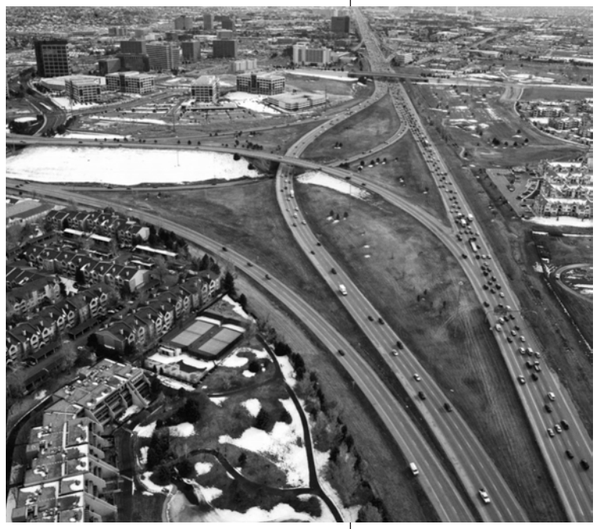
Table of Contents

Light rail testing on the rebuilt I-25/I-225 interchange in 2006.

SOUTHEAST CORRIDOR HISTORY

Highway History

In 1915, Colorado's total number of registered automobiles was 27,000. In 1923, the number of cars registered in the state had jumped to 188,000. Until the 1940s, the official north-south route through Colorado was called the Great North and South Highway. Generally, it followed today's U.S. 87 and U.S. 287 from Cheyenne through Denver, then U.S. 85 to Castle Rock. Santa Fe Drive was the primary north-south route through the city of Denver for most drivers, until the 1950s.



The I-25/I-225 interchange looking south in 2001, prior to the beginning of construction, with the left merge and exit ramp to northbound I-225.

In 1944, the first consulting engineers were hired to consider a route for a north-south freeway through Denver, since the Santa Fe Drive route was becoming hopelessly clogged. This new freeway was originally to be called the Platte Valley Drive Road.

Considered for the Platte Valley Drive Road were: Federal Boulevard, Broadway, University and Colorado Boulevards, and a route along Cherry Creek. Instead, the route that is now called the Valley Highway was adopted. Total cost, including rights-of-way, was estimated at $14.5 million (in 1945 dollars).

Groundbreaking took place on November 16, 1948, to construct a sewer and drainage system near 46th Avenue. Budget for the entire Valley Highway project (11.2 miles) was $33 million.

The full length of the Valley Highway, from 52nd Avenue to Evans Avenue, was officially opened November 23, 1958. When opened, it carried about 33,000 vehicles a day. In 1964, it carried 52,000 vehicles a day. In 1958, state transportation officials estimated the Valley Highway would carry about 127,000 vehicles per day, or 13,970 vehicles at peak hours. In 1998 the Valley Highway carried up to 230,000 cars a day.

Construction of I-225 started at I-70 in 1964, and progressed in segments toward the south. Segments opened to traffic as completed. The official completion of I-225 was celebrated May 21, 1976. The highway's final 1.2 miles included the I-25/I-225 interchange. The addition of an interchange at Yosemite and Tamarac streets, not included in the original design of the highway, added more than a year to the project's timetable. I-225 was originally built to handle 50,000 vehicles per day along its 12-mile length. Today, the highway carries as many as 120,000 vehicles per day between Mississippi Avenue and I-25.

In the decade between 1985 and 1995, traffic on Colorado's interstates increased 43 percent. In 2000, a year before the Transportation Expansion (T-REX) Project construction began, a Texas-based institute that studies traffic issues identified the metro Denver area as the seventh most congested metropolitan area in the United States, and the I-25/I-225 interchange was identified as the 14th busiest interchange in the country.

Transit History

Regional Transportation District's (RTD) light rail transit (LRT) was first established in Denver in October 1994, 44 years after Denver's last trolley line stopped operations. RTD's initial 5.3-mile-long Central Corridor line was built without new taxes or federal money. It links the Broadway light rail station, south of downtown Denver at I-25, to 30th and Downing north of downtown. This line serves the Auraria Campus and downtown Denver, providing service for downtown offices, cultural centers, hotels, shopping, restaurants and entertainment.

RTD's second light rail line opened July 14, 2000, with service along the Southwest Corridor, stretching from the Broadway station through Englewood and ending at Mineral Avenue in Littleton.

The Central Platte Valley line, which opened April 5, 2002, provides service to the Denver Union Terminal north of downtown Denver. The Central Platte Valley line serves educational, entertainment, sports and cultural venues in central Denver and in the city's popular Lower Downtown, or LoDo district.

In 1987, the Colorado Legislature created the Transit Construction Authority to design and construct rapid transit along Buchtel Boulevard from Broadway at I-25 to Holly Street. The authority was dissolved in 1989 when businesses and landowners along the route opposed it.

The concept of transit in the corridor was revived in a Denver Regional Council of Governments (DRCOG) study in 1994,

The Narrows section of I-25 in 2001.

identifying the Southeast Corridor as the "major rapid transit corridor in all planning studies for rapid transit since 1973…possibly the highest ridership potential of all the proposed rapid transit corridors."

Corridor Growth

As metro Denver area development extended south during the 1960s and 1970s, it was clear that the Valley Highway needed widening. The corridor grew in sections toward the south. When the Denver Tech Center was first proposed in the mid-1970s, it was viewed as an unlikely enterprise, but it did galvanize the completion of construction on the I-225 corridor from Mississippi Avenue to I-25.

The Denver Tech Center grew slowly. A recession in the mid-1980s led many observers to declare it defunct. But more businesses moved to the new area, lured by open space for building, tax breaks from local municipalities, and access to employees who didn't want to commute downtown. The area began to bloom with showcase architecture — and more traffic.

One phenomenon that makes the Southeast Corridor particularly unique — and particularly well traveled — is that both the northbound and southbound lanes of the Southeast Corridor are busy during the day. In other words, almost as many commuters are driving south to the Denver Tech Center in the morning as are driving north to the downtown business district.

As the Denver Tech Center expanded southward, new office parks, such as Inverness and Meridian, were opened for development. Residential growth exploded, and the southeast area of metro Denver has been measured for the past decade as among the fastest growing in the United States.

The corridor connects the two major employment centers in the Denver metro area — the Denver Central Business District, or downtown, and the Southeast Business District, which includes the Denver Tech Center, Greenwood Village, Inverness, Meridian, and the cities of Centennial and Lone Tree. More than 200,000 people work in these two employment centers, and another 30,000 or so work along the corridor, including businesses along Colorado Boulevard, Evans Avenue and University Boulevard. Meanwhile, forecasters expect downtown and the Denver Tech Center alone to add another 150,000 jobs during the next 20 years.

PROJECT BACKGROUND

In May 2001, Southeast Corridor Constructors was selected to build T-REX because of its innovative funding plan and design-build approach.

In 1992, the Denver Regional Council of Governments (DRCOG), which serves as a planning organization for the metro Denver area, commissioned a congestion study for the region. The study's purpose was to identify the most congested corridors in the Denver area, and to determine whether those corridors had appropriate traffic management planning in place through the year 2015.

Although the Transportation Expansion (T-REX) Project corridor (I-25/I-225) had been identified as a likely candidate for highway expansion for more than 20 years, the DRCOG study was a wake-up call. It indicated that expected growth along the corridor had already been surpassed, and the rate of growth was such that the highway was exceeding its original estimated maximum capacity of 180,000 vehicles a day.

The DRCOG study also showed that traffic volumes in the corridor were rising even faster than increases in population and employment, a phenomenon that made congestion in the corridor that much more severe.

The study recommended that not only should DRCOG and the Colorado Department of Transportation (CDOT) consider expanding the highway, it should incorporate some kind of mass transit element — such as light rail — into the solution as well.

Challenges with this recommendation were multiple: land along this urban corridor had been developed to such an extent over the past half-century that space for the expansion was very expensive; the corridor passes through several municipalities, which makes planning much more complicated; and, there was some controversy surrounding rail transit in the years before the first light rail line in the Central Corridor opened.

Then, there was the dual nature of the project. Highway construction is the purview of CDOT, but not light rail transit. In metro Denver, light rail is the responsibility of the Regional Transportation District (RTD). In response to the 1992 study, RTD estimated that mass transit through the corridor could cost more than $500 million, beyond any costs for highway expansion.

Because the corridor is in such a heavily developed urban area, there were a number of other issues. More than 20 bridges would have to be replaced, expanded or repaired. The I-25/I-225 interchange would have to be completely reconstructed. Other interchanges would have to be rebuilt as the number of traffic lanes expanded. There was also the question of how to incorporate mass transit into a space already crowded with traditional traffic.

Besides congestion and the growing development in the area, a variety of basic infrastructure corrections needed to be made. Bridges built in the 1950s and 1960s were reaching a point where major repair was coming due. Drainage on the highway, a problem for decades, also had to be fixed.

CDOT and RTD began studying the corridor together. For the short term, CDOT implemented ramp metering and some interchange improvements, and RTD steadily added park-n-Ride capacity and increased bus service to Denver's Central Business District and the Denver Technological Center, both major employment centers.

Still, there was significant debate as to the best long-term solution to the problem. Some people favored structuring the future of the corridor to force mass transit and carpooling; others actively opposed any kind of mass transit element, arguing that it would take lane space away from the highway. Different municipalities suggested different solutions; but of course, there needed to be one consistent plan to keep traffic flowing as smoothly as possible all the way through the corridor.

Below are some of the options considered (1995 dollars):

- Only building new freeway lanes — cost: $20 to 25 million per lane per mile.
- Double-deck existing freeway lanes — cost: $100 million per lane per mile.
- Heavy rail — cost: $25 to $100 million per mile
- Monorail — cost: $70 to $100 million per mile.
- "People Movers" on elevated right-of-way — cost: $50 to $75 million per mile.
- Electric high-speed rail — cost: $75 to $100 million per mile.
- Maglev high-speed rail — cost: $100+ million per mile.

Major Investment Study

In 1995, CDOT and RTD commissioned the Southeast Corridor Major Investment Study (MIS), in an effort to find the best solution to the ever-growing problem of congestion in the corridor. The MIS was one of several studies of transportation and growth in metro Denver conducted over the same period of time.

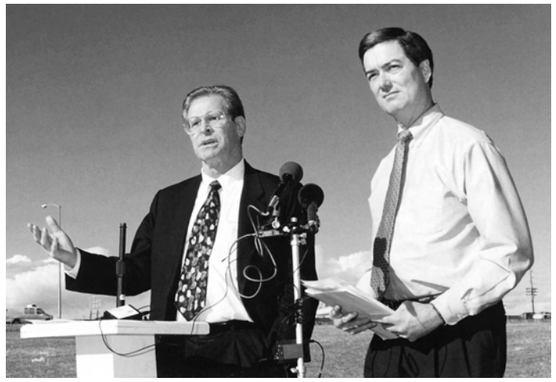
The MIS examined the entire length of the corridor, including I-25 from Broadway in the north to Lincoln Avenue in Douglas County in the south, and the spur of I-225 from the I-25 interchange to Parker Road in Aurora.

In addition to other transportation issues, the MIS identified the following:

Transit travel times versus the private auto — A 1991 DRCOG study found local bus service travel times were about twice that of cars in the Southeast Corridor. Buses are subject to the same congestion as cars, but are further delayed by frequent stops to pick up passengers. Express bus travel times were closer to that of cars.

Demand for additional transit services — The Southeast Corridor Transportation Management Organization (SETMO) was formed to address transportation issues impacting the business community from the Denver Technological Center to Lincoln Avenue in Douglas County along I-25. In addition, the Southeast Transit Authority (SETA) was formed to implement a new circulator bus service called the LINK.

Provision of transit service to the Southeast Business District — Southeast Business District employers had been concerned with the inadequacy of transit service in the area, particularly for people unable to find affordable transportation. This situation made it difficult for businesses in the Southeast Business District to recruit and retain employees.



Tom Norton, Executive Director of CDOT, and Governor Bill Owens address questions regarding the transportation needs on the Southeast Corridor.

In 1997, DRCOG adopted the MIS recommendations, which included:

- 19.7 miles of new, double-track light rail: 15.2 miles from the current I-25/Broadway station to a new station at Lincoln Avenue in Douglas County; and 4.5 miles along I-225 from Parker Road to a brand-new I-25/I-225 interchange
- 13 new light rail stations
- Highway improvements to address safety and operation: increasing lanes and reconfiguring several interchanges, replacing 13 bridges and repairing nine more, replacing drainage systems, and widening shoulder space along the highway
- Improved pedestrian/bicycle facilities
- Transportation Management elements, such as added High Occupancy Vehicle (HOV) lanes and other strategies to encourage carpooling

Light Rail Transit was endorsed because:

- It had substantially fewer impacts to existing residences and businesses in the corridor and to natural resources, such as wetlands, parks and historic properties
- Its capital costs were as much as $200 million less than the bus/HOV alternative
- It had the greatest potential carrying capacity
- It had the best travel time
- It required the lowest investment per user
- It had stronger potential for joint development
- It was reliable and safe
- It had community support

Environmental Impact Statement

In 1998, CDOT and RTD partnered to create a unique entity called the Southeast Corridor Multi-Modal Transportation Project Team (the precursor to the T-REX Project), to design and build improvements to the corridor together. In March 1998, the first public open house was hosted as part of the Environmental Impact Statement (EIS) process for the Southeast Corridor Project to consider issues such as nearby wetlands and wildlife. However, just as important as environmental issues to an EIS are current and future justification for the project, the incorporation of public comment, and some design of the project — enough to make an accurate estimate of the actual costs. The EIS considered the consequences of a number of options, including a "no-build" alternative. It also considered right-of-way and condemnation issues.

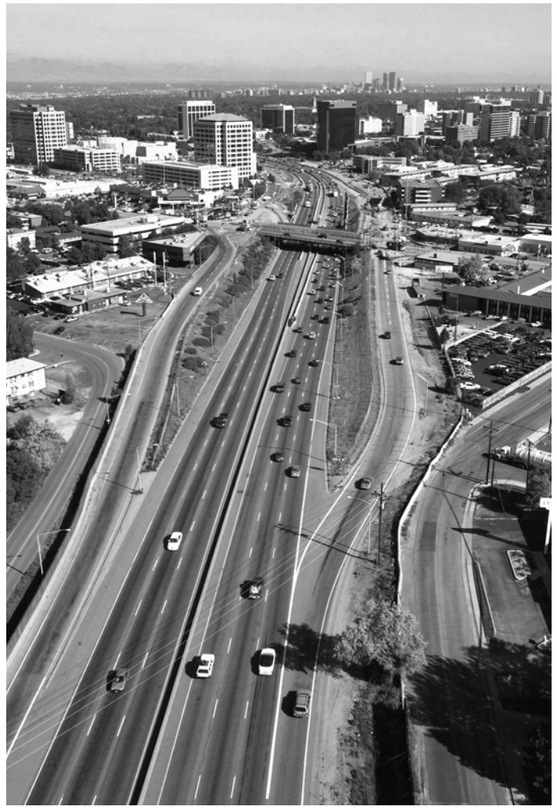
An aggressive public involvement program, which included a series of public open houses, provided information to the public while giving them the opportunity to participate in the Southeast Corridor Project environmental planning process. Four rounds of public open houses, in addition to numerous presentations to public and civic groups, took place during the environmental planning process, as required by the National Environmental Policy Act (NEPA).

In September of the same year, DRCOG adopted the Metro Vision 2020 Regional Transportation Plan (Fiscally Constrained Element). The long-range agreement focused on improving transportation in metro Denver by using various kinds of mass transit and pedestrian/bicycle transportation options, building highway improvements and encouraging transportation management programs such as expanding traffic signal coordination on arterial streets and upgrading ramp metering equipment. The Southeast Corridor Project was prominently featured in the plan, bringing it directly to the attention of the public.

With the initiation of the EIS process, the question of how to pay for the Southeast Corridor Project became an issue for public debate and consideration. Then-Governor Bill Owens signed a new law in June 1999, allowing Colorado to use Transportation Revenue Anticipation Notes (TRANS) for budgeting purposes. TRANS allowed CDOT to borrow against federal monies not yet granted to the state.

Other legislative efforts in the 1999 session were also required to keep the Southeast Corridor Project on track including:

- House Bill 1325 (TRANS) allowed the Colorado Department of Transportation to issue transportation revenue anticipation notes to fund transportation projects.
- House Bill 1206 provided funding to complete 28 Strategic Transportation Projects including the Southeast Corridor Project.
- House Bill 1324 (Design-Build/Best Value) allowed contract selection based on design-build best value rather than low bid.
- House Bill 1327 (co-development) allowed for increased private participation in public transportation transfer facilities.
- House Bill 1294 (areas in special district) authorized landowners adjacent to existing RTD boundaries to petition for inclusion into the RTD tax district.



I-25 at Evans looking north in 2001, before the start of construction.

On November 2, 1999, voters approved two separate bond initiatives that allowed funding for the project and endorsed the concept of light rail through the corridor. These two bond issuances meant that CDOT and RTD could proceed with the project without having to divert funds earmarked for other construction. It also meant that the project could move forward as a whole, instead of being designed and built in segments. Instead of different contractors bidding on those different parts, a single contractor group could bid for the entire project. The November 1999 vote gave CDOT and RTD a unique opportunity to join together in asking for federal grants and municipal matching funds.

The EIS was completed in 18 months, with a Record of Decision issued on March 16, 2000. In addition to the light rail improvements, significant highway expansion elements were added to the original MIS recommendations. Federal support of the project came in the form of a $525 million Full Funding Grant Agreement from the Federal Transit Administration in November 2000. Local municipalities joined forces and contributed millions of dollars to help ensure federal financial support for the light rail construction.

In late 2000 the Southeast Corridor team issued the Request for Proposals (RFP). Two design-build contractor teams submitted proposals to design and construct the light rail and highway improvements. Responding to the RFP, at over 3,000 pages, was a significant task for the potential contractors. It was decided that the contract would be awarded to the team that could provide the "best value" for the project. Best value was determined by the components of the Technical and Price Proposals.

In anticipation of the selection of the design-build contractor and to signify the beginning of this momentous construction effort, the Southeast Corridor Multi-Modal Transportation Project changed its name and became the Transportation Expansion Project, or T-REX Project. In May 2001, Southeast Corridor Constructors (SECC), a joint venture between Kiewit Construction and Parsons Transportation Group was selected to build the $1.67-billion project. Due to the innovative funding and design-build approach, the schedule and cost savings were anticipated to be significant, with SECC planning to finish the project in the fall of 2006, almost two years ahead of the schedule established earlier by CDOT and RTD.

SECC completed substantial construction on T-REX August 22, 2006. In the following months, RTD tested the new light rail system. The T-REX Project officially came to an end on November 16, 2006, with the opening of RTD's Southeast Light Rail on November 17, 2006.

PROJECT SCOPE

Opposite: This photo shows I-25 at Yale looking north, in 2006. T-REX encompassed one of the busiest sections of highway in the state, including the two major business districts, between downtown Denver and the Denver Tech Center.

The Colorado Department of Transportation (CDOT), in partnership with the Regional Transportation District (RTD), improved 17 miles of two interstate highways in the metro Denver area and added 19 miles of a new double-track light rail transit line, including 13 new stations. The light rail transit line connects to RTD's existing light rail system providing service to the Central Platte Valley, downtown and Denver's southwest suburbs.

The Transportation Expansion (T-REX) Project increased transit options, enhanced safety for motorists, replaced aging infrastructure, improved mobility and supported the rapidly growing residential and commercial areas served by the Southeast Corridor.

T-REX:

- Added 19 miles of double-track light rail, connecting to the existing system at Broadway in Denver and extending along the west side of I-25 to Lincoln Avenue in Douglas County, and in the median of I-225 from I-25 to Parker Road in Aurora
- Built 13 stations, with park-n-Rides at 12 of the stations, and three new parking garages
- Added 34 light rail vehicles to RTD's fleet
- Constructed a new light rail maintenance facility in Englewood
- Constructed pedestrian bridges at six light rail stations

On I-25, T-REX:

- Added one through-lane in each direction from Logan Street to I-225 (for a total of four lanes in each direction)
- Added two through-lanes in each direction from I-225 to the C-470/E-470 interchange (for a total of five lanes in each direction)

On I-225, T-REX:

- Added one through-lane in each direction from Parker Road in Aurora to I-25 (for a total of three lanes in each direction)

T-REX also:

- Reconstructed seven interchanges, including I-25/I-225
- Reconstructed and/or widened 60 bridges, including numerous light rail bridges and the Colorado Boulevard and Hampden Avenue bridges
- Improved drainage, installing 27 miles of pipe
- Enhanced safety
- Added and improved shoulders
- Improved ramps and acceleration/deceleration lanes
- Improved highway lighting

AGENCY PARTNERSHIPS

The Transportation Expansion Project (T-REX), originally known as the Southeast Corridor Multi-Modal Transportation Project, was the result of a unique partnership between the Colorado Department of Transportation (CDOT) and the Regional Transportation District (RTD). The two agencies combined highway and light rail elements in one single project — a partnership that was one of the first of its kind in the United States. CDOT and RTD adopted this unique approach because the T-REX Project addressed highway mobility and safety issues and would offer travelers the option of riding 19 miles of new light rail.

CDOT and RTD formally entered this working relationship when Cal Marsella, RTD general manager, and Tom Norton, CDOT executive director, signed an Intergovernmental Agreement (IGA) on September 9, 1999. The IGA outlined the responsibilities of each agency, a project description, an explanation of the design-build concept and the proposed method of financing the project.

By signing the agreement, both agencies agreed to work together to finance and construct T-REX and to enter into a single design-build contract for both the design and construction of transportation improvements using a "best value" rather than a low-bid approach for contracting. The agreement also outlined the development of specifications for the project, the composition of the team to select the design-build contractor, and how the project would comply with state and federal laws regarding Disadvantaged Business Enterprises.

RTD General Manager Cal Marsella, Governor Bill Owens and CDOT Executive Director Tom Norton celebrate the opening of the rebuilt I-25/I-225 interchange in June 2003.

The agencies involved in the project, including CDOT, RTD, FHWA and FTA, partnered throughout the project, from the initial planning stages to the actual construction.

CDOT and RTD combined highway and light rail elements in one single project — a partnership that was one of the first of its kind in the United States.

This unique working agreement also included cooperation between two federal agencies.

The Federal Highway Administration (FHWA) and Federal Transit Administration (FTA) developed a unique agreement regarding their work on T-REX. The Interagency Agreement outlined guiding principles and designated responsibilities for each of the agencies. FHWA and FTA officials signed their Interagency Agreement on October 7, 1999.

FHWA and FTA agreed to "cooperatively work together to seamlessly implement the U.S. Department of Transportation…procedures that pertain to the Transportation Expansion Project in a manner that embodies the 'One DOT' approach."

CDOT, RTD, FHWA and FTA agreed to work together in a similar manner that embodied a "One DOT" approach. CDOT, RTD and the federal management team coordinated efforts on T-REX.

All four agencies agreed to the following goals for the project on Nov. 11, 1999:

- To minimize inconvenience to the public
- To provide for a quality project
- To meet or beat the total program budget of $1.67 billion
- To meet or beat the schedule to be fully operational by June 30, 2008*

DOT · U.S. Department of Transportation · RTD

* The T-REX contractor, Southeast Corridor Constructors, completed major construction and long-term closures on August 22, 2006 — 22 months ahead of the original completion date.

PARTNERING ON T-REX

What is Partnering?

While a written contract establishes the legal requirements of each party on a construction project, partnering is a structured process that defines the working relationship among parties. That working relationship is based on a covenant of good faith and fair dealing, with emphasis on a core set of partnering tools that include commitment to mutual goals, an issue-resolution process, and frequent joint evaluation of team effectiveness.

The objective is to positively affect the project goals, including safety, quality, budget and schedule.

Partnering During Construction

The partnering process with the contractor on the Transportation Expansion (T-REX) Project was developed by emphasizing the principles of collaboration, accountability and consistency. Collaboration among all team members was critical in a design-build environment, where the number of issues requiring decisions and the speed of decision-making increases dramatically from the typical design-bid-build project delivery method. Individual accountability was crucial within an organization that developed as quickly as the T-REX organization and evolved as the various phases of the project were initiated and completed. Finally, consistent communication was essential within an organization made up of more than 20 task force teams.

Engineers, designers and other staff members from the contractor's team and from the T-REX Project team were co-located in several buildings along the corridor throughout the life of the project. This facilitated better communication, faster problem solving and more efficient conflict resolution.

Executive-Level Partnering

Critical to the success of any partnering endeavor is the active support and commitment of executive managers. On T-REX, executives from the Colorado Department of Transportation (CDOT), the Regional Transportation District (RTD), Federal Highway Administration (FHWA), Federal Transit Administration (FTA) and their counterparts from Southeast Corridor Constructors (SECC) began meeting in July 2001 in bimonthly Board of Directors partnering sessions. At the initial session, a project charter of mutual goals was finalized, a team evaluation process established, and principles on issue escalation agreed upon. During the partnering sessions, the team goals were reviewed, project status was provided by the project management team, key issues were discussed, and action plans were established. In addition, task groups met weekly to discuss pertinent issues.

T-REX Project Partnering Process

Executive Board of Directors

↕

Project Steering Committee

↕

Task Force Teams

Monthly Partnering Report
Update dealbreakers and rocks
Update goals
Summarize team evaluations

Follow-up Partnering Sessions
Review team goals
Review issue escalation process
Problem-solving on key rocks

Issue Escalation Meetings
Formal and informal

Partnering Training
Topic-specific

Project-Level Partnering

The comprehensive approach to partnering involving the project management team through the 20-plus task force teams included the following activities:

Initial Partnering Sessions — Each task force team had its own initial partnering session to develop team goals and an issue-escalation ladder specific to its discipline needs. Follow-up sessions took place periodically throughout the project.

Monthly Partnering Reports — The co-leads of each task force team submitted a monthly report that summarized deal-breakers (issues where task force members were in disagreement and had reached an impasse, requiring escalation), rocks (issues that were being worked on but not needing escalation), goal progress, and status of team relationships. These reports were compiled into a master report of all task force teams that was reviewed by the project management steering committee once a month. Co-leads from select task force teams periodically attended this meeting to provide an in-depth explanation of their monthly team results. The information generated from these reports was consolidated and presented to the Executive Board of Directors bimonthly.

Issue-escalation Meetings — When task force members or co-leads reached an impasse on the resolution of a specific issue, the partnering process required them to escalate the issue to the next level of management. The issue was either resolved or escalated through the levels of management. If all levels of management were exhausted in this effort, the issue could be taken to a neutral Dispute Resolution Board, which existed to assist the team in resolving issues.

Dispute Resolution Board

The T-REX design-build contract outlined the requirements for partnering between the contractor and the CDOT/RTD team. While all contractual disputes on the project were resolved through the partnering process, in the event that resolution of an issue could not be achieved through partnering facilitation between the team members, an alternative dispute resolution process was available. A tripartite Dispute Resolution Board (DRB) was convened in 2001. SECC selected one board member and CDOT/RTD selected another. Those two board members selected the third member, who was the Chairperson of the DRB. If any dispute needed to be heard by the DRB, a meeting would be convened for a hearing of the facts that would be presented by each party to the contract. Though any DRB decision would not be legally binding, the process had the potential to eliminate the need for costly litigation and court proceedings.

T-REX Project Issue Resolution/Escalation Process

Issue Escalation Ladder	
Level 1	**Task Force Teams** • T-REX • SECC
Level 2	**Task Force Co-Leads** • T-REX • SECC
Level 3	**Discipline Managers** • T-REX • SECC
Level 4	**Project Management Team** • T-REX Project Director • T-REX Deputy Project Director • SECC Project Manager
Level 5	**Executive Team** • CDOT Executive Director • RTD General Manager • SECC Executives
Dispute Resolution Board	

Issue Escalation Process

If a specific issue cannot be resolved by the T-REX and SECC representative at a given level, resulting in a disagreement or impasse at problem resolution, then the issue must be escalated to the next level of management with the following information prepared:

- Project goal(s) impacted and contract provisions affected
- Facts to the issue
- Actions taken to date
- Proposed resolutions
- Timeline needed to resolve the issue

If an issue cannot be resolved following the issue escalation process, the issue is presented to a Dispute Resolution Board (DRB). The DRB consists of three members with the Chair to be a lawyer or retired judge. The contractor may appeal the final DRB decision in accordance with C.R.S. § 24-4-106.

Partnering does not eliminate all of the issues on a project. The purpose of the issue resolution/escalation process is to ensure that any potential disagreements or disputes among team members are resolved timely and in an equitable manner. This helps foster a productive business relationship on the project among team members.

PROJECT FUNDING

The Colorado Department of Transportation (CDOT) and the Regional Transportation District (RTD) worked jointly to pursue federal and local funding for the Transportation Expansion (T-REX) Project.

The project's financial plan assumed that 60 percent of the light rail funds to finance the capital costs would come from the Federal Transit Administration (FTA) and that 40 percent would come from local sources.

Financing features included:

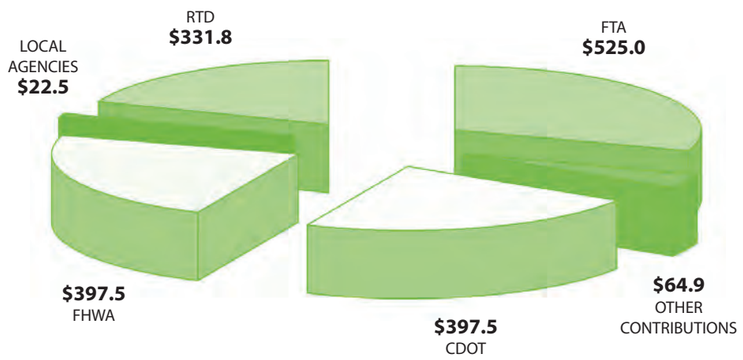
- No new taxes
- No increased taxes
- Cost savings from accelerating construction
- Financing the highway elements through bonding future federal allocations
- Funding the transit elements through bonding from sales tax revenues, federal funds from the FTA, and local matching funds from various municipalities and jurisdictions

The total cost of the project was $1.67 billion.

- The design-build contract with Southeast Corridor Constructors (SECC) was worth $1.18 billion.
- The light rail component cost $879 million. Forty percent of the light rail funds ($437 million) came from the RTD budget and local matching funds. The FTA's $525 million Full Funding Grant Agreement funded the remaining portion.
- The highway component cost $795 million and was funded with a combination of Highway Users Tax Fund dollars, Senate Bill 97-01 money and bonding/federal revenues.

T-REX Project Revenue Sources

(in millions)



Colorado Senator Wayne Allard, RTD Board Member Mary Blue and CDOT Executive Director Tom Norton look on as Nuria Fernandez, FTA Administrator, signs the Full Funding Grant Agreement on Nov. 17, 2000.

Other elements in the T-REX budget, but not included in the SECC contract were:

- The purchase of 34 new light rail vehicles — $91.8 million
- The cost to design and build the new Elati Light Rail Maintenance Facility — $40 million
- The purchase of ticket vending machines for the new light rail lines — $4.4 million
- Several pedestrian bridges over I-25 and I-225
- The reconstruction of the Colorado Boulevard and Hampden Avenue bridges

Municipalities along the corridor also helped fund enhancements to T-REX, contributing approximately $75 million to the project.

Disadvantaged Business Opportunities

The T-REX Project placed significant importance on providing opportunities for minority/women-owned and small businesses to participate in the $1.67-billion project. To accomplish this, T-REX set an aggressive 15-percent project goal for Disadvantaged Business Enterprise (DBE) participation.

SECC made a substantial commitment to not only achieving the DBE participation goals, but also to developing programs that better enable small and disadvantaged businesses to participate on T-REX. As SECC met yearly small and disadvantaged business subcontracting requirements, additional funding was provided to the business community to provide programs and services to further the growth of small and disadvantaged businesses.

DESIGN-BUILD PHILOSOPHY

The Transportation Expansion (T-REX) Project was constructed using the design-build method.

Design-build allows for a single contractor team to design and build the entire project, for a predetermined price, under the oversight of the Colorado Department of Transportation (CDOT) and the Regional Transportation District (RTD). Using the traditional design-bid-build approach, a project as large and complex as T-REX could take 20 years or more to build. Design-build, simply put, means that design and construction take place simultaneously. The combination of design and construction in one contract means cost efficiency, more innovation, flexibility and creativity, and faster project completion.

Southeast Corridor Constructors (SECC), the design-build contractor, was selected to construct T-REX based on an evaluation of its price and technical proposal, which included project management, quality, safety and schedule. The contractor committed to complete the design and construction of the project 22 months ahead of the proposed schedule, and three percent under the established budget.

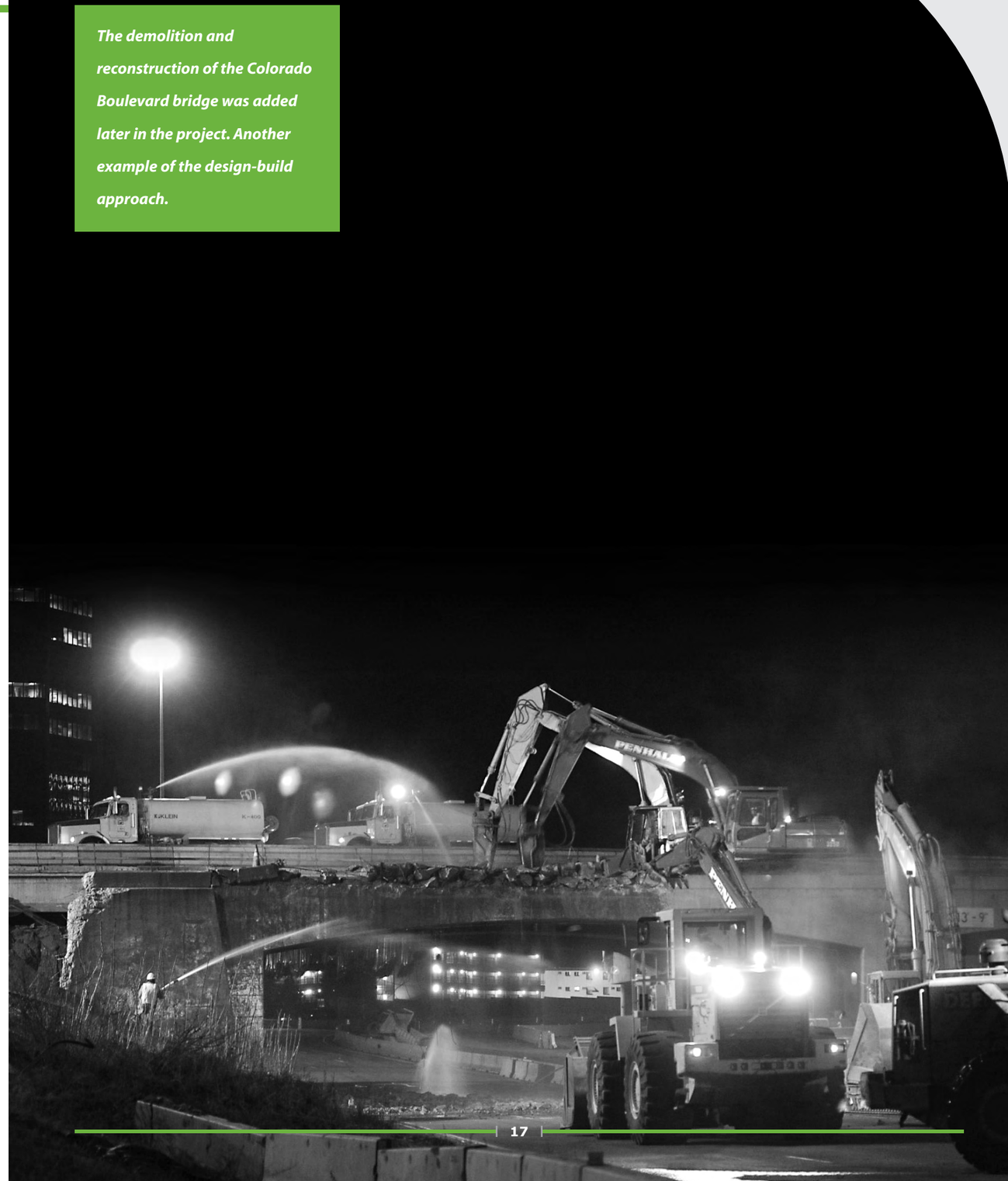
The Dry Creek pedestrian bridge was not a part of the original contract, but T-REX was able to add the structure because of the design-build approach and with the addition of private/ public dollars.

CDOT and RTD provided preliminary engineering design and guidelines (about 30 percent of overall design completion) to SECC for reference. SECC used the CDOT and RTD preliminary plans to complete the design. Construction and design occurred simultaneously. For example, SECC could demolish a bridge and order construction materials while completing the final design for the new bridge structure.

Using the design-build method, construction was completed by the contractor much faster. CDOT and RTD established June 2008 as the original T-REX design-build construction deadline. Using the design-build method, SECC was able to complete the project August 22, 2006 — 22 months ahead of the original schedule.

Several elements of the T-REX Project were not originally included in the SECC design-build contract. Those elements included the Elati Light Rail Maintenance Facility, 34 new light rail vehicles for the corridor, the fare collection system and the Nine Mile parking structure at I-225 and Parker Road in Aurora.

The demolition and reconstruction of the Colorado Boulevard bridge was added later in the project. Another example of the design-build approach.



LIGHT RAIL FACTS

A light rail vehicle is tested along I-225 prior to the opening of T-REX.

The Transportation Expansion (T-REX) Project opened the Southeast Light Rail for service on Nov. 17, 2006. The line is fully compatible and connects with the Downtown, Central Platte Valley and Southwest lines.

Fare Collection

The Regional Transportation District (RTD) uses a self-service fare collection method on its rail system. Passengers may purchase passes at a number of locations or a variety of tickets from ticket vending machines at each station. Because fares operate on the honor system, riders may be asked to provide proof of payment by uniformed RTD security staff.

Power Source

Light rail trains operate on electric power from overhead power lines. Power is converted from AC power to 750 volts of DC power at 16 traction power substations located along the corridor.

Signals/Switches

An upgraded train control system was installed along the Southeast Corridor and portions of the existing system.

Communications

A new central control facility is in constant communication with light rail vehicles that are in service. As part of the T-REX Project a new Supervisory Control and Data Acquisition (SCADA) system was installed on the entire light rail system. This allows continuous monitoring and control of the system from a central location. The communication equipment includes closed-circuit television (CCTV), audio messages and vehicle location information.

Light Rail Vehicles (LRVs)

Thirty-four Siemens SD-160 light rail vehicles were acquired as part of the project. The new vehicles are fully compatible with RTD's fleet of light rail vehicles. The vehicles are 80 feet long and carry 150 passengers. The new vehicles incorporate AC propulsion. Four doors on each vehicle are equipped to allow easy entry from wayside ramps meeting the Americans with Disabilities Act (ADA) requirements.

The vehicles also feature a modern passenger information system consisting of automated visual and audio announcements, public address, passenger-operator intercom and electronic destination signs.

Light Rail Tracks

Light rail trains on the Southeast Corridor operate on 19 miles of double-track line. Switches and pocket tracks are located along the line to assure flexibility in the event of service disruptions. The rail is continuously welded and rests on concrete ties for a smooth and quiet ride. The tracks for the Southeast Corridor are on the west side of I-25 from Broadway to Lincoln Avenue in Douglas County. The tracks on I-225 are in the median from the I-25 interchange to the Nine Mile park-n-Ride facility at Parker Road in Aurora.

The tracks are completely grade-separated at all roadway crossings, which means the tracks do not interfere with street traffic along the corridor, including the tracks that traverse the I-25/I-225 interchange. This ensures increased safety, operational efficiency and speed.

The steel used to manufacture the tracks was recycled from the former Mile High Stadium, the long-time home of the Denver Broncos football team. The steel was set aside following the demolition of Mile High and shipped to Pueblo, Colo., where it was melted down and formed into rail for the new Southeast Light Rail corridor. The rail is inscribed "Mile High to T-REX."

Bus Connections

Passengers may connect to light rail from bus routes at each of the 13 light rail stations. Eight new bus routes serve light rail stations along the Southeast Light Rail.

Light Rail Stations

The Southeast Light Rail has 13 light rail stations that include:

- A bus plaza or bus bays
- A light rail platform (to enter and exit trains)
- A kiss-n-Ride drop-off
- Landscaping
- High-block platforms for accessibility
- Bicycle parking
- A new public address and video messaging system installed at key stations along the entire Southeast Light Rail

With the exception of the Louisiana•Pearl Station, all stations have park-n-Ride facilities. There are nearly 7,000 parking spaces at light rail stations along the Southeast Corridor.

Each light rail station includes features so passengers can wait for trains in safety and comfort.

- Three overhead shelters cover the ramps and center of each platform.
- Windscreen benches provide protection from wind.
- Crash, splash and glare barriers in depressed or median stations protect transit patrons from traffic on the adjacent highway.

The steel used to manufacture the tracks was recycled from the former Mile High Stadium. Each section of rail along the project is inscribed with "Mile High to T-REX."

Light Rail Station Location	Parking Spaces
Along I-25 (north to south)	
• Louisiana•Pearl	0
• University of Denver	540
• Colorado	363
• Yale	129
• Southmoor	788
• Belleview	59
• Orchard	48
• Arapahoe at Village Center	817 (east side) 1,000 (west side)
• Dry Creek	235
• County Line	388
• Lincoln	1,734
Along I-225	
• Dayton	250
• Nine Mile (Parker Road)	1,225

Stations have benches, trash receptacles, ticket vending machines, message boards, lights, warning strips next to tracks, telephones, bike racks and lockers.

All stations are designed to meet Americans with Disabilities Act (ADA) standards. Each light rail boarding area has stairs and elevators or ramps for strollers, wheelchairs and other wheeled devices.

park-n-Ride

park-n-Ride facilities include handicap-accessible parking, benches, roadway and pedestrian area lighting, emergency phones and closed-circuit TV cameras for security.

Bus transfer plazas have shelters at each bus bay, trash receptacles, bike racks, lockers, lighting and signage.

Several stations will be integrated with ongoing Transit Oriented Development (TOD). TODs are compact, mixed-use developments situated at or around transit stops. Consisting of housing, office, neighborhood retail and civic uses, these transit villages are jointly developed by the private sector and are carefully designed to be pedestrian-friendly communities.

art-n-Transit

RTD created a committee of local volunteers that helped decide what public art to place at the new light rail stations. The T-REX Art Advisory Committee, formed in late 2001, was made up of arts and community members, and representatives from the project and RTD.

Art at the stations is important because it helps create a sense of shared value. It discourages vandalism while at the same time celebrates the cultural diversity and richness of the community. Public art also helps provide a connection between neighborhoods and transit, adding value to the transit system and community as a whole.

The committee considered issues such as community identity and values, aesthetic excellence, how the art fits with the architecture and the look of the community, and the enduring value of the artwork for the Denver region.

Artists also developed enhanced concepts for functional elements of the system, such as railings, seating and shelters at each of the stations.

Commissioned art at each station reflects the surrounding community. "The Plow" is meant to capture the agricultural heritage of the area around the County Line Station.

The light rail runs down the median on I-225, while staying on the west side of the highway along I-25.

Safety and Security

Several safety and security measures were incorporated into the Southeast Light Rail. These include:

- Closed-circuit television (CCTV) at platforms, pedestrian tunnels and parking areas
- Compliance with safety codes and the Americans with Disabilities Act (ADA) requirements
- Access for emergency response personnel
- Adequate lighting and maximum visibility
- Frequent patrols by uniformed and armed security guards
- Clearly marked emergency telephones, connected directly to 911, at stations on platforms, in pedestrian tunnels and near pedestrian bridges
- A new operations control center and communications system that allows continuous monitoring and control of the light rail system
- Yellow warning strips on platforms next to tracks
- Safety certification of all elements prior to entering service

Commissioned Art Program

As part of the art-n-Transit program, RTD has placed site-specific art at each light rail station along the T-REX corridor. The T-REX Art Committee and a selection panel of community members from each station area participated in the art selection for their neighborhood station (see pages 23-31 for renderings).

The Colorado Station is below grade and is located along the only part of the line that diverts from its place immediately adjacent to the highway.

Light Rail Station Canopy Styles

There are three canopy styles evident at the stations on the Southeast Corridor. A "*Gable*" or "*A-frame*" canopy style is featured in the northern sections of the corridor: Louisiana•Pearl, University of Denver, Colorado, Yale, Southmoor and Belleview stations. This style is intended to reflect the more traditional architecture in the south-central area of Denver. The second style, a "*Gull Wing*" style, has been incorporated at the two I-225 stations, Dayton and Nine Mile. The shelter is an inverted "A-frame" or "Gable" style to look like a gull wing. This canopy reflects more contemporary architecture in this section of the corridor. The third canopy style, used in the southern portion of the corridor, is a "*Village*" or classic style consistent with the architecture of the Denver Tech Center area. The station shelters at Orchard, Arapahoe at Village Center, Dry Creek, County Line and Lincoln Stations feature this canopy style.

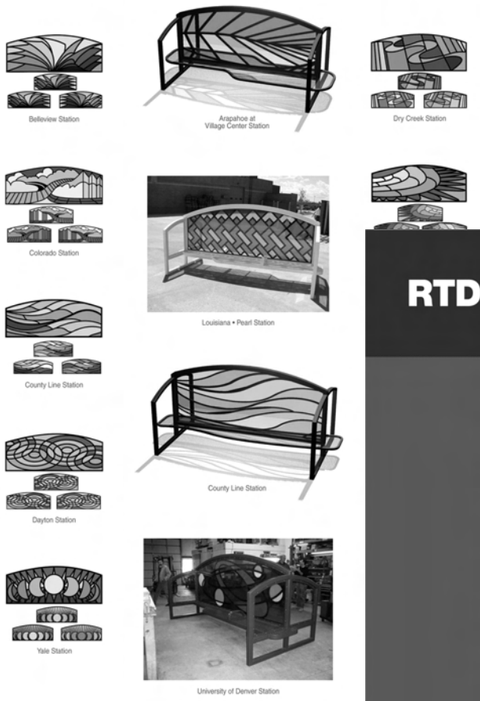
University of Denver Light Rail Station Gable style canopy.

Nine Mile Light Rail Station Gull Wing style canopy.

Orchard Light Rail Station Village style canopy.

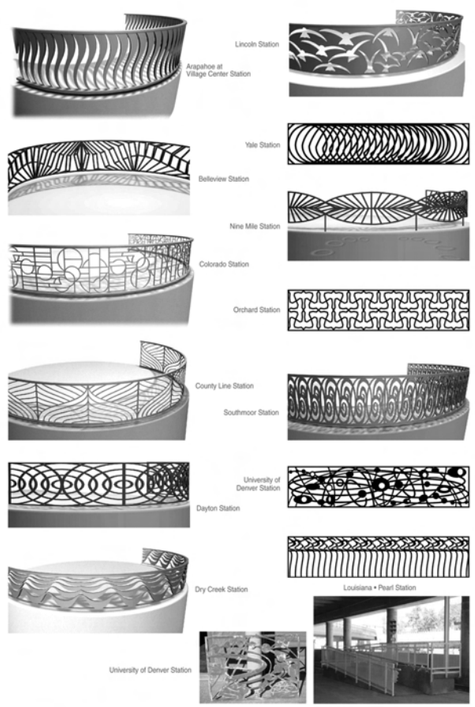
RTD Windscreen Benches

Station Enhancements



RTD Highblock Railings

Station Enhancements



RTD Orchard Station

Artist Wopo Holup — *"Orchard Road Orchard"*

Project Description

"Orchard Road Orchard" is a work about memory and observation. It's about exaggeration in memory and simple observation in nature. Enlarged impressions of apple leaves symbolize a long gone orchard, an orchard remembered and magnified; and bird sculptures referring to observations of the world around us.

I was fascinated to learn that an ancient rain forest existed in Castle Rock 65 million years ago. As construction continues on I-25, leaf fossils are still being found, some of them 12 inches in length. As I thought about the ancient rain forest, I was reminded of name references in the neighborhood — Greenwood, Cherry Hills and, of course, Orchard Road. These thoughts about ancient forests and recent orchards combined to form images and ideas for this project.

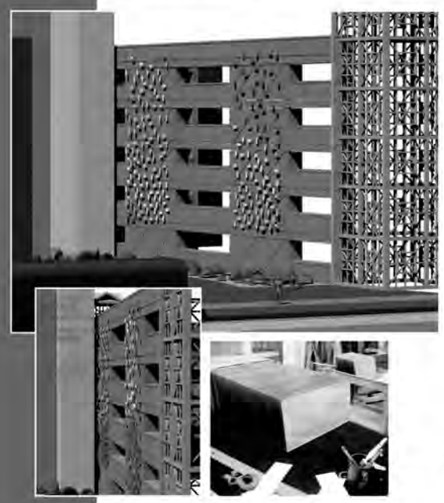
Actual apple leaves were pressed into clay, the image scanned and enlarged, then milled in foam, and finally cast as a rubber mold. The mold was used to stamp wet concrete on the walkway. There are also 11 highly polished stainless steel bird sculptures placed at random on the fence that divides the tracks and walkway. These are modeled from a Western Blue Bird — small, subtle, symbolizing watchfulness.

About the Artist

I have completed more than a dozen public art commissions around the country. These include projects for Philadelphia's Zoo, historic Battery Park in Manhattan and DART in Dallas (my hometown). Articles about the work have appeared in *Sculpture, Landscape Architecture* and *The New York Times*. Installation was recently completed for a large carved granite work for the State of New York DOT. Digital prints made from scans used to carve the granite will be shown at Sonoma State University Gallery, Rohnert Park, California, in the fall. I am currently working on a piece for a new fire station in Los Angeles and another for Kansas City's Police Academy. It pleases me to be working here in Denver (my new hometown).

RTD Lincoln Station

Artist Ray King — *"SunStream"*



Project Description

My proposal for artwork to enhance the parking garage, surrounding plaza and viewpoints at Lincoln Station is "SunStream," a light-responsive, wall-mounted sculptural frieze on the façade of the garage.

I plan to animate the building by introducing a dynamic, gently curved wall of color by attaching nearly 250 chromatic rectangles of laminated holographic glass that respond to sunlight by refracting brilliant, glistening color, and exhibit a shimmering iridescence, similar to fish scales, at other times. The holographic film reacts to ambient light in unpredictable ways depending on the angle of light, time of year and position of the viewer.

The glass panels will be positioned in an eccentric and cryptic pattern. The sculpture will be visible from a wide range of viewpoints and will serve as a landmark for the area.

About the Artist

Ray King is an accomplished artist who uses the natural phenomena of light as it interacts with the optics of glass as an art medium. By creating dynamic sculptures that interact with the sun by reflecting light into shadow and refracting light into colors — rainbow-like emanations that shift and change as the viewer moves or as the light source changes — King creates a magical environment that appeals to viewers' sense of wonderment and delight.

A resident of Philadelphia, King has exhibited his work internationally since 1976, including exhibitions in Italy, Japan, England, Spain and France. Major permanent installations of his work have been commissioned throughout the United States and abroad. All are site-specific and inspired by the surrounding space and landscape to create a unique sense of place and identity.

RTD Belleview Station

Artist Richard C. Elliott — *"Thunder Over The Rockies"*

About the Artwork

By gluing 4,000 roadway reflectors to the walls and ceiling of Belleview Station's pedestrian tunnel, Elliott will transform this space into the art piece "Thunder Over The Rockies," the first reflectorized art tunnel in the world. When Elliott visited Denver last year to do research for this project, he was greeted with a spectacular display of earth, air, fire and water in a dramatic event of thunder, lighting and rain. The unique convergence of the high plains meeting the Rockies, western culture intertwined with native influences, and the ghost of herds of wild buffalo running along the freeways is what inspired "Thunder Over The Rockies."

About the Artist

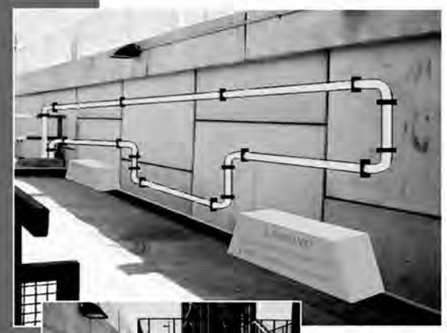
Richard C. Elliott received a bachelor's degree in art from Central Washington University in 1971. Since then he has been in 54 juried exhibits, 50 invitational & group exhibits, and has had 46 solo exhibits of his work as well.

His work is in 25 public collections. His public art career began 20 years ago. "Thunder Over The Rockies" at RTD's Belleview Station will be his 23rd public art commission. Recent public art projects are: Hiawatha Light Rail, Minneapolis, Minnesota (brick pavers); Kittitas County Millennium Labyrinth, Ellensburg, Washington (etched tiles); University High School, Spokane, Washington (reflective window treatment); Hinsdale Wave Facility, Oregon State University, Corvallis, Oregon (reflective wave mural); Kelly Engineering, Oregon State University, Corvallis, Oregon (reflective mural); TriMet, Portland, Oregon (reflective sculpture); Municipal Parking Garage, Renton, Washington (reflective window treatment); and Sea-Tac International Airport, Seattle, Washington (backlit reflective mural).

He is currently working on a reflective window treatment for the Charlotte Area Transit, and an integrated artwork for the new transit center at Portland's TriMet 205 light rail corridor at Clackamas Town Center.

RTD Dry Creek Station

Artist John McEnroe — *"Pure Gold"*



Design in process of being revised

About the Artwork

There is ready-made irony provided by the name "Dry Creek." It is a harbinger of things to come, given the rapid development of the South Valley Corridor. It also reflects the water crisis throughout the state of Colorado. Over-development is our modern fool's gold. Without the water resources to support continued growth, we risk the same fate of the early 49ers. The riches will go to the infrastructure, and those seeking more modest gains, such as a new home or a small business, will be stuck in a dry creek bed.

Our water basins truly are the closest thing we have to pure gold, and the rush is on. The artwork proposed here is not a solution to this problem, only a reflection of it. I hope to acknowledge and highlight the precious nature of our water resources, while at the same time pay homage to the historical significance of this site. It is a hopeful and somewhat humorous notion; the idea of gold flecks visibly coursing through a glass waterway, or water main, depending on your point of view. It is also sardonic, in that our focus of what is valuable can be so easily diverted by fool's gold.

About the Artist

John was born in Independence, Missouri, and following undergraduate school was accepted to The Ohio State University's art department on a scholarship for graduate school. He has taught at Ohio State, Columbus College of Art and Metropolitan State College in Denver. After realizing he couldn't afford teaching, he started Tesserah Tile, a tile installation company that he still runs today.

He has had gallery exhibits around the country and, in 2002, was awarded a public project for the Denver Convention Center Expansion. He currently has another public project in the works for Green Valley Ranch K-8 School.

John lives in Lakewood with his wife and family where he has his studio.

RTD Yale Station

Artist Gregory Gove — *"Connections"*

Project Description

My idea for the Yale Station wall came out of my thinking about the constant shifting and changing of communities as various people travel via the light rail system. What are people thinking, dreaming, etc., as they are transported from place to place, what do they have to offer the places they are going, and what might they take away with them when they leave? The idea of ever-changing groups led to the idea of larger compositions that break apart and seem to flow into one another as they scatter across the wall. I've created 11 compositions that will be scattered across the wall that all relate to one another and come together to form sort of one greater community at the far right, which is the most visible to commuters as they approach the stairs that lead to the platform. The Yale Station wall was a very challenging problem to solve for a muralist because of the odd shape, the great size, and its exposure to the harsh weather elements of the region. My usual method is to work on canvas for interior installations, which was not an option; I found a laminate material on which it's possible to print any image, and will stand up to the weather. The 4'x10' panels will be arranged in a pattern and mounted across the wall.

About the Artist

I have been designing and creating art for primarily privately-owned commercial spaces since 1992. This is my first actual public art project. I was born in 1967 in St. Louis, Missouri, and raised in an environment that was supportive of artistic pursuits. As far back as I can remember, I've always been aware of the power and presence that art of any scale can have. After graduating from The Columbus College of Art & Design, Ohio, in the winter of 1990, I relocated to Chicago, where I was inspired by the abundance of public art, especially murals, and began to pursue large-scale projects. Although my work varies stylistically from project to project, I've probably been most influenced by the Art Deco period. My work is driven by a love of dynamic composition, with strong color and movement. In most cases, forms are simplified and stylized for the purpose of carrying the message without getting bogged down by details that have no significance. The intention is to distill things down to their basic core recognizable elements, and then give them power through the use of color, movement, light and darkness.

RTD Louisiana • Pearl Station

Artist Ira Sherman — *"The Stange Machine"*

Project Description

I have developed my design by abstracting the outlines of the human form and melding these lines with the eccentric motion of steam locomotive wheels. Three large, overhead tubular structures enhanced with deco design elements and LED neon will be set into motion by pedestrians on the rail platform who will manipulate a large stainless steel orb. The sturdy, finely crafted aluminum and stainless steel used in the slowly gliding tubular wheels will further reflect and redirect reflected light. This sculpture will be one of the first ever public outdoor monumental kinetic sculptures in Colorado that the viewer can actually manipulate and set into motion.

About the Artist

"I am passionate about creating kinetic objects in metal. My extensive background in metalsmithing, architectural metal design and jewelry design make all my sculpture 'jewel-like' both in the application of extremely fine craftsmanship and careful, thoughtful site-specific design. I love the strength, malleability, durability and mechanical opportunities inherent in metal. I love the tools, machines and fabrication facilities used to form metal. All these qualities become apparent when I am commissioned to create site-specific sculpture."

Renowned in the metalsmithing field, Ira has conducted lectures and workshops throughout the USA and abroad including Israel, Canada, Spain, Australia, England and Scotland. In 1988, 1991 and 1997, Sherman was a guest instructor at the Bezalel Academy of Art and Design in Jerusalem, Israel.

Ira was the 2004 overall winner of the Kinetic Art Organization International Kinetic Art competition. In 2003, Ira received one of three top prizes awarded leading international artists designing Judaic Art. The Colorado Federation of the Arts awarded Sherman the 1993 Arts Innovation Award in the visual arts. The Smithsonian Renwick Gallery, Regional Transportation District of Colorado and The Spertus Museum have recently acquired one of Sherman's pieces for their permanent collections.

Sherman has been elected a distinguished member of the Society of North American Goldsmiths, and is President and a founding board member of the Colorado Metalsmithing Association.

RTD University of Denver Station

Artist John Goe

Project Description

I am interested in the power of language as a communicative tool, disseminating the customs and rules that guide and inform our lives. With the light rail station and the university being in such close proximity it seemed logical to make a connection of some kind. I chose words, verbs specifically, that I could relate back to academics or the result of education. Interspersed is a second, smaller list of verbs. This list emphasizes the character development of a person. What do we see in the shiny surface; the negative space between letters and words?

The light rail station will be a hub of transportation for not only the university but the community surrounding it as well. Architecturally, the tunnel is a connection between the transit and community, either work or home; destination or origin. Continuing with a sense of continuity, I again use panels of text in the tunnel. Not necessarily verbs, the words communicate travel from one point to another. These lower case words highlight what we do too little of during the mundane and sometimes frustrating commute.

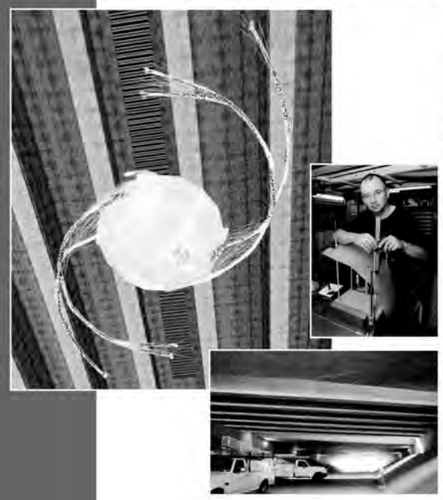
About the Artist

It was in my first typography class at the University of Redlands where I fell in love with text, both as image and as letter form. I began work with type as an integral part of my work there, which developed into a double major in both graphic design and printmaking. While I worked briefly as a professional graphic designer, the desire to continue my art education and exploration drew me to study at the Art Institute of Chicago. While pursuing my MFA, I was working with text and motion graphic, but found the need to make text have a more physical presence. Casting and sculpture caught my attention and I have been hooked since. In particular, the ideas of permanence and disposability and what is in between continues to captivate me.

I am still a visual communicator and strive to build a connection between myself and the audience using language as the bridge.

RTD Nine Mile Station

Artist Dwight Atkinson *"Troll Trouncer"*



Project Description

The Troll Trouncer project evolved from a mere talisman into a grand chandelier expressing the conflict between technology and nature. The sculpture is a whirlwind of overlapping metal panels intertwined with a flying sprite whose outstretched arm spills nectar from a broken bowl. This figure symbolizes the futility of preserving nature in a technological world. The assembly is illuminated theatrically with an internal fiber-optic lighting system adding visual warmth to the cold tunnel.

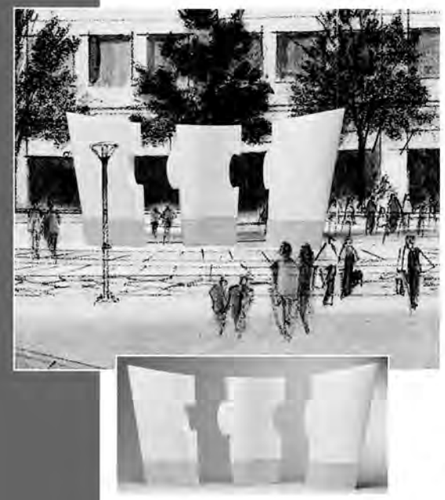
About the Artist

Dwight Atkinson is an artist, inventor and retired architect living in Vancouver, Canada. He's using the latter years of his life to satisfy his curiosity about art, computing and metalwork. "Being an architect simply required too much pontificating and meaningless gesticulating. In my professional work, I missed the mind/machine connection and really enjoy building artistic things that I can touch." His artistic work explores irony in the relationship of humanity and environment.

In addition to pursuing public art assignments in North America, Atkinson writes and lectures about computer illustration.

RTD Arapahoe at Village Center Station

Artist Michael Clapper *"Nucleus"*



My intent for the Arapahoe at Village Center light rail station is to create a signature sculpture that honors the uniqueness of the community of Greenwood Village.

I will illustrate this concept with a sculptural installation that will look as if it is made from a unified whole. Actually made from three large marble sculptures, the overall outline and form will be constant when viewed from afar. Each individual piece will be set apart from each other, and will be shaped to look as if they interlock. Set somewhat apart from each other within the new elliptical plaza, the sculpture will allow and encourage pedestrian interaction. The three interlocking forms, when placed together, will convey a sense of interdependence.

As people approach the installation and walk through and among the curved forms, they will discover that the interior interlocking edges of the marble planes are covered with a carved texture that resembles a stitched pattern. Upon closer inspection the viewer will discover that the abstract pattern for the texture has actually been created from hand prints. I want to involve the students from the various elementary schools within the boundaries of Greenwood Village for this part of the project. By involving students from one particular grade level, we will be creating a time marker, of sorts, that is meant to honor the town's youth as its future.

About the Artist

Educated in design at the distinguished Wendell Castle School in Rochester, New York, Michael now focuses on creating contemporary public and residential sculpture. Typically working in the medium of stone and steel, his art conveys a natural palette of color, pattern and texture that are inherent within the materials themselves. "In addition to encouraging thought, it is my desire that my works of art evoke a sense of timelessness, serenity and transcendence within the viewer."

The winner of numerous commissions and awards, Michael maintains a studio in Denver, Colorado, where he is represented by the William Havu Gallery. Michael has taught at the Genoa School for Design in Ithaca, New York, and more recently at Metropolitan State College in Denver.

RTD Southmoor Station

Artist Christopher Janney *"Light Moves Denver"*

About the Art

LIGHT: Within each column there would be a photo-electric sensor shooting an infra-red beam of light across the 20-foot space to its matching half-column. As a person moves through the red-hued tunnel breaking one of these beams, he/she will trigger the light in the column which will be one of various blue colors ranging from blue-violet to blue-green.

SOUND: Within each column there would be an audio speaker. When a person triggers the light, they will also trigger a sound which will emanate from the speaker into the individual columns. The sound score will be composed of a mixture of melodic and environmental sounds. The sounds will be programmed to change over time so the returning pedestrian will never hear the same pattern twice.

RIDDLE: For the truly inquisitive pedestrian, there will be a riddle etched in a plaque somewhere in the tunnel. If a person can decipher the riddle and trigger the columns in the pattern described, the tunnel will "dance" a pattern of light and sound in reply.

About the Artist

Christopher Janney was trained as an architect (Princeton University, B.A., magna cum laude; M.I.T., M.S.) and a jazz musician (Dalcroze School). Believing that there was more to creating a dynamic urban environment than erecting buildings, Janney developed his own multi-media studio, PhenomenArts, Inc. in 1980. He has created numerous permanent interactive sound/light installations, attempting, on the one hand, to make architecture more "spontaneous" and on the other hand, to make music more physical.

He has been awarded "Sound Designer of the Year," by *LDI/Theatre Arts Magazine* for his innovative public sound environments and the Edison Award from General Electric for innovation in design. His work has been profiled on CBS *Sunday Morning* and HGTV, in *Architectural Record* and *The New York Times*, and in a 30-minute award-winning documentary titled "Drum of Time."

Believing also that architecture is about a manifestation of the "public spirit," Janney is also a Visiting Professor at Pratt Institute School of Architecture, where he teaches his course, "Sound as a Visual Medium." For more information, go to www.janney.com.

RTD Dayton Station

Artist Christopher Weed — *"Windswept"*

Project Description

This project entails using more than four dozen steel spheres mounted on stainless steel posts. The spheres are 12" and 18" in diameter. As its title suggests, Windswept will transform the viewers as they walk through a field of brightly colored steel that seems to be in perpetual motion.

Artist Statement

The fundamental point of public art is to encourage interaction and evoke emotional responses. Public art, as opposed to a museum, does not always have the luxury of a willing audience. The most essential step in conveying one's artistic expression is, first and foremost, getting the viewer's attention. Artists displaying their works in a museum accomplish this initial step without prior thought. Art in the public domain, however, requires the artist to enhance this initial step.

In my work as a sculptor, I use primarily luminous and tactile materials, creating large abstract shapes. These materials consist of stainless steel, copper, concrete, and powder-coated steel. My purpose is first and foremost to overwhelm the observer, using size, variation and multiplicity of elements. My intent is not to shock, but to ultimately inspire a sense of awe through visual stimulation.

RTD Colorado Station

Artist Ries Niemi — *"Big Boots"*

Project Description

On such a large site, encompassing long platforms and a huge parking lot, it takes an artwork with a lot of presence and personality to make an impact.

The Big Boots are a pair of stainless steel cowboy boots, each taller than a person. They are open and transparent, like a cross between ornamental iron and jewelry.

Big enough to be visible from a long distance, they attract attention from afar, but reward close inspection with texture, pattern and intricate detail. They beg to be inspected and touched, as the amount of hand craftsmanship that went into them is obvious and intriguing.

The cowboy boot is a creation of the American West, a melding of European and Native American ideas, imagery and needs, a unique solution to a unique geography. Originally a utilitarian work boot, the cowboy boot has been adopted over the years by presidents and ranch hands, high school kids and rock and rollers, truck drivers and movie stars, people of every ethnic background and social strata.

The Big Boots draw their inspiration from Native American rug designs, Mexican Pitiado patterns, Pueblo Deco architecture of the 1930s and Gene Autry's stage wear.

I use a combination of centuries-old hand-forging techniques with very modern tools and materials to make a sculpture that is virtually indestructible, with no large areas to graffiti, impossible to skateboard, impervious to weather and able to be easily cleaned.

The stainless steel is hand forged into textures, hand bent into curves and shapes, then welded together into one solid and strong piece. The entire piece is electropolished—a technique of chemically shining the stainless. There is no paint, coating or color to wear off or be damaged. The stainless steel looks good no matter the weather, gleaming in the sunlight, but glowing under overcast skies as well.

There is no overt message. Viewers can bring their own interpretation to the piece, but the boots suggest the West—and its heritage—albiet in a very modern way.

RTD County Line Station

Artist Emmett Culligan — *"Plow"*

Project Description

The sculpture entitled "Plow" that I am creating for the County Line light rail station is a bit of a departure for me in terms of the work's representational approach and implied meaning. The sculpture depicts an 18'x30' steel plow aggressively turning over the prairie to make way for the agricultural communities that first settled the Colorado plains. This plow would have been pulled behind a horse and can be seen as a testament of the hard labor our ancestors endured for survival. Conversely, the 30' diameter landscaped circle in which the plow sits shows land in its natural state as well as in regimented plantings representing the drastic changes brought forth by human land use.

About the Artist

Born in Colorado, Emmett Culligan discovered his passion for sculpting early in life before studying art at the Art Students League in New York, and later received his BFA from the University of Colorado at Denver. Studying the principles and aesthetics of metal fabrication in art school, Emmett began to explore stone carving in an effort to combine the two media. His art ranges in scale from large monumental public art to small wall-hung works, and can be found in collections and municipalities both nationally and internationally. Emmett works from his studio in Denver, where the state's numerous raw materials are close at hand. Likewise, Colorado's large spaces and natural beauty provide the inspiration needed to capture the spirit of the region.

RIGHT-OF-WAY

To the greatest extent possible, Transportation Expansion (T-REX) Project construction took place within the available right-of-way of I-25 and I-225 owned by the state and the Regional Transportation District (RTD). However, the widening of I-25 and the construction of light rail transit and related facilities required some right-of-way purchases. By the time the last right-of-way parcel was turned over to the contractor in May 2002, the T-REX Project had relocated 68 businesses, acquired six single-family homes, two duplexes and two apartment buildings. It negotiated 30 total acquisitions and 172 partial acquisitions. The budget for right-of-way acquisitions was $108 million. The T-REX Project contractor, Southeast Corridor Constructors (SECC), was responsible for obtaining temporary easements during construction and acquiring additional right-of-way to accommodate project design changes.

To ensure all the property owners and residents were treated fairly, the T-REX team followed established federal procedures that outline specific steps for moving homeowners, tenants and businesses.

Once the owner received an offer for a property, occupants had at least 90 days to move, and no one had to move until they found comparable replacement housing.

All residents and tenants were eligible for relocation assistance and compensation. To further help, the T-REX team took every precaution to minimize the inconvenience to everyone who moved.

Each party worked directly with a relocation expert, who served as an advocate for the homeowner or tenant.

The relocation expert worked one-on-one with residents and tenants to evaluate their needs and provide help by:

- Explaining homeowner/tenant rights
- Helping with financing
- Contacting real estate agents and movers
- Locating replacement housing

Individuals also received relocation benefits, which varied depending on individual circumstances. The benefits included:

- Help finding comparable replacement housing that is decent, safe and sanitary
- Help replacing housing costs, including money to supplement a home purchase, money to supplement rent and down payment assistance
- Moving costs

Businesses were also eligible for replacement property costs and moving costs. Like with residential properties, the T-REX Project purchased business properties and relocation experts helped businesses move.

The Woodwinds Apartments were acquired by the right-of-way program, relocating 100+ people. SECC demolished the building to make way for the University of Denver Station and parking garage.

UTILITIES

The T-REX lighting system enhances the visual appearance of the road and improves driver safety.

Utilities located within the proposed right-of-way on the Transportation Expansion (T-REX) Project were relocated to accommodate highway improvements and construction of light rail transit. The T-REX budget for utility relocation was $37 million and involved many different metro area utility companies.

Utilities impacted include:

- Electricity
- Telephone
- Cable TV
- Natural gas
- Sanitary sewer
- Water
- Fiber optic

The T-REX Project identified all utility locations before construction in order to minimize disruption of customer service and to reduce safety hazards during construction. Utility companies or qualified contractors performed all utility relocation work in accordance with all state and local laws and safe work practices.

The T-REX utility project goals were to:

- Minimize inconvenience to the public by ensuring utility service continuity
- Ensure safety in all aspects of the project
- Meet or beat the total program utility budget for both T-REX and the utility companies
- Provide for a quality project for both T-REX and the utility companies
- Implement and maintain the design-build utility schedule to achieve the overall project schedule
- Apply teamwork among the participants — T-REX, Southeast Corridor Constructors (SECC), utility companies — to achieve the common goals

To prepare the T-REX corridor for construction, preliminary utility work, including subsurface utility engineering activities, had to be performed. Following are some examples:

- Colorado Senate Bill 00-203 was passed and signed in spring 2000, providing for a "master" relocation agreement. The Project Specific Utility Relocation Agreement (PSURA) was processed with 10 public utility companies and eight private utility companies for the T-REX Project. The law required a new level of cooperation and coordination among utility companies and the contractor, essential for ensuring the success of statewide design-build projects.
- Identified 45 utility companies within the corridor that had responsibility for 800 separate utilities. About 400 of those utilities required relocation. In addition, 200 new power feeds for various new facilities along the corridor were identified (e.g., lighting, signage, intelligent traffic signal devices, power for the light rail stations and traction power substations).
- 600 subsurface locations throughout the corridor were identified and surveyed to accurately locate the utilities with minimal impacts to the traveling public.
- 1,051 manholes were opened throughout the corridor to record the size and elevation of utility pipes.
- Completed approximately $2.5 million of utility relocation work before SECC, the T-REX contractor, received its Notice to Proceed.

The T-REX Project used new boring technologies, reducing inconvenience to the traveling public by eliminating the need to relocate utilities by open cuts on roads.

Highway Lighting

SECC took responsibility for the maintenance of all existing streetlights within the corridor.

The project installed a new highway lighting system, primarily in the median of I-25 and I-225. SECC's subcontractor developed the new lighting system, which was approved by T-REX. The new lighting system addressed driver safety while considering residents living near the highway. The lighting system complies with the requirements of legislation passed by the Colorado Legislature in 2001. The bill, which addresses light pollution, requires the use of lamps that reduce light pollution, or light that impacts surrounding properties.

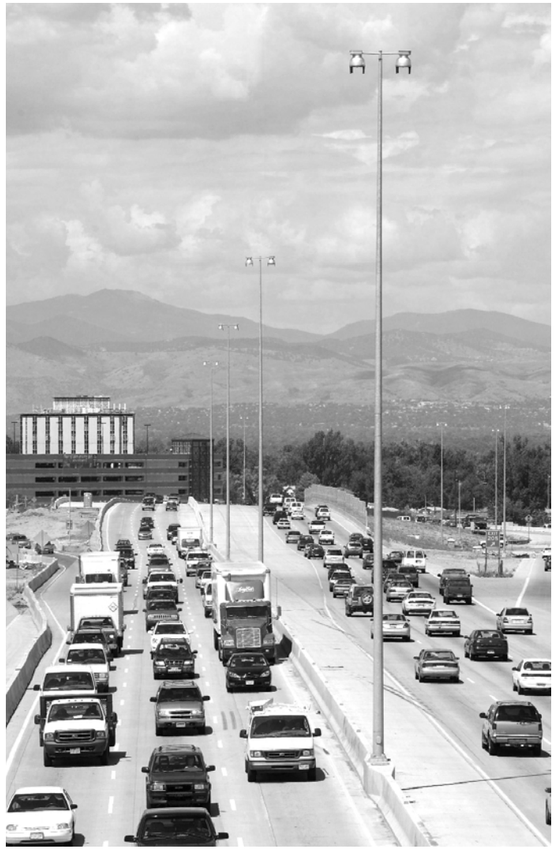
The original highway lighting design for the T-REX Project required 40-foot light poles with 400-watt lamps every 180 feet on both sides of I-25 and I-225. This design required more than 1,500 light poles for the 17-mile project. The new cost-saving design proposed by the contractor uses 1,000-watt lamps mounted on 65-foot poles placed about every 370 feet in the highway median. This reduces the number of required light poles to about 230. In addition, since most poles are in the highway median, they are 68 feet to 80 feet farther away from properties adjacent to the highways.

The new median lighting advantages include:

- The number of light poles on the project was reduced significantly, enhancing the visual appearance and improving driver safety
- Lighting uniformity is superior to the original design
- Light pollution to adjoining properties was minimized by using more efficient lamps and shields where necessary
- Future maintenance will be reduced because fewer light poles and lamps are required
- Future energy costs will be reduced

Program Recognition

The T-REX Project won the Federal Highway Administration's (FHWA) inaugural Excellence in "Utility Relocation and Accommodation" competition, and was selected to receive an award in the Innovation and Subsurface Utility Engineering for projects greater than $100M category. FHWA selected T-REX based on the project's success with challenges such as providing facilities that meet the nation's transportation needs while considering the environment and local communities.



New highway lighting in the median soon after installation on I-25 at University Boulevard.

T-REX PROTECTS THE ENVIRONMENT

The Transportation Expansion (T-REX) Project team and Southeast Corridor Constructors (SECC) used every means available to minimize the project's impact on the environment, including wildlife. Measures included working with local municipalities and state and federal agencies to comply with all established local ordinances and state and federal laws.

SECC, recognizing the need to minimize the impact of noise on residents during the demolition of bridges in the City and County of Denver, devised an innovative temporary noise wall using freight trailers modified with special noise dampening skirts. The trailers proved to be an effective means of mitigating noise during the demolition of concrete reinforced bridges. The contractor also implemented a hotel voucher program that provided residents living closest to the demolition projects the opportunity to stay in local hotels.

The Dayton Station is located adjacent to a sensitive wetlands area.

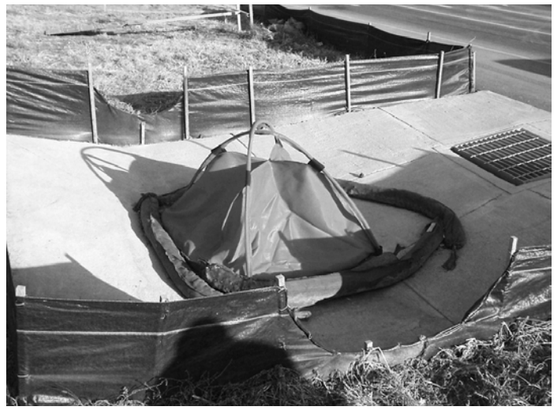
To ensure the success of the noise mitigation program, SECC representatives and others from the City and County of Denver continuously monitored noise levels throughout the demolition process. Residents also had access to a 24-hour telephone hotline to report excessive noise levels. The contractor provided a team to respond to noise calls immediately. The hotline center would alert the team, which would travel to the construction site and take noise measurements to determine if the noise was excessive, and provide a solution.

Impacts on wetlands were limited through design elements. For example, the pedestrian bridge at the Dayton Light Rail Station spans a wetland with no piers encroaching on it. The station platform is outside the wetland as well. In another area, the wetland was protected and enlarged by grading and planting in an adjacent area.

The T-REX Project team and the contractor worked closely with local, state and national agencies to ensure environmental impacts were minimized during construction.

Measures included:

Air Quality
- Suppressing dust through watering or other methods
- Covering trucks hauling soil
- Stabilizing and covering stockpile areas
- Replanting exposed areas
- Washing construction equipment to minimize tracking debris off construction sites
- Monitoring air quality during construction



A storm water tent keeps debris from entering the drainage system.

Water
- Adhering to local and state erosion control requirements
- Treating contaminated trench water
- Avoiding impacts to wetlands and other sensitive habitats and replacing wetlands that were damaged
- Developing permanent storm water management practices
- Adhering to U.S. Army Corps of Engineers limits regarding impacts to wetlands and streams

Noise/Vibration
- Where necessary, building temporary noise barriers during construction
- Using noise blankets on equipment and quiet-use generators
- Minimizing nighttime construction in residential areas
- Routing truck traffic away from residential streets, where possible
- Combining noisy operations to occur simultaneously
- Using quieter construction methods in sensitive areas
- Accomplishing high-noise construction activities during the day

Prairie Dogs

The T-REX Project successfully relocated 100 prairie dogs from two colonies to Cherry Creek State Park, marking one of the first successful prairie dog transfers across county lines.

The T-REX Project plans encroached on approximately 175 prairie dogs.

The project followed specific Colorado Department of Transportation guidelines, which outlined a four-step process for addressing prairie dog colonies:

1. Avoidance of prairie dogs, if feasible.
2. If a colony cannot be avoided, the colony will be relocated in accordance with Senate Bill 99-111 requirements.
3. If relocation sites cannot be found, the colony will be captured by an approved contractor and turned over to the Fish and Wildlife Service for the Black-Footed Ferret Reintroduction Program.
4. The Office of Environmental Services (OES) or the Region Specialist will review each project on a case-by-case basis to ensure minimal impacts to black-tailed prairie dogs and their habitat.

During the Environmental Impact Statement (EIS) process, it was determined that avoiding five specific colonies was not viable or feasible. In accordance with step two of the policy, the project obtained a permit from the Division of Wildlife to relocate 100 prairie dogs from two of the colonies to Cherry Creek State Park. These efforts were completed in February 2002 and required the approval of the Arapahoe County Commission.

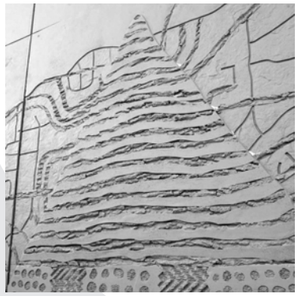
After relocating the first 100 prairie dogs, 75 still remained. T-REX pursued several potential relocation sites that included Chatfield State Park, Rocky Mountain Arsenal, Pawnee National Grasslands, Banner Lakes and the City of Aurora. In each case, the project was unable to obtain approval or acceptance of the sites for relocation of the remaining prairie dogs.

Additional efforts by T-REX and The Wild Places, Inc. (the relocation contractor), as well as the Division of Wildlife were unsuccessful. The 75 prairie dogs were humanely exterminated after all relocation efforts were exhausted.

Program Recognition

The T-REX Environmental Design Coordinator was awarded the Colorado Department of Transportation (CDOT) Environmental Excellence Award for leadership and efforts in environmental oversight on the T-REX Project. The award was presented based on exceptional work on the sediment and erosion control efforts. In addition, the T-REX team met the challenge of storm water quality regulations by creating an effective inspection process, increasing awareness of environmental issues and serving as a liaison between the many different agencies working on the project.

NOISE WALLS



The Colorado Department of Transportation (CDOT) uses noise walls along state roadways to soften noise from highway traffic. Noise walls are usually made of masonry or concrete panels, and are usually around 10 to 12 feet high. Noise walls are not the same as retaining walls, which can range in height from three to 20 feet. Retaining walls can sometimes work as noise barriers as well, depending on how they are built and where they are placed.

Noise assessment plays a role in major CDOT and Regional Transportation District (RTD) projects, and the Transportation Expansion (T-REX) Project was no exception. Southeast Corridor Constructors (SECC), the project's design-build contractor, was required to assure that the noise of construction and traffic was reduced as much as reasonably possible.

The contractor's work was supplemented by the T-REX Project team's previous work with local residents and businesses on the wall design. All existing wooden noise walls were replaced with a new masonry or concrete noise wall.

The T-REX Project team met with neighborhood associations, local elected officials and other groups regarding noise wall design in an effort to incorporate local input as much as possible.

To be considered effective, a wall must achieve a minimum of a five-decibel noise reduction and must not create any safety or unacceptable maintenance problems.

The T-REX Project team conducted a preliminary noise analysis in the Southeast Corridor as required by the National Environmental Policy Act (NEPA). SECC completed the final noise analyses, with more complete design and construction detail.

Noise levels and traffic volumes were modeled to determine where it most made sense to build the noise walls. This analysis presented a likely picture of where noise walls would be most effective, and identified areas between Logan Street and Quincy on I-25 and along segments of I-225. Essentially, where there are residences along I-25 and I-225, there are walls.

The T-REX Project team located the walls to be as effective as possible, given constraints of budget and aesthetics. The project also had an established process if a community chose to modify the wall planned for a specific location.

To minimize graffiti on noise walls, a non-toxic coating was applied to the walls in the public right-of-way. Graffiti was closely monitored and removed throughout the construction phase of the project by the contractor.

Wall Art on T-REX

In looking at historic maps of Denver and the icons in the maps, the wall artists visualized how the plains border the city on three sides with the mountains rising above the city to the west. Their goals were to depict Denver's history and what has occurred along this route historically, geographically and ecologically. The textures have several layers of visual information for the purpose of supporting different levels of viewing interest. It is the hope of the artists that travelers will continue to discover new details and pattern arrangements each time they use the I-25 corridor.

Wall panels containing only the art subjects are painted with a gray concrete stain, producing a smooth satin finish. The walls south of Quincy Avenue and throughout the Denver Tech Center are painted a sandy/tan color with special accents on the bridges over arterial streets. The stain used on the walls allows for quick graffiti removal, minimizing the cost of maintaining the walls.

The art on the sound walls and retaining walls of the T-REX Project is intended to remind us of our environmental, historical and cultural roots as Denver defines a new century.

Buffalo Pattern — Historically, gentlemen farmers established orchards from Hampden Avenue south on I-25 and built weekend vacation homes. Buffalos roamed these open plains grazing on native vegetation. Additionally, this part of the highway is above grade, providing travelers with vast mountain views. Locating the buffalo and mountain map patterns along this stretch of I-25 will call to mind thoughts of the great open space, contrasting the sensation of confining space travelers may feel in the Narrows. Because this image has a strong visual presence, the buffalo pattern will be a landmark for travelers entering or leaving the Denver metro area.

Mountains Map Pattern — The Rocky Mountains are the dominant focal point looking from the plains westward across Denver. Denver neighborhood maps were incorporated into the wall art to give texture and body to the mountain pattern.

Looking at the mountains, we see a layering of ranges rather than a flat silhouette. The mountain map pattern echoes the feeling of depth one may get from looking at the mountains and the continual change to the contours of mountain peaks as they are affected by weather and light throughout the day.

Farm Fields Pattern — Gentlemen farmers settled in the plains southwest of Denver, planting crops and orchards. Although many of these farmlands have disappeared as Denver has expanded, farming remains a significant part of Denver's history and of Colorado's present. The farm fields are represented by an aerial view, similar to what one sees when flying into Denver.

Cottonwood Pattern — There are stars in the cottonwoods. If you grasp a cottonwood twig, neither too green nor too rotten, and snap it at a wrinkled growth node, a perfect five-pointed star may be revealed on the broken ends.

As the only tall tree encountered by the Arapahoe and Cheyenne Indians, the plains cottonwood naturally assumed a powerful and creative role in their cosmos. Currently in Denver, cottonwood trees line the Highline Canal, which winds through the city and along I-25, providing a recreational greenbelt.

Tipi Pattern — Denver sits in a shallow descending slope, a mile high on its floor, rising gently on its sides into plateaus, foothills and mountains. The confluence of the Platte River and Cherry Creek created a natural campsite for Native American plainspeople.

In honor of this heritage, the tipi pattern was created, based on a composite of Native American dwellings.

Swallow Pattern — Swallows are migratory, urban birds often seen coasting and dipping on the short, warm updrafts created by vehicles at intersections.

They are likely to be seen from our cars in any city neighborhood. They dart gracefully across a landscape built of Denver maps.

Magpie Pattern — Magpies, charming scavengers of the city and the plains, fly through the native grasses of Colorado. Although raucous and sometimes aggressive, magpies are beneficent creatures in the grassland's ecosystem. Historically, they followed the buffalo, cleaning their hides and gleaning insects.

Grass Pattern — Within the grass pattern are native Colorado grasses including blue grama, the Colorado state grass that is native to both sides of the Continental Divide.

William Morris, a leading designer in the Arts and Crafts school, influences the pattern. The Arts and Crafts style is a dominant, architectural style in the part of Denver where the grass pattern is located.

An urban design team composed of landscape architects, engineers and local wall art designers met with the neighborhoods and municipalities along the corridor for input on the proposed wall art concepts.

URBAN DESIGN

The bridges in the Narrows section of I-25 exhibit several urban design features, including new light fixtures and widened sidewalks.

The Transportation Expansion (T-REX) Project team provided specific detail for all urban design elements including bridge architecture, retaining and noise wall appearance, landscaping, light rail stations and related architecture. This was done to ensure all the elements reflected their surroundings and to ensure the quality of the finished project.

The T-REX Project Urban Design Team met one-on-one with neighborhood residents, homeowner associations and municipalities to gather input on the proposed design concepts for the corridor's appearance. During 190 public meetings hosted by T-REX, neighborhoods and municipalities had a chance to voice their needs and concerns regarding corridor aesthetics. The meetings gave participants the chance to endorse the proposed concepts and improvements.

Public meetings also provided participating groups an opportunity to identify how local communities would be identified and represented through the urban design elements while enhancing local communities through private participation.

Groups taking part in the urban design process included:

- East Holly Hills Homeowners Association
- City of Greenwood Village
- Wellington Square Homeowners Association
- Southmoor Park Neighborhood
- Washington Park East Neighborhood
- University Park Neighborhood
- Promontory Townhomes
- Southmoor West Townhomes
- Southmoor Park East Homeowners Association
- West University Community Association
- City and County of Denver
- Southeast Transportation Mobility Organization (SETMO)
- East Colorado Homeowners Association
- Joint Southeast Public Improvements Association (JSPIA)
- Douglas County
- Arapahoe County
- Arapahoe County Homeowners Associations

All registered neighborhood association presidents and local municipalities were invited to meet with the T-REX Project team.

The meetings provided the team with a list of suggestions and concerns including:

- Green space
- Noise abatement
- Aesthetics of walls
- Landscaping
- Right-of-way fencing
- Improved pedestrian and bicycle access to light rail stations and across I-25 and I-225

Ideas from participating organizations can be seen in various parts of the project, including wall appearance, landscapes, light rail stations and other architecture.

Program Recognition

Members of the T-REX Project team received the Urban Design and Planning Merit Award for excellence in landscape architecture. The award was presented to the T-REX Urban Design Team for its careful stewardship, wise planning and artful design. The Colorado Chapter of the American Society of Landscape Architects (ASLA), a national professional organization, presented the Urban Design and Planning Merit Award.

T-REX worked with Denver City Council officials to create a gathering place above the light rail tracks at the Louisiana•Pearl Station.

BRIDGES/INTERCHANGES

A light rail bridge was constructed over Broadway to connect the Southeast Light Rail with RTD's existing light rail lines.

Light rail stations are portals to the light rail system, and bridges are the gateways to the communities that lie along the Transportation Expansion (T-REX) Project corridor. Bridges are the highly visible links that ensure smooth traffic flow. Bridges also support recreational activities such as biking, walking and running.

The T-REX team designed bridges along the corridor to act as prominent civic icons. The bridges serve as safe passages over the roadway, but also announce that travelers have arrived at a particular place. Whether that place is the Denver Technological Center or the neighborhoods around Washington Park, neighborhood identity is distinct and identifiable.

A number of bridges along the I-25 corridor were replaced during T-REX construction. Most of these were in the area from Logan Street to Evans Avenue where bridges built in the 1950s were beginning to show their age. New bridges were also built where the new highway lanes and light rail required more clearance.

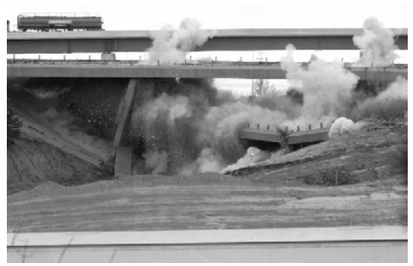
Bridges in the Narrows area from Broadway to University Boulevard were replaced beginning in December 2001 with the demolition and reconstruction of the Franklin Street Bridge, which reopened to traffic in July 2002. Bridge replacement in the Narrows continued until April 2004, when the last of the six bridges reopened to traffic.

The reconstructed bridges in the Narrows are:

- Logan Street
- Washington Street
- Emerson Street
- Louisiana Street
- Downing Street
- Franklin Street

Other replaced bridges on I-25:

- University Boulevard
- Steele Street
- Colorado Boulevard
- Evans Avenue
- Hampden Avenue
- Quincy Avenue



Two bridges were imploded in the I-25/I-225 interchange, making way for new highway and the addition of light rail.

On I-225, the northbound and southbound bridges over Cherry Creek were replaced.

These bridges on I-25 were widened to accommodate additional traffic lanes:

- Belleview Avenue
- Orchard Road
- Arapahoe Road
- Dry Creek Road
- County Line Road

The Highline Canal/Bike Path under I-25 south of Yale Avenue was improved for pedestrians and bicyclists. In addition, the I-25/I-225 interchange was reconfigured and reconstructed to improve safety and to accommodate the addition of light rail.

Light rail bridges were built along I-25 at:

- Broadway
- University Boulevard
- Yale Avenue
- Highline Canal/Bike Path
- I-25/I-225
- Belleview Avenue
- Orchard Road
- Arapahoe Road
- Dry Creek Road
- County Line Road
- C-470

Light rail bridges were built along I-225 at:

- Denver Tech Center Boulevard
- I-225 at Cherry Creek
- Parker Road

Light rail along I-25 passes through short tunnels at:

- Colorado Boulevard
- Evans Avenue
- Hampden Avenue
- I-25/I-225 interchange

In partnership with the local municipalities along the corridor, T-REX erected six pedestrian bridges at light rail stations, to facilitate easy access from light rail stations to surrounding office buildings, restaurants and other facilities for light rail passengers.

Pedestrian bridges are at the following light rail stations:

- Dayton Station
- Orchard Station
- Arapahoe at Village Center Station
- Dry Creek Station
- County Line Station
- Lincoln Station

Most of the bridges in the Narrows were more than 50 years old prior to the construction of T-REX. All of the bridges in that area were reconstructed.

DRAINAGE UPGRADES

Rapid and dense residential and business growth along the Southeast Corridor over several decades increased storm water runoff, an issue not handled effectively by the aging storm water system in use prior to the Transportation Expansion (T-REX) Project. The 40-year-old storm water system that served the north end of the project, especially between Broadway and University Boulevard, contributed to highway flooding on I-25 during heavy rains and following heavy snows. Floods, which would shut down the highway at Logan Street, occurred once every three to five years. During the 1990s, flooding was serious enough to close the highway four times.

Drainage problems were frequent in the Narrows section of I-25 (Lake Logan, Sept. 13, 2002) prior to the completion of the new drainage system. Opposite: T-REX used a massive boring machine to drill the new drainage tunnel, replacing an inadequate drainage pipeline.

The new drainage system is easy to maintain and was designed to handle rain from a 100-year flood (a flood that occurs once every century). Facilities designed to remove pollutants and enhance storm water quality were built at the University Boulevard and Colorado Boulevard interchanges, and in other areas of the corridor.

In the Narrows section of I-25, the area between Broadway and University Boulevard, a new box culvert storm sewer trunk main was built along the south side of the highway from Broadway to Veterans Park (near University Boulevard). In August 2002, crews completed boring a tunnel, 13 feet in diameter, under Mississippi Avenue from just west of Broadway to I-25 and Logan. The new tunnel replaced a drainage pipe that was just three feet in diameter. This tunnel carries storm water to the South Platte River, just west of the Broadway/I-25 interchange. Additional storm sewers were constructed under Buchtel Boulevard, which parallels I-25 on the east and west in the Narrows. The new storm sewers connect to the drainage systems under Mississippi and Arizona Avenues, which also empty into the South Platte River.

The storm sewer in the median of I-225 from the I-25 interchange north to Parker Road was relocated to accommodate the Southeast Light Rail.

The cost to replace the old drainage system was approximately $50 million for the entire project. Of that, around $21 million was spent to replace the storm sewer system in the Narrows area. Approximately 27 miles of drainage pipe was installed.

INTELLIGENT TRANSPORTATION SYSTEMS

New dynamic message signs provide travelers with traffic information before they reach problem areas.

Intelligent Transportation Systems (ITS) is the application of advanced technology for transportation. As information technologies and advances in electronics continue to revolutionize all aspects of our modern-day world, transportation networks are now incorporating new ways of managing roadways and transit. These technologies include the latest in computers, electronics, and communication and safety systems.

ITS devices incorporated on the Transportation Expansion (T-REX) Project include computer-controlled systems that promote safe traffic flow at an intersection.

This includes such systems as:

- Ramp metering — controls access to freeways to improve traffic flow
- Traveler information systems — allows transportation agencies to share information about traffic conditions that drivers may encounter

ITS played an important role during Transportation Expansion (T-REX) Project construction and continues to play an integral role on the completed corridors. During construction, ITS technologies monitored traffic on the interstates and on roads most likely used as alternate routes by drivers.

It also played a crucial role in helping agencies respond to emergencies on and off the highways during construction.

During T-REX construction a number of ITS elements were used to minimize inconvenience to the public. Elements included:

- Expanded ramp metering to regulate traffic entering I-25 and I-225
- A 24-hour courtesy patrol in the T-REX construction zone to help stranded motorists
- An enhanced network of closed-circuit cameras and vehicle detectors to monitor traffic on the interstates and on major feeder roads
- Highway advisory radios and variable message signs to provide travelers with up-to-date construction and traffic information
- An interim traffic operations center operated by the T-REX contractor, Southeast Corridor Constructors, to monitor traffic conditions and coordinate response with state and local agencies
- Real-time traffic detail map on the T-REX Web site

Project-included ITS Components

Closed-Circuit Television Cameras — Cameras allow transportation agencies to monitor regional traffic conditions 24 hours a day. The cameras installed during the T-REX Project continue to benefit travelers, as the camera images are available to various agencies, the news media and the public.

Dynamic Message Signs — T-REX installed seven dynamic message signs (DMS) within the project area and another six within the region. The DMS on the interstates expanded the existing network of signs used by the Colorado Department of Transportation (CDOT), providing travelers with traffic information before they reach problem areas.

Freeway and Arterial Vehicle Detection Systems — Using non-intrusive technologies, T-REX installed vehicle detection systems to monitor traffic both on the freeways and on major arterials in the region.

Traffic data collected by these systems help the traffic operations staff monitor and manage regional traffic. This traffic data, including observed average speeds and observed congestion classification, is also shared with the traveling public.

Communications — Because the ITS field devices and the transportation agencies involved are spread over a broad area, the communications system ties the operations of seven agencies together and allows transportation agencies to communicate with one another. In addition, the Department of Homeland Security has access to the cameras installed by T-REX.

Traffic Management Center — Except for the ramp metering system, all of the Intelligent Transportation Systems installed and expanded by the T-REX Project are monitored and controlled from the CDOT Traffic Operations Center. The Traffic Operations Center is staffed 24 hours a day, seven days a week, allowing CDOT to manage traffic along the corridor.

Transit Applications

The T-REX Project also includes ITS applications designed for light rail and bus passengers as well.

There are three systems:

Parking Management System — This system monitors the status of the parking facilities adjacent to the light rail stations along the corridor and provides updates to the traveling public via message boards.

Light Rail Station Traveler Information System — This system provides transit passengers information on light rail and bus operations at the light rail stations within the project area.

Transit Signal Priority — This system coordinates signal operations near light rail stations along the corridor to give preference to buses leaving the stations.

Intelligent Transportation Systems installed and expanded by T-REX are monitored and controlled from the CDOT Traffic Operations Center (TOC). The TOC is staffed 24 hours a day, seven days a week.

ELATI LIGHT RAIL MAINTENANCE FACILITY

The Elati facility has the capacity to employ up to 300 people and operates 24 hours a day.

With the addition of 19 miles of double-track light rail and 34 new light rail vehicles, the Transportation Expansion (T-REX) Project greatly expanded the Regional Transportation District's (RTD) existing system. The Elati Light Rail Maintenance Facility was constructed to provide maintenance space for approximately 100 light rail vehicles, including the new light rail vehicles, and the rest of RTD's increasing fleet. The Elati facility was built just east of the existing Southwest Corridor light rail line on the west side of Yale Avenue and Elati Streets, along the boundary of the City of Englewood and the City and County of Denver.

The 125,000-square-foot maintenance facility was constructed at the site of the former General Iron Works facility. The Elati Light Rail Maintenance Facility incorporates requirements for maintenance, inspections, light rail vehicle storage and operations offices. Groundbreaking for the $40 million facility was in July 2002. The facility was dedicated in June 2004 and became operational in January 2005.

The Elati Light Rail Maintenance Facility is an award-winning structure built on a site that required extensive clean-up. The attractive facility was selected as the 2005 award winner by the Colorado Chapter of the American Public Works Association. Cooperation between local governments and innovation in site selection and design were cited as some of the facility's achievements.

"Light maintenance" performed at the facility includes minor repairs and routine service and cleaning, such as washing the vehicles, replacing broken windshields and replacing brakes. The maintenance facility yard and its miles of track is large enough to store 100 light rail vehicles, the number of vehicles expected to be operating by

The Elati Light Rail Maintenance Facility was constructed along RTD's Southwest Corridor in Englewood at the former site of the General Iron Works.

The facility can accommodate 100 vehicles — the number of vehicles that will eventually be a part of RTD's fleet.

the year 2020. Nine tracks run through the interior of the facility, each one with the capacity to accommodate two light rail vehicles.

The facility has the capacity to employ up to 300 people and operates 24 hours a day. Staff includes administrative workers, facility personnel to maintain the property, and service and maintenance people who inspect and maintain light rail vehicles. Mechanics make minor repairs on the vehicles and train operators begin and end their daily operations from the maintenance facility.

The Elati facility joins the existing Mariposa light rail maintenance facility, which is south of the 10th and Osage light rail station adjacent to RTD's Southwest light rail line.

Elati at a Glance

- Site Area . . . . . 22.5 acres

Building Square Footage

- Administration . . . . . 9,000 sq. ft.
- Operation . . . . . 6,500 sq. ft.
- Maintenance . . . . . 82,500 sq. ft.
- Second Floor/Mezzanine . . . . . 27,000 sq. ft.
- Total . . . . . 125,000 sq. ft.

PUBLIC INFORMATION PROGRAM

The demolition of the Colorado Boulevard bridge in 2004 captured an audience that found an advantageous but safe viewing location. Much of the major construction was done at night in order to minimize inconvenience to the public.

The Transportation Expansion (T-REX) Project management recognized the importance of public information in all phases of the project, as well as the need to identify and resolve issues and concerns raised by citizens. Though the overall project goals were interrelated, the public information (PI) program concentrated on minimizing inconvenience to the public, which was the project's number one goal. The primary public information objective was to develop and maintain a high level of communication to create an informed public about the T-REX Project. Consequently, an effective, responsive communications program that recognized the fluid nature of the project and its goals was essential. The T-REX Public Information team, with members from the Colorado Department of Transportation, the Regional Transportation District and Southeast Corridor Constructors (SECC), was one team, with one vision, speaking with one voice.

Successful communication required that the T-REX team and SECC be prepared to respond to public comment and concerns in an accurate, consistent and timely effort. An effective partnership with the people impacted by the project and the general public was critical to developing a successful transportation system responsive to the needs of those living and working near the corridor and for potential users.

This required establishing two-way communications strategies that:

- Conveyed information and responded to feedback from the public
- Helped the community develop ownership and pride in the T-REX Project
- Mitigated construction impacts to the greatest degree possible by developing an effective relationship with SECC
- Conveyed completion of key project milestones

The T-REX PI team developed a comprehensive strategic communications plan. The team used a grassroots approach in its PI program.

Public outreach was accomplished through a variety of means including:

- Presentations to service organizations, homeowners associations, employers in the area, school groups and others concerned with the project's impact
- *Tracking T-REX* and *Inside T-REX*, e-mail newsletters distributed every two weeks with project updates and construction-related information
- Staffing telephone call centers at local television stations
- Developing a highly interactive Web site serving as a one-stop resource for construction information, schedules and ways to cope with construction
- The Web site served as a source of feedback from the public; Web site visitors could e-mail questions and comments to which the team responded within 2 to 3 days
- Booths at a variety of community events reaching thousands of residents, including those from minority communities
- The T-REX InfoVan, a colorfully decorated van staffed by PI team members at various community events and at project milestone events

- The establishment of a public affairs task force to local, state and national government representatives to ensure they had the information they needed to discuss T-REX and respond to questions or concerns from constituents
- An aggressive media relations program that encouraged the local media to report on T-REX and the project's long-term benefits to the community; the PI team also distributed news releases and construction advisories frequently and provided weekly updates to local broadcast media outlets, and PI team members were accessible to the media 24 hours a day
- Responding to calls to the T-REX Project telephone hotline; the 24-hour-a-day phone line served as a source of information, but also provided callers an opportunity to leave voice messages or speak with a project representative

The Hotline Information Reporting System (HIRSYS) was used to track contacts within the community, media and other stakeholders. HIRSYS contacts were compiled monthly and served as a valuable tool in identifying project information needs and areas of interest in the community.

The PI team also relied on feedback received from periodic research conducted by independent organizations. The research results were used to identify trends in community opinion about the project and helped the team develop new strategies and tactics for public outreach.

Minority Outreach

Early in the development of the public information program, the T-REX PI team realized the importance of establishing effective communication with the minority communities in the metro Denver area. Two PI team members served as liaisons to the area's minority communities. They assisted the team with broad education outreach and information to help these communities cope with the impact of day-to-day construction.

The objective was to ensure that all communities received current information regarding the T-REX Project. This was accomplished through a host of ongoing communication efforts, including interfacing with minority elected officials, community leaders, chambers of commerce and minority news media, and providing presentations to civic and community entities. One of the tools used regularly was a local cable television show specific to the project that was broadcast twice a month. Daily construction updates also were provided to the Spanish-speaking population through the Hispanic/Latino media.

TRANSOPTIONS

The T-REX Project dedicated $3 million to help commuters cope with T-REX construction.

Transportation Demand Management (TDM) is often associated with air quality or long-term traffic mitigation. During the development of the Transportation Expansion (T-REX) Project Environmental Impact Statement (EIS), it became clear that TDM would be a critical part of surviving T-REX construction.

The number one goal of the T-REX Project was to minimize inconvenience to the public during construction. To achieve this goal, the project team worked with a number of businesses and transportation organizations and associations to develop the TransOptions program. The program offered solutions and strategies to help commuters travel the 19-mile T-REX corridor as quickly and easily as possible.

Among the TransOptions strategies were:

- *Carpooling* — neighbors took turns driving each other to work
- *Vanpooling* — similar to carpooling, only bigger, using a van
- *Public Transit* — using bus and existing light rail service
- *Alternative Work Schedules* — working non-traditional hours
- *Teleworking* — using new technology to work without the drive
- *Walking* — pedestrian access was expanded
- *Biking* — annual bike-to-work days were supported by T-REX
- On-site amenities at businesses (day care centers, shuttles, etc.)

Commuters looking to avoid increased traffic as a result of construction used a variety of additional travel options, including light rail, bus and carpool.

The Colorado Department of Transportation (CDOT) and the Regional Transportation District (RTD) dedicated $3 million to help commuters cope with T-REX construction.

The funds were used to support:

- RTD transit subsidies
- Internet-based transit and transportation service information
- Vanpool subsidies
- Commuter education and outreach campaigns

This program marked the first time the agencies had ear-marked funds to support TDM, in this case TransOptions.

Vanpool Subsidies

The T-REX Project partnered with the Denver Regional Council of Governments (DRCOG) to provide subsidies to those that vanpool. First-time vanpool participants received 50 percent off their first three months in vanpools traveling to, through or from the T-REX corridor.

RTD Transit Subsidies

Eco Pass Program — Annual bus and light rail pass that employers could purchase for all employees. T-REX offered a 50 percent discount to new applicants.

Individual ValuPass Program — Annual bus and light rail pass that employers or individuals purchased. First-time applicants were eligible for a T-REX discount that allowed them to purchase a 12-month pass for the price of eight months.

Commuter Check Program — A transit voucher that was exchanged monthly for a bus or light rail pass. All applicants received the T-REX discount of 50 percent off the face value of all vouchers.

Employers Pass Outlet Program — Employers ordered monthly transit passes, which were sold to employees through an on-site outlet. The T-REX discount was 50 percent off the face value of all passes.

Guaranteed Ride Home — Employees who rode transit to work received a free taxi ride home in case of an emergency. The program was free for commuters in the T-REX corridor who purchased Individual ValuPasses. The program was already included as an option in the Eco Pass and Vanpool programs.

To be eligible for any of these discounts, commuters needed to travel to, through or from the T-REX corridor.

Several Transportation Management Organizations and Associations (TMO/As) in the metro Denver area received TDM funding and supported the TransOptions effort by offering free consultations and services to businesses.

Those organizations included:

- *Southeast Business Partnership (SEBP)* — for the Denver Tech Center, Inverness and Meridian business parks
- *Transportation Solutions* — for the Cherry Creek and Colorado Boulevard corridor
- *Downtown Denver Partnership* — for the central business district
- *Denver Regional Council of Governments* — for vanpool and carpool efforts

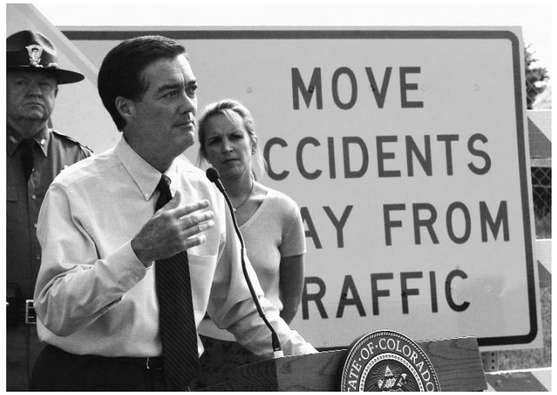
Organizations along the Southeast Corridor provided subsidies and promoted vanpools as an alternative to single-vehicle commuting.

T-REX Protects People and Property

The Transportation Expansion (T-REX) Project was built in the safest and most cost-effective manner possible for the people who worked on it, traveled through it and lived next to the construction areas.

In the case of the T-REX Project, construction had to be done adjacent to and with consideration for the needs of the traveling public and nearby residents and businesses. About 230,000 vehicles per day traveled through the T-REX corridor, typically passing quite close to construction operations. Accidents in the T-REX corridor had the potential to impact people, schedules and equipment. From conceptual planning to groundbreaking to project completion, safety was a primary concern on the T-REX Project. In addition, around 40 percent of work activities were performed during nighttime hours, meaning less traffic but sometimes increased risks to workers.

Safety was a priority on T-REX because of the close proximity in which travelers and construction workers were placed.



Governor Bill Owens promotes moving accidents from traffic to increase safety and keep traffic moving smoothly.

Keeping T-REX Workers Safe

At the peak of construction, there were about 1,200 workers on the project.

Key safety philosophies included:

- Zero Accidents, which indicated a belief that all accidents could be prevented
- Zero Tolerance, which required that each person on the project take immediate action when they observed any unsafe act or condition

Among others, the construction-related hazards faced each day on the job included:

- Worker and worksite exposure to traffic
- Potential for falls
- Excavations
- Heavy equipment operations
- Construction on the light rail system

A competent workforce was maintained through strict hiring practices, training, coaching and by holding people accountable for their actions. In addition, Southeast Corridor Constructors (SECC), the project's contractor, involved workers at all levels in job planning, hazard analysis and safety mitigation before any phase, activity or task was begun.

Monitoring Performance and Compliance

The project owners — the Colorado Department of Transportation (CDOT) and the Regional Transportation District (RTD) — and SECC were responsible for hiring staff that was dedicated to safety. The owner established safety parameters and then continually monitored the contractor's compliance to assure a safe project while meeting quality standards.

During the selection process for the T-REX contractor, SECC met and/or exceeded all qualifications, but the area that stood out was SECC's safety experience, commitment and record. SECC was known in the construction industry for its exemplary safety record, which was reinforced during its work on T-REX.

Move-It!

The T-REX Public Information team launched the "Move-It" campaign in June 2002 to encourage travelers on interstates, such as I-25 through the T-REX Project, to move minor traffic accidents to a safe location. T-REX distributed informational material on the Colorado state law indicating that a vehicle that can be safely driven following an accident must be moved off the traveled portion of the highway. The campaign raised awareness of the law and helped keep traffic running smoothly through the construction zones on the T-REX Project.

The Move-It campaign was launched with the support of Governor Bill Owens, insurance industry representatives and local law enforcement agencies.

PARTNER CONTROLLED INSURANCE PROGRAM

Partnering Insurance

A unique attribute of the Transportation Expansion (T-REX) Project was the Partner Controlled Insurance Program (PCIP). Controlled insurance programs are fairly common in the construction industry, but T-REX was different because of the partnership formed between the project owners, the Colorado Department of Transportation (CDOT) and the Regional Transportation District (RTD), and the project contractor, Southeast Corridor Constructors (SECC). CDOT and RTD shared the development, decision-making and the resulting savings from this unique insurance program.

Safety managers from various agencies worked to ensure the well-being of laborers on the project.

A construction project as massive as T-REX required a rather complicated insurance plan to ensure proper coverage. Large value coverage, which included workers' compensation; general, excess and professional liability; pollution; builder's risk; and railroad protective liability, was used on T-REX. These policies were provided by five separate insurance companies and were managed by an insurance broker.

To be successful, all contractors and subcontractors had to subscribe to the same project-instituted insurance policies. Consolidating reporting and costs in this manner had the potential to save the project millions of dollars, while providing assured and streamlined control, and a higher level of overall safety performance by participants. Shared savings were returned to the primary contractor, subcontractors, owners, and ultimately the taxpayers. No other construction project in the United States had used a controlled insurance program that was managed this way.

The project owners provided valuable oversight and help through the CDOT and RTD risk managers, as well as a full-time, on-site RTD systems safety manager and a construction safety technician. In addition, the T-REX Project's federal partners, the Federal Transit Administration and the Federal Highway Administration, played a significant role in ensuring project safety.

CDOT and RTD provided significant financial incentives to the contractor for safety and claim management. The more effective the contractor's performance, the greater its share of PCIP savings.

QUALITY MANAGEMENT

Concrete paving in the Narrows section of I-25 in April 2005.

One of the Transportation Expansion (T-REX) Project's four goals was "to provide for a quality project." This simply-stated goal was the driving force behind a systematic approach to ensuring that all work produced on T-REX complied with governing requirements. This approach included multiple levels of involvement.

Quality Control

Quality control included all the operational techniques and activities used to fulfill a set of quantitatively or qualitatively stated requirements. These activities were typically carried out at the production level and included such activities as work planning, training and process control. T-REX Project contractors documented their quality control approaches and methods in Quality Management Plans that were approved by the T-REX team. If work was subcontracted, the subcontractor had to meet the same requirements.

Quality Assurance

Quality assurance is a management tool typically fulfilled by staff independent of those producing the work. For the T-REX design-build contract, Southeast Corridor Constructors (SECC), the T-REX contractor, achieved international quality standard (ISO9001-2000) certification of its program within 12 months of Notice to Proceed. Certification demonstrated that SECC had a systematic approach to fulfilling quality requirements.

Contract Compliance Auditing

All audits were formally documented through an interactive, Web-enabled database. Quality issues, if any, were tracked in the database until they were corrected to the auditor's satisfaction. Information from these programs provided feedback to the contractor for continuous improvement. It also allowed the owners to accept the work with confidence that it was done correctly.

T-REX received the Colorado Performance Excellence's (CPEx) Timberline Award in 2004, recognizing the project's sound management and systems practices, including the contract compliance audit program.

Milestones and Final Acceptance

The T-REX design-build contract allowed for milestones, interim completions and final completion of the work so that ultimately, project acceptance and closeout occurred in phases through the end of the warranty periods, which typically lasted one year.

Through a joint task force, T-REX and SECC developed a process for communicating the status of project milestones, completions and acceptance. Open issues such as items that did not meet requirements, incomplete work (punch list items), warranty issues and system safety certifiable items were tracked within a central database. That database was accessed by members of the contractor's team and the owner's oversight team.

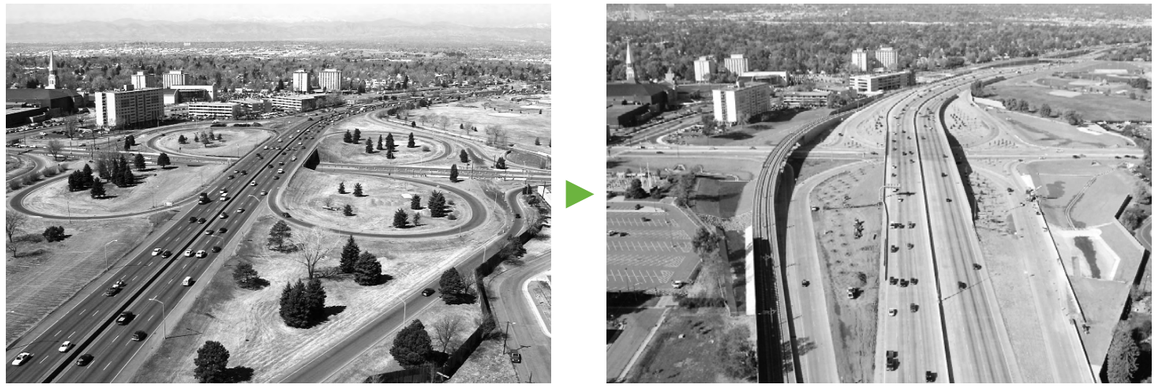
When all of the items within the scope of a contract milestone, interim completion or final completion were deemed complete, an SECC representative so indicated in the database using color codes. This signaled to the T-REX oversight representative that the contractor was done, and T-REX could concur or provide feedback that more work was to be completed.

A project chart, or "dashboard," allowed all members of the team to instantly view the current status of the work at any time, thereby eliminating potential surprises.

Landscaping in the I-25/I-225 interchange was completed in 2006.

T-REX: THEN & NOW

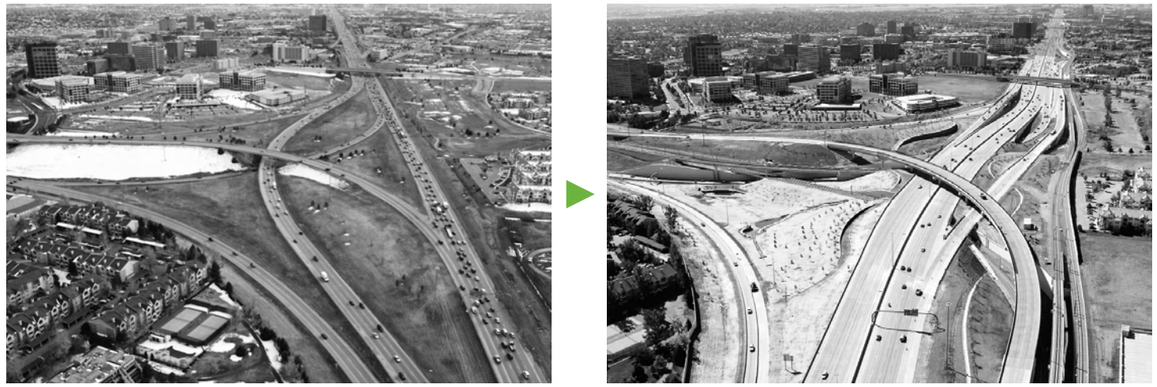
I-25 at "The Narrows" (Logan Street to Steele Street) and the Louisiana•Pearl Light Rail Station



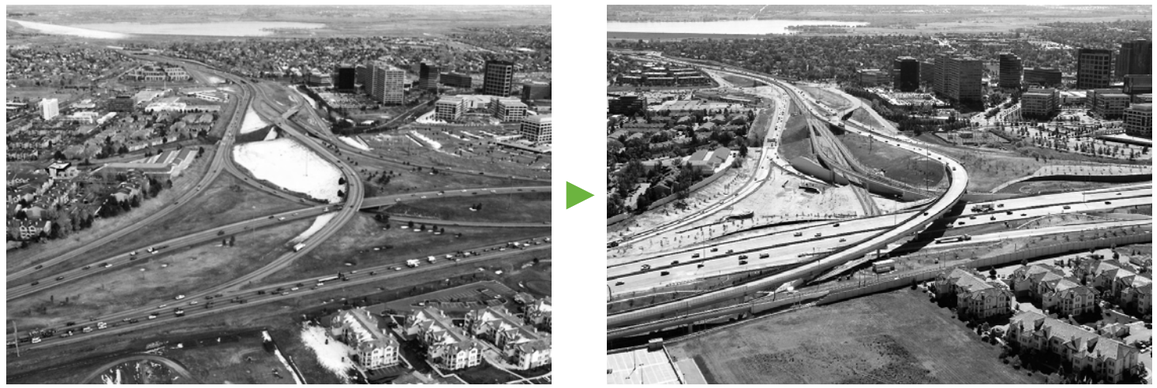
I-25 at University Boulevard and the University of Denver Light Rail Station

I-25 at Colorado Boulevard

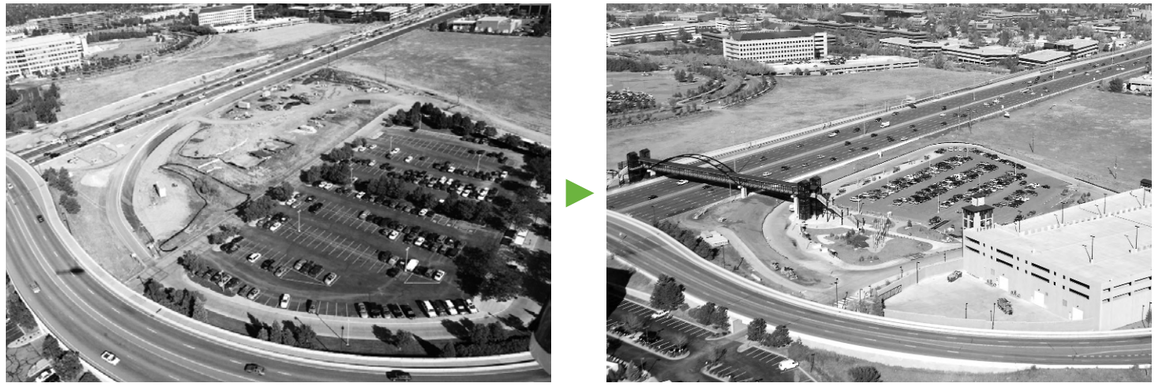
I-25 at Hampden Avenue and the Southmoor Light Rail Station



I-25 / I-225 Interchange "The Centerpiece" (looking south)

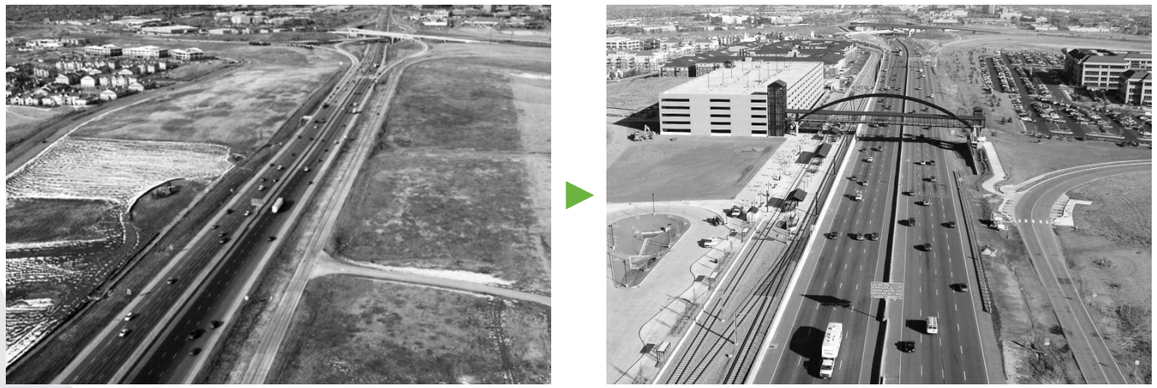


I-25 / I-225 Interchange "The Centerpiece" (looking east)

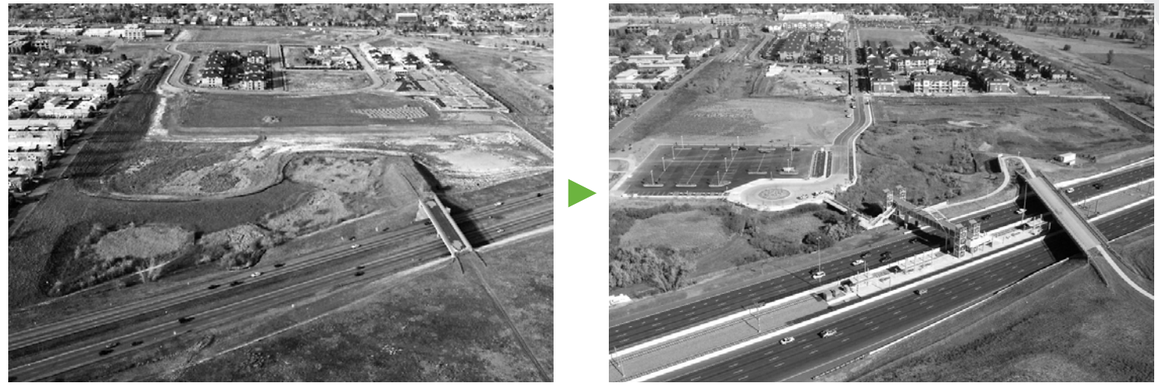


I-25 and the Arapahoe at Village Center Light Rail Station parking garage and new CDOT Maintenance Facility

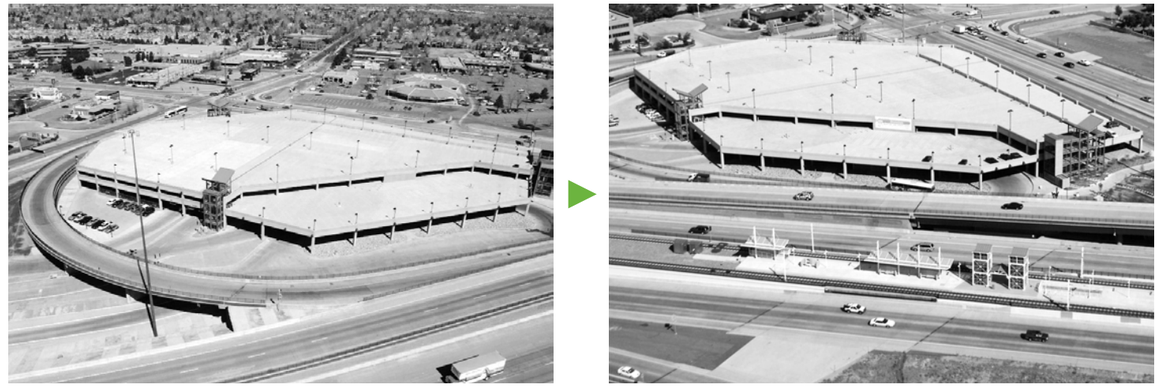
I-25 at County Line Road and the County Line Light Rail Station



I-25 at Lincoln Avenue Light Rail Station and parking garage



I-225 and the Dayton Light Rail Station



Nine Mile Light Rail Station at I-225 / Parker Road

Elati Light Rail Maintenance Facility

GLOSSARY

AC — Alternating Current. An electric current that reverses direction in a circuit at regular intervals. Power arrives at light rail substations in this form.

ADA — Americans with Disabilities Act. A federal mandate requiring public facilities to be accessible to the disabled.

Baseline survey — An initial survey, which is used as a comparison for all subsequent surveys.

Best value — Term applied to the selection of a contractor, which allows evaluation of the bidder to be based on the solutions they provide rather than granting the project to the lowest bidder.

Bike lid — A hard plastic shell that is hinged and can be pulled down over a bike and locked.

Bike locker — An enclosed box in which a cyclist may store and lock a bicycle.

Bus bay — A place for buses to stop and drop off or pick up riders who are continuing or ending their travels using light rail.

Bus transfer plaza — A facility including bus bays, bus shelters, and bike racks and lockers for riders who are continuing or ending their travels using light rail.

CBD — Central Business District. A major employment center in metro Denver.

CCTV — Closed Circuit Television. A means of providing surveillance in which cameras record activities at locations and are monitored at a central location.

CDOT — Colorado Department of Transportation.

Central control — A facility for communications with light rail vehicles.

Central Corridor — Light rail transit line that provides service to downtown Denver.

Communications bungalow — A facility housing communications equipment including closed circuit television, audio messages and vehicle location information. Every light rail station will have such a facility where equipment will be operated and monitored.

DC — Direct Current. An electric current flowing in one direction only. Power is provided to the light rail vehicles in this form.

DOT — Department of Transportation.

Design-bid-build — Traditional method of construction in which the design is fully completed, then the bidding process occurs and finally construction begins. This method is slower than the design-build method, which was used on the T-REX Project.

Design-build — Construction method in which the client provides preliminary engineering design and guidelines (approximately 30 percent of the project) to a team of designers and builders. This team completes the design based on their methods, expertise and innovations with oversight from the client. Construction may occur as design takes place, providing a much shorter time frame for project completion. This method was used for the T-REX Project.

Design-build contractor — The company hired to build the project.

DRCOG — Denver Regional Council of Governments.

DTC — Denver Technological Center.

EIS — Environmental Impact Statement. A document required by the National Environmental Policy Act of 1969.

FEIS — Final Environmental Impact Statement. A two-volume publication.

FFGA — Full Funding Grant Agreement.

FHWA — Federal Highway Administration.

FTA — Federal Transit Administration.

High-block — A concrete ramp structure with overhead shelter. Persons with disabilities, wheelchairs, strollers or other circumstances that prevent them from accessing the light rail vehicle via stairs use the highblock. These are necessary because the floor of light rail vehicles is approximately three feet above the boarding platform level.

HOA — Homeowners Association.

HOV — High Occupancy Vehicle.

I-25 — Interstate 25. The only north-south freeway in Colorado.

ITS — Intelligent Transportation Systems. Technology, such as cameras and ramp meters used to monitor traffic and parking availability, and communication devices, such as variable message signs to convey information to travelers.

kiss-n-Ride — A drop-off point for light rail riders to be left at the station by the driver of a vehicle.

Light rail maintenance facility — A light maintenance facility to serve the Central, Southeast and Southwest Corridors and the Central Platte Valley Light Rail Lines. Routine cleaning and repair of light rail vehicles takes place at the facility.

Light rail station — Stations at which travelers access light rail vehicles.

LINK — A circulator bus service operated by the Southeast Transit Authority.

Local match — A type of funding that matches federally provided funds with funding from local sources. T-REX Project funding included 40 percent from local matches including Regional Transportation District funding, contributions from local agencies and individuals, and non-cash donations.

LRT — Light Rail Transit. An additional 19 miles of light rail was constructed, connecting the Southeast Light Rail to the Central Corridor line providing service to downtown Denver and to the Southwest Corridor line providing service to Englewood and Littleton.

LRV — Light Rail Vehicle. Trains powered by overhead electricity. LRVs travel up to 55 miles per hour and accommodate up to 150 passengers per car.

MHT — Method for Handling Traffic.

MIS — Major Investment Study. The Southeast Corridor MIS began in 1995 and examined overall corridor mobility needs and identified and analyzed solutions. The recommendations from the MIS were incorporated into the Denver Regional Council of Governments Year 2020 Plan for the region.

MSE — Mechanically Stabilized Earth. A construction method for retaining walls in which concrete panels are interlocked and stacked to create a wall. Their stability comes from fabric straps, which are integrated with the soil behind the wall, using the weight of the soil to hold the wall in place. This method is useful in tight places where there is no room to provide a slope transition between two different grades.

Multi-modal — More than one form of transportation. The T-REX Project improved travel time and enhanced safety along I-25 and I-225 by incorporating highway improvements and the addition of light rail. Highway work included adding lanes and improving interchanges and drainage systems. Enhancements for pedestrians, bicycles and joggers were also included.

NEPA — National Environmental Policy Act. Established in 1969 and applicable to federal agencies, requiring them to produce an Environmental Impact Statement to identify potential environmental impacts before construction.

No-Action — An alternative considered and rejected which would have done nothing to alleviate congestion or improve safety along the Southeast Corridor.

Noise wall — Also called a sound wall. A concrete or masonry wall paralleling a roadway and designed to mitigate roadway noise. In the past, noise walls were constructed from wood fencing.

One DOT — The approach used by the Federal Highway Administration and the Federal Transit Administration to work together on the T-REX Project.

park-n-Ride — A place for light rail riders to park their cars before boarding the train or bus.

PCIP — Partner Controlled Insurance Program. A coordinated master insurance, safety and claim management program for all enrolled contractors working on the T-REX Project. This is different from an Owner Controlled Insurance Program in that the contractor and subcontractors had input in the development and operation of the PCIP.

Platform — Where light rail patrons enter and exit the train.

QA/QC — Quality Assurance/Quality Control. The process management procedures employed to ensure the quality and compliance of construction on the project.

ROW — Right-of-Way. The parcels of land adjacent to the roadway and light rail transit along the construction project. Widening of I-25 and construction of light rail transit made it necessary to purchase additional right-of-way.

RTD — Regional Transportation District.

RFP — Request for Proposal. A legal document that specifies how a project will be built. It offers instructions to bidders and provides a scope of work and other important information that govern the construction of a project.

Retaining wall — A wall used to transition between two different grades without the need for a slope.

SBD — Southeast Business District. An area in Denver in which approximately 120,000 people work. The district includes the Denver Technological Center, Greenwood Village, the cities of Centennial and Lone Tree, Inverness, Meridian and Greenwood Plaza business parks.

SCADA — Supervisory Control and Data Acquisition system. Allows continuous monitoring and control of the light rail system from a central location.

SEBP — Southeast Business Partnership. An organization of business and government leaders focused on the economic vitality and sustainability of South Metro Denver.

SECC — Southeast Corridor Constructors.

SETMO — Southeast Corridor Transportation Management Organization. This group addresses transportation issues that impact the business community from the Denver Technological Center to Lincoln Avenue along I-25.

Sound wall — See noise wall.

SETA — Southeast Transit Authority.

TABOR — Taxpayer's Bill of Rights. The Regional Transportation District was granted approval for exemption from the revenue and spending limitations of TABOR until the year 2026.

TPSS — Traction Power Substations. Places where power is converted from AC power to DC power to provide electricity for light rail vehicles. The Southeast Corridor light rail transit system has 16 substations.

T-REX Project — Transportation Expansion Project. The project area included Interstate 25 from Broadway in Denver to Lincoln Avenue in Douglas County and I-225 from I-25 to Parker Road in Aurora.

TVM — Ticket Vending Machine. A large machine from which light rail patrons purchase tickets.

Urban design — An element of design that focuses on aesthetics, or what people see, use and perceive. These may include park-n-Rides, boarding platforms, bridge architecture, landscape and wall imagery.

Windscreen — A wall on light rail platforms designed to provide protection from the wind.

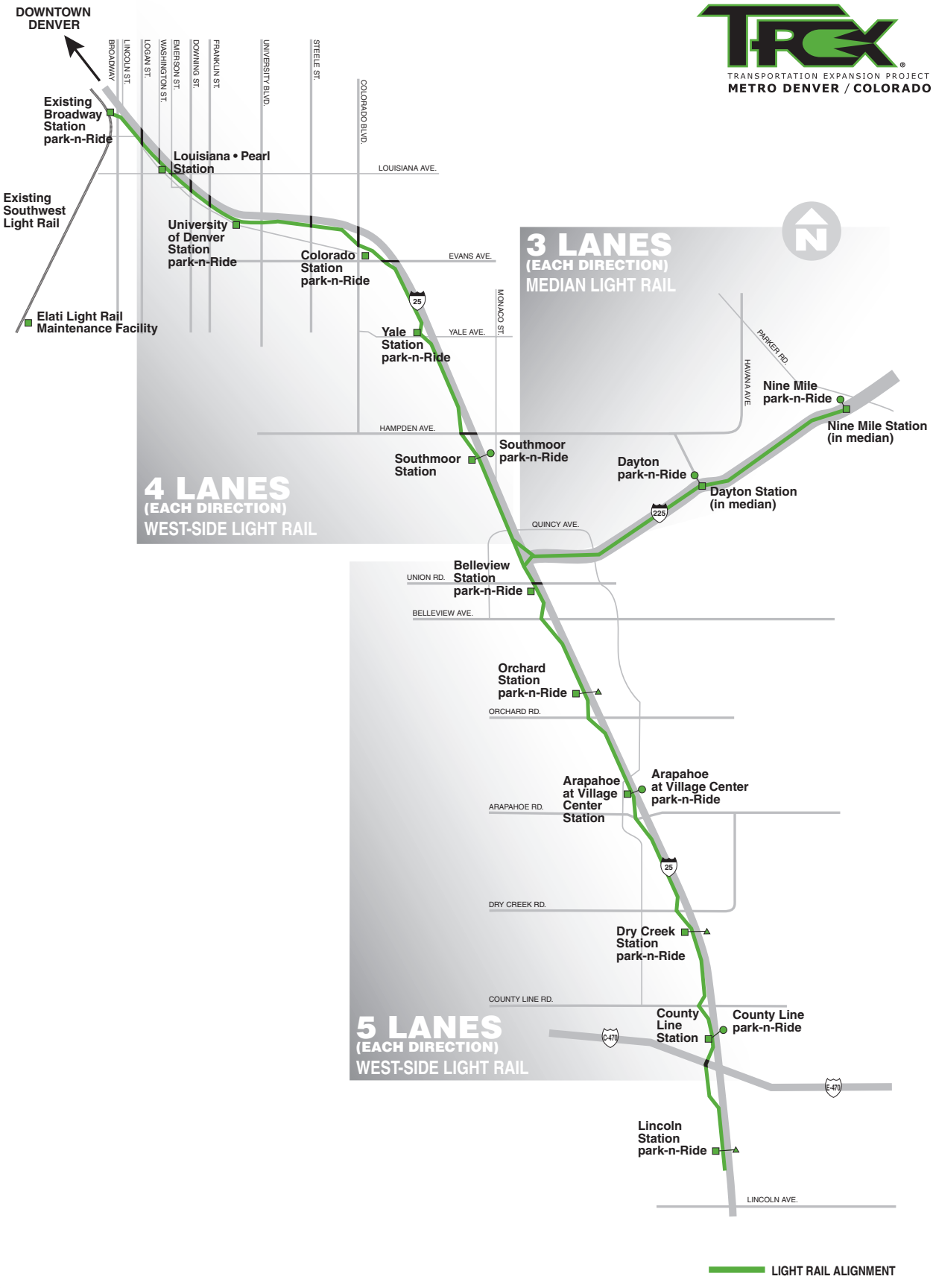
VECP — Value Engineering Change Proposal. A contractual mechanism provided by the project owners that gives a financial incentive to the contractors to reduce the cost of systems, supplies and services for work in progress. On the T-REX Project, the owners and contractor split the savings resulting from these changes.

USDOT — United States Department of Transportation.

PROJECT MILESTONES

Summer 1995	Major Investment Study (MIS) started by CDOT
Fall 1997	Denver Regional Council of Governments (DRCOG) adopted MIS recommendations
March 1998	Began Southeast Corridor Multi-Modal NEPA/EIS Process
June 1999	Governor Owens signed legislation allowing funding for project
Sept. 1999	Colorado Department of Transportation and Regional Transportation District executed Intergovernmental Agreement for the project
Nov. 2, 1999	Voters approved bond initiatives independently for RTD and CDOT to fast-track the project
Nov. 11, 1999	Project Goals established by the project's Executive Oversight Committee
Dec. 30, 1999	Design-Build Rules established by CDOT
March 16, 2000	The Record of Decision signed by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA)
April 28, 2000	Project issued Request for Qualifications
July 21, 2000	Project announced Short-List of Proposers
Aug. 1, 2000	Issued Draft Request for Proposal to short-listed firms
Aug. 16, 2000	Full Funding Grant Agreement to Congress
Nov. 2, 2000	Project issued Final Request for Proposal
Nov. 17, 2000	Full Funding Grant Agreement signed
March 23, 2001	Proposals received from design-build teams
May 17, 2001	Transportation Expansion (T-REX) Project "brand" announcement
May 22, 2001	Southeast Corridor Constructors (SECC) introduced as design-build contractor
June 1, 2001	T-REX contract awarded to SECC
June 18, 2001	SECC given Notice to Proceed
Sept. 24, 2001	T-REX Groundbreaking Ceremony
Dec. 2-4, 2001	Franklin Street Bridge demolition
Feb. 3-4, 2002	Steele Street Bridge demolition
March 13, 2002	Nine Mile Parking Garage opens
May 5-7, 2002	Washington Street Bridge demolition
July 30, 2002	Elati Light Rail Maintenance Facility Groundbreaking Ceremony
July 30, 2002	Franklin Street Bridge re-opens to traffic
Aug. 18, 2002	Louisiana Avenue Bridge demolition
Nov. 1, 2002	Opening of temporary High Occupancy Vehicle lane from Evans Avenue to Dry Creek Road
Nov. 3, 2002	Downing Street Bridge demolition
Dec. 9, 2002	Washington Street Bridge re-opens to traffic
March 16, 2003	Logan Street Bridge demolition
May 18, 2003	Quincy Avenue Bridge demolition
May 28, 2003	Arapahoe at Village Center parking garage Ground-breaking Ceremony
June 5, 2003	Southbound I-25 to northbound I-225 flyover bridge opening eliminates left merge and exit from I-25
June 7, 2003	Downing Street Bridge re-opens to traffic
June 8, 2003	Emerson Street Bridge demolition
June 27, 2003	Louisiana Avenue Bridge re-opens to traffic
Dec. 8, 2003	High Occupancy Vehicle lane eliminated from Evans Avenue to Dry Creek Road
Jan. 8, 2004	Quincy Avenue Bridge re-opens to traffic
Jan. 11, 2004	Colorado Boulevard Interchange reconstruction begins
Jan. 18, 2004	Hampden Avenue Interchange reconstruction begins
Feb. 2, 2004	Southbound I-225 to southbound I-25 tunnel opens eliminating left-lane entrance onto I-25
March 27, 2004	I-25/I-225 Interchange bridges imploded
April 1, 2004	Logan Street Bridge re-opens to traffic
May 24, 2004	Emerson Street Bridge re-opens to traffic
June 17, 2004	Elati Light Rail Maintenance Facility construction completed
Aug. 22, 2004	North portion of Hampden Avenue Bridge demolition begins
Sept. 29, 2004	Groundbreaking Ceremony for Lincoln, Dry Creek and Orchard light rail station pedestrian bridges
Oct. 2004	I-25 construction completed from Belleview Avenue to C-470
Jan. 3, 2005	Elati Light Rail Maintenance Facility is fully operational
Jan. 18, 2005	First new light rail vehicles delivered to T-REX
April 17, 2005	First pedestrian bridge set at Arapahoe at Village Center light rail station
May 27, 2005	Belleview flyover bridge to northbound I-25 opens
Sept. 25, 2005	Pedestrian bridge set at Dayton light rail station
Sept. 29, 2005	I-225 construction completed from I-25 to Parker Road
Oct. 2, 2005	Pedestrian bridge set at County Line light rail station
Nov. 10, 2005	Ceremonial milestone of last light rail track section installation (E-Clipping Event)
Nov. 29, 2005	Opening date of light rail is announced — Nov. 17, 2006 — to mark official project completion
Dec. 5, 2005	I-25/I-225 Interchange construction completed
Dec. 14, 2005	Arapahoe at Village Center parking garage opens
Aug. 22, 2006	Milestone ceremony celebrates completion of major construction and opening of all remaining highway lanes and ramps closed since 2001; introduction of The Last Big Step
Sept. 1, 2006	SECC construction is complete
Nov. 16, 2006	T-REX Project comes to an end with a celebration at Magness Arena
Nov. 17, 2006	Southeast Light Rail opens to the public

PROJECT MAP


TRANSPORTATION EXPANSION PROJECT
METRO DENVER / COLORADO
DOWNTOWN DENVER
BROADWAY
LINCOLN ST.
LOGAN ST.
WASHINGTON ST.
EMERSON ST.
DOWNING ST.
FRANKLIN ST.
UNIVERSITY BLVD.
STEELE ST.
COLORADO BLVD.
Existing Broadway Station park-n-Ride
Louisiana • Pearl Station
LOUISIANA AVE.
Existing Southwest Light Rail
University of Denver Station park-n-Ride
Colorado Station park-n-Ride
EVANS AVE.
Elati Light Rail Maintenance Facility
25
Yale Station park-n-Ride
YALE AVE.
MONACO ST.
3 LANES
(EACH DIRECTION)
MEDIAN LIGHT RAIL
N
PARKER RD.
HAVANA AVE.
Nine Mile park-n-Ride
Nine Mile Station (in median)
HAMPDEN AVE.
Southmoor Station
Southmoor park-n-Ride
Dayton park-n-Ride
Dayton Station (in median)
4 LANES
(EACH DIRECTION)
WEST-SIDE LIGHT RAIL
225
QUINCY AVE.
UNION RD.
Belleview Station park-n-Ride
BELLEVIEW AVE.
Orchard Station park-n-Ride
ORCHARD RD.
Arapahoe at Village Center Station
Arapahoe at Village Center park-n-Ride
ARAPAHOE RD.
25
DRY CREEK RD.
Dry Creek Station park-n-Ride
COUNTY LINE RD.
County Line Station
County Line park-n-Ride
5 LANES
(EACH DIRECTION)
WEST-SIDE LIGHT RAIL
C-470
E-470
Lincoln Station park-n-Ride
LINCOLN AVE.
LIGHT RAIL ALIGNMENT