

Mountain Link BRT Project Before-and-After Study (2014)

Flagstaff, Arizona



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Mountain Link Bus-Rapid-Transit Project; Flagstaff, Arizona

Mountain Link is an arterial bus rapid transit (BRT) project serving a four-mile corridor from downtown Flagstaff southwest through the campus of Northern Arizona University to the Woodland Village residential area. The figure provides a map of the project and the corridor that it serves.

The project was developed by the Northern Arizona Intergovernmental Public Transportation Authority (NAIPTA), the City of Flagstaff, and Northern Arizona University (NAU). It is the first BRT service in Flagstaff. Mountain Link is now operated by NAIPTA as part of its transit system of seven fixed routes and a fleet of 20 buses.

Mountain Link was developed as a Very Small Starts project, entering into project development (PD) in January, 2009, and receiving a Small Starts grant in May 2011. After a brief construction period, the project opened to service in August 2011.

Mountain Link was one element of the 2005 Transit Master Plan that called for a substantial expansion of NAIPTA services funded by a proposed increase in the City of Flagstaff sales tax. Voters approved a 0.29-cent increase in the sales tax in 2008. NAIPTA has increased its fixed-route system from service provided by four buses in the peak periods in 2001, to 10 buses in 2009, 11 buses in 2011, and 15 peak-period buses in 2013.

Over the interval between 2001 and 2010 – just before the opening of the Mountain Link project – NAIPTA ridership increased from 115,000 annual boardings to 1.1 million annual boardings. With the project and continued growth, ridership is expected to surpass 2.0 million boardings for all of 2014.

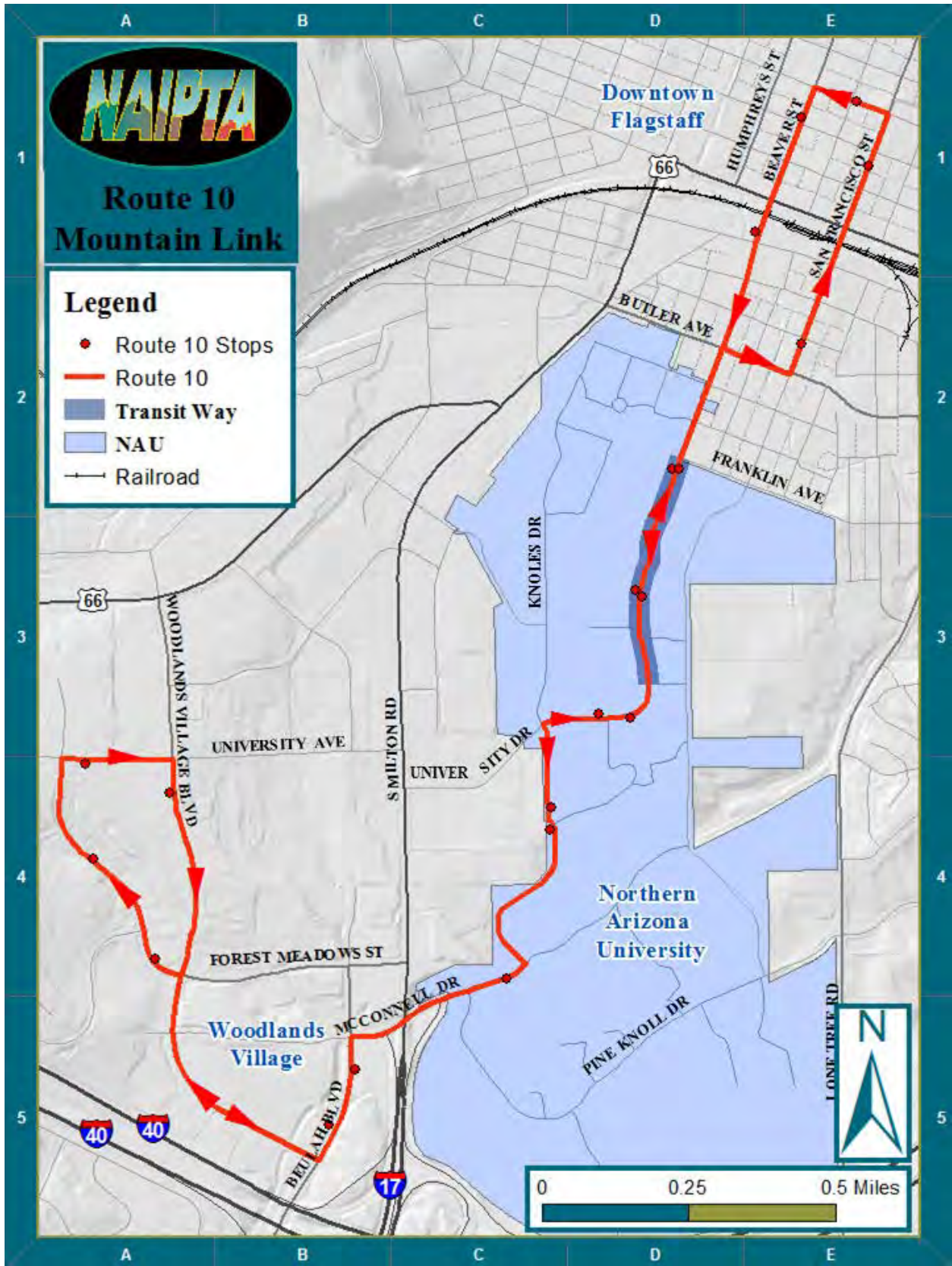
For the Before-and-After Study, the “before” milestone was October 2010. The “after” milestone was October 2013, 26 months after the beginning of service.

Physical scope of the project

Mountain Link is an arterial BRT project that includes 2.3 miles of two-way operation on campus roadways and city streets, a 1.2-mile one-way loop through downtown, and a 1.0-mile one-way loop through residential areas at the southwest end. The on-campus segment includes a 0.4-mile transit-way, a new facility built as part of the project and reserved for BRT buses, campus buses, bicycles, and pedestrians. Overall, including the central two-way segment and both terminal loops, the project comprises 6.8 one-way lane-miles. Except for the 0.8 lane-miles on the transit-way, all BRT service operates in mixed traffic on pre-existing roadways and streets.

Development of the transit-way was coordinated with an ongoing effort by NAU to remove surface parking lots from the center of campus and relocate spaces to new parking structures around the campus periphery. For the transit-way, NAU removed a string of narrow parking lots and made the resulting right-of-way available to the project.

The project also includes 21 passenger stops with passenger shelters and other amenities, and six hybrid-electric 35-foot buses. Shelters at BRT stops are branded with architectural treatments unique to the BRT service. BRT buses are branded with a Mountain Link design unique to the BRT service. The buses are effectively based on the same hybrid-electric vehicle specifications



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used by most of the NAIPTA fleet – a strategy that avoids extra costs associated with the maintenance of different vehicle types.

Mountain Link has no traffic-signal priorities or reserved lanes outside of the transit way.

Predictions of the project’s scope at the planning and development milestones were close to the actual outcome. At entry to project development, the anticipated scope was different from the as-built scope in four ways.

- The predicted scope anticipated a longer transit-way across the NAU campus – 0.7 miles rather than the as-built 0.4 miles – that would have provided a more direct reserved routing for BRT buses. Problems with right-of-way availability led to the shorter as-built transit-way and added 0.5 miles in each direction to the mixed-traffic routing of BRT buses on existing campus roadways.
- The predicted scope anticipated 24 BRT stops but engineering and property-acquisition problems led to the elimination of three of those stops in the as-built project.
- The predicted scope included eight new BRT vehicles but refinements to the operating plan and efforts to contain costs led to the acquisition of six BRT vehicles as part of the as-built project.
- The predicted scope included a pro-rated contribution to the construction of a new facility for vehicle maintenance and administration. Subsequently, other funding was found to cover the full costs of that facility and the contribution was dropped from the project budget.

NAIPTA made these refinements to the project scope during project development.

Consequently, the project scope defined in the grant accurately anticipated the as-built scope of the project.

Capital cost

The actual cost of the Mountain Link project was \$8.25 million in year-of-expenditure dollars. Principal cost items were construction for the transit-way and at stop locations, the BRT vehicles, engineering and design services, and passenger facilities at the stops.

Without vehicle costs, the average project cost was \$1.8 million per guideway-mile (counting every 2.0 lane-miles in the terminal loops as equivalent to 1.0 guideway-mile), well below the \$3.0 million per mile limit for Very Small Starts projects.

Predicted costs at entry to project development were \$10.41 million in year-of-expenditure dollars. The principal sources of over-estimates of the actual costs were two extra scope items: eight anticipated vehicles versus six in the as-built project (\$1.5 million), and the planned contribution to the vehicle-maintenance facility (\$1.5 million) that was actually funded from other sources. The principal under-estimates were for unanticipated right-of-way purchases (\$0.6 million) and engineering services (\$0.8 million).

Predicted costs in the Small Starts grant accurately anticipated the actual costs of the as-built project.

Transit service

Mountain Link provides service every day, including weekends, with 10 minutes between buses during weekday peak times, 15 minutes between buses early and late on weekdays, and 40

minutes between buses on weekend days. The 6.8-mile round trip is scheduled at 32 minutes on weekdays, an average operating speed of 12.8 miles-per-hour. Travel time lengthens during peak hours when crush loads on the NAU campus add to dwell times at bus stops. Travel time may also increase when Mountain Link buses encounter trains at the two at-grade railroad crossings on their loop through downtown Flagstaff.

Mountain Link initially provided service only on weekdays but feedback from riders and from NAU led to the addition of weekend service within two months after project opening.

In general NAIPTA bus services require a \$1.25 cash fare for each trip or a \$2.50 day-pass for unlimited travel. Monthly, semester, and annual passes are available at discounted prices. Fares and passes are available to youths and seniors at 50-percent of regular prices. Mountain Link and the campus shuttle system are free-fare to NAU students, all of whom pay a transportation fee among other academic fees. Further, NAU faculty and staff who choose to obtain a free ecoPASS from the university can ride all NAIPTA routes, including Mountain Link, at no fare.

Prior to the introduction of Mountain Link, no NAIPTA services operated on the NAU campus. The campus shuttle system provided internal transportation, connecting south campus to north campus via Pine Knoll Drive, McConnell Drive, and Knoles Drive. Shuttle buses operated at 3-5 minute spacing during the school day but not in evening hours or on weekends.

NAIPTA made no changes to its existing routes because of the introduction of Mountain Link. NAU rerouted the northern segment of the campus shuttle from Knoles Drive to the transit-way and eventually added a second shuttle route to restore some service along Knoles Drive.

The introduction of Mountain Link BRT continued the ongoing expansion of the NAIPTA fixed-route bus system. By itself, Mountain Link added 12,100 annual service hours to the system, a 32 percent increase. Adjustments to existing routes, where service had been significantly expanded in recent years, added another one percent to service hours over the same interval.

During project development, NAIPTA accurately anticipated weekday service levels on Mountain Link but did not anticipate the immediate demand for service on weekend days.

Operating and maintenance costs

The per-hour operating and maintenance (O&M) costs of Mountain Link BRT service are essentially the same as other NAIPTA routes because, while the BRT vehicles are uniquely branded with a distinct color scheme, they are effectively the same hybrid-electric vehicles that NAIPTA uses for other fixed routes.

The overall NAIPTA O&M budget has increased by 35 percent between 2010 and 2013 – a direct consequence of service expansion driven primarily by the addition of Mountain Link to the fixed-route system.

At the planning and development milestones, NAIPTA underestimated Mountain Link O&M costs by 20 percent, primarily (1) because of the unanticipated demand for BRT service on weekend days and (2) because administrative costs were not fully allocated to the new service in the predictions.

Ridership

Mountain Link has averaged 3,300 trips per weekday when the university is in session and reached its highest average of 4,200 trips in October, 2013. Continued growth is attributable to continued efforts by NAU to foster transit use and relocate parking to the campus periphery, and to changes in student residential choices to locations in the Mountain Link corridor where they can take advantage of BRT connections to campus.

The principal ridership market on Mountain Link comprises students traveling between the NAU campus and their off-campus residences in the Woodlands Village area. This market is large enough to cause crush-loading conditions during peak times of the day. The second largest ridership market is travel between on-campus locations where BRT buses complement the similarly crush-loaded campus shuttle system. Travel to and from downtown Flagstaff represents a small share of Mountain Link ridership, largely because downtown is within walking distance of many on-campus locations.

The Transit Master Plan in 2005 predicted that the BRT project would attract 3,500 weekday transit trips. Although no ridership prediction was required for the project under FTA's Very Small Starts procedures, a forecast of 4,150 weekday trips was documented in FTA's 2007 profile of the project. With current ridership in the range of 3,500 to 4,200, ridership predictions for Mountain Link have proven to be quite accurate.

Development impacts

The substantial use of Mountain Link by students living in off-campus residences has begun to affect the development pattern for additional off-campus housing. Four new student-oriented housing developments have been proposed in the BRT corridor compared to only two in all other near-campus locations. Developer feedback indicates that the BRT route is now a major factor in decisions about new off-campus student housing developments.

The NAU student body is projected to grow from 19,000 to 25,000 by 2020. With on-campus housing already capped by NAU at 9,500 beds, all of this growth will have to be accommodated by the addition of off-campus student housing. Mountain Link is expected to continue to help shape the pattern of these new developments.