

Central Mesa Light Rail Extension Project Before-and-After Study (2019)

Mesa, Arizona



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Central Mesa Light Rail Extension; Mesa, Arizona

The Central Mesa project is a 3.1-mile eastward extension of the Central Valley – East Phoenix light rail line that introduced light rail in Phoenix in 2008. It extends light rail service on Main Street in Mesa from its former eastern terminus at Sycamore to a new, interim terminus in downtown Mesa. A second eastward extension is scheduled to open in 2019, adding another 1.9 miles of light rail on Main Street to a new terminus at Gilbert Rd. Figure 1 is a map of the Central Mesa Extension and its location in the Phoenix-Mesa area.

The project was developed and built, and is now operated, by Valley Metro, the regional provider of bus and light rail transit services in the metropolitan Phoenix area.

Planning for the project began as part of a Major Investment Study initiated in 1996 to consider options for fixed-guideway transit in the Phoenix-Tempe-Mesa area. In 1998, Valley Metro and the three municipalities identified a locally preferred alternative (LPA) comprising 22 miles of light rail with an eastern terminus at Mesa Drive on Main Street in Mesa. Subsequent discussions with the Federal Transit Administration (FTA) considered the size, cost, funding challenges, and potential risks inherent in an initial rail project of that magnitude. FTA approved a 13-mile project into New Starts Preliminary Engineering (PE) with truncated termini including an eastern terminus on Apache Blvd. at McClintock Dr. in Tempe, approximately five miles west of the proposed eastern terminus. During PE, FTA agreed to the restoration of two miles of the eastern segment to a terminal station at Sycamore and Main Street in Mesa. That modified LPA became the Central Valley – East Phoenix light rail line.

In 2007, Valley Metro undertook the Central Mesa Alternatives Analysis/Environmental Assessment to consider options for an eastward extension of the initial rail line. In 2009, the City of Mesa and Valley Metro identified an LPA that called for an extension to Mesa Drive, the proposed terminus of the 1998 LPA.

The project entered FTA's Small Starts Project Development (PD) in August 2010, was awarded a Project Construction Grant Agreement (PCGA) in October 2012, and opened to service in August 2015.

This summary of findings from the Before-and-After Study of the Mesa extension project is an interim version that will be updated in 2020 to a final version. The update will include the results of a comprehensive rider survey in 2019 of all transit services in Phoenix, including the Mesa extension and bus routes in the project corridor. FTA and Valley Metro agreed in 2017 to await the results of that regularly scheduled rider survey before completing the study. Meanwhile, an interim final report from Valley Metro and this interim summary provide complete and final documentation on all non-ridership findings from the study.

The FTA annual report to Congress in 2013 summarized the findings of the Before-and-After Study of the initial 20-mile rail project in Phoenix. The second eastward extension scheduled to open in 2019 has been built with other federal and local funds that are not subject to the requirement for a Before-and-After Study.

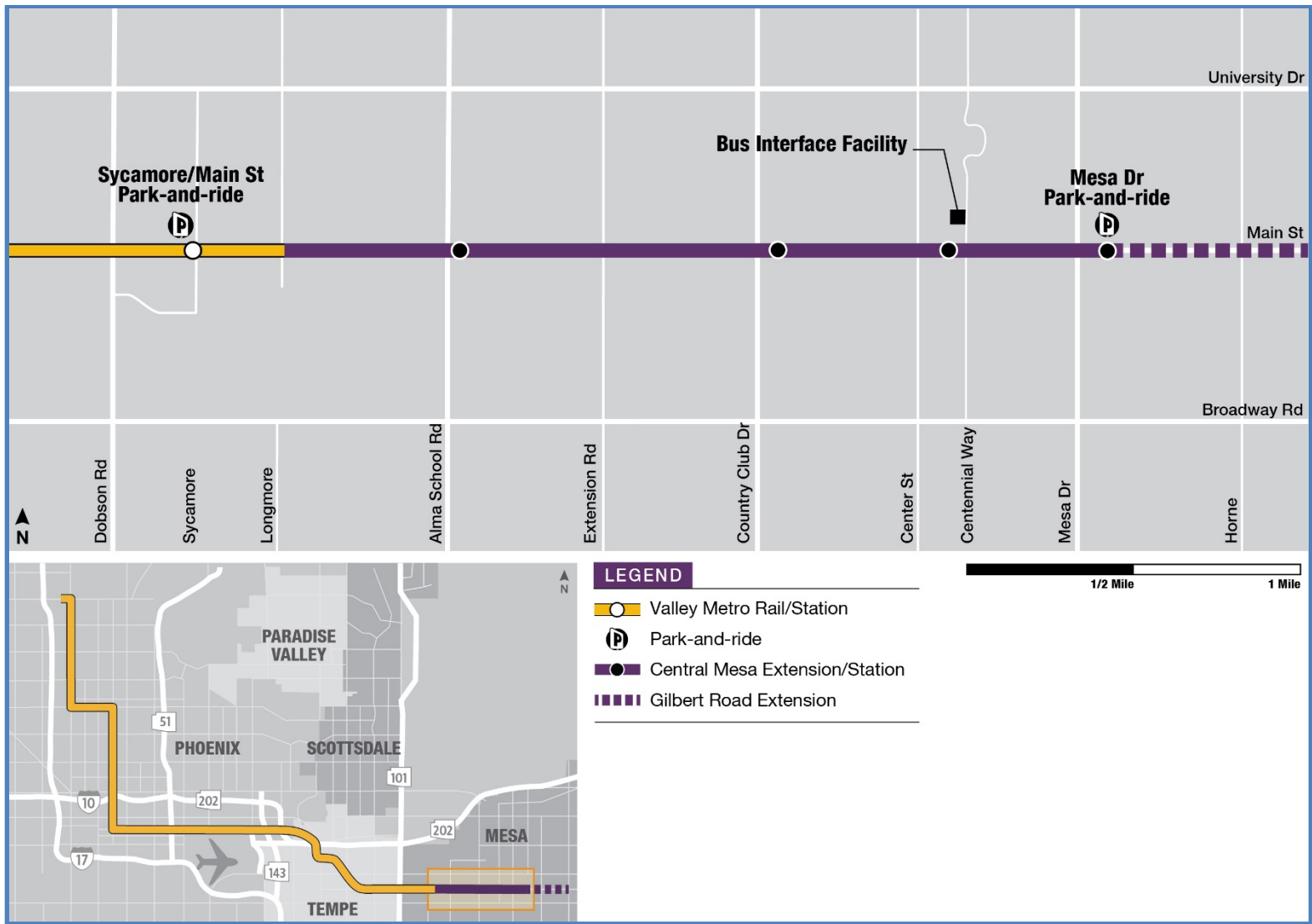


Figure 1. Maps of the Project Location, Alignment, and Station Locations

Physical scope

The Central Mesa extension adopted the physical features established by the eastern-most segment of the starter line: double-track light rail in a concrete median created as part of the project along the centerline of Main Street in Mesa.

The new eastern terminal station of the light rail line at Mesa Drive is 2.8 miles east of the former terminus at Sycamore. The project also rebuilt the existing 0.3-mile tail track at Sycamore and added a new 0.3-mile tail track at Mesa Drive for a net project length of 3.1 miles. The extension is entirely double-tracked. Both tracks run at grade in a new 26.5-foot wide median on Main Street that was created as part of the project. The extension includes three two-way cross-overs between the tracks. The median trackway is separated from parallel traffic lanes with vertical 6-inch curbs along its western segment between Sycamore and Country Club Drive, like the other median running sections in the starter light rail line. East of Country Club Drive to Mesa Drive, the separation is accomplished with rumble strips to reduce visual impacts in downtown Mesa. The tracks cross intersecting streets at grade and rely on signals to control trains and traffic movements through the intersections.

The extension includes four at-grade center-platform stations. Station platforms are approximately 280 feet long to accommodate three-car trains. Platforms are 16 feet wide and 14 inches above the top of rail. Access to station platforms is via crosswalks and ramped walkways that conform to requirements of the Americans with Disabilities Act. The full length of the platforms provides level boarding with all doors on the trains. Station amenities include horizontal shade canopies and vertical shading louvers, seating, ticket vending machines, a drinking fountain, security cameras and station-specific artwork. The new park-and-ride lot at the Mesa Drive terminal station has 448 spaces.

The project scope did not include the acquisition of any additional light rail vehicles. The 42 vehicles needed to provide peak service on the extended rail line – an increase of three vehicles because of the extension – were available in the existing fleet of 50 vehicles that were purchased as part of the starter line project. Consequently, the project did not include any modifications or expansion of the existing operations and maintenance facility built as part of the starter line project.

The project modified Main Street to accommodate the median trackway. From Sycamore to Country Club Drive, the modifications reduced the number of traffic lanes from three to two in each direction, added bike lanes, and removed on-street parking. From Country Club to Mesa Drive, the modifications reduced the number of traffic lanes from two to one in each direction, maintained on-street parking on both sides, and replaced existing bike lanes with shared-lanes markings in both directions. Left- and U-turns are accommodated by means of flared intersections with left-turn lanes and a left-turn traffic signal phase.

In the early construction phases, utilities beneath Main Street were relocated to the outside curb lane. Between Sycamore and Country Club, the project installed new street lighting poles at the curbs to replace lights that previously ran through the Main Street median. From Country Club Drive to Mesa Drive, the project integrated the new streetlights with the poles supporting the

overhead catenary system in the centerline of the trackway to reduce visual clutter and preserve the historical nature of downtown Mesa.

Train control signals are interconnected into the traffic control signals and operate with a predictive priority system for the trains. There are 14 signalized intersections on Main Street along the project alignment. At two of these intersections, new signals were added as part of the project and the remaining underwent modifications to incorporate train controls and left-turn signals. Additional signals were installed at the stations to provide pedestrian access to and from the platforms.

Overhead catenary supplying power for trains is electrified by three traction power substations (TPSS).

The project acquired a total of 9.9 acres of right-of-way (ROW) as either partial or full parcel takes. From Sycamore to Country Club Drive, additional ROW was primarily required to accommodate the station at Alma School Road and left turn lanes at several intersections. From Country Club Drive to Hobson, ROW was required for the park-and-ride lot at Mesa Drive and for the station at Center Street. ROW was also required for the three TPSS sites along Main Street.

During the development of the project, Valley Metro accurately anticipated its as-built physical scope. Minor differences at PD-entry were the configuration of two stations as a split center-platform straddling the cross-street rather than a single center platform; the location of the Alma School Road station east, rather than west, of the intersection; 516 spaces in the park-and-ride lot at Mesa Drive rather than the actual 448 spaces; the absence of the bus interface facility at the Center Street station; the assumed reliance on the existing, unmodified train-control system; a shorter-than-actual tail-track at the Mesa Drive terminal station; the planned acquisition of 8.8 acres, rather than the actual 9.9 acres, of ROW; and the inclusion of 6-inch curbs, rather than rumble strips, to separate the median trackway from adjacent traffic lanes through downtown Mesa.

By the PCGA-award, the anticipated scope of the project had been refined to the point that only the curb treatments, bus interface facility, park-and-ride sizing, and the upgraded train-control system remained as differences from the actual outcome. These adjustments to the scope were made after the PCGA-award.

Capital cost

The actual capital project cost was \$196.7 million in year-of-expenditure (YOE) dollars with a mid-point of expenditures in December 2013. An additional \$7.6 million was spent outside of the PCGA budget for early relocation of some utilities, the commissioning of free-standing artwork at stations, and the late addition of the bus-interface facility. Seventy three percent (73 percent) of the total project cost was for construction, 24 percent for professional services and 3 percent was finance charges. Valley Metro is wrapping up work to upgrade the train-control system using the remaining \$1.1 million of unallocated contingency funds. The aggregate unit cost was \$63.5 million per mile, less than the \$74.1 million per mile cost of the starter line (adjusted to 2015 dollars and omitting vehicles).

Valley Metro accurately anticipated the costs of the project throughout its development. At PD-entry, the predicted total cost in YOE dollars was \$198.5 million, an overestimate of less than one percent. The underlying baseline cost estimate was \$174.7 million in 2009 constant dollars compared to the actual project cost of \$172.3 million translated back into equivalent 2009 dollars. Predicted add-on costs caused by inflation effects were \$23.8 million with a dollar-weighted mid-point of expenditures in September 2013 leading to project opening in August 2015. Actual inflation costs after PD-entry were \$24.4 million. Overall, the predictions at PD-entry were quite accurate in terms of the overall scope of the project, the unit costs used in the baseline cost estimate, the anticipated construction schedule, and the assumed annual rates of inflation.

Some differences between predicted and actual costs occurred for individual scope elements. Station costs were overestimated because two of the four stations were planned to have a more expensive configuration than the actual outcome and station art was included in station costs but later removed because of a change in federal transit law and funded locally instead. Systems costs were underestimated because the need to upgrade the train-control system was not yet recognized. Right-of-way costs were underestimated because additional right-of-way needs for stations and turn lanes were not yet identified. Reallocation of contingency funds covered the net underestimate of actual costs.

At award of the PCGA, the predicted total cost in YOE dollars was \$196.7 million, an overestimate of 1.2 percent. As at PD-entry, the predicted costs were quite accurate in terms of the overall scope of the project, the unit costs used in the baseline cost estimate, the anticipated construction schedule, and the assumed annual rates of inflation. Further, most of the differences in costs for individual scope elements had been resolved. Only the underestimate for the upgraded train-control system remained because the need for the upgrade was not recognized until the project was under construction.

The accurate predictions of the project's cost may be attributed to the straightforward nature of the project, the reduction in uncertainties associated with underground utilities caused by utility-relocation work done by the City of Mesa before the start of project construction, and the delivery of the project via Valley Metro's customary design-build approach.

Transit service

Service on the project (and the entire 26-mile Valley Metro light rail line) operates for 20 hours a day. On weekdays, trains depart every 12 minutes during peak hours and every 20 minutes at other times. Trains depart every 15 minutes on Saturdays and every 20 minutes on Sundays. Running time on the 2.8-mile extension is 11 minutes, including station stops, for an average speed of 15 miles per hour.

Three local bus routes on north-south streets spaced one mile apart interface with three of the project stations, while a circulator bus connects at the fourth station. One bus route serves Main Street, providing local coverage for short trips to stops between the rail stations. Other local routes run parallel to the rail line on streets one-half mile north and south of Main Street, within the pronounced grid structure of the bus system.

Valley Metro made only minor changes to these bus routes to integrate the rail extension into the bus system – adjusting routings and the hours of service to better match rail service. The most significant change was the truncation of two priority bus routes that served Main St. from the east and Country Club from the south, previously connecting to light rail at its previous terminus at Sycamore. With the opening of the Mesa extension, both priority bus routes were truncated to connect to the new terminal station at Mesa Drive. Both, however, were eventually eliminated 14 months after project opening because of declining ridership.

The transit service plan for the corridor prepared during the development of the project anticipated well the modest adjustments to service associated with the project. The plan accurately anticipated the hours, headways, and runtime of light rail service as well as the modest adjustments to existing bus routes. The plan differed from the actual outcome in that it (1) did not anticipate the addition of a bus interface facility at the Center/Main station and rerouting of two bus routes to connect to that station and (2) called for the continued operation of the two priority bus routes that were eventually eliminated.

Operating and maintenance costs

In Valley Metro’s Fiscal Year 2017 (FY2017), the first full fiscal year of service on the project, operating and maintenance (O&M) costs for the entire 26-mile light rail system were \$40.7 million. Valley Metro categorizes costs into four categories: transportation (42 percent of all O&M costs), including wages and fringes for vehicle operators, fare inspectors, and security personnel; vehicle maintenance (18 percent) for labor and materials; maintenance of systems and facilities (24 percent), covering tracks, stations, and the electrical and signal systems; and administration (16 percent), covering agency management, general and administrative costs, and insurance.

Vehicle-miles of service on the Central Mesa extension comprised 12 percent of system-wide vehicle-miles. Proportionately by system-miles, annual O&M costs for service on the project were an estimated 12 percent in FY2017, or \$4.9 million.

Similarly, for bus O&M costs, bus service in the project corridor incurred \$20.9 million in O&M costs before the project opened. Bus service adjustments after project opening, including the eventual elimination of both priority bus routes, reduced bus vehicle-miles of service in the project corridor by seven percent, or \$1.5 million.

Valley Metro predicted O&M costs for the project as a fraction of its projection of system-wide light rail costs. At PD entry, the prediction of \$4.69 million was 4.9 percent less than actual opening-year costs, while the PCGA prediction of \$4.42 million was 10.3 percent low. In both cases, the underestimate was caused by the allocation of too small a share of systemwide costs to the project for general/administrative costs and for the costs of labor and materials for maintenance of vehicles and.

Valley Metro did not prepare any estimates for the small change in O&M costs associated with the minor adjustments to bus service in the corridor.

Ridership

Pending the completion and processing of the 2019 system-wide rider survey, insights thus far into the ridership outcomes of the Central Mesa project are based entirely on counts of station boardings and bus-route volumes. This summary will be updated in 2020 to include the results of the rider survey and the insights it will provide on actual characteristics of project ridership, changes in ridership in project corridor after the project opened, and the accuracy of ridership forecasts prepared for the project during its development.

The actual number of trips on the Central Mesa extension was 8,100 per average weekday in April 2018, 32 months after project opening. Approximately 6,700 of these trips traveled between one of the project stations and a station on the rest of the 26-mile light rail line. The remaining 1,400 trips traveled between two of the project stations – representing either short trips entirely within Central Mesa or longer trips to/from Central Mesa connecting with a bus route at a project station. Nearly half of the riders at the new stations used the Mesa Drive terminal station, reflecting the volumes of riders either connecting to/from bus routes at the station or parking one of the average of 230 cars in the 448-space park-and-ride lot.

Some of the 8,100 trips on the project were diverted from the eastern-most stations (at Sycamore and at Price/101) on the starter line. The combined volumes at Sycamore and Price/101 dropped by 5,200 trips, from 10,300 to 5,100 per average weekday. The number of cars in their park-and-ride lots dropped by 500 vehicles, from 700 to 200 per average weekday.

Bus ridership in the project corridor dropped by 22 percent in the two years after project opening, from 18,100 to 14,100 boardings per average weekday. Within this broad decrease, the only routes with significant increases were the two local routes on streets where the priority bus services were eliminated. Some of the decrease reflects the expanded areas in which riders can walk directly to new stations rather than having to connect via a bus. Some may also be due to a 10-percent system-wide drop in bus ridership over the past several years in metropolitan Phoenix – and similar drops in bus and rail ridership in many metro areas throughout the U.S. The nature of this trend in Phoenix will be examined closely with the results of the 2019 rider survey.

Valley Metro prepared ridership forecasts for the project with a regional travel model developed by the Maricopa Association of Governments (MAG). The same ridership forecasts prepared during project planning supported local and FTA decision-making at both PD-entry and the PCGA award.

The ridership forecasts anticipated 8,700 average weekday trips on the project, compared to the actual 8,100 project trips. Forecasts were also quite close to actual volumes at the individual project stations plus the reduced volumes at the two easternmost stations on the starter line – differing by 15 percent or less. The only significant difference from actual rail ridership volumes occurred in the over-estimate of park-and-ride demand: the forecasts anticipated a combined 1,100 vehicles in the three park-and-ride lots (the new lot at Mesa Drive and the two easternmost lots on the starter line at Sycamore and Price/101) compared to the actual combined volume of 450 vehicles. Valley Metro and MAG will examine the sources of this difference with data from the 2019 rider survey as well as the general system-wide decline in park-and-ride usage – by 30

percent since its peak in 2011 even as overall light rail ridership has remained stable -- and document their findings in the final version of this report.

The ridership forecasts overestimated bus ridership in the corridor by a substantial margin, anticipating that corridor bus volumes would increase from 18,100 boardings before project opening to 26,800 boardings after opening. Instead, bus ridership dropped to 14,100 boardings. Again, Valley Metro and MAG will examine the sources of this difference with data from the 2019 rider survey and document their findings in the final version of this report.

FTA notes that the overall accuracy of the predicted ridership on the project and at its individual stations reflects the level of good practice maintained by Valley Metro and MAG in the measurement, understanding, and prediction of transit ridership patterns. Ongoing work to understand unforeseen changes in ridership characteristics – including the general decline in park-and-ride usage and bus ridership as light-rail volumes remain steady – are also emblematic of these efforts. Valley Metro collected system-wide surveys of bus and rail riders in 2001, 2007, 2010-2011, 2015, and currently in 2019. MAG has routinely monitored the ability of its regional travel-forecasting methods to produce current-year forecasts consistent with the evolving ridership patterns and characteristics revealed by this stream of data – and updated the methods as needed.

The relative accuracy of the ridership forecasts for the starter line and the Central Mesa extension is indicative of the merits of the agencies' diligence. Ridership predictions for the 20-mile starter line underestimated opening-year ridership by 37 percent – 26,100 predicted versus 41,300 actual trips. The predictions were based on MAG travel models developed with data from the all-local-bus transit system that existed in 2007. To understand the ridership responses to new premium transit services as they were introduced to the Phoenix area, and to support MAG's update of its ridership-forecasting methods, Valley Metro conducted two special survey of riders on new "premium" services: the system of "RAPID" bus routes that use reserved freeway lanes and serve the first formal transit park-and-ride lots in the metro area, and the light rail starter-line riders. Ridership forecasts for the Central Mesa extension prepared during project planning using the updated MAG forecasting methods are within seven percent of actual opening-year ridership.