. First, the PVL prediction was part of a system-wide forecast that dramatically overstated the growth in Metrolink ridership by 2010, the then-anticipated opening year of the project. At the PCGA, the forecasts predicted 109,000 system-wide Metrolink trips in the forecast of PVL project ridership at the PCGA compared to the actual 38,400 Metrolink trips measured in the 2018 system-wide survey. Second, the forecast overpredicted overall Metrolink ridership from the PVL corridor to activities in Riverside. The PCGA forecasts predicted 1,500 of the 7,400 project trips would be between a between Riverside-Downtown and a project station. Current ridership data shows just 60 trips per average weekday in this market. Third, the forecast anticipated a substantial number of trips among the new PVL project stations, where no market (zero trips) materialized. Fourth, the forecast anticipated that nearly all Metrolink trips produced in the PVL corridor would use the PVL project while the rider surveys show that most of PVL corridor riders bypass the new PVL stations and instead use non-PVL Metrolink stations.

The causes of the substantial system-wide overprediction are unclear. Detailed analysis of the predicted-actual differences was not possible because the original forecast files from the late 2000s were lost with the failure of the server on which they were stored. Second-quarter Metrolink ridership ranged from 34,800 trips (2003) to 41,900 trips (2006) per weekday in the timeframe of the model calibration. Consequently, the model was calibrated to then-current Metrolink ridership, the calibration target would have been roughly 35,000 to 40,000 trips per weekday. However, it seems very unlikely that a model calibrated to the then current Metrolink trips could have produced a forecast of 108,000 Metrolink trips for 2010. Only two conclusions are possible: (1) either the model was not well calibrated to existing system-wide Metrolink ridership, or (2) some malfunction occurred in its application to the 2010 forecast in either the model itself or the various projections that serve as inputs to the application (year 2025 population and employment, highway congestion, parking costs, etc.).

As the service section describes, Metrolink service on the project was predicted to include six trains per day between South Perris and LA Union Station – three more in each direction than the actual PVL schedule provides. The difference in PVL train service seems likely to have had significant effects on the overprediction of project ridership. In the real world, the narrow service window of the three trains between Perris – South and Union Station (65 minutes in the morning, one hour and 55 minutes in the evening) substantially degrades the usefulness of the service, and has a pronounced negative effect for travel to/from locations nearer to the PVL corridor. The use of shuttle trains for half of the weekday service (mostly off-peak hours) forces PVL riders to transfer at Riverside-Downtown. More challenging is the fact that riders must wait approximately 30 minutes to board a Riverside Line train to complete their trip to other locations on the Metrolink system.

Several elements of the PVL project are challenging to represent in travel forecasting models. Most transit ridership models represent service levels on each line by representing the average “headway” between transit vehicles. A corresponding waiting time is easily calculated as a half of this headway. This approach works well for transit services with relatively frequent services. Infrequent services, such as the PVL service with six trains per day are particularly challenging with this approach. The project concentrates morning inbound rush hour service to Los Angeles Union Station into three trains over 90 minutes (30 minute headways between trains), while the afternoon service concentrates that service over 120 minutes (60 minute headways between

trains). The peak-period service was represented in the travel forecasting model as a 30-minute frequency which both 1) overstates the service over the entire peak-period and 2) over-represents service in the PM peak period, where trains are spaced every 60 minutes.

Much of the overprediction of the Riverside-bound and intra-project market appears to be related to the scheduling of PVL trains. The three PVL trains in the morning peak are scheduled so that they serve commuters arriving at LA Union Station at appropriate work-hour times -- between 7:05am and 8:10am. This scheduling means that the three through trains arrive at less distant stations quite early, between 4:45am and 6:00am, likely too early for most workers. The LA bound trains arrive at Riverside – Downtown between 5:27am and 6:32am, with one train departing from Perris – South and terminating at Riverside – Downtown at 7:35 for service in the local area’s morning peak. The afternoon service is scheduled to serve commuters departing LA Union Station between 3:35pm and 5:30pm. Due to the long travel time between LA Union Station and Riverside, the first outbound train departs Riverside-Downtown at 5:03, some 9.5 hours after the last inbound morning peak train arrives in the morning. This duration between last train in and the first train out from Riverside-Downtown makes it challenging, perhaps impossible, for most workers to use the PVL for intra-corridor commuting.

The forecast predicted that 82 percent of Metrolink trips generated by residents of the PVL corridor would board at one of the project stations. In the actual outcome, the 2018 survey found that just 26 percent of Metrolink trips from the corridor chose to use a PVL station. The forecasting methodology relied on a station-choice procedure which was responsible for sorting out choices between access to Metrolink at a PVL project station versus non-project Metrolink stations. These components largely missed reality that most Metrolink riders from the PVL corridor bypass the project stations and board at Riverside – Downtown instead. Two parameters in the station-choice model contributed to this outcome. First, the weight on commuter-rail in-vehicle time is discounted so that a minute on a train is less onerous – a common feature of travel models nationally that reflects the relative comfort of commuter rail travel and the potential use of time for other activities (reading, working, napping). Second, the weight on drive-access time is set much higher – also a common feature of travel models used to discourage unrealistically long drive-access trips.

These two-parameter settings interact to make the use of PVL stations look to the model to be much more appealing than the reality for PVL corridor residents. To compound this problem, the anticipated schedule for PVL trains at the PCGA assumed 1) all PVL trains would operate to LA Union Station and 2) included a running time from Perris – South to Riverside – Downtown that was seven minutes faster than the actual service. In addition, the anticipated driving time from the PVL corridor to Riverside was represented with congested peak-period conditions – longer by 15-20 minutes than the congestion-free conditions that occur in the very early morning when Metrolink riders are driving to the early trains at Riverside – Downtown. These factors together caused the overreaction of the forecasting model to PVL service.