

The Denver Experience: Starting Small

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The Denver Regional Transportation District (RTD) successfully implemented a 5.3-mi (8.53-km) starter light-rail project solely with local dollars on time and under budget. The Central Corridor light-rail line opened on October 7, 1994. The \$116 million project was designed and built through the heart of downtown Denver in 4 years. The Central Corridor alignment and operations and how they fit into the RTD system both today and in future planned expansion are described. The focus is on the strategy of using local funds for a starter project and the prospects for completing and implementing the Southwest Corridor light-rail extension (currently near the end of the preliminary engineering and draft environmental impact statement phase).

October 7, 1994, was a day that was 25 years in the making: light-rail transit (LRT) became a reality in the Denver region. The 5.3-mi (8.53-km) Central Corridor light-rail line opened for passenger service on time and on budget.

The Denver Regional Transportation District (RTD) was created in 1969 to provide public transportation for the region. The district encompasses all or part of six counties and spans 2,400 mi² (3864 km²), which is the largest service area of any transit district in the country. A fleet of approximately 870 buses (both RTD buses and RTD-contracted buses) and 11 light-rail vehicles (LRVs) is deployed during peak commuting periods. The system

works well, well enough to earn RTD the honor of Transit System of the Year in 1993 from the American Public Transit Association. RTD has enjoyed seven consecutive years of increasing ridership (over 6 percent in 1993), bucking all of the national trends.

However, traffic congestion and air quality in the region continue to worsen. The combination of the Clean Air Act and the Intermodal Surface Transportation Efficiency Act (ISTEA) makes the likelihood of adding major roadways to the region slim. Downtown Denver is by far the largest employment center currently and into the foreseeable future. Therefore, much of the RTD system is focused on the Denver central business district (CBD) and currently carries over 30 percent of the commuters to and from the Denver CBD. In addition, regional growth has produced strong suburban city centers and office parks. Residential growth has occurred in a low-density fashion, primarily around the fringe of the urbanized area. Therefore, it is increasingly difficult for RTD to provide efficient public transportation connecting all activity centers within the entire service area.

Figure 1 shows the seven planned rapid transit corridors, all of which traverse or parallel the most heavily congested roadways within the region. The North and Northwest corridors have been implemented with bus and high-occupancy-vehicle (HOV) solutions. Both corridors have been extremely successful in the early phases and will become increasingly popular as efficiency is improved and expanded with future phases. A problem

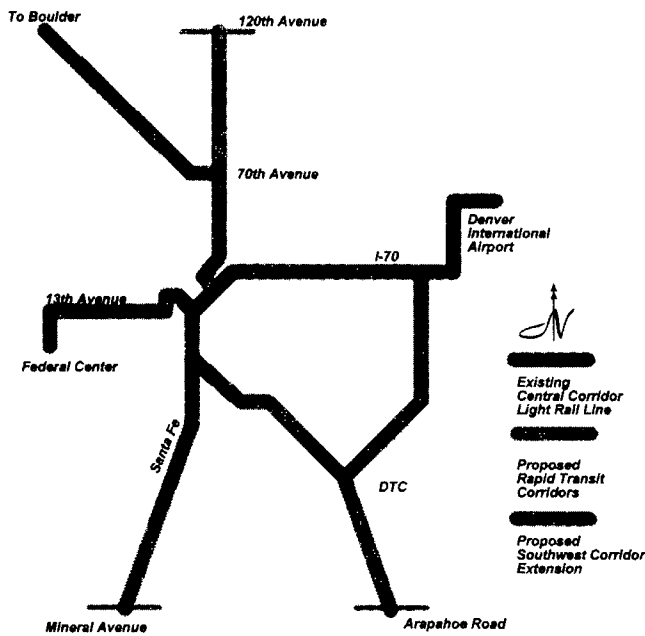


FIGURE 1 Proposed rapid transit corridors in Denver, Colorado.

with bus rapid transit solutions is collection and distribution capacity in the downtown as large numbers of buses converge. For example, the current Market Street Station bus facility in downtown Denver will not be able to accommodate all the buses from the combined North and Northwest corridors.

Light-rail technology provides a fast, efficient, and high-capacity solution, thereby offering a viable alternative to many automobile users and replacing buses that currently enter the CBD. Operating costs are reduced and buses are available for other purposes, allowing RTD to utilize the bus fleet to better serve the outlying areas whether it be for LRT feeder service, suburb-to-suburb service, or enhanced local service.

Light-rail technology is flexible to provide high-speed operation between park-and-ride lots and suburban stations and slower operation in mixed traffic in the CBD where stations are closely spaced.

The Central Corridor light-rail line was planned and developed to be a starter line and to act as the hub of a regional light-rail system. By and large, if any of the remaining rapid transit corridors (Southwest, Southeast, West, or East) were constructed, they would include the Central Corridor. The Central Corridor was built totally with local funds. Future corridors will require other funding sources. Federal funds are currently being sought for the Southwest Corridor, which is in the preliminary engineering phase.

The planning and design of the Central Corridor was done so that it could accommodate future corridors. Stations were built for three-car trains, conduit was included

for future communications needs, and the interface between traffic signals and train signals was established to easily accommodate future enhancement.

The concept for the Central Corridor was conceived in the summer of 1989, and a feasibility study was undertaken. Engineering and construction took approximately 4 years. The schedule was very aggressive, and few believed that a project of the Central Corridor's magnitude through the center of downtown Denver could be accomplished in a 4-year time frame. RTD created a new department dedicated to the design and construction of the Central Corridor. The team was enhanced by a few committed individuals from the City and County of Denver (CCD) Traffic Division and design and construction management consultants.

The project was very visible and political. The political process took its course and steered the way. The project team focused on the day-to-day activities, problems, and crises. In part, the future of a regional light-rail system rested on the success of the Central Corridor. All were committed to on-time and on-budget performance. The project had to be a showcase for what light rail could be. Construction would be disruptive in the downtown, and therefore impacts on businesses and the traveling public had to be minimized, coordinated, and communicated. Partnering sessions were held including RTD, CCD, contractors, utility companies, railroads, and business interests.

CENTRAL CORRIDOR PROJECT

The Central Corridor line is a 5.3-mi (8.53-km) light-rail line with 14 stations and a fleet of 11 LRVs. The project cost approximately \$116 million. Implementation of the Central Corridor line was expected to eliminate approximately 560 bus trips a day into the CBD and to carry 14,000 riders a day. As shown in Figure 2, the line begins at the I-25 and Broadway Station in the south with major bus transfer and park-and-ride facilities. The bus transfer facility has 18 bus bays and accommodates 30 bus routes; this operation has been shifted from Civic Center Station in downtown, thus eliminating the bus travel into the CBD. The park-and-ride lot was planned for 220 cars; however, demand required a quick expansion to over 600 spaces.

From the I-25 and Broadway Station the double-track line goes north through the railroad corridor to a second, smaller bus transfer facility at the Alameda Station directly behind the new Broadway Marketplace superstore complex, a community station at 10th and Osage, and leaves the railroad corridor as it passes under the Colfax Viaduct. The railroad corridor stretch of the line is approximately 3.2 mi (5.15 km) long and operates at speeds of up to 55 mph (88.5 km/hr). The high-speed

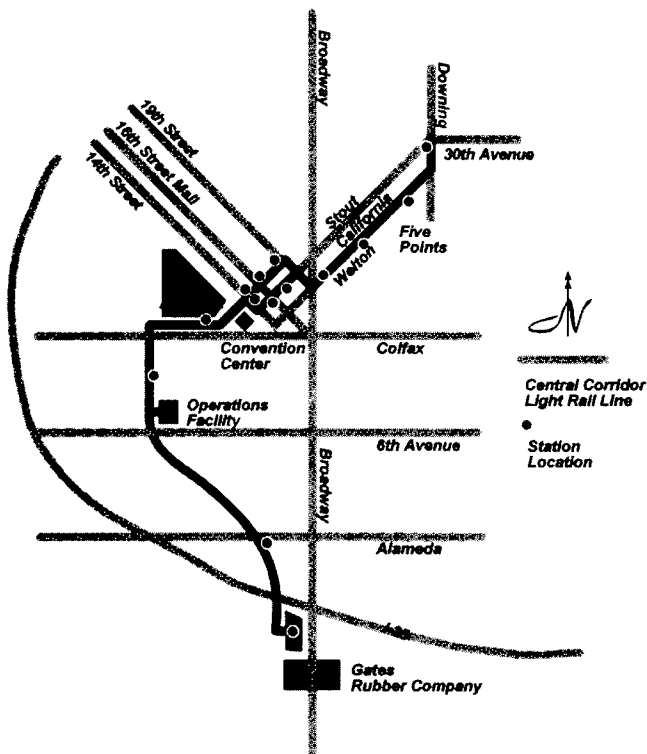


FIGURE 2 Central Corridor light-rail line.

operation is accomplished with a grade separation over Santa Fe and Kalamath streets and protected crossings of Bayaud and 13th Avenues.

From the Colfax Viaduct to the 30th and Downing Station, approximately 2.1 mi (3.38 km), the operation is running in or adjacent to city streets and is controlled by integration with the CCD traffic signal system. Adjacent to Colfax is the Auraria Station, which serves the three-campus, 37,000-commuting-student (no dormitories) Auraria Higher Education Center. The line then crosses Speer Boulevard and Cherry Creek and traverses Stout Street in a double-track configuration to 14th Street. At 14th Street the line splits into a one-way loop through the CBD to 19th Street, northbound along 14th and California streets and southbound along 19th and Stout streets. The loop contains six stations in pairs at the Convention Center (14th Street), the 16th Street Mall, and 18th Street.

The loop becomes double track again at 19th and California streets and continues north along 19th to Welton Street, where it crosses Broadway at the 20th and Welton Station. At 24th Street the line becomes single track with stations bracketing the Five Points Business District at 25th and 29th streets. The single-track section allowed on-street parking to remain. After the 29th Street Station the line again becomes double track to the end of Welton Street and around the corner adjacent to Downing Street to the end of the line at 30th Avenue.

The 30th Avenue and Downing Street Station also includes a small bus transfer facility and a 26 car park-and-ride lot.

The in-street running sections in the downtown loop along California and Stout streets and along Welton Street had numerous property access locations that required crossing the tracks at driveways in an unprotected fashion. In the downtown loop, along California and Stout streets, the system was designed for the LRVs to run in a contraflow operation, that is, opposite the direction of traffic. The design was such that the street-LRT operation is done in a "drive right" setting. Therefore, a car making a left turn across the tracks can see the on-coming LRV and make the turn when it is safe.

The Welton Street situation was more difficult to solve. The two-way, side-running LRT operation along one-way Welton Street meant that a northbound LRV would be overtaking a car turning right across the tracks, and this was determined to be an unsafe and unacceptable movement. Therefore, RTD elected to purchase all of the access rights to the property along Welton Street. All of the affected properties have alley access, which was determined to be sufficient for existing uses. (In many cases, however, damages were assessed and paid.) CCD then modified the zoning along Welton Street to accommodate potential future development that would allow off-site parking. In addition, seven cross streets along Welton Street were unsignalized and did not warrant signals. Automated No Right Turn signs were installed at these locations and are activated to flash when LRVs approach.

SYSTEM INTEGRATION AND START-UP

The Central Corridor was designed and configured to integrate and interface efficiently with the bus system. Even as the light-rail system is expanded, the bus network will continue to be the backbone of the integrated transit system. Therefore, an enormous amount of planning and coordination was done for the bus interface at the I-25 and Broadway, Alameda, 16th Street transit mall, and 30th and Downing stations. Convenient and efficient passenger transfers between bus and light rail is critical to the success of the system. The Central Corridor was planned and scheduled for 5-min headways in the peak periods, 10-min headways in the off-peak periods, and 15- and 30-min headways in the early morning and late night operations. All connecting bus routes were then modified to interface accordingly.

Testing of the system and training of the operators began in August in preparation for the October 7 grand opening. The experience gained during the testing period revealed necessary modifications to the system. Numerous signing and striping additions and modifications

were implemented, continuous adjustments were made to the traffic signal timing interface, and modifications to the operating procedures were made as appropriate. RTD was ready for opening day, or so it was thought.

The grand opening was October 7, 1994, followed by a weekend of free rides and activities. Bad weather had cleared, and Colorado Governor Romer and Denver Mayor Webb were present for the opening ceremony. Free rides for the public began at noon and continued through the weekend. RTD had estimated 50,000 to 70,000 riders throughout the three-day free-ride weekend. The final tally was closer to 200,000. Trains were packed to crush loads for the entire weekend.

Monday morning, October 10, was the actual opening day for revenue service and the integration with the bus system; this was the real test. Additional RTD staff volunteers guided bus riders and answered questions. The operation went fairly well, but heavily loaded trains did not permit the LRVs to remain exactly on schedule, particularly in the afternoon peak. During the first 2 weeks of operation commuters and regular riders were joined by joy riders and interested parties. Light rail was carrying in excess of 16,000 riders per day, nearly 15 percent more than expected. While enjoying the success of the system, RTD management was faced with overcrowded trains, a faltering bus interface, and missed schedules. Regular customers were patient but were beginning to complain. Many commuters were beginning to modify their travel to other park-and-rides or, worse, driving to work.

RTD responded by switching three bus routes back to Civic Center Station to flatten the peak demand on the LRVs as an interim measure. This action helped but did not solve the problem. Continuing operating experience and analysis determined that the real solution to the problem was to increase the LRV fleet from 11 vehicles to 17 vehicles. The additional six vehicles are in production, with delivery to begin in January 1996. In the interim additional bus routes have been diverted to Civic Center Station (with a stop at the I-25 and Broadway Station), and a modification to the LRT schedule has been implemented.

WHY START SMALL?

As stated earlier, RTD had been debating whether to implement light rail for 25 years. Earlier attempts at a regional system or a full corridor were not successful, primarily because of a lack of funding. The strategy behind the Central Corridor light-rail project was to start small, building the hub of the regional system and, most important, to build it quickly and efficiently with local dollars. RTD wanted to show the Federal Transit Administration and Congress that it was committed to rapid

transit and willing to take the initiative to start on its own.

The Central Corridor was designed to provide a useful purpose as a stand-alone project until additional legs of the regional system could be implemented. It was built to show the general public what light-rail technology really is and that it could satisfactorily fit into the surrounding environment. The alignment was conceived with a grade-separated or protected high-speed section and a street-running downtown collection-distribution section to show the flexibility of light-rail technology. The system was also structured to significantly reduce the number of bus trips into the Denver CBD.

The determination of need for a rapid transit system had been made long ago. One of the main objectives was to get started. Building the Central Corridor light-rail project in tandem with the North Corridor bus and HOV project would provide good examples of the two premier rapid transit alternatives for everyone to see and use.

The Central Corridor was made possible as a result of a 1989 Colorado Supreme Court ruling to the effect that any entity collecting a sales tax (RTD has a dedicated 0.6 percent sales tax) was also entitled to a "use tax" for goods purchased outside the district but used within the district. Consequently, the use tax generated approximately \$10 million per year in additional revenue. The RTD Board of Directors dedicated the use tax windfall to rapid transit development. At this time the options were evaluated, and it was decided by the RTD Board of Directors not to continue to accumulate capital reserves as matching dollars for desired federal funds but to combine the use tax revenues with available capital reserves to finance a \$115 million to \$125 million locally funded starter system.

In conjunction with the design and construction of the Central Corridor, planning progressed on the regional system. In December 1992, the Southwest Corridor Alternatives Analysis was initiated; the Southwest Corridor was the region's priority corridor to pursue federal funding. However, timing was not such that the region could attain authorization for the Southwest Corridor through ISTEA. In the meantime, the alternatives analysis was modified per ISTEA to a major investment study (MIS) and completed with light rail as the locally preferred alternative as an extension of the Central Corridor. Currently, preliminary engineering and the environmental impact statement for the Southwest Corridor are being prepared through an FTA Section 9 grant.

During the 1994 legislative session RTD worked closely with the Colorado delegation in pursuing authorization for the Southwest Corridor light-rail project through the National Highway System (NHS) bill. In the House of Representatives version, RTD was able to get the Southwest Corridor included, plus secure language

crediting the majority of the Central Corridor and prior expenditures in the Southwest Corridor as a local match. In addition, the House version would have earmarked approximately \$13 million for final design and early action construction activities. This would have been a great step forward for the project and the region and was exactly where RTD wanted to be. However, the Senate version of the NHS did not include any unauthorized projects, and a conference committee hearing never occurred.

A similar strategy was taken by RTD during the 1995 legislative session. The House of Representatives indicated that they would begin their deliberations on the NHS bill where they had left off in 1994. RTD had progressed in the Southwest Corridor well into preliminary engineering and completed the draft environmental impact statement (DEIS). In addition, the city of Englewood had structured a deal with a major developer adja-

cent to the Hampden Station for the demolition and re-development of a major shopping mall (Cinderella City), including the integration of a light-rail station, bus transfer facility, and park-and-ride lot as a joint development component. Therefore, RTD was able to solidify a \$15 million request package for fiscal year 1996 that included final design, purchase of the remaining right-of-way, contribution of the RTD share for the public-private joint development at the Hampden Station, and a significant portion of the required railroad relocation.

As of this writing, RTD had presented two rounds of testimony in March 1995 before congressional committees for the requested \$15 million 1996 earmark, both with positive response. RTD remains optimistic about the chance to attain the 1996 earmark and subsequently to secure a full funding grant agreement for the 8.7-mi (14-km) extension of light rail in the Southwest Corridor.