

Mid-Jordan Light Rail Project Before-and-After Study (2016)

Salt Lake City, Utah



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Mid-Jordan Light Rail Project; Salt Lake City, Utah

The Mid-Jordan Light Rail Project is a 10.6 mile, at-grade, double tracked addition to the Utah Transit Authority's (UTA) TRAX light rail system. The project is located in the southwest quadrant of the Salt Lake Valley in Salt Lake County and traverses parts of the cities of Murray, Midvale, West Jordan, and South Jordan as well as the new major community of Daybreak. The project connects to the TRAX North-South line, built in the late 1990s, at the Fashion Place West Station. Figure 1 provides a map of the project.

UTA planned and built the Mid-Jordan line and now operates service on the line as part of the TRAX system.

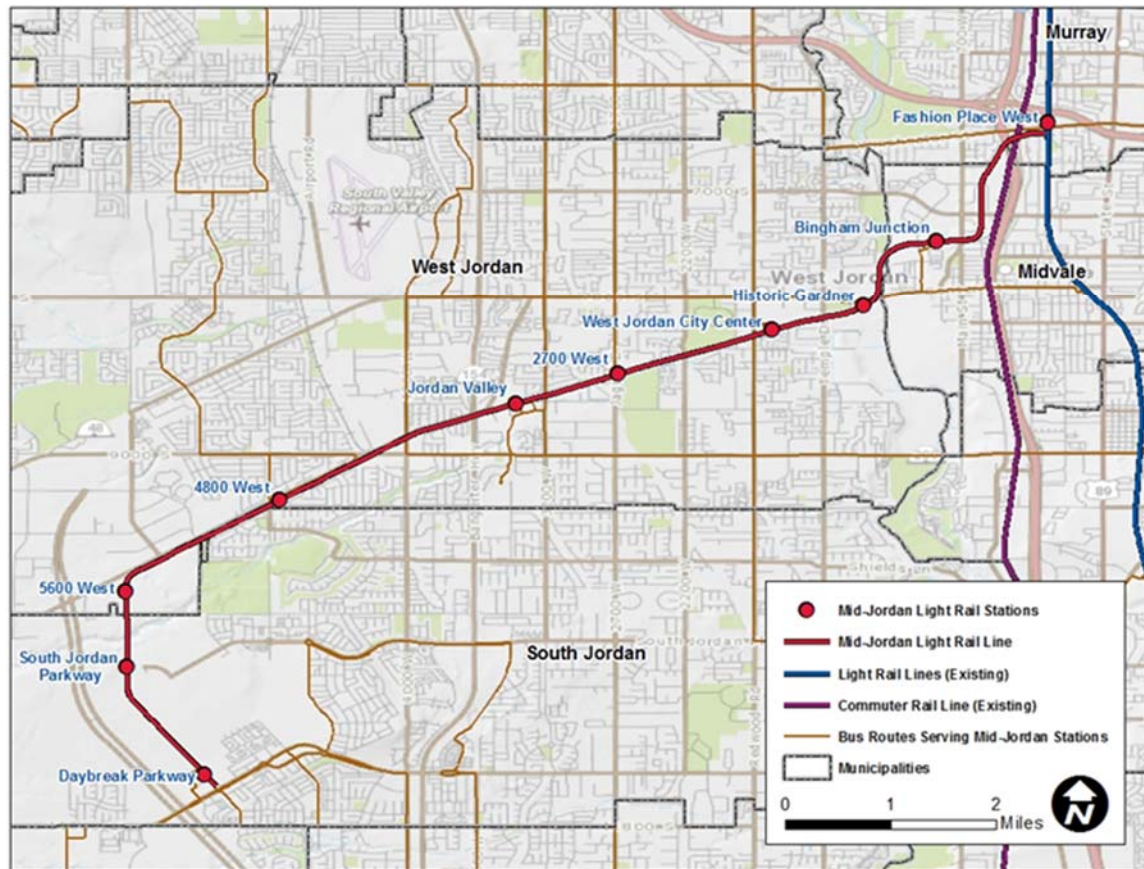


Figure 1. The Mid-Jordan Light Rail Extension

In December 2000, the South Salt Lake County Transit Corridors Analysis identified the Mid-Jordan corridor as a priority for transit improvements. In July 2005, UTA completed a Draft Environmental Impact Statement (EIS) that considered alternative transit investments in the corridor. Based on this analysis, UTA selected a light rail project as the locally preferred alternative for the corridor. These studies emphasized the importance of high capacity transit as part of a “shared solution” to meet regional transportation and land use goals and to prepare for the projected 60 percent growth in population and employment by 2030 in Salt Lake County generally and even higher growth anticipated specifically in the southwest quadrant of the county.

The project entered into Preliminary Engineering (PE) in May 2007, entered into Final Design (FD) in April 2008, received a Full Funding Grant Agreement (FFGA) in January 2009, and opened to service in August 2011.

Development of the Mid-Jordan project occurred as part of an ongoing program of rail construction by UTA that began in the mid-1990s. Under that program, UTA completed multiple rail projects: the TRAX North/South line in 1999, the TRAX University Line in 2001, FrontRunner Commuter Rail North in 2008, the Mid Jordan and West Valley TRAX branches in 2011, FrontRunner South in 2012, and the Airport TRAX extension in 2013.

Physical scope of the project

The Mid-Jordan Light Rail project is 10.6 miles long and double-tracked throughout. The project is entirely at-grade but is located in two different environments. For 8.3 miles southwest from its junction with UTA's North/South line, the project is located in the right-of-way (ROW) of the former Union Pacific Railroad (UPRR) Bingham Branch. The ROW ranges from 50 to 200 feet wide, more than sufficient to accommodate two tracks. The UPRR Bingham Branch was single-tracked, however; so all bridges and underpasses were built to accommodate only one track. UTA purchased this ROW from UPRR in 2002 under an agreement that permits continued freight service in this 8.3-mile section, operating only during night-time hours when TRAX provides no service.

The scope of the Mid-Jordan project in this segment included the replacement of the existing single track, the addition of a second track, and the provision of revised connections to freight sidings. For the eight existing structures, all of which accommodated only the single freight track, the scope included either (1) continued use of the existing structure plus the addition of a second structure for the second track or (2) replacement of the existing structure with a new 2-track structure.

At approximately 5600 West, the Mid-Jordan line leaves the railroad ROW and follows the alignment of a future roadway for 2.3 miles to a terminus in the Daybreak development in South Jordan. Both tracks are located on ballast in the median of the future roadway, separated from the roadway by curbs. The roadway will be one lane in each direction with signalized intersections approximately every tenth of a mile through the major downtown area envisioned for the future.

The Mid-Jordan extension added nine new stations, each with feeder-bus facilities and a park-and-ride lot or structure that together provide a total of 3,100 parking spaces. The low-level rail platforms are 400 feet long and are equipped with ticket vending machines (TVM). All stations comply with requirements of the Americans with Disabilities Act for access to transit service. The project also expanded the Fashion Place West Station (originally built as part of UTA's North/South project) to add a new platform, a new parking lot, and a new third track to allow greater operating flexibility at the junction with the TRAX North/South line. An overhead catenary power distribution system and eight substations electrify the line. As part of the project, UTA acquired 28 new low-floor light rail vehicles and expanded the capacity of the Lovendahl Rail Service Maintenance Facility in Midvale from 69 to 100 rail vehicles. The project crosses 16 active roadways at grade. At another 12 at-grade crossings that will eventually be built as the

roadway system in the Daybreak area is completed, the project scope included only the construction of the underground elements of the crossings so as to avoid future disruptions to service. Other elements of the future crossings were outside of the project scope.

UTA's predictions of project scope during the development of the Mid-Jordan project accurately anticipated the length of line, the ROW requirements, the number of stations and rail vehicles, and the nature and extent of systems elements. At PE-entry, differences from the as-built scope of the project were generally minor. The largest differences related to the way that UTA planned to adapt the UPRR line to joint use by transit and freight operations. At PE-entry, UTA planned a three-track configuration that retained the single UPRR track and its structures and built new double tracks and structures for the light rail line. During PE, however, UTA entered into successful negotiations with UPRR to instead demolish the existing UPRR single track, build an entirely new double-track facility for both freight and light rail, and separate transit and freight operations by time-of-day restrictions. Other minor elements missing from the anticipated scope at PE-entry included items typically identified during PE as the physical scope of the project is refined including additional trackwork, fencing, and relocation of unanticipated utilities in the right-of-way.

One element of the scope was over-estimated at PE-entry. The scope anticipated 4,377 parking spaces in total at the Mid-Jordan stations, based on ridership forecasts and projected parking needs for the 2030 horizon year. Subsequently, FTA agreed to participate in funding only those spaces that would be required in the opening year of the project; so UTA reduced the number of parking spaces during PE, eventually building 3,103 spaces.

UTA engaged a design-build contractor six months prior to entry of the project into FD. This arrangement allowed UTA and the design-build contractor to make significant progress towards final design and address many potential risk issues before FD-entry. As a result, UTA did not have to make scope changes during the nine months between entry into FD and the FFGA.

At the FFGA, the anticipated scope of the project matched the actual as-built scope with one isolated exception. UTA did not anticipate the opportunity that arose after the FFGA to create a Transit Oriented Development (TOD) at the Jordan Valley station. To conserve land for the development, two parking structures were built at that station rather than the surface parking lot anticipated at the FFGA.

UTA's success in the accurate prediction of the project scope, even at early milestones, reflects four characteristics of the context for the Mid-Jordan project. First, the right-of-way for the project was friendly to light-rail construction in both the UPRR and future-roadway segments. Second, UTA's experience with implementing light rail projects in similar settings helped the agency to predict accurately the Mid-Jordan scope, beginning in early project planning. Third, UTA's experience with the UPRR as part of both the initial North/South light-rail project and the Frontrunner commuter rail projects prepared the agency for early negotiations with UPRR. Finally, the engagement of a design-build contractor at the conclusion of PE and entry to FD stabilized the scope of the project, reduced overall risk, and helped UTA to complete the project on schedule.

Capital cost

The actual cost of the Mid-Jordan project was \$509.8 million in year-of-expenditure (YOE) dollars, equivalent to \$48.1 million per mile (\$38.0 million per mile excluding the vehicles). The subtotal cost of construction of physical facilities was \$269 million (53 percent of the total project cost). The 28 new light rail vehicles cost \$107.1 million, a relatively high share (21 percent) of the total cost because trains serving the 10.6-mile Mid-Jordan extension also run through downtown Salt Lake City to the University – a total of 23 miles. The required number of vehicles therefore reflects new rail service that extends well beyond the limits of the project itself. Notably, the construction of guideway and track elements cost only \$47.4 million (9.3 percent) of total project costs because 98.7 percent of the project is at grade, the alignment includes few bridges over roadways or watercourses, and UTA was able to use some of the existing UPRR bridges and infrastructure.

At PE-entry in 2007, UTA predicted that the project would cost \$521.8 million, an overestimate of \$12.9 million (2.5 percent). This small overestimate resulted from UTA's projection that the annual rate of inflation in construction costs would continue at the high levels that occurred over the previous several years. Inflation cooled significantly, however, with the subsequent onset of the severe national recession in 2008 and actual inflation effects were lower than UTA anticipated. This overestimate of inflation costs was partially offset by an \$8.6 million underestimate of the constant-dollar (uninflated) cost prediction – largely caused by the minor elements missing at PE-entry from the project scope. It was also partially offset by an underestimate of the costs of subsequent delays in the construction schedule.

At FD-entry in 2008, UTA predicted that the project would cost \$535.4 million, an overestimate of 5.2 percent. As at PE-entry, this overestimate was driven primarily by the assumption of persistently high inflation in construction costs. In contrast to the prediction at PE-entry, the underestimates of constant-dollar costs and the construction schedule had been corrected and no longer offset the overestimate of inflation effects.

At the FFGA in 2009, UTA continued to use the \$535.4 million cost estimate as the best available prediction of project costs. Overall, the predicted capital costs at all three project-development milestones were quite accurate.

Transit service

The TRAX Red Line provides service on the Mid-Jordan extension. Figure 2 shows the Red Line in the context of entire UTA light rail system. The Red Line extends from the Daybreak station along the full length of the project, merges with the Blue Line as it heads north into downtown, and then turns east to its terminus at the University Medical Center.

Red Line service operates every day of the week: at 15-minute headways from 5:00 a.m. until midnight Mondays through Saturdays; and on 20-minute headways from 9:30 a.m. until and 8:45 p.m. on Sundays. Travel time on the project itself, from the Daybreak station to the junction with the Blue Line is 21 minutes, including stops at stations – an average speed of 30 mph. Travel time on the full length of the Red Line – from Daybreak station to its terminus at the University of Utah – is 59 minutes – an average speed of 23 mph.

Bus connections are available at six of the nine new stations on the Mid-Jordan project. Most connecting buses operate on weekdays only, with 30-minute headways in peak periods and 60-minute headways off-peak.

Prior to the Mid-Jordan extension, the TRAX system comprised two lines: the North-South line from downtown Sandy to the Intermodal Hub (the connection to the FrontRunner commuter rail line now renamed Salt Lake Central station) just west of downtown Salt Lake City; and the University line running east-west from Salt Lake Central station to the University of Utah Medical Center. Both TRAX lines operated on 15-minute headways on weekdays and 20-minute headways on weekends. TRAX riders from the south reached the University of Utah by transferring at the Courthouse station in downtown Salt Lake City from the North-South line to the University line, or by waiting for a less-frequent service variation that routed North-South trains directly to the University.



This additional university-direct service, added to the 15-minute headway of the basic North-South service, yielded a combined 12-minute headway during weekday peak periods as far as the Courthouse station in downtown.

The opening of the Mid-Jordan extension in September 2011 was part of a large expansion of the TRAX light rail system between 2011 and 2013. The 2011-2013 TRAX extensions were Mid-Jordan (September 2011), West Valley (September 2011), Salt Lake City International Airport (May 2013), and Draper Town Center (August 2013). (The FrontRunner South project also opened during this interval in December 2012.)

Figure 2. The Red Line and the 2013 TRAX System

With these openings, UTA reconfigured TRAX service into three lines – Red, Blue, and Green – and dropped the east-west line between the Intermodal Hub and the University Medical Center. Figure 2 shows the revised services on the TRAX system. All three TRAX lines operate on 15-minute headways on weekdays and 20-minute headways on weekends. These changes had three significant consequences for existing TRAX riders.

First, the changes improved transit access to and from the corridors served by the extensions. Second, they made TRAX service more frequent at most stations on the north-south segment. Where the Red Line and Blue Line share tracks into downtown, the combined headway became 7.5 minutes on weekdays and 10 minutes on weekend days compared with the previous 15- and 20-minute headways, respectively. Over the short distance where the Green Line also shares these tracks, the combined headways became 5.0 minutes peak and 6.7 minutes off-peak. Third,

for riders from existing stations south of the junction of the Red and Blue lines, the changes made TRAX service marginally less convenient. With the elimination of the university-direct service, the combined headway to the Courthouse station lengthened from 12 to 15 minutes and all riders destined for the University now had to transfer to a Red Line train.

The 2011-2013 expansion of the TRAX system occurred simultaneously with UTA's reduction of its operating budget in response to declining sales tax revenues caused by the national recession. Since the opening of the extensions, UTA has slightly reduced weekend rail service and moderately reduced bus service by (1) the elimination of some express routes, (2) cut-backs of some fixed- and flex-routes to feeders at Red or Green Line stations, and (3) conversion of other fixed routes to flex-routes. Flex routes help to maintain geographic coverage by departing from their fixed routings at riders' requests for an additional fare. Overall in the Mid-Jordan corridor, these changes reduced bus-miles of service by six percent.

UTA accurately anticipated the broad outlines of the light-rail system expansion during the planning and development of the Mid-Jordan project. Predicted hours of service, headways, and operating speeds for TRAX matched the actual outcomes closely for Monday through Thursday service. Predictions for weekend LRT service were similar to the actual outcomes but anticipated somewhat more frequent service and slightly longer service hours. The predictions at each milestone for TRAX did not foresee systems-level decisions made after the Mid-Jordan FFGA that revised the pairing of southern and northern termini of two lines. UTA revised the Red Line to run from the Mid-Jordan extension to the University rather than its earlier planned terminus at the Intermodal Hub. UTA also revised the Green Line to run from West Valley to the Airport rather than to the University. UTA continued with the plan to operate Sandy/Draper trains to the Intermodal Hub.

Predicted bus service levels did not anticipate the sales tax revenue declines during the recession or the resulting moderate reductions in bus service. Bus services predicted for the Mid-Jordan corridor after project opening included the retention of some express services and the addition of bus rapid transit (BRT) routes but did not include the introduction of cost-saving flex routes. The actual bus network includes flex routes (also introduced in other corridors) and the elimination of all express bus services. UTA anticipates the implementation of the BRT routes when operating revenues permit their introduction in the future.

Operating and maintenance (O&M) costs

In 2013, the actual system-wide O&M cost of UTA's bus and light rail service was \$61.0 million -- \$51.1 million for bus and \$9.9 million for TRAX light rail. Based on an allocation of TRAX costs based on the vehicle-hours and vehicle-miles of service on each operating line, the actual O&M cost for the entire Red Line was \$4.1 million, of which \$1.7 million was attributable to service on the Mid-Jordan extension itself.

To predict the additional O&M costs of the Mid-Jordan and West Valley project openings in 2011, UTA extrapolated from the costs predicted by the agency's O&M cost model for the TRAX system in place at the time. The predictions matched the actual outcome fairly well, underestimating Mid-Jordan O&M costs by seven percent at PE-entry and 12 percent at FD-entry.

Ridership

Actual ridership on the project was 7,400 trips per average weekday in 2013, two years after project opening. Of this total, 81 percent were made by residents of the corridor traveling to locations outside of the corridor. Some 70 percent of these trips (equivalent to 57 percent of all trips on the project) were to jobs, school, and other activities in the urban core comprising downtown Salt Lake City, the University, and other areas east of downtown. Only 15 percent of all trips on the project were made by residents of other areas traveling to jobs and other activities in the Mid-Jordan corridor. The remaining 4 percent were made entirely within the corridor itself.

At FD-entry and the FFGA, UTA predicted that 6,300 weekday trips would be made on the project in its opening year, an under-prediction of 15.0 percent. Within this overall outcome, the prediction of trips by corridor residents to other areas was low by 28 percent – almost entirely for travel to the urban core. Offsetting this under-estimated component were over-estimates of trips by residents of other areas traveling to the Mid-Jordan corridor and trips made entirely within the corridor; both were approximately double the actual ridership in these two markets.

These variations aside, the overall accuracy of the ridership predictions continues a pattern of realistic forecasts produced by UTA and the Wasatch Front Regional Council, the metropolitan planning organization that develops and maintains the travel forecasting methods for the Salt Lake City metropolitan area.