

South Sacramento Corridor, Phase II; Sacramento, CA

The Phase II project is 4.3-mile light rail extension in Sacramento's south corridor. The project was planned and built by Sacramento Regional Transit District (SacRT), the principal provider of public transportation services in the metro area. SacRT now operates Blue Line service on the project as part of its 43-mile light rail system.

Figure 1 is a map of the SacRT light rail system, highlighting the location of the South Corridor Phase II project. Figure 2 is a detailed map of the Phase II project and the areas within the South Corridor that it serves.

The project initially emerged as part of the locally preferred alternative (LPA) from an Alternatives Analysis conducted by SacRT in 1994-95. The LPA was an 11.5-mile light rail line in the south corridor that would be built in two phases because of constraints imposed by the availability of local funding. The 6.3-mile Phase I project from downtown Sacramento south to an interim terminus at Meadowview Road was completed in 2003.

SacRT revisited the planned alignment of the Phase II project beginning in 2002. An agreement with the Los Rios Community College District led SacRT to revise the Phase II alignment to a relocated terminus at the Cosumnes River College (CRC) where a no-cost right-of-way easement, a cooperative agreement to build a shared parking garage, and an overall shorter alignment would reduce capital costs and lead to higher anticipated ridership.

SacRT identified this revised LPA for the Phase II project in November 2004 and the project entered Preliminary Engineering (PE) in February 2005. The subsequent PE effort spanned seven years because SacRT needed four years to complete the Final Environmental Impact Statement and then three years to deal with changes in project scope and FTA requirements to demonstrate sufficient technical and financial capacity to build the project. The project entered Final Design in May 2012. SacRT and the Federal Transit Administration entered into a Full Funding Grant Agreement (FFGA) in December 2012 and the project opened for revenue service in August 2015.

Physical scope

The project is a 4.3-mile light rail extension from the Phase I terminus at the Meadowview station to a new terminus at the CRC station. The extension is double-tracked over its entire length and, except for two flyover segments, is entirely at-grade. The alignment comprises three distinct segments. Proceeding south from the existing Meadowview station for 1.4 miles, the extension is located next to right-of-way owned by the Union Pacific railroad, which continues to operate freight service on the adjacent single track. The line then transitions on a flyover over Morrison and Union House Creeks into a 2.6-mile segment along Union House Creek and adjacent to Cosumnes River Boulevard. Finally, the line then transitions via a flyover over the Boulevard into a 0.3-mile segment adjacent to Bruceville Road and terminating at the CRC station. Except at the three at-grade street intersections, the extension is fully separated from traffic, bicycles, and pedestrians.

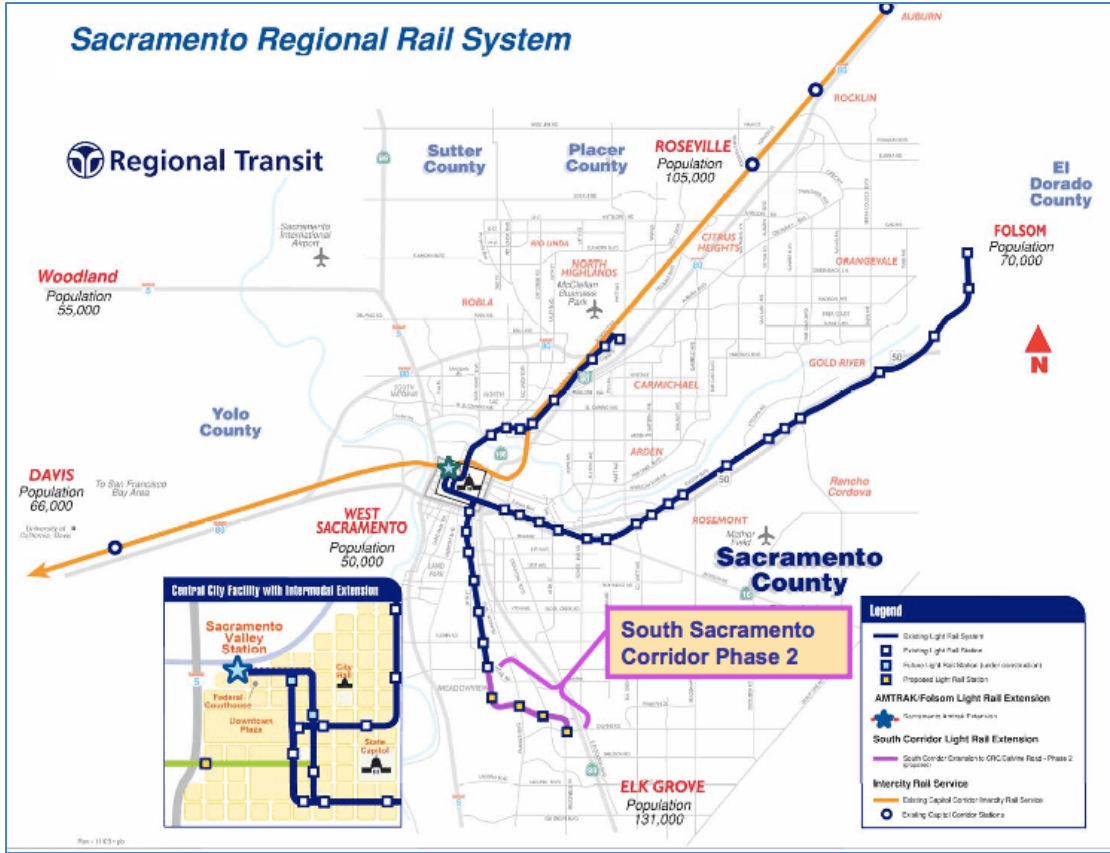


Figure 1. Project Location in the Regional Rail System

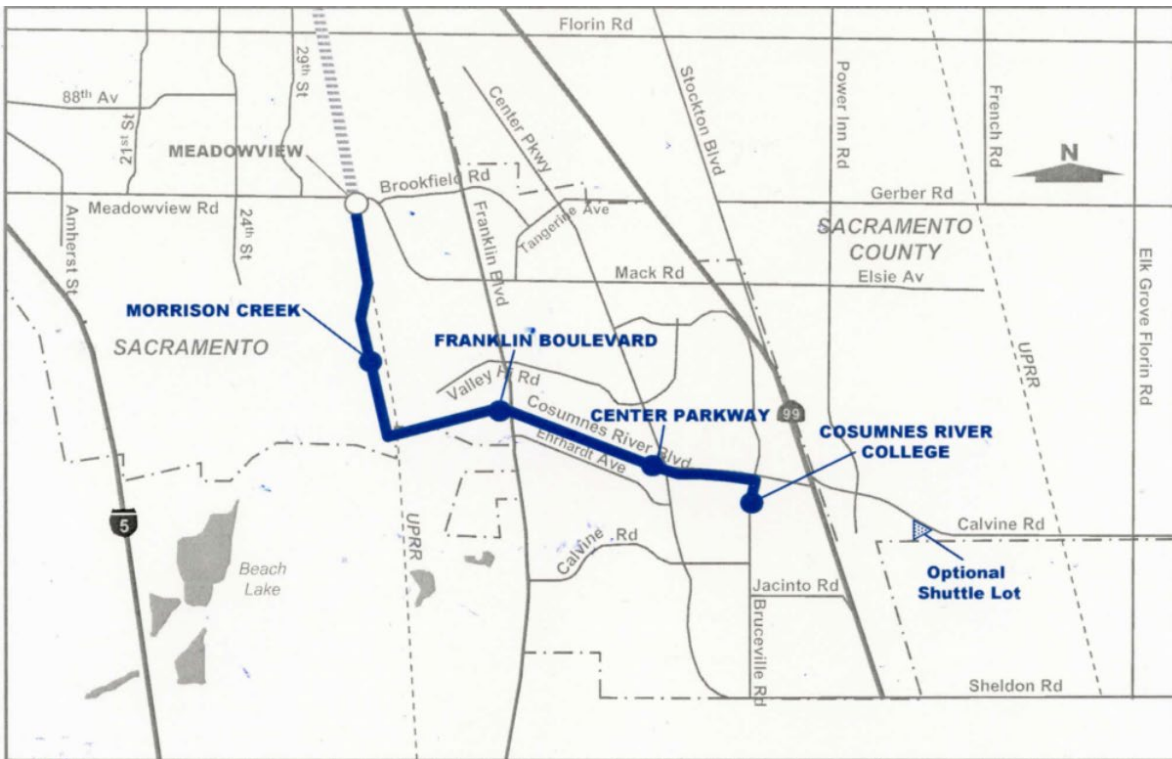


Figure 2. Details of the Phase II Project and Its Corridor

In the 3.87 miles of at-grade running, the two tracks are supported by concrete ties placed on ballast. On the two aerial flyovers with a combined length of 0.43 miles, the tracks are directly affixed to the flyover structures. Two tail tracks extend beyond the new terminal station.

The full scope of the project includes four new stations. As of this 2020 summary, SacRT has built three of the stations while, under an agreement with FTA, deferring completion of construction of the Morrison Creek station until future development near the station will generate sufficient ridership potential. Because the station foundations and park-ride lot have been completed, cost estimates for completion are based on current bid prices for similar work and include contingency allowances, and the remaining costs represent a small fraction of total project costs, FTA has agreed to treat the station as completed in the scope and capital cost analyses of the Before-and-After Study.

Each station has two 360-foot-long side platforms designed to accommodate trains with a maximum of four vehicles. The low-level platforms require passengers to navigate steps inside rail vehicles except at one door location where mini high platforms provide for floor-level entries and exits. Station designs meet the requirements of the Americans with Disabilities Act. Each station has passenger shelters, furniture, fare machines, and artwork. The terminal CRC station has a 2,000-space parking garage shared by transit riders and CRC students. The Franklin (650 spaces) and Morrison Creek (50 spaces) stations have at-grade park-ride lots. Pedestrian bridges provide station access over Union House Creek to the Franklin and Center Parkway stations.

The project did not acquire any new light rail vehicles because the existing SacRT fleet had enough spares to provide the additional trains needed to operate service on the extended line. Consequently, the scope also did not include any expansion of, or modifications to, the existing vehicle storage and maintenance facility.

Trains are powered through overhead catenary and four new traction-power substations. Train operators are guided by automatic red-yellow-green block signals. Standard railroad crossing gates control traffic and pedestrians at the three at-grade street crossings and give full priority to oncoming light rail trains. Communications include radio links to operator cabs and train-to-wayside detectors at stations that monitor the status of on-board systems. SacRT is implementing a Supervisory Control and Data Acquisition (SCADA) system throughout its light rail network to monitor the status of trains, the signaling system, and the power substations. The SCADA system on the Phase II project will become operational when the system-wide SCADA installation is completed, tentatively expected in 2026 depending on funding availability.

Real estate purchases were needed for several elements of the project. Along the 1.4-mile long railroad segment immediately south of the Meadowview station, a 40-foot swath acquired from the UPRR and a 20-foot strip from more than 30 residential parcels provided a sufficiently wide right of way to establish a 50-foot separation between light rail and UPRR tracks. Land acquired along the Morrison Creek levee provided a minimum 50-foot separation between the levee and the light rail alignment. An easement along the Detroit Boulevard development obtained from the State of California provided space for relocation of a high-voltage power line. Additionally, various parcels acquired at station areas provided room for station platforms, bus transfer facilities, and parking lots. Finally, through the agreement with the Los Rios Community College District, the project obtained the land needed for the tracks and CRC station in return for project funding of the construction cost of the 2,000-space parking garage and lease payments to allow transit riders to share use of the garage with the college.

At entry into Preliminary Engineering in 2005, the anticipated scope of the project aligned closely with the actual project outcome in terms of its length, alignment, and station locations. The scope at that milestone did not include four significant elements of the actual as-built project. These elements were added much later in the development of the project because of requirements and opportunities introduced by others.

First, in the project segment adjacent to the UPRR right-of-way, the scope at PE-entry provided for a 25-foot separation between the light rail and freight railroad tracks. Four years later in 2009, UPRR revised its required separation distance to 50 feet. The subsequent redesign of this project segment moved the centerline of the tracks, required additional real-estate purchases, and led to relocation of a high-voltage powerline – none of which was anticipated at PE-entry.

Second, the scope at PE-entry maintained a 20-foot separation between the rail line and the levee along Morrison Creek. Subsequently in 2013, the City of Sacramento increased the required separation to 50 feet, leading to the redesign of the line through that segment.

Third, the scope at PE-entry anticipated an at-grade crossing of Cosumnes River Boulevard. While the project was in PE, the City and the California Public Utilities Commission decided that grade separation of the crossing would be necessary to avoid adverse impacts on traffic. In response, SacRT modified the scope to include a flyover structure to carry the rail line over the roadway.

Fourth, at PE-entry, the scope anticipated parking at the CRC terminal station to be provided in a 2,000-space at-grade lot across Bruceville Road from the station. During PE in 2011, SacRT and the Los Rios Community College District agreed instead on the 2,000-space shared parking garage on CRC grounds that is now part of the as-built project.

In addition, the scope at PE-entry was not sufficiently developed to identify a range of smaller elements that were eventually part of the as-built project including: retaining walls, sound walls and vibration mitigation, masonry structures at the CRC station, and earthwork structures at various locations; the tail tracks at the CRC terminal station; relocation of some utilities; lighting for a pedestrian pathway; environmental mitigation features; and real estate acquisitions needed to permit the wider separations from the UPRR and the levee.

By entry into Final Design in 2012, SacRT had resolved nearly all differences between the anticipated scope and the actual project outcome. Only the relocation of the high-voltage power line and the addition of pathway lighting were still absent from the anticipated scope; both items were required by others during FD and were added to the scope.

Consequently, the scope of the project defined at the FFGA matched the scope of the as-built project.

Capital cost

The actual cost of the project was \$270.0 million in year-of-expenditure (YOE) dollars – 57 percent for construction, 14 percent for land acquisition, 24 percent for professional services, five percent for finance charges, and no expenditures for new rail vehicles. Total YOE cost per mile was \$62.8 million.

At PE-entry, the predicted cost was \$153.0 million in YOE dollars, an underestimate of 43 percent. Three factors contributed to the underestimate. First, \$71 million of the underestimate was caused by an underestimate of baseline constant-dollar (uninflated) costs – chiefly because

of the various elements missing from the project scope at the time but also because of: low unit costs assumed for station shelters and train control, signaling, and power distribution; an underestimate of the costs of professional services for the extended PE effort, preparation for bidding, and oversight of construction; and the absence of any finance charges that later became necessary because of changes in state law that temporarily disrupted the flow of federal grants.

Second, \$21.6 million of the underestimate was caused by anticipated annual rates of inflation that turned out to be lower than actual inflation over the period of project development and construction. SacRT assumed a constant 3.0 percent annual rate of inflation from PE-entry in 2005 through the actual Opening Year in 2015 – yielding a 30 percent overall increase in construction costs. Nationally, construction inflation over that period actually increased costs by 42 percent.

Third, \$24.5 million of the underestimate was caused by an anticipated construction schedule that was shorter than the actual schedule by 5½ years – thereby omitting the inflation costs incurred in those out-years. At PE-entry, SacRT anticipated that the mid-point of project expenditures would occur in late 2007 in contrast with the actual mid-point that occurred in spring 2013.

The \$8.3 million (5.0 percent) unallocated-contingency allowance included in the PE-entry estimate turned out to be insufficient to cover the problems in the predictions of both baseline and inflation costs.

At entry into Final Design in May 2012, the estimated cost of \$270.0 million YOE, including a larger contingency allowance of \$16.1 million (6.6 percent), matched exactly the amount necessary for SacRT to complete the Phase II project. The cost estimate assumed a construction schedule that was a year shorter than the actual outcome. However, the resulting underestimate of inflation costs (\$10 million in YOE dollars, or 3.7 percent) was offset by small overestimates of the baseline (constant dollar) cost and annual inflation rates.

At the FFGA seven months later in 2012, the \$270.0 million estimate of total costs remained unchanged. Its accuracy was again partially the result of a larger contingency allowance of \$20.1 million (8.5 percent) that was fully expended, along with a smaller underestimate of the length of the construction schedule offset by small overestimates in anticipated inflation costs.

Transit service

In 2017, two years after the Phase II project opened, service on the project is provided by the Blue Line which extends from the Watt/I-80 station in northeast Sacramento through downtown and the south corridor to its new terminus at the CRC station. On weekdays, trains run every 15 minutes during most of the day, except for every 30 minutes from 4:00 a.m. to 7:00 a.m. and again from 6:00 p.m. until midnight. On weekends, trains run every 30 minutes all day, from 5:00 a.m. to midnight on Saturdays and 6:00 a.m. to 8:00 p.m. on Sundays. Runtimes on the Phase II project itself averages 11 minutes including station stops, for an average speed of 22.9 miles per hour.

Bus connections to the project are available principally at the CRC terminal station where a transit center built before the Phase II project in the 1990s continues to provide for bus transfers among local bus routes, and now between those routes and the Blue Line. Most of this local bus service is provided by six routes of the e-Tran system, operated by the City of Elk Grove located immediately to the south of the Phase II corridor. Three local routes operated by SacRT extend

from areas to the north to the CRC transfer center, providing connections to the Blue Line, the e-Tran bus routes, and the college. Two other SacRT local bus routes provide connections from areas to the north to the Meadowview station and one other SacRT route stops at the Franklin station.

The City of Elk Grove's e-Tran system also provides commuter bus services from areas immediately south of the Phase II corridor to downtown Sacramento. Three of these routes operate on I-5 that parallels the Blue Line corridor to the west while four run on State Route 99 that parallels the corridor to east.

Introduction of the extended Blue Line service on the Phase II project led to only one modification to the bus services in the corridor. Prior to the extension, e-Tran provided non-stop bus service between the CRC transfer center and the then-terminus of the Blue Line at the Meadowview station. The Blue Line extension with the Phase II project made this bus service redundant and e-Tran discontinued it when the project opened to service.

SacRT did not prepare an Opening Year service plan or ridership forecast for the Phase II project. For this Before & After Study, SacRT and FTA have agreed that a "facsimile" Opening Year service plan could be derived from the transit network used in a travel forecast for 2012 that was developed in 2007 by the Sacramento Area Council of Governments (SACOG) to quantify the air quality and noise impacts of its Metropolitan Transportation Plan update. This forecast was developed roughly at the same time as the Phase II project's 2005 Entry to PE. The forecast was prepared using the same forecasting procedures and the same assumptions on 2012 transit network (including the Phase II project), transit service levels, population, employment, and traffic congestion. It therefore provides a snapshot of then-current thinking about the near-term future of transit in the Sacramento metro area and the south corridor.

SacRT and FTA agreed to make one modification to the SACOG transit network in deriving the facsimile plan for the Phase II Opening Year. The service plan that SacRT prepared for the Phase II project in the Horizon Year called for the truncation of all e-Tran commuter bus routes at CRC Station. On the assumption that SacRT would likely have truncated the commuter routes in an Opening Year service plan as well, the "facsimile" Opening Year service plan includes these truncations.

Compared with the actual service outcomes, the plan anticipated marginally better light rail service than the actual outcome: the speeds were to be slightly faster (and run times therefore somewhat shorter) and -- on weekends -- service twice as frequent and spanning more of the day. Anticipated eight-minute end-to-end runtimes on the Phase II project underestimated the actual runtime by three minutes. Because of this underestimate, and because SacRT has added time to the Blue Line schedule to improve schedule reliability, the facsimile plan marginally underestimated the number of train-hours and the number of train sets (nine, rather than eight) needed to provide Blue Line service.

For the bus system, the only significant difference between the plan and the actual outcome is that none of the planned truncation of e-Tran commuter routes at the CRC station has occurred. A second difference is that the plan continued the levels of SacRT bus service that existed in 2007 but SacRT has had to reduce service system-wide because of reductions in State Transit Assistance in 2008 through 2010.

Overall, except for the e-Tran commuter bus truncations, the facsimile service plan derived from the 2007 travel forecast prepared by the Council of Governments agrees closely with the actual service provided by the Phase II project and its connecting buses.

O&M costs

Based on the fractions of the SacRT light rail system and service that are associated with the Phase II project, the fully allocated costs of operating and maintaining the project in calendar year 2016 represented 9.3 percent of system-wide costs, equal to \$5.8 million. Within this Phase II subtotal, 24 percent is for traction power and maintenance of the vehicles, 62 percent is for train operators and supervisors, and 14 percent is for maintenance of way and stations. Total O&M costs for bus services in the corridor are \$6.7 million – 44 percent for SacRT local services, 51 percent for e-Tran local services, and five percent for e-Tran commuter routes.

Application of the 2005 SacRT O&M cost model to the facsimile service plan produced an 11 percent overestimate of light rail O&M costs for the Phase II project. This result reflected key assumptions that SacRT made during project development: that wage inflation would accelerate in response to labor shortages caused by recent hurricanes (including Katrina) and that future staffing levels would increase proportionately with system expansion. In the actual outcome, the Great Recession in 2008 led to reductions in staffing, salaries, and benefits for the existing system and for new service on the extended Blue Line. These reductions more than offset the underestimates of the number of train-hours (because of overestimated train speeds) needed to provide service on the Phase II project.

Ridership

In 2016, the first full year after the project opened to service, ridership on the project averaged 4,300 trips on weekdays. This count included all trips that used any of the three new stations to enter or exit from Blue Line trains. Ninety percent of these trips comprised an inbound market – traveling from residences in the corridor northbound to various activities and then returning home southbound later in the day. Two-thirds of these trips were to Central City Sacramento and nearly all of the remaining trips were to surrounding areas north and east; only a handful were destined for areas along the south corridor. Three-quarters of these trips were to/from work and another 15 percent were college students traveling to/from school. Some 60 percent relied on cars – either park-and-ride or drop-offs – to access the Blue Line from home, while 20 percent used a bus connection and 20 percent were close enough to walk to a station. Twenty-seven percent of the inbound market reported that they had no car available for the trip.

The project also had a small outbound (“reverse commute”) ridership market. Residents of locations elsewhere in the metro area produced some 420 trips on the project to jobs, school, and other activities within the project corridor – most (240 trips) to Elk Grove and the remainder (180 trips) to the Meadowview/CRC area. This outbound market had a smaller share of work trips than the inbound market, more school trips, a much larger share of bus-access connections, and significantly higher likelihood (67 percent) that riders had no car available for the trip.

Comparison of station ridership volumes before and after project opening shows the way existing light rail trips shifted to other stations and the number of new light rail trips added in response to the project. Before project opening, the Meadowview terminus station had a total of 4,800 weekday boardings and alightings. After opening, the Meadowview volume dropped to 2,400 daily trips while a total of 4,350 trips used the three Phase II stations (including 2,560 trips at the

new CRC terminus station), suggesting that the Phase II project netted 1,900 additional light rail trips.

An assessment of the accuracy of the ridership forecasts has been made difficult by the apparent absence of an actual Opening Year forecast prepared during the development of the Phase II project. Information provided to FTA by SacRT in the mid-2000s included an estimate of Opening Year project “ridership” of 7,400 trips. No record of an Opening Year application of any forecasting procedures exists in SacRT files or those of its ridership-forecasting contractor from that time – only horizon-year forecasts. Further, it is not clear what definition SacRT used for “ridership” in its response to an FTA form that used wording that was ambiguous in the case of extension. Indications are that the SacRT number included the ridership predicted for the existing Meadowview station after project opening; those riders should not have been counted among the trips using one of the new stations built by the project.

To address this problem, FTA agreed that SacRT would prepare a “facsimile” Opening Year ridership forecast for the project. The facsimile forecast was based on the same SACOG travel forecast from which the facsimile Opening Year service plan was derived. Consequently, the facsimile is based on the same travel forecasting procedures and assumptions that would have been used in 2005 for an Opening Year forecast, including projections of population and employment, representations of the transit system and the Phase II project, as well as projected transit fares, fuel prices, highway congestion, and other conditions.

The facsimile forecast yielded a prediction of 3,700 trips on the project in the Opening Year, marginally less than the actual outcome of 4,300 average weekday trips. However, the forecast also predicted that 3,800 trips would continue to use the Meadowview station – notably higher than the actual outcome of 2,400 trips. In summary, the forecast underpredicted the number of trips on the project itself by approximately 700 trips, or 16 percent, but overpredicted the total number of light rail trips that would use the project plus the former terminus station by approximately 800 trips, or 12 percent.

Most of this 800-trip overprediction is attributable to 500 trips that the forecast anticipated would transfer from e-Tran express buses to light rail at the CRC station – based on the incorrect expectation that those buses would be truncated at that station. The cause of the overprediction of trips using the Meadowview station was quite evident in the predicted park-ride volumes: the facsimile forecast largely missed the shift of park-ride trips from the Meadowview station to the new stations on the project (largely the CRC station). The forecast anticipated that 1,800 trips would continue to use park-ride at Meadowview in contrast with the actual decline to 550 park-ride trips. And the forecast anticipated 1,200 park-ride trips on the project compared to the actual outcome of 2,200 park-ride trips. Inspection of the facsimile model indicated the cause: an overly attractive representation of drive-access to the Meadowview station that, in the forecasting models, induced Blue Line riders from the south to bypass the new CRC station on their way to park-ride at Meadowview – a behavior not commonly found in the actual choice of boarding station made by transit riders.