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16. Abstract

Freight transportation is a major component of the transportation activity in metropolitan areas of Texas where both highway and rail routes converge. Traffic conflicts in urban areas are especially acute in areas surrounding urban rail facilities. Rail operations are also greatly hindered in urban rail facilities, which are often surrounded by incompatible land-use activities. One approach to addressing urban vehicle-rail conflicts and urban rail operations issues is to consider the relocation of train operations to new rail corridors located outside urban boundaries.

This project examines rail relocation projects in the United States to determine best practices, document project costs and expected benefits, and develop recommended policies for TxDOT use in assessing potential urban rail relocation projects throughout the state. Case studies deliver information on a broad variety of issues to be considered in railroad relocation projects including example project costs, impacts upon urban and outlying communities, potential funding mechanisms, and how potential rail relocation projects may be integrated with planning for other transportation improvements.

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RAIL RELOCATION PROJECTS IN THE U.S.: CASE STUDIES AND LESSONS FOR TEXAS RAIL PLANNING

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DISCLAIMER

The contents of this report reflect the views of the authors, who are responsible for the facts and the accuracy of the data, opinions, findings, and conclusions presented herein. The contents do not necessarily reflect the official view or policies of the Texas Department of Transportation (TxDOT), Federal Highway Administration (FHWA), The Texas A&M University System, or the Texas Transportation Institute (TTI). This report does not constitute a standard, specification, or regulation. In addition, the above listed agencies assume no liability for its contents or use thereof. The researcher in charge of the project was Curtis A. Morgan.

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- Salt Lake City Treasurer's Office
- Steve Varela, P.E., Public Works Director/City Engineer, Reno, Nevada
- Mark A. Demuth, Principal, MADCON Consultation Services

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EXECUTIVE SUMMARY

PROJECT BACKGROUND

The purpose of this project was to examine rail relocation projects in the United States to determine best practices, document benefits and costs of varying types of projects, and to develop recommended policies for the Texas Department of Transportation (TxDOT) to use in assessing proposed urban rail relocation projects throughout the state. Several detailed case studies deliver information on a broad variety of issues to be considered including project costs, impacts upon urban and outlying communities, potential funding mechanisms, and how potential rail relocation projects may be integrated with planning for the Trans Texas Corridor (TTC) or other state rail planning efforts. The lessons compiled from the case studies identified several critical issues important for the state of Texas as it considers rail relocation projects as part of its long-term strategy to address transportation system changes that will improve mobility and safety, reduce congestion, increase capacity, and provide economic opportunities.

POTENTIAL BENEFITS OF RAIL RELOCATION

Freight transportation by rail is a major component of the transportation activity within the metropolitan areas of Texas; however, conflicts between rail and highway routes are especially acute in and around urban rail facilities. Rail operations, as well as roadway traffic movement and efficiency, can be adversely affected by delay, increased emissions, and increased fuel use as a result of highway-rail traffic conflicts. Rail movement can also be impeded by the requirement to slow trains within urban areas in order to reduce the likelihood that accidents will occur—most often near at-grade highway-rail grade crossings.

These effects could potentially be minimized by relocating through-train operations to alternative rail corridors located outside the urban area or by consolidating rail operations from several urban routes into a single corridor that is grade separated or has other safety features that improve mobility and improve safety. Corridors within the urban core could be redeveloped as passenger rail or other transportation routes. New economic opportunities could also result as a variety of redevelopment projects and reduced urban sprawl.

Implementing certain types of rail relocation projects could also potentially improve the efficiency of the regional rail transportation system to the point that incremental but essential

growth in truck-to-rail modal diversion could result. This diversion could be achieved if the alternative rail corridor is planned in a way that allows railroad companies to increase overall system speed by grade separating the new line from highway traffic without substantially increasing the distance traveled or changing the grade characteristics from existing rail routes. Railroad costs incurred due to increased distance or increased grades requiring additional locomotive power must be considered when evaluating new corridors. Another potential benefit of such routing could be gained by removing some hazardous material transport to routes outside the urban core.

RAIL RELOCATION AS AN OPTION

Rail relocation is one of several options identified for dealing with the issues discussed above. As shown in Figure ES-1 and Table ES-1, the consideration of rail relocation is one part of a larger rail planning process. These charts, both taken from the 1978 Federal Rail Administration (FRA) *Rail Planning Manual - Volume II, Guide for Planners*, show that railroad relocation is also not a new solution—rather it is one that has proven to be effective and necessary given the right conditions. Table ES-1 also points out the relative benefits and costs to rail operating companies, highway users, communities and neighborhoods, and the major urban area of relocating through-train movements and yard operations to outlying areas compared with other options.

PROPOSED RAILROAD RELOCATION PROJECTS IN TEXAS

The passage of HB 3588 and other legislation provides TxDOT with the tools to be much more active in the area of rail planning for the state. Part of this planning effort includes the adoption by TxDOT of policies that encourage railroad relocation. TxDOT's Traffic Operations Manual now contains a Railroad Operations Volume, which outlines TxDOT's position in regard to railroad relocation. In Chapter 11 Section 3 of this manual, TxDOT states:

> Railroad relocation to the outer limits of the community may be a viable alternative for alleviating operational, safety, and environmental concerns, while retaining the economic benefits of railroad service to the community. Relocation generally involves the complete rebuilding of railroad facilities, including acquisition of new right of way and construction of track, drainage structures, signals and communications, crossings and separations, station facilities, and utilities *(1)*.

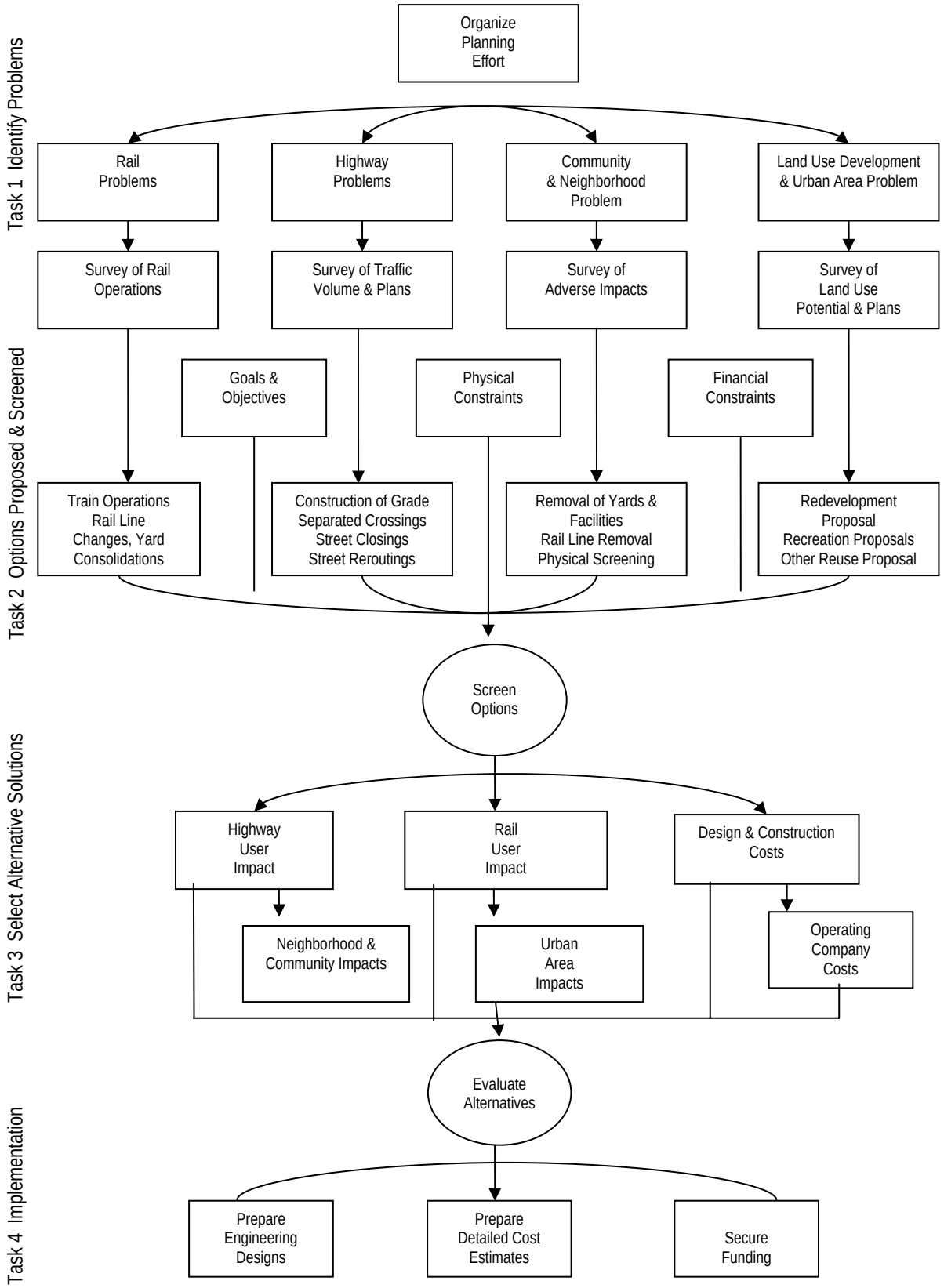


Figure ES-1. Urban Rail Rationalization Process from FRA Rail Planning Manual (2).

Table ES-1. Railroad Relocations Option Table from FRA Rail Planning Manual (*2*).

Potential Options	Potential Benefits and Costs			
	Rail Operating Companies	Highway Users	Community and Neighborhoods	Urban Area
Grade separate to eliminate at-grade crossings	Increased operating speed results in lower operating costs and better service to customers	Reduced train-related delays and accidents	Less noise due to train blowing horns at grade crossings. Improved access provides better business climate	Minor impact
Close streets to eliminate at-grade crossings	Same as above	Potential routes lost and longer travel distances	Less noise but may lose some access	Impact depends on functional class of street
Provide pedestrian bridges	Minor impact	Minor impact	Improved safety for pedestrians	Minor impact
Install crossings gates	Minor impact	Increased safety	Reduction in noise if train horns were no longer sounded	Minor impact
Install noise barrier or other aesthetic shielding	No impact	No impact if proper sight distances maintained at grade crossings	Reduced general train noise but only minor reduction of locomotive horn noise	No impact
Elevate rail lines	Minor impact	Reduced train-related delays and accidents	Increased barrier effect, noise reduction due to grade separation of crossings and installation of noise barrier	Extremely expensive
Depress rail lines	Physical problems due to grades and drainage facilities required	Same as above	Reduced barrier effect, reduced noise	Extremely expensive
Alter train operations – reschedule trains (reduced operating hours)	Decreased operating speed and flexibility may increase costs and quality of service. Capacity problems	Reduced train-related delays and accidents during peak traffic hours	Less noise during late evening hours, improved safety for pedestrians	Minor impact
Remove under-utilized or redundant track	New operating procedures would have to be developed and learned; maintenance costs could be reduced, but there might be increased operating costs.	Reduced train-related delays and accidents	Possible removal of rail problem or at least stored cars	Redevelopment potential exists for land removed from rail service

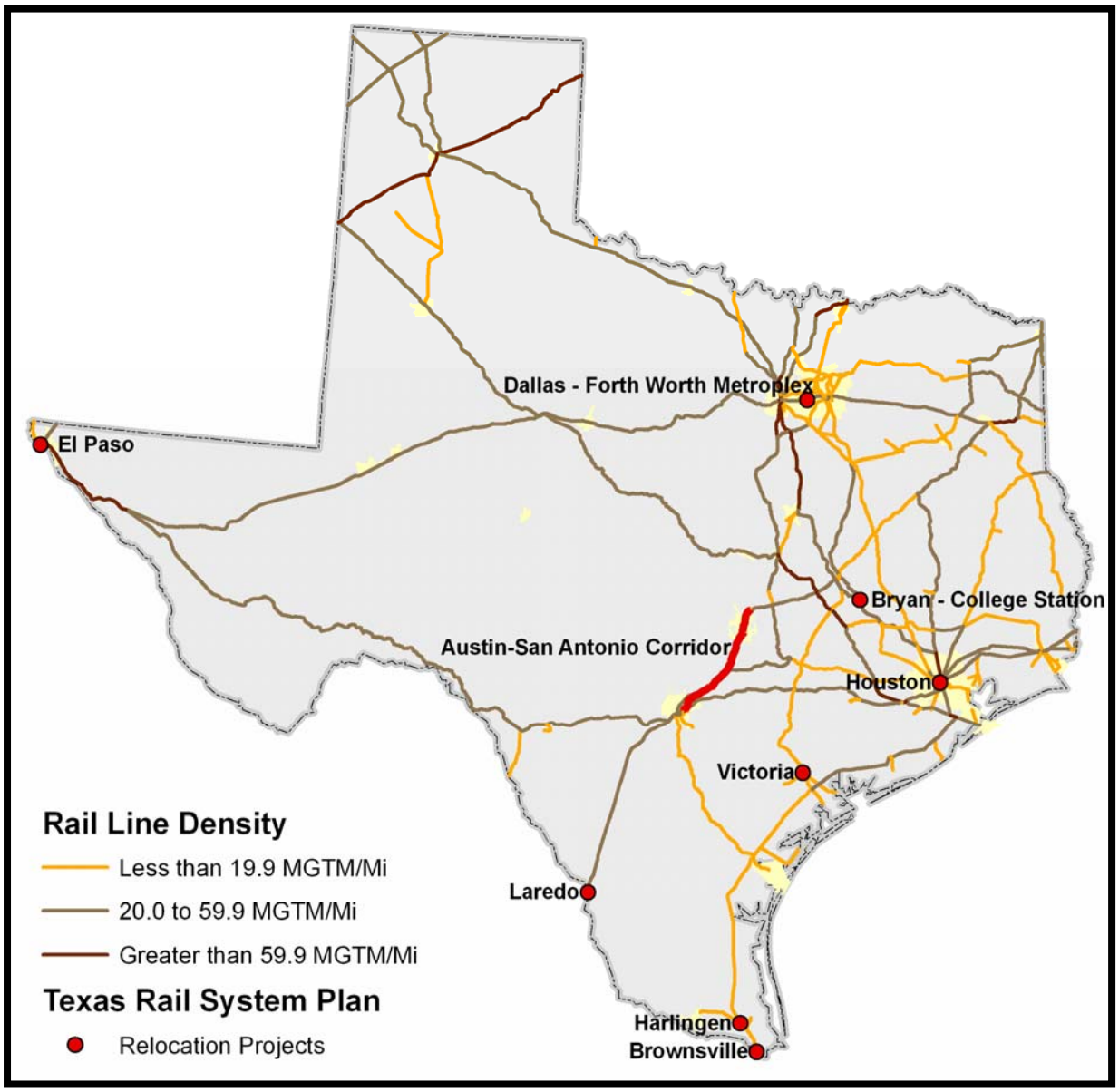
Table ES-1. Railroad Relocations Option Table from FRA Rail Planning Manual (*2*) (Continued).

Potential Options	Potential Benefits and Costs			
	Rail Operating Companies	Highway Users	Community and Neighborhoods	Urban Area
Relocate operations into existing railroad corridors, into existing transportation corridors, or into new corridors	Increase distance but may also increase speed, may create physical operating problems due to steep grades or tight curves, lost service to some customers	Elimination of rail problem in an area	Elimination of rail problem in an area	Extremely expensive, but may open up valuable land for redevelopment; impact of right-of-way (ROW) acquisition or other land use and highway plans must be considered
Reroute through traffic movements	Increased mileage and operating cost, increased interchanges, poorer service to customers	Reduced number of trains and thus reduced delays and accidents	Reduce noise and safety hazards	Minor impact
Relocate yard operations	Increase efficiency of railroad operations by reducing through part time and the number of employees	Elimination of rail problem in same areas but must be balanced against increased problems in other areas	Trade-off between reduced air pollution and noise in same areas and increases in others but net benefit because of more efficient operations	Large scale benefits due to re-use potential of redundant facilities, large cost
Provide centralized train control at critical interchange points	Reduced delays and blockages	Reduced train-related delays caused by blockages	Minor impact	Minor impact

The manual also lists environmental (noise and pollution), land use, public safety (reduced emergency service vehicle blockage), safer routes for hazardous materials, and improvements in railroad operating efficiency as potential benefits of railroad relocation and describes the planning considerations (route, grade, and development-related) that should be implemented (*1*).

TxDOT's Texas Rail System Plan (TRSP) also describes several potential rail relocation projects being considered in Texas. These projects are depicted in Figure ES-2. Several of these projects have advanced since the TRSP was originally written. Railroad relocation projects in both Harlingen and El Paso have received federal funding from the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) while the others await

further funding or planning activities. Several studies associated with these projects are also underway or have been recently completed. Due to this interest in rail relocation projects throughout the state by individual cities, metropolitan planning organizations (MPOs), and TxDOT, this research project was conceived to look at similar projects throughout the U.S. to determine what additional principles and lessons could be applied.



MGTM/Mi: Million Gross Ton-Miles per Mile of track

Figure ES-2. Map of Proposed Railroad Relocation Projects in Texas.

U.S. RAILROAD RELOCATION PROJECTS

Texas Transportation Institute (TTI) performed a wide-ranging search to identify and analyze example railroad relocation projects throughout the United States that have taken place during the past 30 years. This process consisted of finding railroad relocation projects, reviewing their components, comparing the project characteristics with projects proposed in Texas, and projecting the benefits to be derived from further study of each project. A map of these projects is shown in Figure ES-3. The result of this effort was a list of five projects, which TTI recommended for further study because of their diversity and relevance to Texas' rail goals. All of the projects selected were public-private partnerships (PPPs), which exhibit a broad range of the factors involved in implementing beneficial and successful railroad relocation projects.

The matter of interest in all of the projects considered is the degradation of rail and/or highway service as quantified by decreased mobility, limited accessibility, increased delay, and adverse environmental factors such as emissions or noise that have occurred as a result of urban development around existing rail corridors. Additionally, more qualitative measures such as safety, quality of life, and aesthetics or economic concerns such as local real estate values or land use and urban redevelopment planning strategies can also play a role in determining when and how railroad relocation projects are needed. Once the determination has been made that a project of this type is needed, alternatives analysis and more detailed project planning begins, and funding sources can be sought.

The project markers in Figure ES-3 identify both the type of relocation project and the status of the project. The type of project relates primarily to the size of the community: small urban (less than 50,000), large urban (greater than 50,000), and extra-urban, where the rail line would relocate around multiple communities. Based on the information available, the project status represents the stage in which the project currently stands or the last known project stage. Projects marked as considered include projects the research team identified as not moving into a study phase. The studied projects include projects studied in the past that never progressed toward construction and projects with recent studies that have the potential to progress toward construction but have no current indication of such. The completed/under construction projects are those currently under construction or fully implemented. Appendix A in the full report provides the list of projects by project type and status, along with project characteristics.

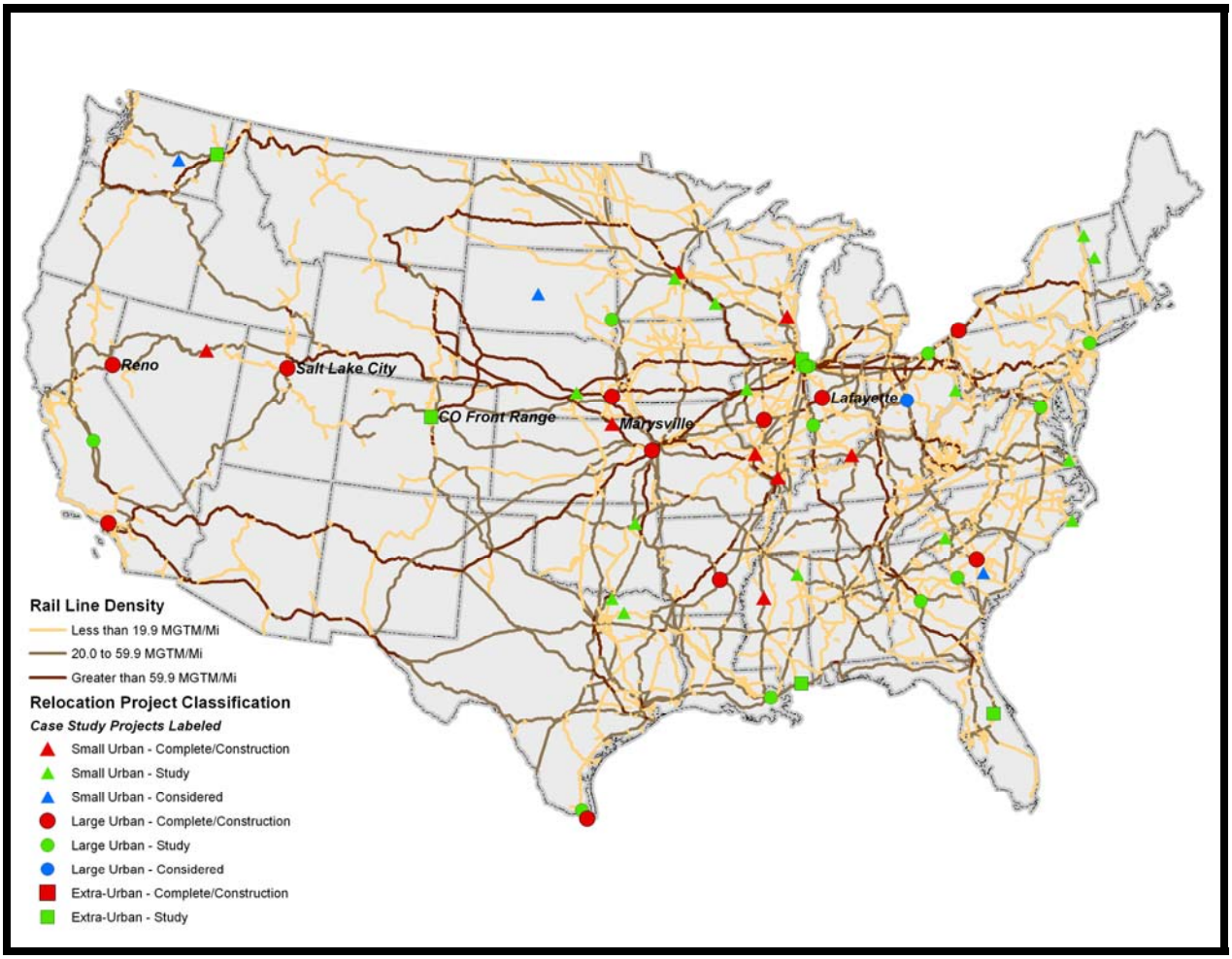


Figure ES-3. Recent U.S. Railroad Relocation Projects by Classification (post-1973).

CASE STUDIES

The research team selected five projects from those identified around the U.S. for extensive review. The process and results of this effort are described in the following sections.

Project Selection Criteria

The project team developed the following selection factors to use in determining which projects to develop into case studies:

- The project must fit any criteria outlined in recent state and federal legislation regarding funding of rail relocation projects.
- The project must be similar to relocation projects being considered in Texas.

- The projects selected must be diverse enough to provide the maximum potential to identify the range of issues related to rail relocation projects.

Identification/Grouping of Types of Projects Being Considered in Texas

The second project selection criteria listed above was to select projects similar to the types of projects being considered within Texas. To accomplish this, the TTI project team conducted a thorough review of the freight rail projects listed in the recently published Texas Rail System Plan. Once this list was complete, the team grouped the projects into three project types—small urban area bypass, large urban area consolidation/relocation, and extra-urban consolidation/bypasses. Texas examples in each of these groups are shown in Table ES-2.

Table ES-2. Texas Relocation Project Examples by Type.

Project Types	Example
Small Urban Area Bypass	Victoria Rail Bypass (Proposed) Bryan/College Station Rail Relocation (Proposed) Harlingen Bypass (Proposed)
Large Urban Area Consolidation/Relocation	Port of Houston- Houston Rail Corridor Consolidation (Proposed) Harris County- DMJM Houston Rail Relocation Plan (Proposed) Brownsville Rail Relocation Project El Paso Relocation (Proposed)
Extra-urban Consolidation/Bypass	North Central Texas Council of Governments (NCTCOG) Dallas Ft Worth (D/FW) Area Western and Southern Bypasses (Proposed) Austin/San Antonio Union Pacific Eastern Bypass (Proposed)

TTI has defined these three project types as indicated below:

Small Urban Area Bypass: Relocation would move the rail line out of a small or mid-sized urban area to minimize traffic and/or safety conflicts.

Large Urban Area Consolidation/Relocation: Consolidation or relocation of routes occur within a large urbanized area.

Extra-urban Consolidation/Bypass: Consolidation or bypass done in an area outside urbanized boundaries to bypass completely a large urban area or to minimize traffic conflicts in an extra-urban location.

Selected Case Study Projects

Five projects were recommended for further in-depth case studies. A common characteristic of all of these projects is that they are PPPs involving both a state or city agency and one or more private sector railroad company partners. In each project, the public sector agencies also use a variety of federal funding programs to pay for the desired rail infrastructure improvements.

- **Marysville, Kansas** (Single-railroad (RR), Small Town): This project was pursued because major arterials were blocked by train traffic for significant amounts of time (projected at up to 14 hours per day) by a UP mainline. The project, which implemented a bypass around a major portion of the city, was opened to rail traffic in early 2006. The project included city, state, railroad, and U.S. Army Corps of Engineers involvement since it was combined with a levee improvement project. Eastern and western bypass plans were rejected before accepting the final plan. Kansas Department of Transportation (KDOT) was responsible for ROW acquisition. This project is an excellent example of teaming to find the best solution to several problems.
- **Lafayette, Indiana** (Single-RR, Urban): This project was pursued because there were several miles of mainline street trackage in the downtown area that blocked traffic and affected public safety in the central business district (CBD) of Lafayette. The routes of two railroads were consolidated into a new alignment adjacent to the Wabash River, and 42 at-grade crossings were removed. Some redevelopment was achieved along the new right of way, also providing examples of land use and economic development benefits that can be derived from a rail relocation project. The project was completed in 2003.
- **Salt Lake City Gateway, Utah** (Multi-RR, Urban): As part of its preparations for hosting the 2002 Winter Olympics, Salt Lake City redeveloped a blighted urban area near a UP yard in downtown and consolidated freight rail service from three lines/yards to one line/yard. Passenger rail services and facilities were also improved; however, the largest public benefits from the project were related to the redevelopment aspects. This project shows the potential for reconfiguration of rail lines within an urban area that may be possible following a merger or abandonment.

State, local, or private purchase of rail corridors and continued freight service were achieved as a result.

- **ReTRAC Project, Reno, Nevada** (Single-RR, Urban): This project, aimed at eliminating 11 grade crossings in downtown Reno, was executed by digging a rail trench over 2 miles long through the highly congested urban area. The trench was opened for service in November 2005 to rail traffic, and the temporary shoofly trackage was removed. This project serves as an example of a vertical relocation within an urban area to reduce traffic congestion and to improve safety and quality of life. An additional value of selecting this project is to study the process by which a number of bypass alternatives were considered before selecting trenching as the preferred relocation method.
- **Front Range Project, Eastern Colorado** (Multi-RR, Extra-urban): This project was conceived to eliminate a large quantity of rail movements that have neither origin nor destination in Denver. This project is still in the study stage; however, it calls for the construction of several mainline connector segments to the east of the city in less developed areas to provide an effective north to south freight bypass. The effect of competition between multiple railroads participating in the planning as it was originally proposed, as compared to the final plan, is an interesting facet to consider.

Case Study Summary Sheets

The following pages contain one-page summary sheets describing the findings in each of the case studies carried out during the research project.

Marysville, Kansas
Rail Relocation, Grade Separation, and Flood Control Project

Description: Relocated UP mainline from center of small urban area where trains blocked traffic on two U.S. highways causing long traffic delays. Constructed two major grade separation structures for U.S. highways 36 and 77. Closed 11 at-grade crossings. Rail line was moved to new alignment along southern and western edge of town. Project also included construction of a flood prevention levee to alleviate long-term flooding issues for town.

Duration: Approximately 14 years to implement; various studies for over 50 years, opened in 2006

Cost: Total Cost Estimate $87 million; Construction costs approximately $51 million

Project Partners: Kansas Department of Transportation
U.S. Department of Transportation
U.S. Army Corps of Engineers (COE)
City of Marysville
Union Pacific Railroad

Funding Sources: $2.9 million earmark from the Transportation Equity Act for the 21st Century (TEA-21)
State highway funding
$1.0 million from City of Marysville
Union Pacific Railway funds
Transportation and Community and System Preservation (TCSP) funds

PPP Aspects: KDOT designed/paid for highway improvements and purchased ROW
UP designed/paid for rail improvements
COE designed levee

Benefits: Reduced traffic/rail conflicts by closing 11 at-grade crossings
Mainline train speed increased from 20 mph to 50 mph
Added UP rail yard capacity along new route
New crew change/office facility may lead to additional local employment
Potential for increased urban development by reducing traffic conflicts
Eliminated long-term flooding problem for western Marysville

Lessons for Texas: Seek projects that address more than one goal when possible.
Seek projects where private partners also benefit.
Seek multiple project partners.
Project work can be split among partners by expertise areas.
Multiple project elements can proceed simultaneously if work is properly phased.

Lafayette, Indiana
Railroad Relocation Project

Description: Relocated CSX Transportation (CSX) and Norfolk Southern (NS) rail lines from city streets through Lafayette's downtown area and consolidated them into a new alignment along the Wabash River. Closed 42 at-grade crossings. Constructed several new grade separations and converted old bridge into bicycle/pedestrian facility with an adjoining park/plaza area. Moved and restored historic rail depot for use as multimodal passenger terminal.

Duration: 29 years, completed in 2003

Cost: $185.7 million

Project Partners: City of Lafayette, Indiana
Tippecanoe County, Indiana
Indiana Department of Transportation (INDOT)
U.S. Department of Transportation
Norfolk Southern Railway and predecessors
CSX Transportation and predecessors

Funding Sources:
- 1973 Federal Aid Highway Act Demonstration Program (1974 Amendment)
- Multi-year Federal Transportation Funding Acts (Surface Transportation and Uniform Relocation Assistance [STURA], Intermodal Surface Transportation Efficiency Act [ISTEA], and TEA-21)
- State funds (highway, bridge, and state Industrial Rail Service funds)
- Local funds (portion of county income tax)
- Railroad participation (primarily consisted of land transfers/swaps)

PPP Aspects:
- City and railroads conducted right-of-way (ROW) swaps
- NS advanced City $9.6 million loan to speed up TEA-21 funded work
- Project built new access roads to existing railroad maintenance facilities

Benefits:
- Increased safety by removing 42 at-grade crossings
- Consolidated rail traffic through city into a single corridor
- Bicycle-pedestrian bridge over Wabash River
- Constructed several new grade-separated highway bridges
- Moved and restored historic rail station to serve as multimodal terminal

Lessons for Texas:
- Leverage available federal demonstration project funding.
- Railroad relocation projects can be divided into independent phases and implemented over an extended period.
- Establish working relationships with railroad companies early in project.
- Implementing agency must work to maintain continued public, legislative, and financial support over the life of the project.

Reno, Nevada
Rail Grade Depression

Description: The project depressed a length of double track main line bisecting downtown Reno for an excess of 2 miles in order to decrease noise, enhance safety and encourage economic development. The resulting infrastructure eliminated 12 grade crossings in the CBD of Reno and increased the local rail speed limit from 20 to 60 mph.

Duration: Approximately 9 years, opened in 2005

Cost: $282 million

Project Partners: City of Reno
Nevada DOT (NDOT)
Union Pacific Railroad

Funding Sources: $21 million earmark from TEA-21
$18 million Assessment District
$58 million Union Pacific Railway funding
Remaining funds from sales/room tax raises (finance bonds/Transportation Infrastructure Finance and Innovation Act [TIFIA] loan)

Funding Vehicles: $113.2 million municipal bond issue
$73.5 million TIFIA loan
Remaining pay-as-you-go

PPP Aspects: NDOT raised most of the funds and hired the consultants and contractors.
UP provided funds, real estate, and design criteria for the rail portion.

Benefits: Reduced traffic/rail conflicts by closing 12 at-grade crossings
Mainline train speed increased from 20 mph to 60 mph
Increased safety and improved mobility
Increased Reno's tax base

Lessons for Texas: Maximize the use of federal loan programs when possible.
Work closely and in good faith with the railroad(s).
It may be desirable to maintain existing freight and passenger service routes and grade separate an entire corridor than to geographically relocate train service.
Keep the public involved by maintaining a robust public information program.

Salt Lake City, Utah
Gateway Project Rail Consolidation and Urban Redevelopment

Description: Consolidation of three rail lines in Salt Lake City's old industrial Gateway District into a single rail corridor, including the construction of a new multimodal transportation center. The project was coordinated with DOT plans for reconstruction of I-15 to shorten existing off-ramp viaducts that prevented redevelopment of the Gateway District.

Duration: Approximately 4 years actual, approximately 22 years in planning, Ongoing development, Rail activities completed in 2002

Cost: Total Cost Estimate $32 million

Project Partners: Utah Department of Transportation
City of Salt Lake
Union Pacific Railroad

Funding Sources: Utah Department of Transportation
Federal Transit Administration
City of Salt Lake
Economic Development Administration
Department of Housing and Urban Development
Union Pacific Railroad

PPP Aspects: Boyer Corporation financed $375 million in urban development.
Artspace financed $12 million in affordable housing/office projects.
UP shared the cost of rail improvements.

Benefits: $2.0 million per year in tax increment revenue

Lessons for Texas: Urban redevelopment can serve as the main public benefit behind a rail consolidation project.
Unique sequences of events may create narrow windows of opportunity.

Colorado Front Range
Railroad Infrastructure Rationalization Project

Description: The main focus of the project is to remove significant through freight rail movements from traveling through the Front Range urban corridor, which consists of communities such as Denver, Colorado Springs, and Pueblo. In addition, improvements to the urban rail infrastructure and strategic placement of highway-rail grade separations will significantly improve rail and vehicular mobility in the urban areas, particularly Denver. Coordinating the freight rail changes with existing passenger rail and mobility improvement planning activities may also provide additional travel options for Front Range commuters.

Duration: Planning horizon encompasses the years 2004 through 2030.

Cost: Mid-range estimate of $1.2 billion

Project Partners: Colorado Department of Transportation (CDOT)
Union Pacific Railroad
BNSF Railway (BNSF)

PPP Aspects: The initial study indicates a public-private partnership is likely required to finance the project.

Benefits: Mid-range total public benefit estimate of $5.17 billion
Transportation efficiency benefits for both railroads and motorists
Economic development and land use benefits
Environmental benefits by reducing emissions, noise, and vibration
Passenger rail facilitation

Next Steps: Received $2 million earmark for next phase, which includes developing the strategy for conducting environmental clearance

Lessons for Texas:
- Coordinate freight rail projects with other transportation planning activities, such as passenger rail planning, to potentially benefit both.
- Examine all direct and indirect ways the project may benefit both the public and private sectors.
- When expecting a project to continue into any new phases, all public and private stakeholders must agree on the findings of the previous stage and the allocation of benefits and costs amongst stakeholders.
- Achieving financial and operational equity amongst several railroads is very challenging.

LESSONS FOR TEXAS RAIL PLANNING

As a result of these case studies, the researchers identified several important lessons for Texas rail relocation projects. The lessons appear at the bottom of each of the case study summary sheets above. In each of the case studies and in Chapter 8 of the full report, each lesson is described in more detail. Additionally, the lessons are summarized into five major categories, as discussed in the conclusions below.

CONCLUSIONS

Railroad relocation is a viable option for addressing several issues within urban areas and should be considered by TxDOT and local planners as one of several potential options for improving mobility and safety, reducing congestion, increasing capacity, and providing new economic development opportunities. This research provides TxDOT rail planners with additional tools to use in evaluating, prioritizing, and implementing rail relocation projects to address transportation needs. Public sector rail relocation planning efforts must take into account the needs of the private rail carriers, businesses served by rail, real estate developers, neighborhoods, and other parties when making decisions. The lessons derived from the case study projects in this research project provide guidance in several areas. These include:

- project prioritization/selection characteristics,
- potential funding sources and methods,
- partnering principles for railroad companies and other private sector partners,
- public information/involvement recommendations, and
- corridor relocation and development recommendations.

By taking these factors into account, the public sector can judiciously use rail relocation as a tool to improve urban transportation characteristics, increase public safety in certain areas, and make incremental improvements to rail operations.

CHAPTER 1:
RAIL RELOCATION PROJECTS

BACKGROUND

The purpose of this project was to examine rail relocation projects in the United States to determine best practices, document benefits and costs of varying types of projects, and to develop recommended policies for the Texas Department of Transportation (TxDOT) to use in assessing proposed urban rail relocation projects throughout the state. Several detailed case studies deliver information on a broad variety of issues to be considered including project costs, impacts upon urban and outlying communities, potential funding mechanisms, and how potential rail relocation projects may be integrated with planning for the Trans Texas Corridor (TTC) or other state rail planning efforts. The lessons compiled from the case studies identify several critical issues important for the state of Texas as it considers rail relocation projects as part of its long-term strategy to address transportation system changes that will improve mobility and safety, reduce congestion, increase capacity, and provide economic opportunities.

POTENTIAL BENEFITS OF RAIL RELOCATION

Freight transportation by rail is a major component of the transportation activity within the metropolitan areas of Texas; however, conflicts between rail and highway routes are especially acute in and around urban rail facilities. Rail operations, as well as roadway traffic movement and efficiency, can be adversely affected by delay, increased emissions, and increased fuel use as a result of highway-rail traffic conflicts. Rail movement can also be impeded by the requirement to slow trains within urban areas in order to reduce the likelihood that accidents will occur—most often near at-grade highway-rail grade crossings.

These effects could potentially be minimized by relocating through-train operations to alternative rail corridors located outside the urban area or by consolidating rail operations from several urban routes into a single corridor that is grade separated or has other safety features that improve mobility and improve safety. Corridors within the urban core could be redeveloped as passenger rail or other transportation routes. New economic opportunities could also result as a variety of redevelopment projects and reduced urban sprawl.

Implementing certain types of rail relocation projects could also potentially improve the efficiency of the regional rail transportation system to the point that incremental but essential growth in truck-to-rail modal diversion could result. This diversion could be achieved if the alternative rail corridor is planned in a way that allows railroad companies to increase overall system speed by grade separating the new line from highway traffic without substantially increasing the distance traveled or changing the grade characteristics from existing rail routes. Railroad costs incurred due to increased distance or increased grades requiring additional locomotive power must be considered when evaluating new corridors. Another potential benefit of such routing could be gained by removing some hazardous material transport to routes outside the urban core.

RAIL RELOCATION AS AN OPTION

Rail relocation is one of several options identified for dealing with the issues discussed above. As shown in Figure 1 and Table 1, the consideration of rail relocation is one part of a larger rail-planning process. These charts, both taken from the 1978 Federal Rail Administration (FRA) *Rail Planning Manual - Volume II, Guide for Planners*, show that railroad relocation is also not a new solution—rather it is one that has proven to be effective and necessary given the right conditions.

Table 1 also points out the relative benefits and costs to rail-operating companies, highway users, community and neighborhoods, and the major urban area of relocating through-train movements and yard operations to outlying areas compared with other options.

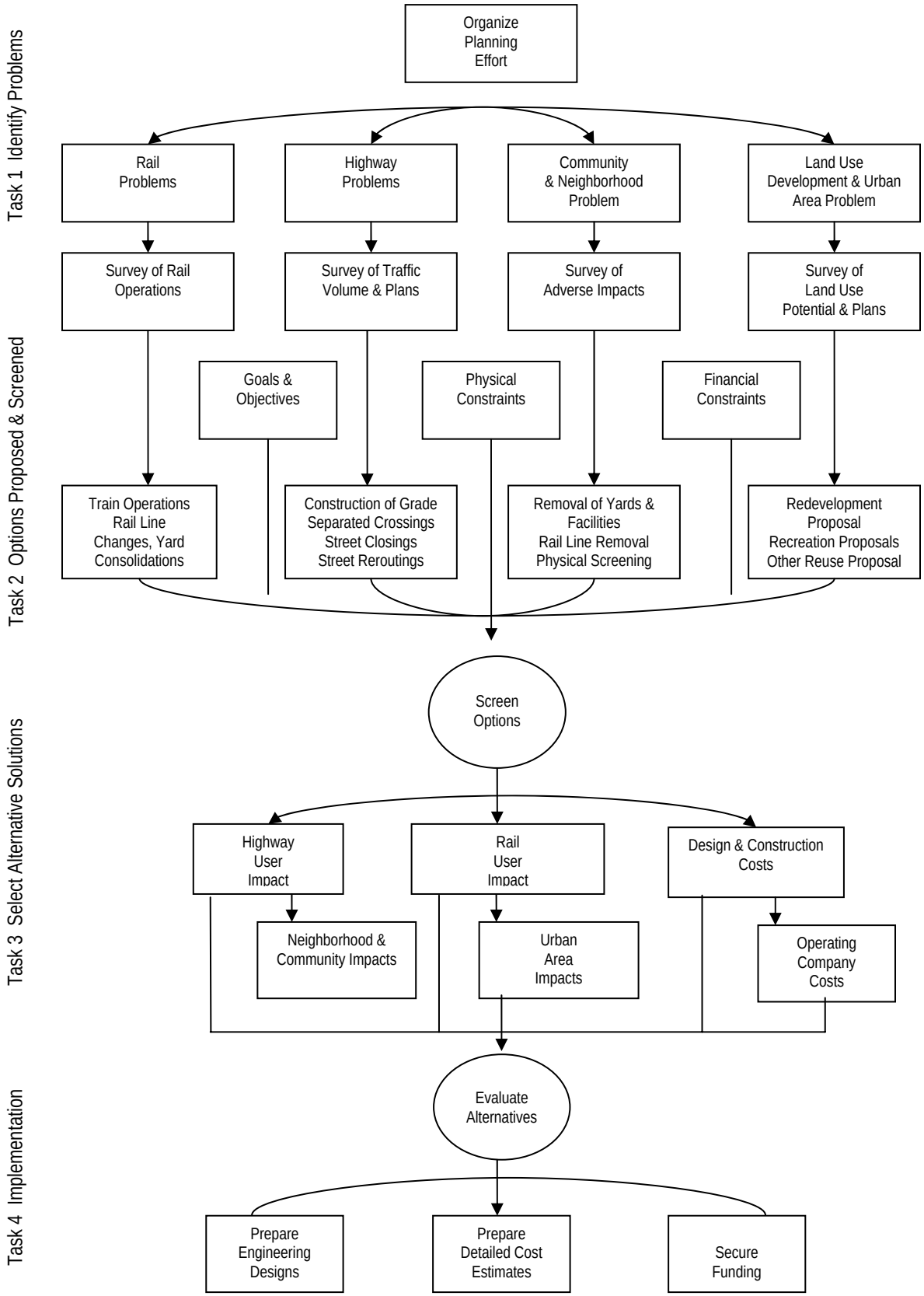


Figure 1. Urban Rail Rationalization Process from FRA Rail Planning Manual *(2)*.

Table 1. Railroad Relocations Option Table from FRA Rail Planning Manual *(2)*.

Potential Options	Potential Benefits and Costs			
	Rail Operating Companies	Highway Users	Community and Neighborhoods	Urban Area
Grade separate to eliminate at-grade crossings	Increased operating speed results in lower operating costs and better service to customers	Reduced train-related delays and accidents	Less noise due to train blowing horns at grade crossings. Improved access provides better business climate	Minor impact
Close streets to eliminate at-grade crossings	Same as above	Potential routes lost and longer travel distances	Less noise but may lose some access	Impact depends on functional class of street
Provide pedestrian bridges	Minor impact	Minor impact	Improved safety for pedestrians	Minor impact
Install crossings gates	Minor impact	Increased safety	Reduction in noise if train horns were no longer sounded	Minor impact
Install noise barrier or other aesthetic shielding	No impact	No impact if proper sight distances maintained at grade crossings	Reduced general train noise but only minor reduction of locomotive horn noise	No impact
Elevate rail lines	Minor impact	Reduced train-related delays and accidents	Increased barrier effect, noise reduction due to grade separation of crossings and installation of noise barrier	Extremely expensive
Depress rail lines	Physical problems due to grades and drainage facilities required	Same as above	Reduced barrier effect, reduced noise	Extremely expensive
Alter train operations – reschedule trains (reduced operating hours)	Decreased operating speed and flexibility may increase costs and quality of service. Capacity problems	Reduced train-related delays and accidents during peak traffic hours	Less noise during late evening hours, improved safety for pedestrians	Minor impact
Remove under-utilized or redundant track	New operating procedures would have to be developed and learned; maintenance costs could be reduced, but there might be increased operating costs.	Reduced train-related delays and accidents	Possible removal of rail problem or at least stored cars	Redevelopment potential exists for land removed from rail service

Table 1. Railroad Relocations Option Table from FRA Rail Planning Manual (2) (Continued).

Potential Options	Potential Benefits and Costs			
	Rail Operating Companies	Highway Users	Community and Neighborhoods	Urban Area
Relocate operations into existing railroad corridors, into existing transportation corridors, or into new corridors	Increase distance but may also increase speed, may create physical operating problems due to steep grades or tight curves, lost service to some customers	Elimination of rail problem in an area	Elimination of rail problem in an area	Extremely expensive, but may open up valuable land for redevelopment; impact of right-of-way (ROW) acquisition or other land use and highway plans must be considered
Reroute through traffic movements	Increased mileage and operating cost, increased interchanges, poorer service to customers	Reduced number of trains and thus reduced delays and accidents	Reduce noise and safety hazards	Minor impact
Relocate yard operations	Increase efficiency of railroad operations by reducing through part time and the number of employees	Elimination of rail problem in same areas but must be balanced against increased problems in other areas	Trade-off between reduced air pollution and noise in same areas and increases in others but net benefit because of more efficient operations	Large scale benefits due to re-use potential of redundant facilities, large cost
Provide centralized train control at critical interchange points	Reduced delays and blockages	Reduced train-related delays caused by blockages	Minor impact	Minor impact

RAIL RELOCATION FUNDING HISTORY

Past Federal Rail Relocation Legislation

The federal SAFETEA-LU transportation allocation bill, passed in 2005, was the first major federal funding act specifically outlined for rail relocation since the Federal-Aid Highway Act of 1973. The 1973 legislation named 19 specific rail relocation projects as part of the Railroad-Highway Crossings Demonstration Program (elsewhere referred to as the Railroad Relocation Demonstration Program). This program provided for "the relocation of railroad lines from the central area of cities to eliminate railroad-highway grade crossing conflicts (3)." These

projects advanced slowly over the coming decades, and many of them have only recently been completed.

A primary example of one of these projects would be the Brownsville, Texas relocation (discussed in more detail in Chapter 7) that began as one of the 19 listed projects, which was only recently completed in 2005. As with most of the projects, the Brownsville relocation was segmented into several smaller projects (grade separations, yard construction, etc.) that were sequentially funded through various annual transportation appropriation acts. Because of this long-term, segmented funding and administration process, little overall analysis of the 19 original projects has been done. In effect, rather than being viewed as "rail relocation projects," many of these projects came to be viewed as a string of highway improvements. A few of the projects were documented and appear in the list of projects the team considered for in-depth review. ISTEA and subsequent acts extended the authorization for these projects throughout the years, but no new "rail relocation" programs were approved.

SAFETEA-LU

SAFETEA-LU, the most recent federal transportation funding authorization act, included a section describing a program of "capital grants for rail line relocation projects" that will be made available to states. While neither the temporary nor final rules for this program have been put forward by U.S. DOT, there are two criteria listed for eligibility of a rail line to receive funding. Section 20154(b) of SAFETEA-LU states:

> A state is eligible for a grant under this section for any construction project for the improvement of the route or structure of a rail line that either—
> (1) is carried out for the purpose of mitigating the adverse effects of rail traffic on safety, motor vehicle flow, community quality of life, or economic development; or
> (2) involves a lateral or vertical relocation of any portion of the rail line *(4)*.

The program authorizes allocation of up to $350 million per year for fiscal years 2006 through 2009 to fund rail relocation projects at a 90 percent federal -10 percent local basis. The law also states that at least half of the approved projects must be under $20 million in cost to ensure that a few major projects do not consume the majority of the funds *(5)*.

Texas Rail Relocation and Improvement Fund (Proposition 1)

In addition to the new federal funding program, in November 2005 Texas voters approved Proposition 1, which amends the Texas Constitution to allow the creation of the Texas Rail Relocation and Improvement Fund. According to the legislation (HJR 54 from the 79th Legislature), this revolving fund would be used to:

> …finance or partially fund the relocation and improvement of privately and publicly owned passenger and freight rail facilities. Funds would be use in the interest of improving mobility and public safety around the state for projects such as:
>
> - relieving congestion on public highways;
> - enhancing public safety;
> - improving air quality; or
> - expanding economic opportunity (*6*).

These criteria are similar to the recent federal program and give the Texas Transportation Commission the power to bond monies allocated to the fund by future legislatures to increase available funding.

PROPOSED RAILROAD RELOCATION PROJECTS IN TEXAS

The passage of Proposition 1, along with HB 3588, HB 2702, and other state legislation, has provided TxDOT the tools to be much more active in rail planning activities including railroad relocation. Part of this growing planning effort has included the adoption by TxDOT of policies that encourage railroad relocation. TxDOT's Traffic Operations Manual now contains a Railroad Operations Volume that outlines TxDOT's position in regard to railroad relocation (*1*). It states the following in Chapter 11 Section 3:

> Railroad relocation to the outer limits of the community may be a viable alternative for alleviating operational, safety, and environmental concerns, while retaining the economic benefits of railroad service to the community. Relocation generally involves the complete rebuilding of railroad facilities, including acquisition of new right of way and construction of track, drainage structures, signals and communications, crossings and separations, station facilities, and utilities.
>
> *Benefits.* Benefits of railroad relocation extend beyond those associated with crossing safety and operations. Possible additional benefits may include:

- improved environmental quality resulting from decreased noise and air pollution
- improved land use and appearance
- improvements in the railroad's operational efficiency.
- elimination of obstructions to emergency vehicles
- safer routes for hazardous materials movement.

Planning. Many factors exist in planning for railroad relocation. The new route should provide good alignment, minimum grades, and adequate drainage. Sufficient right of way should be available to provide the necessary horizontal clearances, additional rail facilities as service grows, and a buffer for abating noise and vibrations. The number of new highway-rail intersections should be minimal. Zoning the property adjacent to the railroad as light and heavy industrial further isolates the railroad corridor from residential and commercial activity. Businesses and industry desiring rail service can locate in this area.

The planning guidelines described in the TxDOT manual are vital to enforce with new projects. An historic example of how a railroad relocation project in the last century, without subsequent development guidelines, has resulted in strikingly similar issues 80 years later is included in the next section.

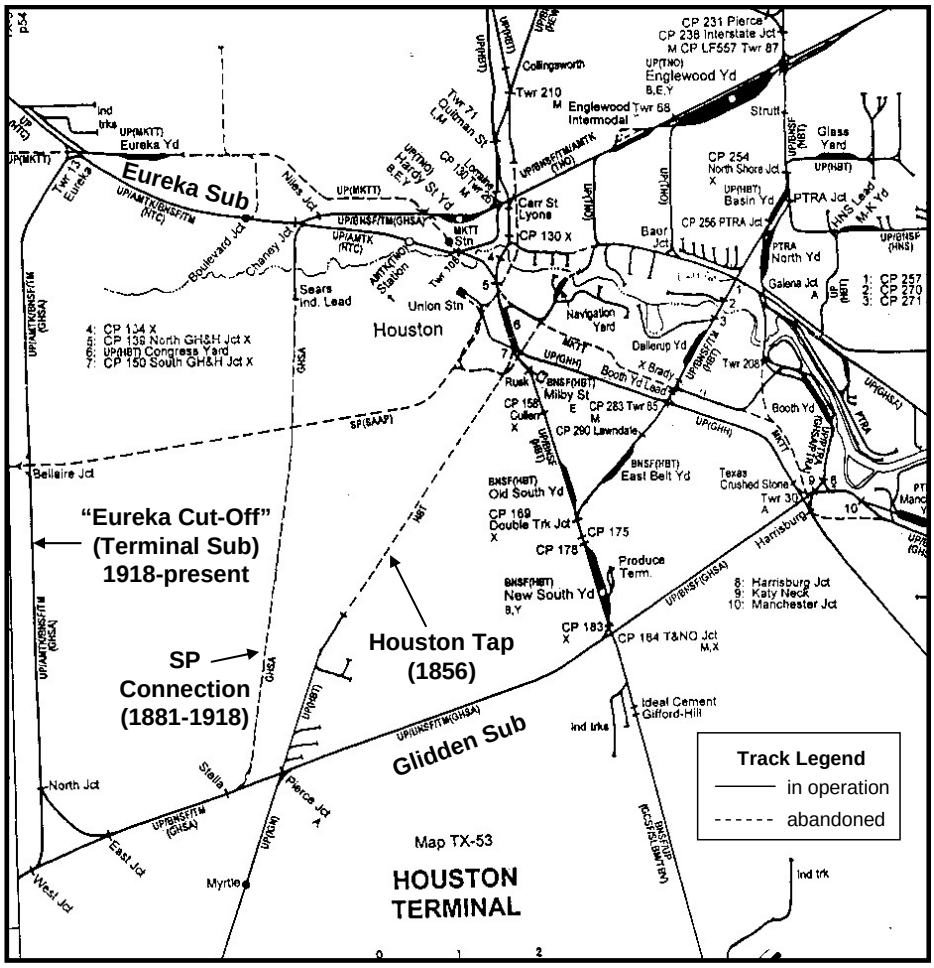
Historic Example of Rail Relocation in Texas

Regardless of the degree to which political and financial commitments may be available for relocating rail facilities, there is a shortage of information that would allow for the long-term effectiveness of these projects to be assessed. While numerous cases of track abandonment and new railroad right-of-way acquisitions are available for evaluation, the numbers of negotiated relocations that provide a perspective of any historic significance are minimal. And, in contrast to the consolidation of local tracks for the benefit of pending land development projects, the impact of completely relocating rail lines away from urban areas can only be judged from this long-term perspective.

As with other large cities in Texas, relocating rail facilities in Houston has assumed considerable prominence as an option to moderate conflicts between trains and vehicular traffic. Fortunately, within Houston's extensive rail history exists a unique opportunity to study the long-term effects of the negotiated relocation of an entire rail corridor. UP's Glidden Subdivision is currently Houston's primary westbound rail corridor, handling upward of 20 trains per day through some of the region's most populated urban areas. Despite this being

Houston's first railroad, it was never built directly in Houston. Instead, the line initially known as the Galveston, Harrisburg & San Antonio Railroad (GHSA) actually extended from Harrisburg westward to San Antonio, as shown in Figure 2. Prior to 1881, the only access this Southern Pacific (SP)-owned company had to Houston was over the Houston Tap, which was a four-mile line constructed in 1856 by the City of Houston to "tap" into the GHSA (see Figure 2).

In 1881, the GHSA secured access to Houston via its own 10-mile track connecting with the Houston & Texas Central Railroad (HTC), now known as Union Pacific's Eureka Subdivision, which was Houston's second railroad and companion Southern Pacific holding that itself had direct access to the Houston market. As Figure 2 shows, this new corridor extended from the GHSA at Stella to the HTC at Chaney Junction (see SP Connection). During the next few decades, what would become prominent components of Houston began to emerge as the city expanded westward. For example, in 1911 the cornerstone of Rice Institute's first building was laid at a location just west of the GHSA-HTC rail connection. By 1915, plans were being devised for a residential district in that same area to be known as "Montrose." By 1918, developers had negotiated an agreement with the Southern Pacific Company to relocate its rail corridor to accommodate the land requirements of Montrose. Consequently, in that same year, a new corridor farther west was constructed between what is now the Glidden Subdivision's West Junction and Eureka on the Eureka Subdivision, shown as the "Eureka Cut-Off" in Figure 2.



Note: Labeling of routes added by TTI.

Figure 2. Relocation of the Southern Pacific Company's GHSA-HTC Connection (7).

Today, the Eureka Cut-Off comprises the western limits of Union Pacific's Terminal Subdivision and itself now traverses through heavily populated areas of Houston. In fact, Union Pacific currently moves approximately 11-16 trains per day over this line, averaging 22 million gross tons of freight annually. Figure 3 compares the former and current locations of this corridor with respect to existing city landmarks. Some of Houston's most frequently trafficked grade crossings occur on this rail line, which (as located in Figure 3) are:

A. San Felipe – 32,680 Average Daily Traffic (ADT)
B. Westheimer – 34,960 ADT
C. Richmond – 37,410 ADT
D. Bellaire – 18,110 ADT

Figure 3 also shows how the corridor abandoned in 1918, a good deal of which is now Montrose Boulevard, has made possible the location of important city features, including Herman Park, the Museum of Fine Arts, the Texas Medical Center, the University of Texas Health Science Center, Reliant Park (sporting arenas and convention center), and the overall development of Houston's Midtown area.

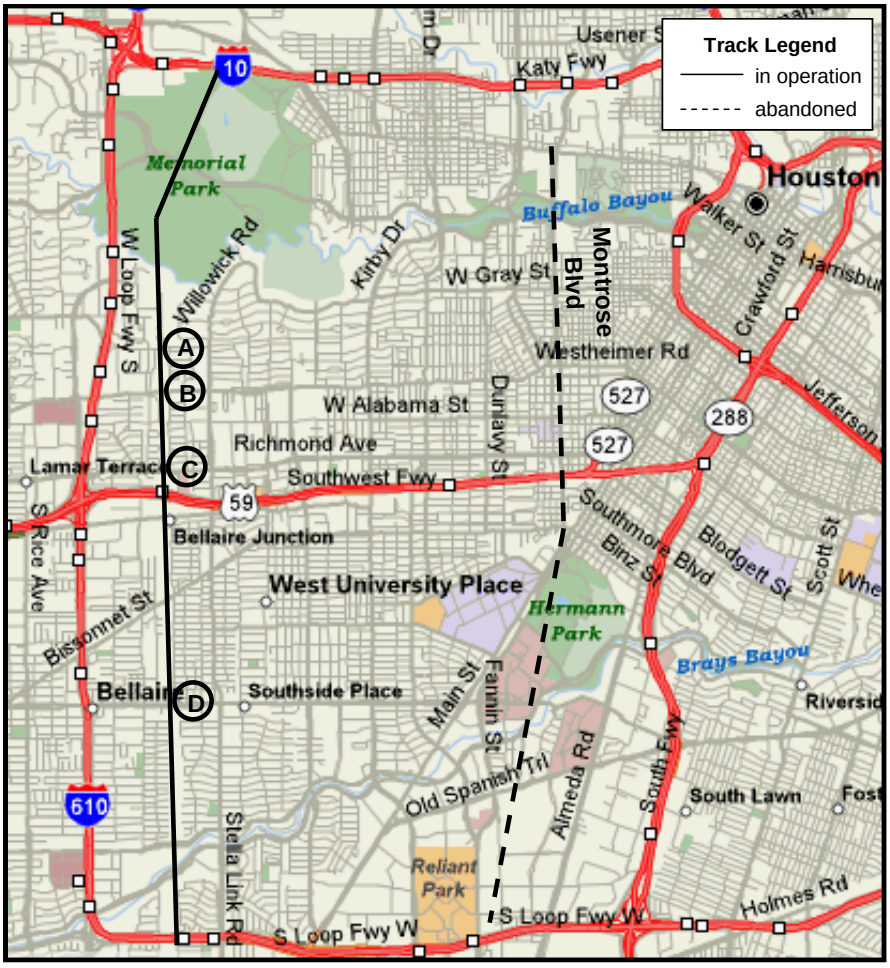


Figure 3. Current Roadway Network and City Landmarks near the Western Portion of Union Pacific's Terminal Subdivision.

Considerations for Future Rail Relocations

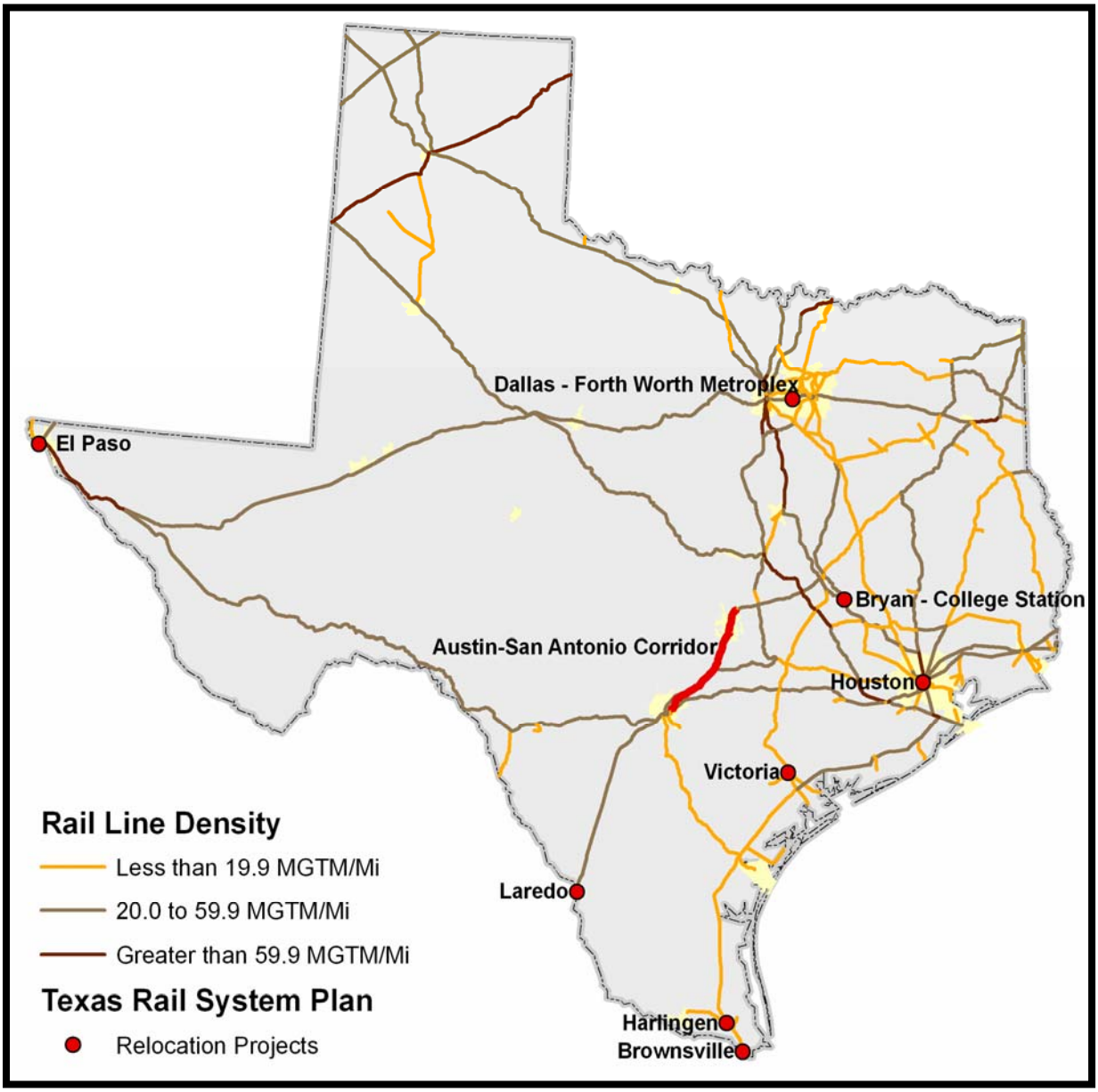
The portion of Union Pacific's Terminal Subdivision discussed herein provides examples of both the benefits and shortcomings of rail relocation projects. Over the last century, the land formerly occupied by the original GHSA-HTC connection has been transformed into critical city features. On the other hand, the relocated rail corridor has itself become a burden to those who choose to reside near the line, particularly as regional population growth continues to magnify

the degree of interaction with trains. In light of this history, future rail relocation proposals should give serious consideration to the following factors:

- How can the relocation of a rail line prevent the reoccurrence of problems confronting the urban area prior to relocation?
- What opportunity costs are incurred by maintaining the location of an existing rail line in terms of alternative land uses and urban development?
- To what degree can the preservation of existing track contribute to urban redevelopment following the negotiated relocation of train operations to outlying areas of town?
- Given the long-term potential of real property value escalation, what is an equitable cost-sharing arrangement between public and private entities for the financing of rail relocation projects?

Potential Texas Rail Relocation Projects

TxDOT's Texas Rail System Plan (TRSP) also describes several potential rail relocation projects being considered in Texas. Figure 4 depicts these projects. Several of these projects have advanced since the TRSP was originally written. Railroad relocation projects in both Harlingen and El Paso have received federal funding from SAFETEA-LU while others await further funding or planning activities. Several studies associated with these projects are also underway or have been recently completed. Due to this interest in rail relocation projects throughout the state by individual cities, MPOs, and TxDOT, this research project was conceived to look at similar projects throughout the U.S. to determine what additional principles and lessons could be applied.



MGTM/Mi: Million Gross Ton-Miles per Mile of Track

Figure 4. Map of Proposed Railroad Relocation Projects in Texas.

U.S. RAILROAD RELOCATION PROJECTS

The Texas Transportation Institute (TTI) performed a wide-ranging literature search to identify and analyze example railroad relocation projects throughout the United States that have taken place during the past 30 years. This process consisted of finding railroad relocation projects, reviewing their components, comparing the project characteristics with projects proposed in Texas, and projecting the benefits to be derived from further study of each project. A map of these projects is shown in Figure 5. The result of this effort was a list of five projects, which TTI

recommended for further study because of their diversity and relevance to Texas' rail goals. All of the projects selected were PPPs which exhibit a broad range of the factors involved in implementing beneficial and successful railroad relocation projects.

The matters of interest in all of the projects considered is the degradation of rail and/or highway service as quantified by decreased mobility, limited accessibility, increased delay, and adverse environmental factors such as emissions or noise that have occurred as a result of urban development around existing rail corridors. Additionally, more qualitative measures such as safety, quality of life, and aesthetics or economic concerns such as local real estate values or land use and urban redevelopment planning strategies can also play a role in determining when and how railroad relocation projects are needed. Once the determination has been made that a project of this type is needed, alternative analyses and more detailed project planning can begin, and funding sources can be sought.

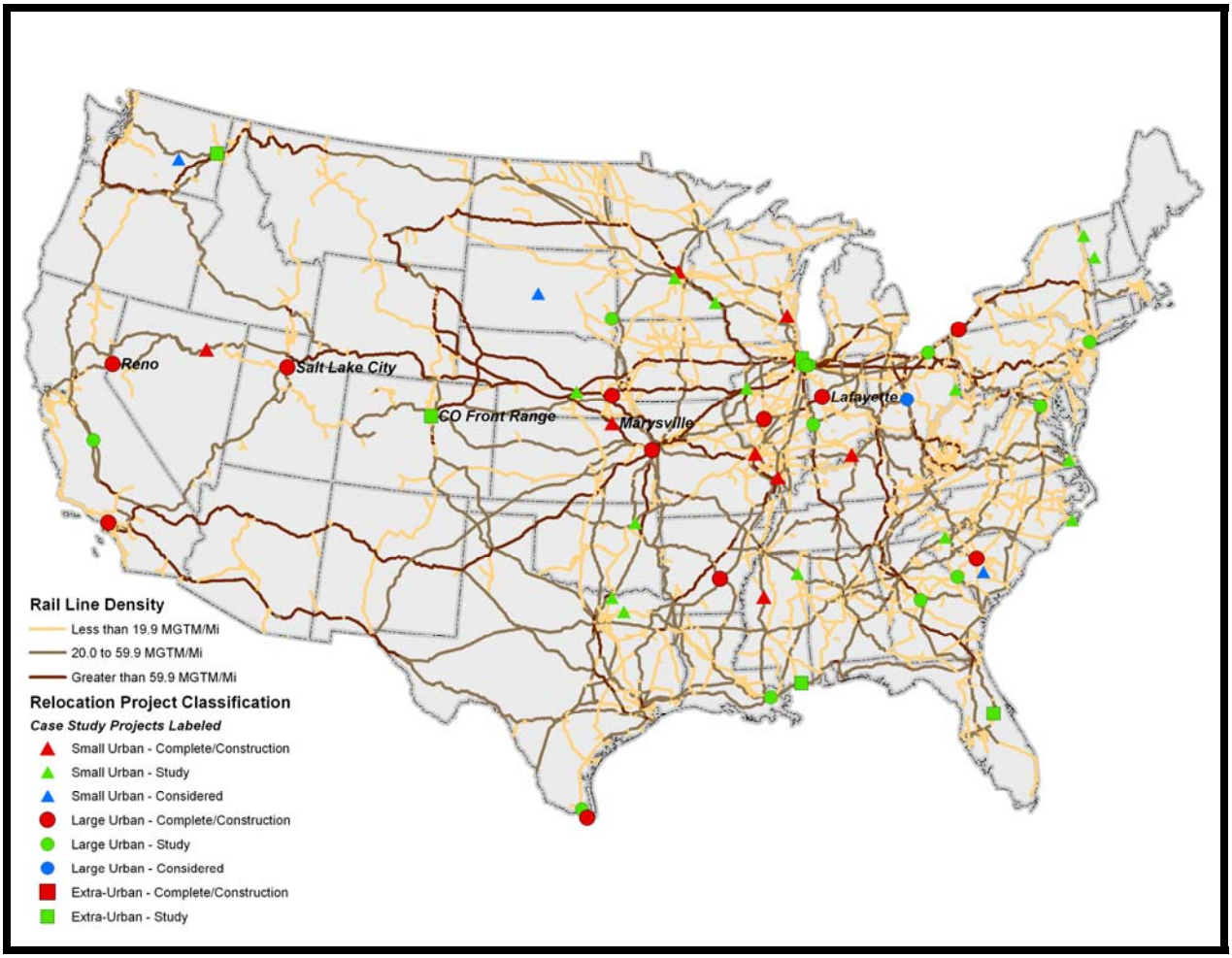


Figure 5. Recent U.S. Railroad Relocation Projects by Classification (post-1973).

The project markers in Figure 5 identify both the type of relocation project and the status of the project. The type of project relates primarily to the size of the community: small urban (less than 50,000), large urban (greater than 50,000), and extra-urban, where the rail line would relocate around multiple urban areas. Based on the information available, the project status represents the stage in which the project currently stands or the last known project stage. Projects marked as considered include projects the research team identified as not moving into a study phase. The studied projects include projects studied in the past that never progressed toward construction and projects with recent studies that have the potential to progress toward construction but have no current indication of such. The completed/under construction projects are those currently under construction or fully implemented. Appendix A provides the list of projects by project type and status, along with project specific information. Chapters 2-6 are the case studies developed from the five selected projects in Marysville, Kansas; Lafayette, Indiana; Reno, Nevada; Salt Lake City, Utah; and Eastern Colorado.

CHAPTER 2:
MARYSVILLE, KANSAS, RAILROAD RELOCATION, GRADE SEPARATION, AND FLOOD CONTROL PROJECT

PROJECT DESCRIPTION

The Marysville, Kansas, project is a small urban area bypass project that moved the UP mainline from its old alignment through the city to a new alignment along the western edge of the city (First Street Alignment), as shown in Figure 6. Marysville had an estimated population of 3,151 in 2005 and is the county seat of Marshall County in northeastern Kansas near the Nebraska border (*8*). Two major U.S. highways intersect in the city—U.S. Highway 36 travels east-west, and U.S. Highway 77 travels north-south through the town.

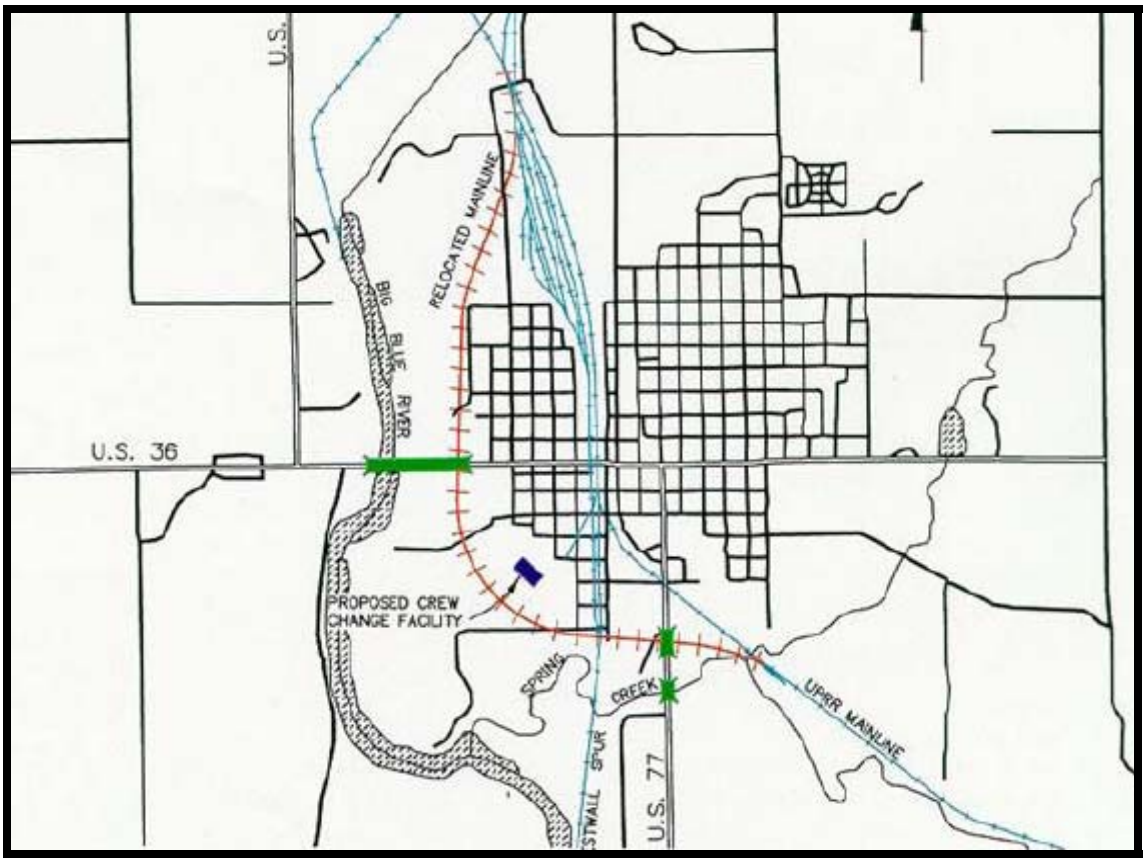


Figure 6. Map of Marysville, Kansas, Rail Relocation First Street Alignment (*12*).

The rail relocation project consisted of several major elements. In addition to relocating the railroad from the urban area to reduce traffic conflicts with two U.S. highways, the project also involved the construction of several major highway-rail overpasses, the construction of a

new rail yard west of town in a former flood plain area, and the construction of a levee that protects the western part of the city from flooding. Bids were let on the project in August 2002, and construction began in October 2002 (*9*). The highway improvements included in the project (two major grade-separated rail overpasses) opened to traffic in August 2004 and the new UP mainlines opened to traffic in February 2006 (*10*). Construction of the levee structures continued into the summer of 2006. UP also plans to construct a new crew change facility and office building along the new route in the future.

PROBLEM

Growth in auto and train traffic through Marysville in recent years has been dramatic. As a result, the amount of travel delay experienced by motorists during train movement has skyrocketed. At-grade intersections between the UP mainline and U.S. Highways 36 and 77 in Marysville have been especially prone to delay, such as that seen in Figure 7. The UP line through the city is one of UP's busiest, carrying Powder River Basin coal from Wyoming to power plants in the eastern and southern U.S. Marysville also serves as a crew change point for the railroad, resulting in additional dwell time for trains traversing the area. Several local trains also perform switching operations that block the crossings for several hours each day.

Figure 7. Example of Traffic Delay in Downtown Marysville, Kansas (*12*)**.**

The 1998 feasibility study for the project reported approximately 65 through trains per day passing through the city, with a projected increase to 135 daily trains by 2017 (*11*). During the same time period, the Kansas Department of Transportation (KDOT) estimates that traffic along U.S. Highway 36 at the rail intersection will grow by 31 percent to approximately 12,000 vehicles per day. This amount of train and highway traffic will result in that crossing being blocked for 14.6 hours each day by 2017 (*12*). Delays at the other crossings in the city aggravate the problem further. Emergency vehicle travel is also restricted by the blocked crossings throughout the city, affecting fire and medical service levels.

PURPOSE/DRIVERS

In addition to the rail-highway grade crossing conflicts described above, the Marysville project also addressed a long-term flooding problem in the western part of the city. The Big Blue River passes north-south just to the west of the city, and solutions to the flooding problems had been sought for the past 50 years (*13*). Much of western Marysville was located in a 100-year flood plain, which restricted development and commerce in that part of the city by limiting the type of structures that could be built. Although projects were considered to address both problems independently, the final project plan combined the goals of both rail relocation and flood control into one project that addressed both issues directly. Construction of the rail line in the selected corridor required that flood control measures be implemented. The flood control levee protected the new infrastructure allowing a new rail yard, a new crew change facility, and other new development to occur.

Several partners were necessary to achieve the completion of this project. These included:

- Kansas Department of Transportation
- U.S. Department of Transportation
- U.S. Army Corps of Engineers (COE)
- City of Marysville
- Union Pacific Railroad

The partnership shown among these entities was recognized in 2004 when the National Partnership for Highway Quality presented this project with its Bronze Award for Partnering as a result of the exemplary outcome of the planning and construction process (*14*).

DECISION PROCESS/ALTERNATIVES

Several different feasibility studies had been conducted over the years to address either the rail relocation or flood control needs of the Marysville area. COE completed studies on flood control in 1950 and 1979 but determined in both cases that federal-level projects were not economically feasible (*11*). These studies did not include railroad infrastructure relocation as part of the analysis. In 1987, a grade separation study was conducted that would have left the railroad in place. Its results suggested construction of two grade separations (at U.S. Highway 36 and at U.S. Highway 77), but these recommendations were not carried out due to the impacts that they would have had on local businesses and adjacent properties (*11*).

In 1991, the City of Marysville began working with both COE and UP to determine if a project combining both railroad relocation and flood control was possible. COE completed a scoping study as requested by the city in late 1994, which suggested the tracks be re-routed around the south and west of the city with a levee being built for flood control, but the study also found that the project was economically infeasible. This finding was as a result of COE benefit/cost accounting practices that did not allow the value of the new rail infrastructure to be included in the calculation (*11*).

By 1997, both the U.S. 36 and U.S. 77 at-grade crossings in Marysville had become ranked in the top-ten most hazardous at-grade rail crossings in the state. KDOT, UP, and the City of Marysville commissioned a railroad relocation feasibility study with the following objectives:

- maintain viability of downtown Marysville;
- provide grade separation for U.S. 77 and U.S. 36;
- increase floodplain protection for Marysville;
- provide more efficient UP railroad operations;
- include a modern crew change facility;
- address Marysville infrastructure improvements; and
- enhance traffic, pedestrian, and emergency vehicle safety (*11*).

The scope of the project was wide enough that it would allow consideration of projects that could alleviate both problems. In determining how to address the grade separation/rail relocation need in Marysville, KDOT felt that several key issues needed to be addressed. These included (*12*):

- increased rail activity on the corridor,
- five at-grade crossings (including U.S. 77 and U.S. 36),
- crew change facility,
- national significance of highway and rail corridors, and
- flooding history of Big Blue River and Spring Creek.

Project partners used the following criteria to evaluate several different potential projects and their ability to address the key issues (*12*):

- travel demand,
- emergency access,
- railroad operations,
- crew change facility,
- environmental impact,
- right-of-way impacts,
- flood protection,
- highway/rail safety,
- construction costs, and
- funding potential.

While the "First Street Alignment," first identified in the 1994 COE study (as shown in Figure 6), was eventually chosen as the preferred project alternative, several other possible solutions were considered. These solutions are included below.

East Railroad Alignment

This option would have relocated the UP mainline to the east and north of the city, as shown in Figure 8. This route would have required the new rail line to be constructed through

some rolling hills north of the city to reconnect with the existing classification yard in north Marysville. It would have also required that the existing line through town remain in place to serve customers on the Bestwall Spur to the south of town on an infrequent basis. Grade separations at U.S. 36 and the Big Blue River would also have been required. This option provided no flood control relief to the City of Marysville (*11*).

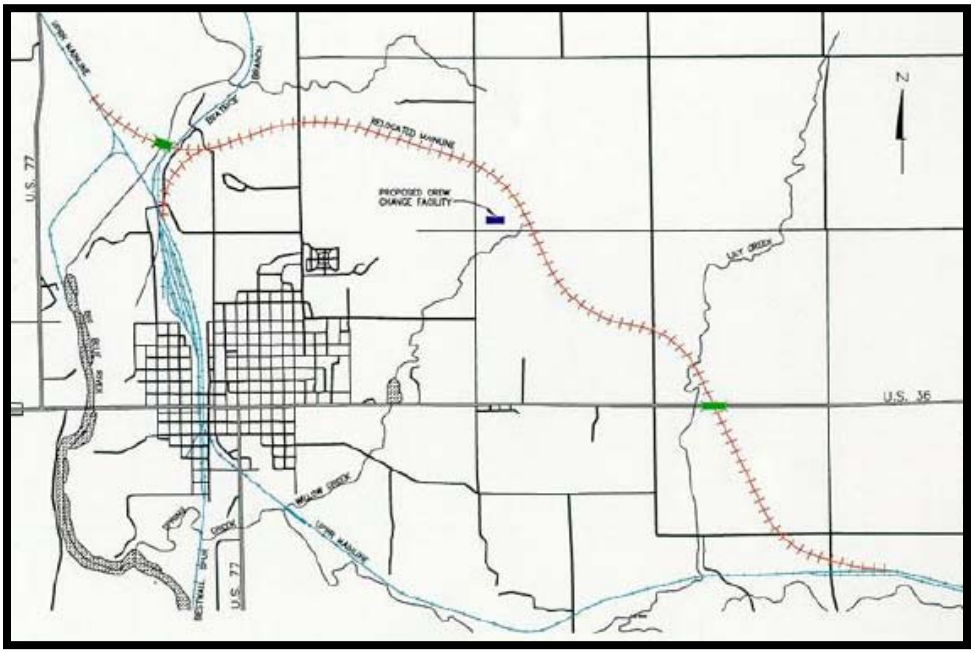


Figure 8. Map of Marysville, Kansas, Proposed East Alignment (*12*).

West Railroad Alignment

This option would have relocated the UP mainline to the south of the city and west of the Big Blue River, as shown in Figure 9. This route would have required the new rail line to be constructed through the hilly bluffs on the western bank of the river, requiring substantial earthwork and a new grade separation structure for U.S. 36 to be constructed west of the river. This route option resulted in several additional rail operational problems. Although the traffic over the Bestwall Spur could be accommodated from the new route, this option would have required an additional bridge over the Big Blue River, and the connection to the Beatrice Branch line would have been difficult. At-grade intersections with U.S. 77 north of town and with U.S. 36 in town would have remained in-place to handle daily switching operations and upkeep of the existing crossing equipment. Two additional grade-separated structures would also have

been required south of town. This option also provided no flood control relief to the City of Marysville *(11)*.

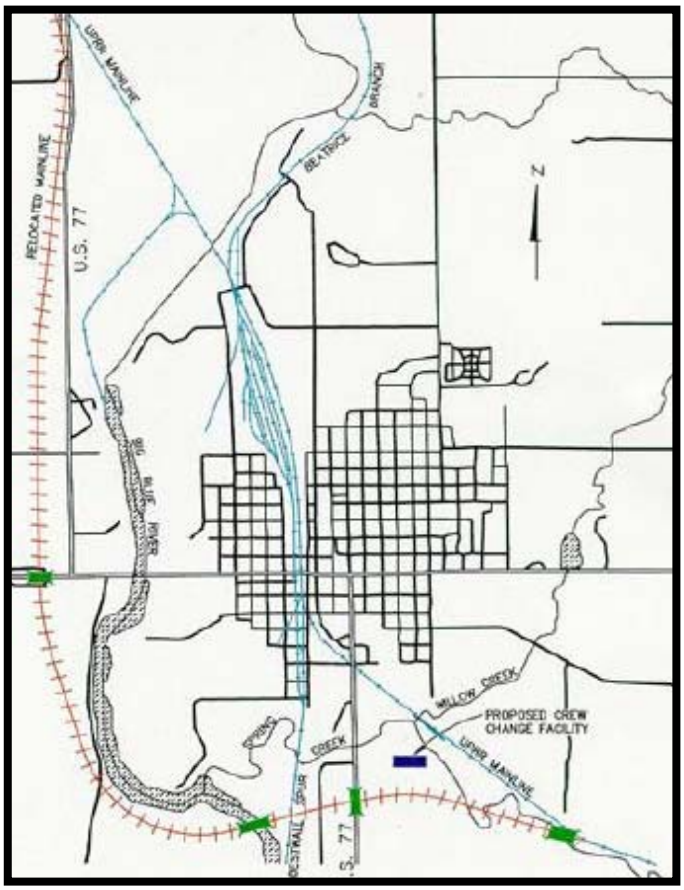


Figure 9. Map of Marysville, Kansas, Proposed West Alignment *(12)*.

Grade Separation Option

The 1987 Grade Separation Study previously examined the option to grade separate the intersections of the UP mainline with U.S. 36 and U.S. 77 in the town of Marysville while leaving the existing rail infrastructure in place. The 1998 rail relocation study also looked at this option, as shown in Figure 10. Grade separations at these two locations would greatly reduce the traffic delay in the city as discussed above; however, this option did not grade separate three additional major at-grade crossings within the city that would remain blocked for over six hours per day, restricting emergency service access, nor did it provide any flood control features or address the need for expansion of the crew change facility. Additionally, there would have been

numerous business and property impacts in the grade separation locations, as identified in the previous study (*11*).

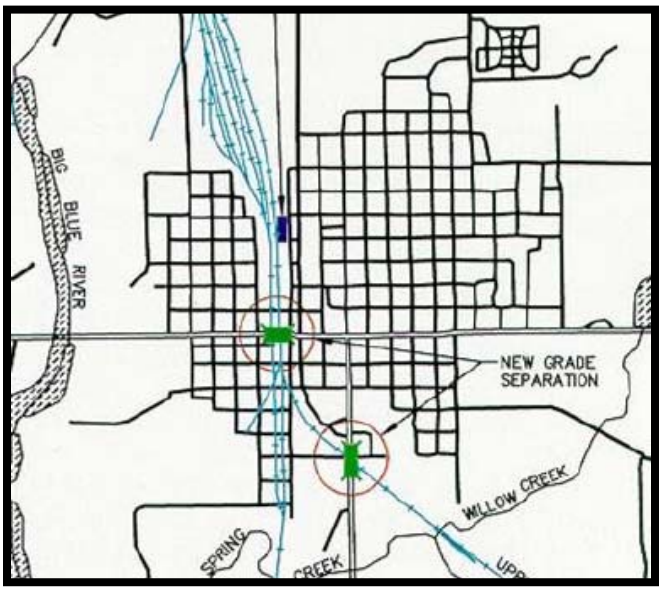


Figure 10. Map of Marysville, Kansas, Grade Separation Option (*12*).

No-build Option

The no-build option was considered but, as discussed previously, it did nothing to address the issues that were determined to result in increased delay and degradation of highway operations, limitations on rail capacity through the urban area, and provided no flood control or crew change facility improvements (*11*).

SELECTED PROJECT

The First Street Alignment, shown in Figure 6, more fully addressed all of the evaluation criteria outlined for the feasibility study. It moved rail operations from downtown Marysville to a corridor to the west and south of the city and constructed six additional siding tracks between the new UP mainline and the levee to the west of town underneath the new U.S. 36 grade-separated overpass. It provided both flood control and relief from the flooding problems experienced in the western part of the city.

BENEFITS OF PROJECT

All of the partners benefited in some way from the project being constructed along the First Street Alignment. Table 2 outlines examples of benefits that each partner received.

Table 2. Partner Benefits from Marysville First Street Alignment Railroad Relocation.

Partner	Benefits
City of Marysville	- Levee construction removed threat of flooding and flood plain designation in western half of city, allowing further development - Railroad operations moved from city increasing safety and decreasing traffic delay - Increased economic development opportunities
Kansas DOT	- Reduced traffic delay at two problem intersections in Marysville - Increased highway traffic flow/capacity on two U.S. highways - Two new grade-separated highway overpass structures
Union Pacific	- Improved train operations and safety enhancements - New 4-mile double-tracked mainline in new corridor - Six new 2-mile passing tracks - Reconfiguration of a spur line - Increased through train speed from 20 mph to 50 mph - 11 closed at-grade crossings (reduced maintenance requirement) - Proposed new crew change facility
U.S. Army COE	- Construction of long-awaited levee to address Big Blue River flooding - Partnership made funding of project possible

COSTS

Table 3 shows the comparative costs that were estimated for each of the build options evaluated in the 1998 Marysville Railroad Relocation Feasibility Study. The advantages of the First Street Alignment in meeting the project criteria set before the study began are clear. It more fully addresses all of the criteria, while having a lower total cost than either the east relocation or the west relocation, and it avoids many of the negative aspects of those two options. The grade-separation option was much cheaper; however, it did not address many of the specified criteria for the railroad or the City of Marysville.

Table 3. Marysville Railroad Relocation Option Costs (*11*).

Project Element	East Alignment	West Alignment	First Street Alignment	Grade Separation
Railroad Relocation	$36,535,600	$41,121,400	$11,819,900	$0
Highway Improvements	$2,015,100	$4,028,300	$10,502,700	$10,075,200
Flood Protection	$1,000,000	$1,000,000	$9,700,300	$1,000,000
Subtotal 1997 Construction Cost	$39,550,700	$46,149,700	$32,022,900	$11,075,200
Estimates				
Year 2000 Construction Cost	$46,048,880	$53,732,096	$37,284,262	$12,894,855
Right of Way Costs	$1,000,000	$1,900,000	$2,000,000	$150,000
Preliminary Engineering (9%)	$4,144,398	$4,835,858	$3,355,540	$1,160,505
Construction Administration (7%)	$3,223,422	$3,761,247	$2,609,898	$902,640
Total Project Costs	$54,416,700	$64,229,200	$45,249,700	$15,108,000

As stated above, the project was let and construction began in 2002, and it is nearing completion at the time of this report. The highway and rail elements are now open to traffic; however the levee construction remains incomplete. The project design engineer from KDOT provided the chart shown in Table 4 to the research team showing the estimated total construction costs for the project as of May 2006 (*15*). COE estimates for levee construction and earthwork are shown as KDOT costs in the chart. These numbers will change as the levee construction is completed and final numbers are provided to KDOT, which is covering the cost of levee construction.

Table 4. Estimated Construction Cost by Partner as of May 2006 (*15*).

Project Element	KDOT	UP	City of Marysville	Total
UP Mainline	$ 6,714,371	$ 6,714,372	-	$ 13,428,743
Bestwall Spur	290,105	-	-	290,015
Siding Tracks and UP Blue River Bridge	-	27,466,000	-	27,466,000
Levee & Earthwork (COE's estimate)	17,803,882	-	-	17,803,882
U.S. 36 Overpass	7,894,485	500,000	-	8,394,485
U.S. 77 Overpass	5,896,263	500,000	-	6,396,263
City Municipal Utility Adjustments	400,000	-	$ 1,000,000	1,400,000
Sub-ballast	413,850	413,850	-	827,700
TOTAL	$ 39,412,956	$ 35,594,222	$ 1,000,000	$ 76,007,088

PROBLEMS ENCOUNTERED

As with all major construction projects, several obstacles had to be surmounted during this relocation. These included:

- *Right-of-way acquisition*- KDOT purchased the entire ROW on behalf of the project partners requiring the purchase of 61 property parcels (26 in the railroad/levee corridor, 18 in the U.S. 36 corridor, and 17 in the U.S. 77 corridor). At the completion of the project, KDOT will retain needed ROW for the highways; UP will receive the needed ROW for the rail corridor, and the City of Marysville will receive the remaining property (*12*).
- *Historic property issues*- Some of the property taken for ROW was located in an historic area near the Big Blue River where an early river ferry operated in the 1840s, where Pony Express riders originated their trips west, and where Oregon Trail emigrants were supposedly buried. Two historic structures had to be relocated, which were some of the oldest in the area. All of these issues were investigated and cleared by state and federal historic and environmental inspection officials.
- *Flood plain issues*- KDOT and the City of Marysville had to coordinate early in the project with the Federal Emergency Management Agency (FEMA) and COE to have the western edge of the city removed from flood plain status so that construction and approval of plans could proceed.

- *Coordination issues*- Coordination of tasks among the project partners and consultants required clear definition of responsibility and authority for varying elements of the project.

LESSONS FOR TEXAS

- **Seek projects that address more than one goal when possible.** This project was ultimately successful because it combined a rail relocation project, two major grade separations, and a flood control levee project into one larger project that addressed multiple goals for the area. By including several partners, the funding and technical issues were easier to tackle during implementation.
- **Seek projects where private partners also benefit.** One of the major successes of this project was the ability to attract UP to invest in the project. Although they were initially reluctant to participate in a rail relocation project, their inclusion in project planning and the addition of features to the project that improved rail operations eventually won their support. Understanding the needs and desires of the private sector partners by the public sector officials was key to this effort.
- **Seek multiple project partners.** In this project, the inclusion of a variety of partners was essential. Common goals and cooperation led to a consensus project that met as many of the goals as possible between the public and private sectors.
- **Project work can be split among partners by expertise areas.** One of the main benefits of including partners with varying expertise is that project tasks can be split up to allow expertise areas to be applied. For example, KDOT was assigned ROW acquisition; UP was assigned rail design functions; COE focused on environmental permitting and levee design, and the City of Marysville focused on its utility relocation project.
- **Multiple project elements can proceed simultaneously if work is properly phased.** In addition to splitting up tasks among partners, multiple project elements can be undertaken simultaneously rather than sequentially with proper planning to reduce the timeframe for project implementation by months or years.

CHAPTER 3:
LAFAYETTE, INDIANA, RAILROAD RELOCATION PROJECT

PROJECT DESCRIPTION

The Lafayette, Indiana, Railroad Relocation project consolidated four railroad tracks of two different railroad companies into a grade-separated, single triple-tracked rail corridor. Routes running along two urban streets were relocated to a route along the Wabash River, as shown in the photograph in Figure 11 and graphically in Figure 12. In total, the project removed 42 at-grade crossings in the city, allowing for improved mobility of both traffic and trains. The project was completed in several major phases and included:

- construction of several new highway bridges/grade separations;
- movement and restoration of a historic rail depot;
- remediation of environmental hazards and preservation of historic artifacts found in the new rail right-of-way;
- right-of-way swaps between the city and the railroads;
- construction of access roads to serve existing rail maintenance facilities; and
- movement of rail operations into the new consolidated corridor.

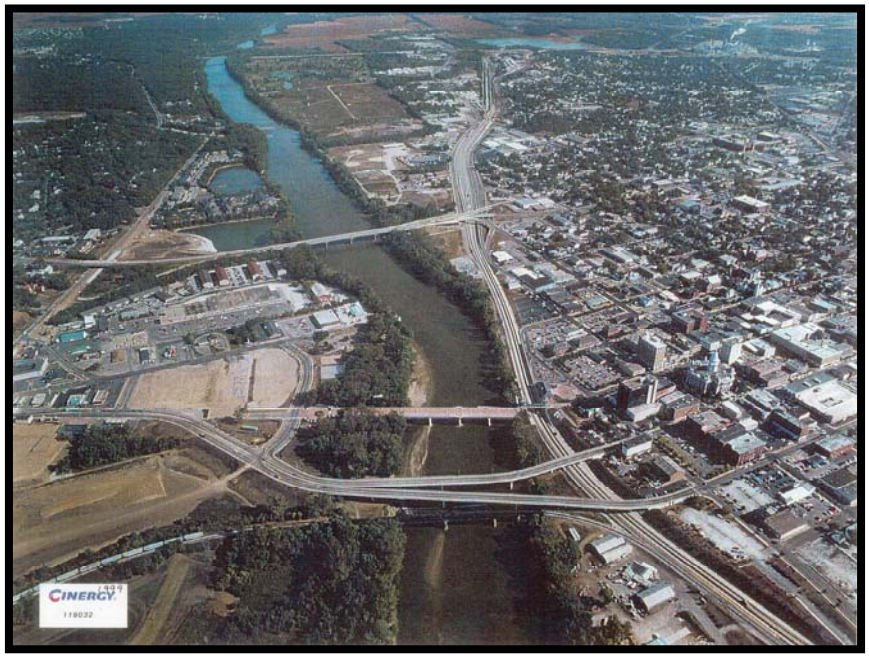


Figure 11. Lafayette, Indiana, Railroad Relocation Project Riverfront Corridor Route.

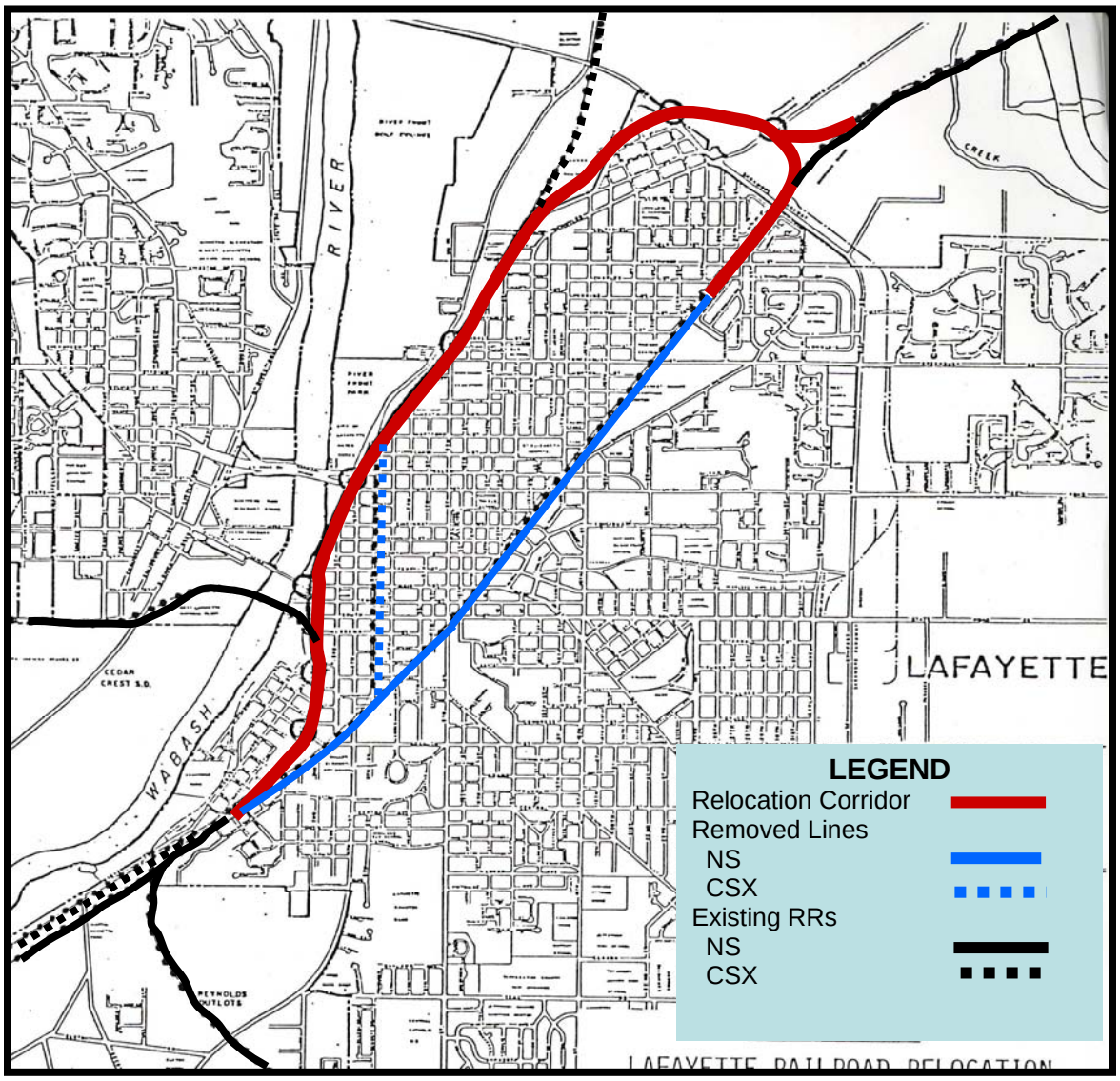


Figure 12. Lafayette Railroad Relocation.

Implementation of the project took over 29 years from the time that the project was first designated as eligible for federal funding to the time it was completed. Several studies of different railroad relocation alternatives had occurred prior to receiving that funding designation.

The City of Lafayette had an estimated population of 60,549 in 2005 and serves as the county seat of Tippecanoe County in northwestern Indiana. Directly across the Wabash River is the City of West Lafayette, the home of Purdue University, which had an estimated population of 28,599 in 2005 (*16*). Rail lines operated in or adjacent to the city streets of Lafayette as early as the 1850s, and efforts by the city to find a way to

relocate them elsewhere began as early as 1926 (*17*). Modern efforts by the city to relocate the railroads began with a study in 1969, but Lafayette was not originally included in the 1973 Federal Aid to Highways Act Highway-Railroad Crossing Demonstration Program. The project was added to the official list for this funding program in 1974 by an amendment to the original act (*17*). The city established a Railroad Relocation Project Office in August 1975, which coordinated activities related to the project until the office was closed and the project was essentially complete on August 1, 2003 (*17*,*18*).

The City of Lafayette's Railroad Relocation Office was the implementing agency throughout this project. The Indiana Department of Transportation (INDOT) acted mainly as a pass-through agency for Federal Highway Administration (FHWA) funds and participated in the highway and grade separation project features and eminent domain actions as directed by the city's project management team. The Railroad Relocation Office negotiated directly with the various railroads during the project. When the project began, the Norfolk and Western Railway (N&W) and Louisville and Nashville Railroad (L&N) were the owners of the two rail rights-of-way that were to be relocated. However, by the time the project was completely implemented, after several rail consolidations and purchases took place during the 1980s and 1990s, the former N&W line was owned by its successor the Norfolk Southern Railway (NS), and the former L&N line was owned by CSX Transportation (CSX).

The railroads' participation in the project consisted mainly of transferring their right-of-way in the existing corridors for right-of-way and rail infrastructure that had been built by the project on city-owned lands along the new, consolidated, riverfront corridor. In 1999, as the project entered its final phase, NS loaned the city approximately $9.6 million to speed up the implementation process for moving its operations to the new corridor. This loan was repaid by the city during the term of the project using federal funds that had already been allocated (but not yet appropriated) in the 1998 TEA-21 allowing the final phase of the project to be completed four years ahead of the projected schedule (*19*). NS also donated the historic Big Four Railroad Depot, which was relocated and restored during the project (*19*).

PROBLEM

The primary concerns caused by the pre-project railroad infrastructure in Lafayette were the public safety and traffic conflict issues caused by the operation of trains at-grade and in the same corridors as city streets. Trains also blocked emergency vehicles and affected transit schedules for the city. By May 1979, when the project's environmental impact statement (EIS) was completed, an average of 22 vehicle-train accidents per year were occurring in Lafayette (*20*). The EIS also mentioned the possibility of train derailments, hazardous materials shipments, limitation of land uses along the rail rights-of-way, visual blights, disruption of street surfaces, reduced land value along the track, and disruption of city services as reasons for seeking the rail relocation (*20*). In-street operations also affected the operation of the railroads. The N&W line was restricted to 20 mph, and the L&N was restricted to 10 mph in the desired relocation corridors (*20*). The EIS states:

> The railroads running through the center of Lafayette present serious problems to the safety, mobility, environmental quality, and development of the community and reduce the cost efficiency of the operating railroads and city services (*20*).

The city also estimated that increased property values along the relocated corridors would result in an increased tax base, which would more than pay for lost tax revenue from right-of-way purchased by the city for the new rail corridor, and that new development would occur, which would add further substantial increases to the city's tax revenues (*17*).

PURPOSE/DRIVERS

Although several of the reasons behind the Lafayette Rail Relocation are listed in the previous section, a primary force behind the success of this project was the political desire and public support to see the lines relocated. Additional public support was built throughout the project by the efforts of the Railroad Relocation Project Office staff and was championed by a succession of local leaders. The long-time city council member and later mayor of Lafayette, James Riehle, was strongly behind the project and fought for both funding and support from representatives at all levels of government. His

successor, Mayor Dave Heath, continued this policy. Although there were several changes in representation and party affiliation among the representatives for the Lafayette area in the U.S. Congress during the span of this project, the mayors of the City of Lafayette and the staff members of the Rail Relocation Office worked diligently to pursue and obtain the necessary federal funding for the project *(21)*.

Key to the long-term success of Lafayette's project was a coordinated and continuous public information process in concert with outreach to public officials at the local, state, and federal levels. Throughout the project, the Railroad Relocation Office staff kept the importance of building public support for the project and each of its phases at the forefront of their activities. Figure 13 depicts the "community participation process model" developed for the project. This detailed process outlines responsibilities, and describes sources for input into project planning and for project review at all levels of government.

In addition to this process to develop support for the project with the public, the city's Railroad Relocation Office staff visited Washington, DC, regularly to reinforce the importance of the project with federal legislators. Events were held where videos and pamphlets outlining the benefits to the Lafayette region and the state of Indiana were explained. This effort resulted in the project receiving support not only from Lafayette-area legislators but also from other influential congressmen as well. During an interview with the project team, the project manager credited these direct meetings with keeping the Lafayette Rail Relocation Project as one of the top-ranked projects from the state of Indiana in each of the federal transportation bills through which it received funding *(21)*.

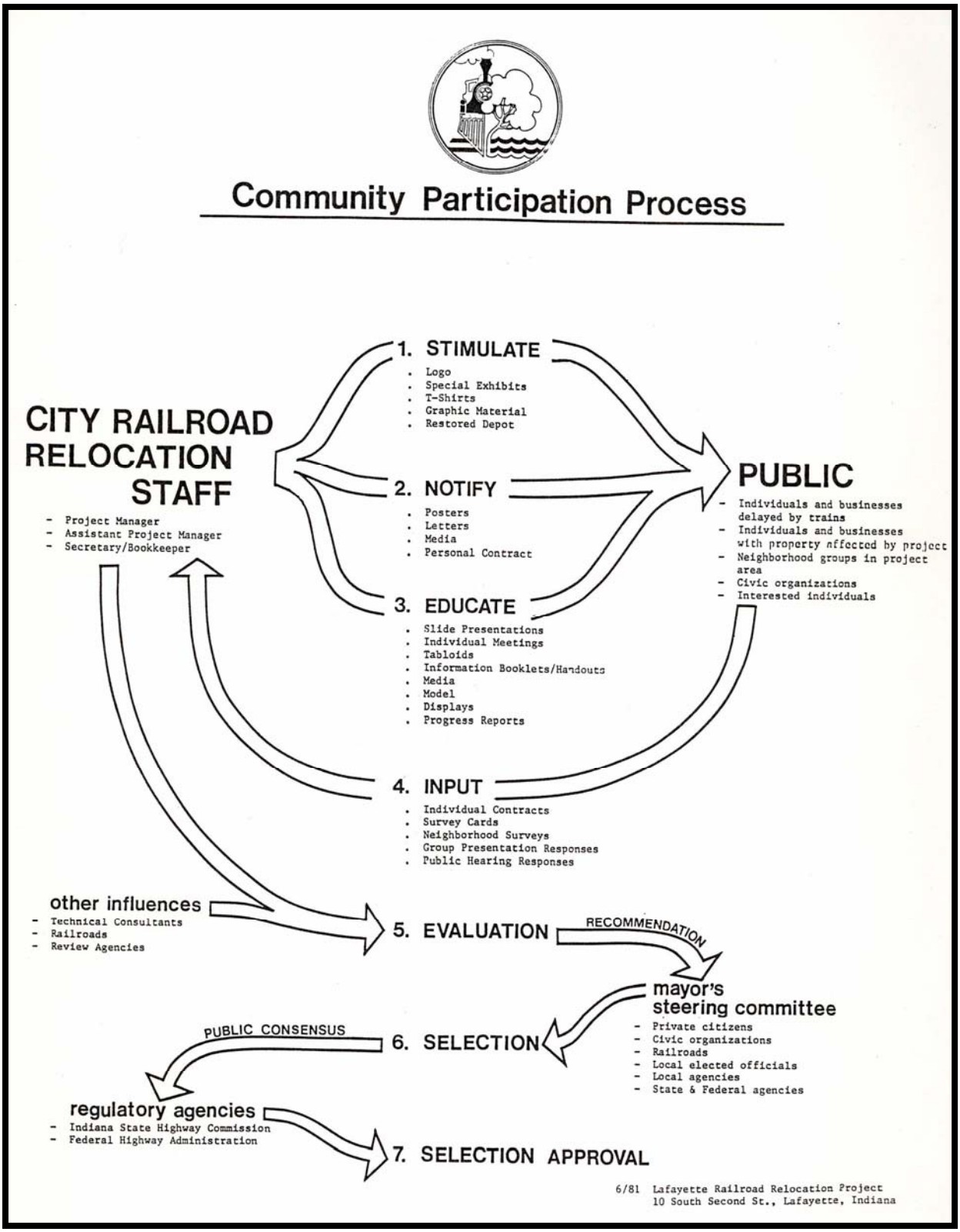


Figure 13. Lafayette Railroad Relocation Project Community Involvement Process *(18)*.

DECISION PROCESS/ALTERNATIVES

As stated in the project description above, the public desire to move the railroads from downtown Lafayette had been active for over 50 years before this project began. A 1930s plan to move the corridors to the abandoned Wabash and Erie Canal route along the river was never implemented. Modern planning efforts to move the railroad began in 1969 with the completion of the Central Lafayette Renewal Plan. This plan, prepared for the Lafayette Redevelopment Commission, called for a rail bypass in a new corridor far to the east of the city, as shown in Figure 14 (*17*). A 1971 study commissioned by the city looked at four main project alternatives: the eastern bypass route recommended in the 1969 study, several alternatives along the existing N&W right-of-way, the construction of a tunnel underneath the existing L&N right-of-way along Fifth Street, and an elevated route along the Wabash River. This study produced a recommended corridor alternative that would have constructed a depressed rail corridor through the city along the existing N&W route, as also shown in Figure 14 (*17*). This alternative was endorsed and adopted by the Mayor's Railroad Relocation Steering Committee at the time; however, political opposition to the route was strong among several elected officials and citizens in the affected area including James Riehle, who was elected mayor before any further work to implement that corridor was begun (*17, 18*).

In 1973, the city obtained funding from the FRA and FHWA to conduct a feasibility study of constructing a depressed rail corridor along a riverfront route and hired Stanford Research Institute (SRI) to carry out the work (*17*). Simultaneously, the city commissioned another study, carried out by a team from Purdue University, Ball State University, and the City of Lafayette Redevelopment Commission and sponsored by the Lilly Foundation, to evaluate and compare all of the previously recommended alternatives to solve railroad problems in Lafayette. This effort involved public outreach through presentations and interviews throughout the community and resulted in a consensus that the riverfront route was the community-desired route for rail relocation (*17*). In 1974, the Lafayette Rail Relocation Project was added to the list of Federal Highway-Railroad Demonstration Projects that had been approved in the 1973 Federal Aid to Highways Act, and the Mayor's Railroad Committee changed its endorsement to the riverfront corridor. In early 1975, the city council adopted the riverfront corridor, and

the city created of the Railroad Relocation Project Office to oversee and implement project activities (*17*).

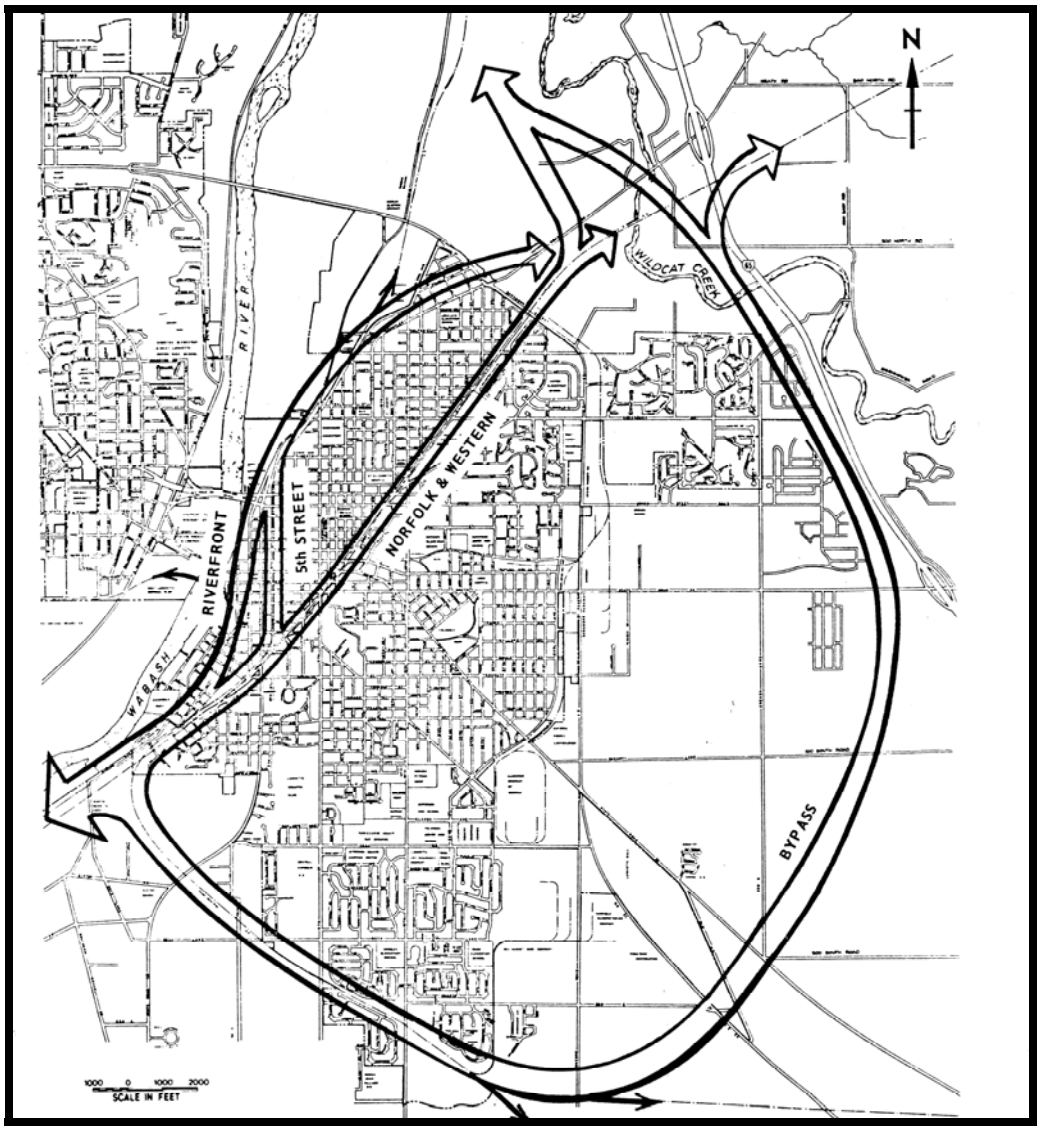


Figure 14. Map of Lafayette Railroad Relocation Alternative Routes (*17*).

SELECTED PROJECT

The addition of Lafayette as a federal highway-rail demonstration project resulted in an FHWA grant of $360,000 to the city for preliminary engineering work and an environmental study of the proposed route (*18*). This EIS process was completed and approved by FHWA in 1979, and a detailed general design study was approved by the

city in 1981 (*18*). The project faced a financial crisis in 1984 when Congress, concerned about the escalating costs associated with funding the 1973 Railroad-Highway Demonstration Projects Program, required that all projects must have begun construction by September 30, 1985, or they would be eliminated from further federal funding. The Lafayette project was able to meet this requirement by securing agreements for land acquisition prior to the deadline in January 1985—thus maintaining its eligibility for future appropriations (*19*).

A second major financial decision was made in the mid-1980s to fund the project in segments rather than as one large project. Mayor Riehle was seeking input from the Indiana legislative designation as to the most appropriate manner to secure the needed $70-80 million to complete the project in one contract. Congress members suggested that funding the project in independent, usable segments was a more conservative way to approach this large project. This decision, while extending the project completion date by approximately 12 years and more than doubling the total cost of the project, was ultimately viewed by the city as a successful policy since it later resulted in gaining the federal support necessary to complete the entire project (*19*). Gaining federal approval for the original (entire) amount would have been much more difficult, especially considering the political atmosphere at the time, as described in the paragraph above.

The final design consisted of the five major construction segments described below. It is important to note that the first three segments completed necessary preparations to city street and highway infrastructure before relocating either rail corridor.

Segment #1: Wabash Avenue Underpass

Segment #1 built the necessary underpass roadway that would connect Wabash Avenue with Second Street once the rails were relocated to the new corridor (*22*). This phase was completed in 1987 at a cost of $6.5 million. The project costs for this segment were split 95 percent federal and 5 percent state funds as part of the highway-rail demonstration program (*23, 24*). Segment 1 is shown in the left half of Figure 15.

Segment #2: State Road 26 Bridges over the Wabash River

Segment #2 consisted of three separate contracts. The first of these was demolition projects necessary to build two new bridges across the Wabash River to replace the single Main Street Bridge. The second contract covered construction of the two bridges that connected State Road 26 north of the river in West Lafayette with two one-way streets, South Street and Columbia Street, in Lafayette as shown in the center of Figure 15 (*22*). The third contract completed landscaping associated with this segment. These contracts were completed in 1989, 1992, and 1995, respectively (*23*). Funding for this project segment was $21.5 million, with the federal government paying 80 percent, the state paying 9 percent, and local funds covering the remaining 11 percent (*24*).

Segment #3: Ninth Street Underpass

Construction of Segment #3 began while Segment #2 was still being completed. This segment prepared the underpass structures necessary for the new rail corridor to cross Ninth Street and constructed adjoining roadways near the underpass to allow traffic to pass underneath the new railroad corridor. Two contracts were included in this project segment. The first built the underpass and was completed in 1993, while the second dealt with groundwater remediation associated with construction of the underpass. It was completed four years later in 1997 (*23*). This segment cost $17.4 million and was funded by 95 percent federal, 2 percent state, and 3 percent local funds (*24*). As shown in Figure 16.

Figure 15. Detailed Project Map Showing Segments 1, 2, and 4 (22).

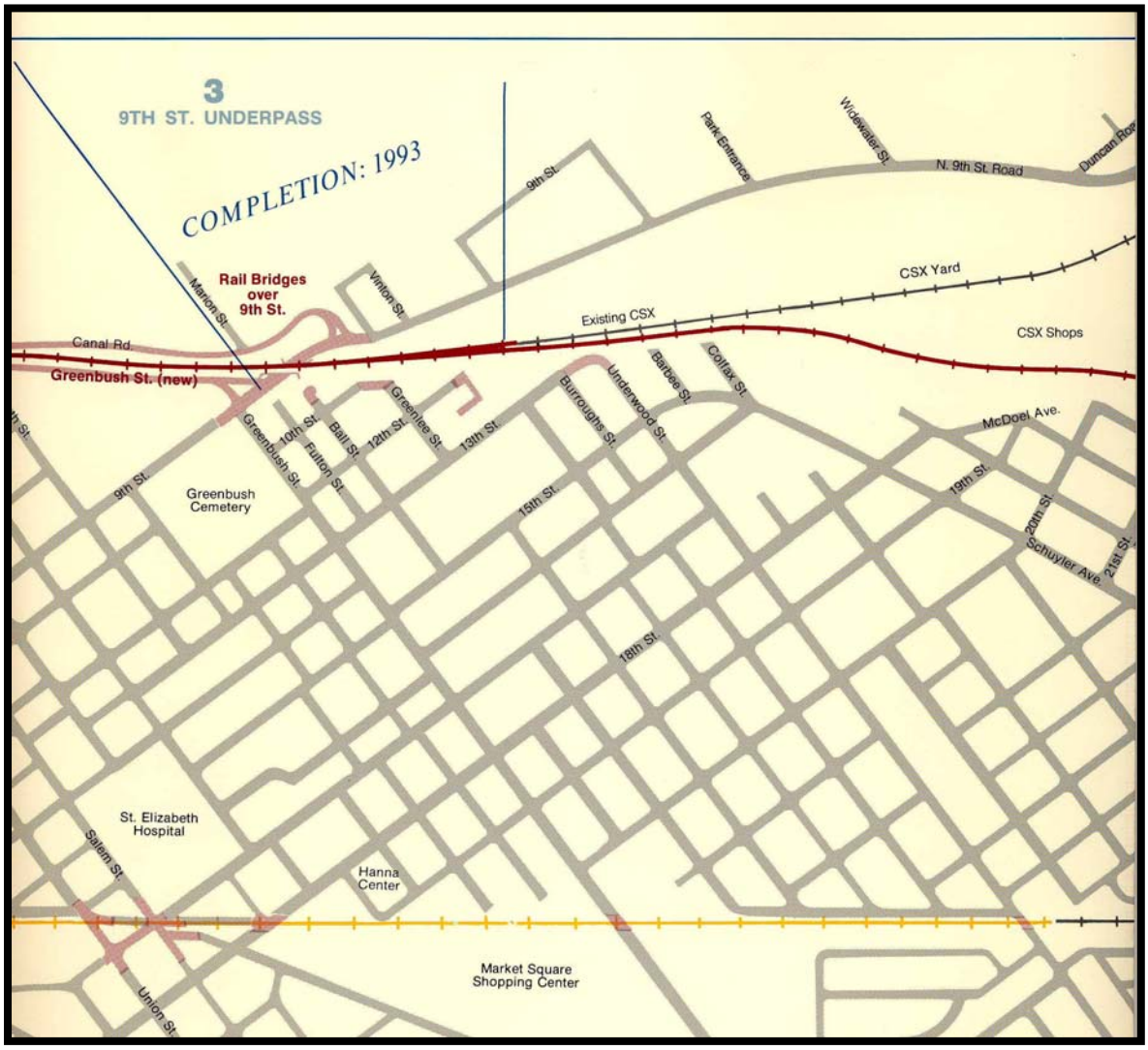


Figure 16. Detailed Project Map Showing Segment 3 (*22*).

Segment #4: CSX Relocation

Segment #4 was the first project segment that actually relocated one of the two rail lines into the new riverfront rail corridor. This segment consisted of several actions divided into four contracts. The primary contract covered:

- construction of several new bridge approaches at the U.S. 231 Harrison Bridge over the Wabash River, which grade-separated and interconnected Lafayette's roadway system from the relocated corridor;

- built an extension of Greenbush Street along the rail corridor to the east to connect to the Ninth Street Underpass built in Segment #3 and to parallel Canal Street on the west side of the tracks;
- built the new CSX track in the corridor; and
- constructed the rail bridge over Wabash Avenue for the new CSX track (*22*).

This contract was completed in 1995. A second contract, which restored the Fifth Street corridor by removing the old rail infrastructure, was also completed during 1995.

The third contract in Segment #4 covered the construction of Depot Plaza near the foot of the old Main Street Bridge, construction of a pedestrian bridge over the tracks between the new plaza and the bridge, and conversion of the former highway bridge into a bicycle/pedestrian facility linking the plaza area with West Lafayette. This project segment also included the relocation of the historic Big Four Railroad Depot from its old location along the former CSX line to the plaza where it was restored with a second underground floor for use as a multimodal transportation facility. The restored depot serves as an Amtrak station, a city bus stop, and an information center. It also serves as the starting point for exploration of a park and trail system that also adjoins the riverfront near the plaza (*22*). This contract was completed in 1996. Figure 17 shows the completed station, plaza, and pedestrian bridge area. The fourth contract in Segment #4 was for landscaping and was completed in 1997. Funding for this segment totaled approximately $40.4 million with the federal government paying 83 percent, the state paying 3 percent, and local funds paying the remaining 14 percent (*24*). Figure 15 depicts the Segment 4 improvements.

Segment #5: NS Relocation

The final segment of the project consisted of six construction contracts. The first consisted of necessary demolition to make way for new structures, while the second constructed the new NS bridges over Wabash Avenue and Ninth Street. The third and fourth built NS rail bridges over Sagamore Parkway (U.S. 52 Bypass) and over State Road 25 at the far north end of the project. Each of these structures required additional surface work to be done to construct streets that would allow the railroads access to existing facilities. In the vicinity of the Sagamore Parkway rail bridge, an access road

was built to allow CSX workers ground access to the CSX railroad shops (maintenance facilities) on the northeastern side of the existing CSX railyard (*21*, *22*). South of the State Road 25 bridge, a wye track was constructed, and a portion of the old track and railroad right-of-way was preserved for use as a lead track for NS's existing yard just north and east of Sagamore Parkway and the existing NS mainline (*22*).

Figure 17. Relocated and Restored Lafayette Big Four Station/Riehle Plaza/Pedestrian Bridge Area
Source: Lafayette Railroad Relocation Office/Liz Solberg

The fifth and sixth contracts in Segment #5 consisted of relocating the NS double-track to the new corridor and reconstructing the route through the city. A pedestrian bridge over the new rail corridor was constructed at Smith Street. Originally, a roadway underpass had been proposed for Smith Street, but this structure was removed from the final plans (*17*). Contracts 1 and 2 of Segment #5 were completed in 1996. Contract 3 was completed in 1998 and Contract 4 in 1999. The final two contracts, which relocated the NS line and closed 23 at-grade crossings, were completed in 2003 (*23*). Overall,

Segment #5 cost approximately $77.8 million, with the federal government paying 80 percent, the state paying 4 percent, and local funds paying the remaining 16 percent of this segment (*24*). Figure 18 shows the Segment 5 improvements.

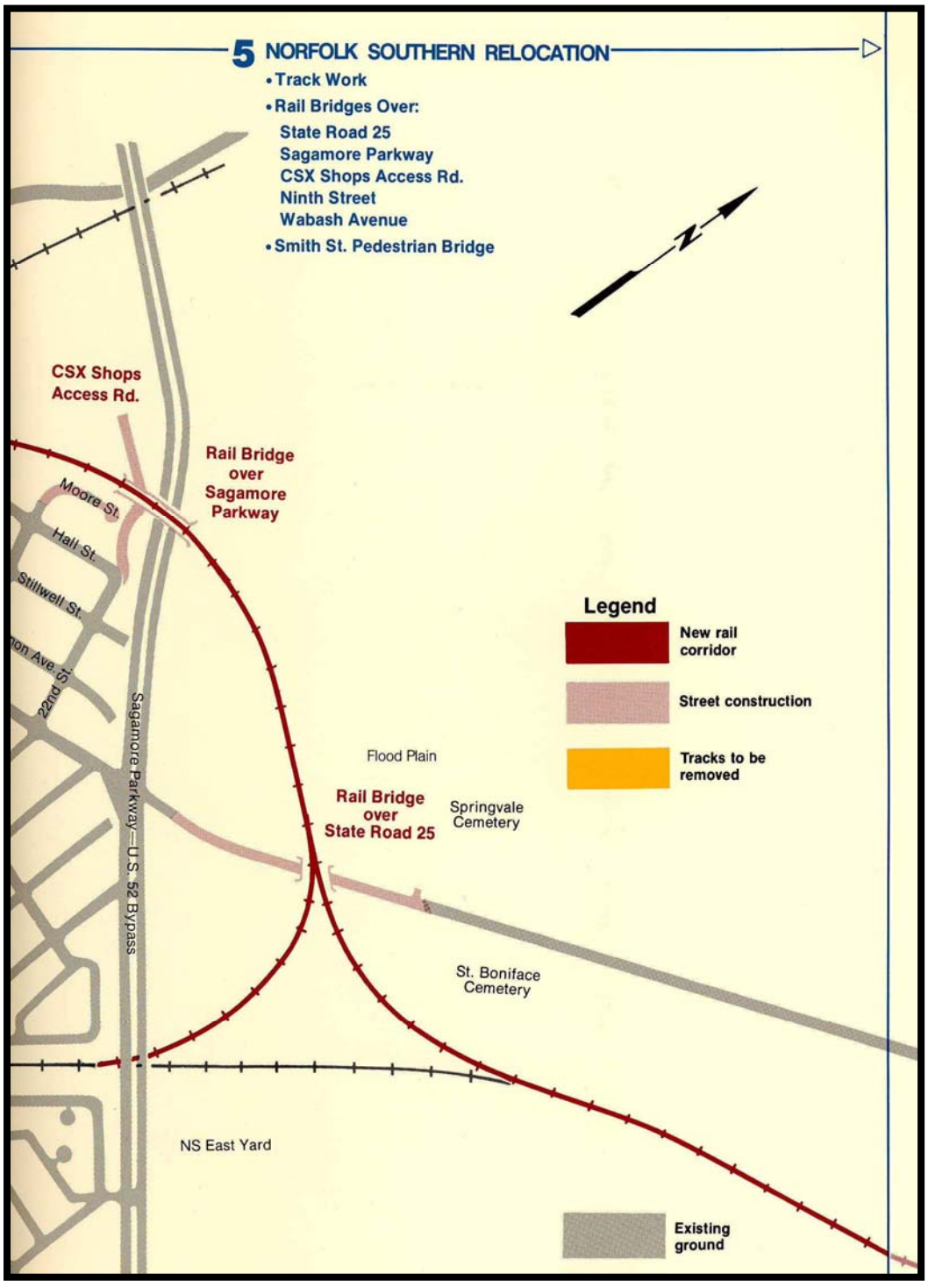


Figure 18. Detailed Project Map Showing Segment 5 (*22*).

BENEFITS

The benefits of this project are tied largely to public safety improvements and economic development opportunities along the roadway corridors from which the rail operations were relocated. The area also gained by including many aspects of non-rail public improvement projects in the overall railroad relocation plan such as highway overpass improvements, creation of a downtown plaza that could also serve as a multimodal transportation terminal, and the restoration of an outdated bridge as a bicycle/pedestrian facility. Additional benefits are from increased auto and train mobility through the urban area.

The city calculated additional benefits of approximately $53 million in city infrastructure and environmental improvements from roadway, pipe, landscape, and environmental projects that took place in conjunction with the railroad relocation project, not including the value of the new state highway bridge over the Wabash River (*25*). While the railroads benefited from the project by being able to increase their operating speeds from 10-15 miles per hour on the old lines to 50 miles per hour on the new corridor, most of the economic benefits accrued to the public and direct financial investment by the railroads were not a part of this project (*26*). Both railroads did participate in other ways, as described above.

COSTS

The overall costs of the project are broken down by segment and funding source as shown in Table 5. This project benefited from several major federal transportation funding acts to receive the majority of its funding. Federal funds provided 83 percent of the final project funding, coming from four main sources, as shown in Table 6. Each of these sources was a major federal transportation funding allocation bill. Other federal funding was directed to the project by the state, as noted below.

State funding provided only 4 percent of the funding for the Lafayette Rail Relocation Project, however the funding provided by the state was key to completing the project. As seen in the notes included on Table 5, 15 separate grants from Indiana's state-level Industrial Rail Service Fund (IRSF) totaling $5,729,917 were applied to the

project. A change in state law had to be made to allow the Lafayette project to be eligible for funding under this program. These state grants provided essential funding for the project at a critical time when new federal funding was being considered. Additionally, two grants from State Highway Funds totaling $1,310,000 were applied to the project for completion of the State Road 26 bridge.

Table 5 also points out that the State of Indiana also made $28,955,781 in federal funds available ($13.53 million-direct state decision; $11.68 million-minimum allocation; $2.07 million-transportation enhancement activities; $1.68 million-rail safety) from discretionary funds beyond what Congress provided specifically for the project. These funds are reflected in the federal column of the table; however, state-level decisions directed them to the project. If these state-allocated federal funds, approximately $29 million, were included in the state funding percentage, the state figure goes much higher to approximately 19 percent of the total project costs. This figure indicates a higher level of state support to the project than would be reflected by the numbers in Table 5.

Local funding for the project came from unanimous and bi-partisan city approval of a bonding and financial program (*18*). Key to this financial plan was the city's allocation of $30 million of its dollars from the Tippecanoe County Economic Development Income Tax, a county-level income tax authorized by the state of Indiana (*26*). From this tax, Tippecanoe County gets 0.4 percent income tax for economic development projects from citizens each year. A portion of those funds were directed to the project. As a result, the city was able to fund approximately 13 percent of the total financial costs of the project (*24*).

PROBLEMS ENCOUNTERED

In addition to the many financial problems already discussed, there were several environmental difficulties to be overcome during the implementation of the project. The riverfront route chosen for the new consolidated rail corridor had been used for industrial purposes throughout the long history of the City of Lafayette. As a result, several contaminated sites had to be cleaned up at the project's expense. These sites ranged in difficulty from former gas stations that had leaky underground storage tanks to former industrial plant sites that had used a "manufactured gas" process for fuel prior to the

Table 5. Lafayette (Indiana) Railroad Relocation Project Financial Summary as of 8/1/03 *(24)*.

SPENT OR OBLIGATED	100%	Federal		State		Local	
Segment #1	6,482,276	6,158,162	95%	324,114	5%	0	0%
Segment #2	21,464,863	17,171,318	80%	1,975,161	9%	2,318,384	11%
Segment #3	17,398,795	16,470,967	95%	482,299	2%	445,529	3%
Segment #4 – CSX Relocation	40,372,035	33,472,208	83%	1,109,440	3%	5,790,387	14%
Segment #5 – NS Relocation	77,867,784	62,644,461	80%	2,745,338	4%	12,477,985	16%
Design & Administration	19,858,459	17,478,407	88%	403,565	2%	1,976,487	10%
Locally Funded Items	2,639,420					2,639,420*	
Totals as of 8/1/03	186,083,632	153,395,523**	82%	7,039,917***	4%	25,648,192	14%
* Includes $638,335 eligible for reimbursement with federal funds by INDOT to the City after all audits have been completed. This is the amount remaining of the federal funds advanced by the city for additional sewer work in the NS Corridor Restoration Contract. Current estimates show an additional $428,407 being reimbursed to the City when the final two construction audits are completed.							
Estimated Final Totals	185,655,225	153,395,523	83%	7,039,917	4%	25,219,785	13%
**In addition to the state funds shown above, the State made $28,955,781 in federal funds available ($13.53 million-direct state decision; $11.68 million-minimum allocation; $2.07m-transportation enhancement activities; $1.68 million-rail safety) beyond what was provided by Congress specifically for the project.							
***Fifteen grants from the Industrial Rail Service Fund totaling $5,729,917 and two grants from State Highway Funds totaling $1,310,000 for the State Road 26 Bridge.							

Table 6. Federal Transportation Bill Allocated Amounts for the Lafayette Rail Relocation Project *(27)*.

Federal Funding Source	Amount
1973 Federal Aid Highway Act (as amended in 1974) Section 163	$41,205,307
1987 STURA Act Section 149	31,911,900
1991 ISTEA Section 1108 and other	39,301,241
1998 TEA-21 Section 1601	27,619,531
Total	$140,037,979

development of cleaner natural gas in the early part of the 20th century (*28*). Cleanup included removal of soils contaminated by lead and chlordane from tank leakage and coal tars from the manufactured gas, leading to the project spending over $4.2 million on environmental cleanup (*28*). These efforts led to several project delays while necessary activities were taking place.

In addition to the environmental hazards identified in the new route, there were several historic properties and articles that had to be preserved. The historic Street Railway Power House had to be removed from its location along the river; however, the EIS determined that the movement of the line to that corridor would, in turn, preserve at least 11 other buildings that were along the existing corridor and listed in or eligible for the National Register of Historic Places (*17*). The relocation corridor also used ROW that had once been the route of the Wabash and Erie Canal in the early- to mid-1800s. Project work came to a stop when several timber beams from the original canal structures were encountered by construction crews. Archaeologists and historians studied the timbers before removal and preservation for a public exhibit on canal history by the Tippecanoe County Historical Association (*19*).

Public support for the project faltered at times during the project due to traffic delays encountered during construction of several segments. The Railroad Relocation Office staff members were able to use their contacts with the media to mitigate some of this anger due to relationships that had been developed in carrying out the community participation plan described earlier (*26*). Despite this cooperation in keeping the public informed of the ultimate project benefits, many citizens tired of the construction delays, and there was some doubt in 1997 as to whether the final project phase (relocation of the NS tracks) would be completed even though it provided over two-thirds of the safety benefits in the form of grade-crossing closures (*19*, *26*). An unfortunate death at a highway-rail grade crossing in 1997 reiterated the need for relocating this final rail corridor. Once funding was approved in TEA-21 in 1998 and NS advanced its $9.6 million loan, the project moved into its final phase and was completed. Public understanding of the project and its benefits has been identified as the major factor in seeing this long and complicated project be fully implemented (*21*, *26*).

LESSONS FOR TEXAS

- **Leverage available federal demonstration project funding.** The City of Lafayette was able to use the initial Federal Demonstration Project funding from its addition to the 1973 Federal Aid to Highways Act to fund a long-awaited project to relocate the area's railroads. Being named as a demonstration project and the follow-up in subsequent years allowed future federal funds to flow to the city much more readily. Federal commitment to the project also freed up additional funds at the state and local levels.
- **Railroad relocation projects can be divided into independent phases and implemented over an extended period.** The difficulty of gaining project funding can be lessened by dividing a large project into several parts and implementing the project incrementally. Although the total budget and timeframe may increase, the project is advanced and can eventually be completed. This was also proven by the Brownsville, Texas, railroad relocation project that was also part of the 1973 demonstration program.
- **Establish working relationships with railroad companies early in the project.** The City of Lafayette's Railroad Relocation Office worked closely with the railroads throughout the life of the project. These relationships allowed for creative financing to take place at the end of the project when NS loaned the city funds to more quickly realize the relocation of its line. Development of detailed Memoranda of Understanding (MOU) between the public sector and the railroad companies ensures that expectations and responsibilities are clear between the parties as the project progresses. This project also shows that multiple railroads and the public sector can work cooperatively to find solutions to urban highway-rail conflicts.
- **The implementing agency must work to maintain continued public, legislative, and financial support over the life of the project.** While early support and buy-in are important, the continued use of proven public involvement strategies and legislative visits made this project feasible and exemplary. Political contacts were important in all phases of the project.

CHAPTER 4:
RENO TRANSPORTATION ACCESS CORRIDOR (RETRAC) PROJECT

PROJECT DESCRIPTION

The Reno Transportation Access Corridor (ReTRAC) was opened to mainline rail use in November 2005. Though the main centerpiece of the project, a depressed rail trench, is complete and the bulk of the budgeted $282 million budget has been spent, many associated projects were still in construction phases when this research was completed. The ReTRAC depressed rail corridor is Reno's selected solution to its downtown rail problems. Although a project of this sort had been considered since the early 1940s, the event that precipitated the development of the project in its final form was the UP and SP merger, which was completed in 1996.

The final design resulted in a full-depth trench with length in excess of 2 miles that depressed a double track mainline 33 feet below grade, nominally along the existing corridor. Eleven at-grade street/rail crossings were replaced by street-level bridges spanning the trench. Union Pacific stipulated that grades should be no greater than 1.2 percent on the west end and that a new connection must be accommodated to the North Reno Branch. The width of the trench is 54 feet measured to the inside of the walls, accommodating two mainline tracks and a service road. The depth of the trench, as stated above, is 33 feet. Figure 19 displays the general east/west ReTRAC corridor along 3rd Street through downtown Reno connecting with the UP division office and crew change point in the city of Sparks, Nevada, just east of Reno.

PROJECT PURPOSE AND DRIVERS

The City of Reno was worried that the UP/SP merger would result in drastically increased train volumes across its 11 downtown at-grade crossings. The city felt that the effects of the increased volume would be to further exacerbate existing problems in the area with traffic mobility, train noise, safety, and depressed tax revenue. Reno and Wichita, Kansas, were the only two cities that were granted federal funding to help mitigate UP/SP merger effects.

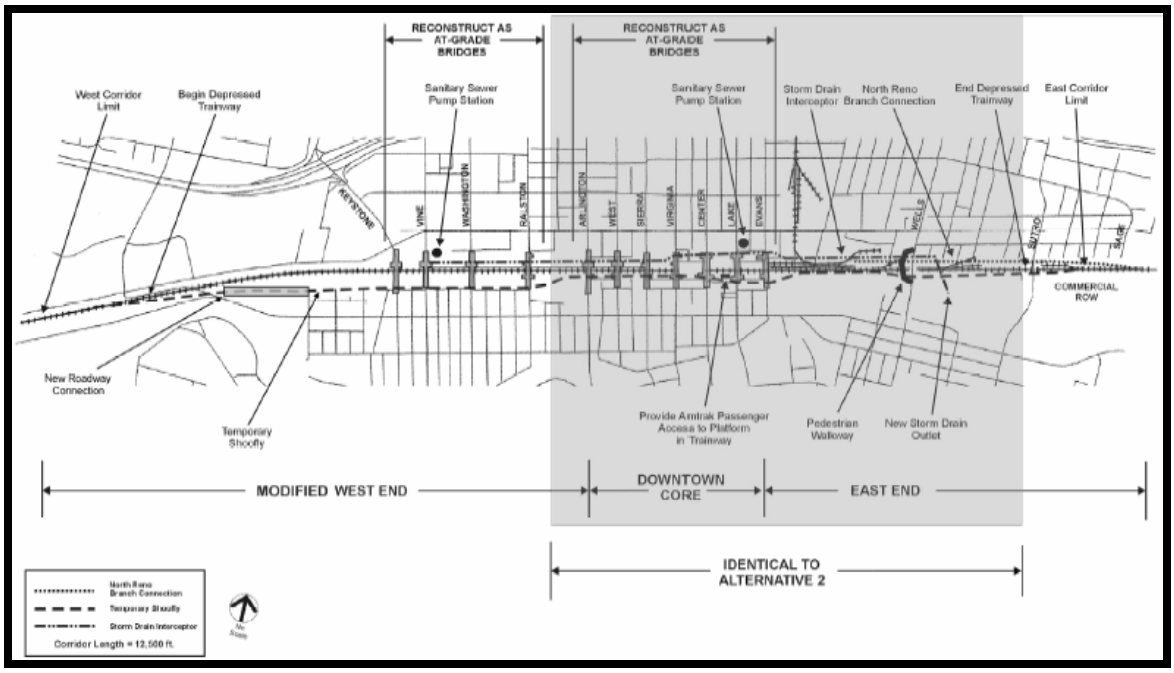


Figure 19. General ReTRAC Corridor Overview (*29*)**.**

At the announcement of the railroad merger, many downtown businesses (predominantly casinos) voiced concern over the perceived effects of post-merger rail traffic volume. Under pre-merger conditions, casinos were already experiencing detrimental effects stemming from their proximity to the rail corridor. Hotel rooms facing the tracks were being discounted, and there was a feeling by some of being on the "wrong side of the tracks." Because of discounted property and room rates, the city claimed lessened tax revenue near the rail route.

There was also concern over grade-crossing safety in and around the downtown tracks for both autos and pedestrians. Grade crossings in the urban area were creating noise, safety concerns, and mobility problems—especially for the mobility of emergency response vehicles. Without raising these issues, it is likely that this long-sought project would not have had enough public or government backing to be adequately funded. Unsurprisingly, a large project like this was packaged with other public works projects and general downtown beautification initiatives to increase the perceived benefit to the community. Another notable benefit of a project like this is the potential to increase government revenue by an associated increase in the tax base.

DECISION PROCESS

Before arriving at the final design, many alternatives were considered. The alternatives analyzed in the Final Environmental Impact Study (FEIS) were diverse and looked at many possible land uses and railroad operational characteristics. In general, the alternatives were divided into three categories—those that keep the existing alignment, those paralleling the existing alignment in nearby corridors, and those bypassing the city completely. Alternatives in the same alignment included full grade separation (both elevated and depressed) and partial grade elevation/depression with corresponding overpasses or underpasses where roads crossed the corridor. Also considered were options for keeping the rail at grade and separating the streets by either overpass or underpass. Table 7 lists the options that were considered.

In addition to alignment along the existing corridor, several alternatives were considered in corridors that closely paralleled it. These included the Second and Fourth Street bypasses as well as the I-80 corridor. Figure 20 shows the existing corridor and potential near-corridor alignment alternatives.

Two alternatives were considered that bypassed the existing corridor significantly to the north. These were the Truckee Meadows Bypass and the McCarran Boulevard Bypass. The Truckee Meadows Bypass would have required the construction of 78 miles of double track mainline while bypassing the entire Reno-Sparks metropolitan area as well as the UP Sparks yard and division office. Similarly, the McCarran Boulevard Bypass would have bypassed the city but would have required construction of only 15 miles of track. Figure 21 shows the considered alignments for these two routes.

Table 7. Alignment Alternatives Considered by the Reno ReTRAC Project.

Build Alternatives along Existing Rail Alignment	
• Downtown depressed trainway	• 2.1 mile trench from W 2nd St. to Sutro St. with at-grade bridges for roads
• Partially depressed trainway	• 2.1 miles in length from W 2nd St. to Sutro St., but only dug to the depth of groundwater (15-20 ft below grade at shallowest) with reduced height overpasses for roads
• At-grade trainway	• Various combinations of full overpasses and underpasses
• Elevated/partially elevated trainway	• Various combinations of street and rail overpasses and underpasses
• Trainway in tunnel	• Constructed using cut and cover techniques
Build Alternatives along other near-Corridor Alignments	
• Move rail corridor to 2nd Street	• Parallel alignment to south
• Move rail corridor to 4th Street	• Parallel alignment to north
• Move rail corridor to I-80 alignment	• At-grade and depressed trainway along Interstate Corridor
Build Alternatives that bypass the Urban Area	
• Truckee Meadows bypass	• Adds 78 mainline miles of track, would eliminate rail service from downtown Reno but would traverse a national forest area and require extensive land acquisition
• North MacCarran Blvd corridor	• Adds 15 additional miles of track and would require significant cuts and/or tunneling

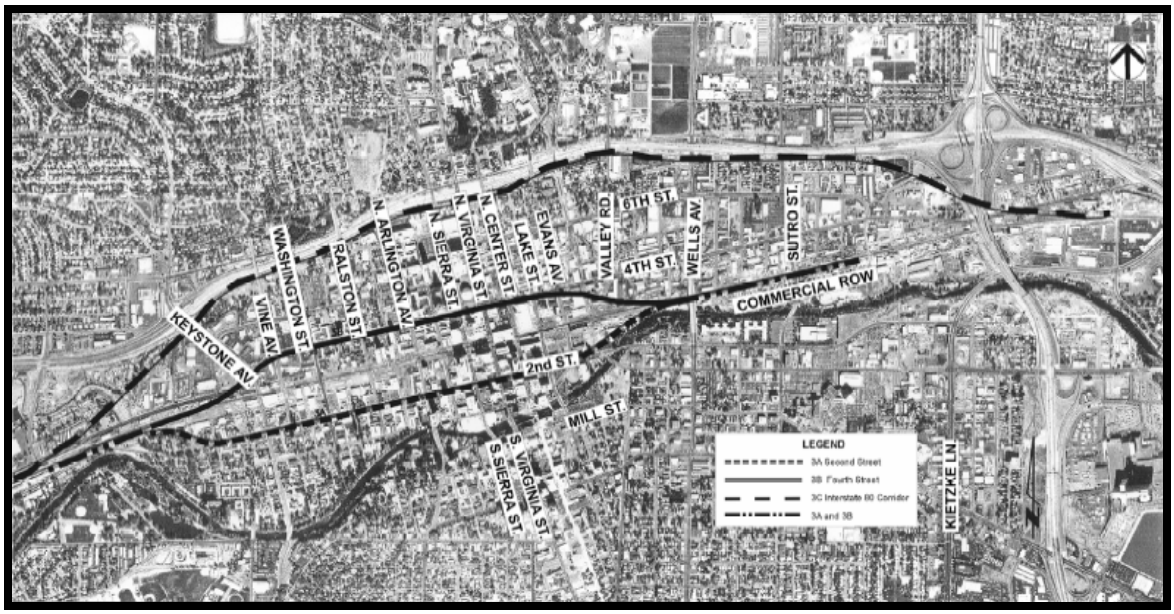


Figure 20. Existing Corridor and Near-Corridor Alignments *(29)*.

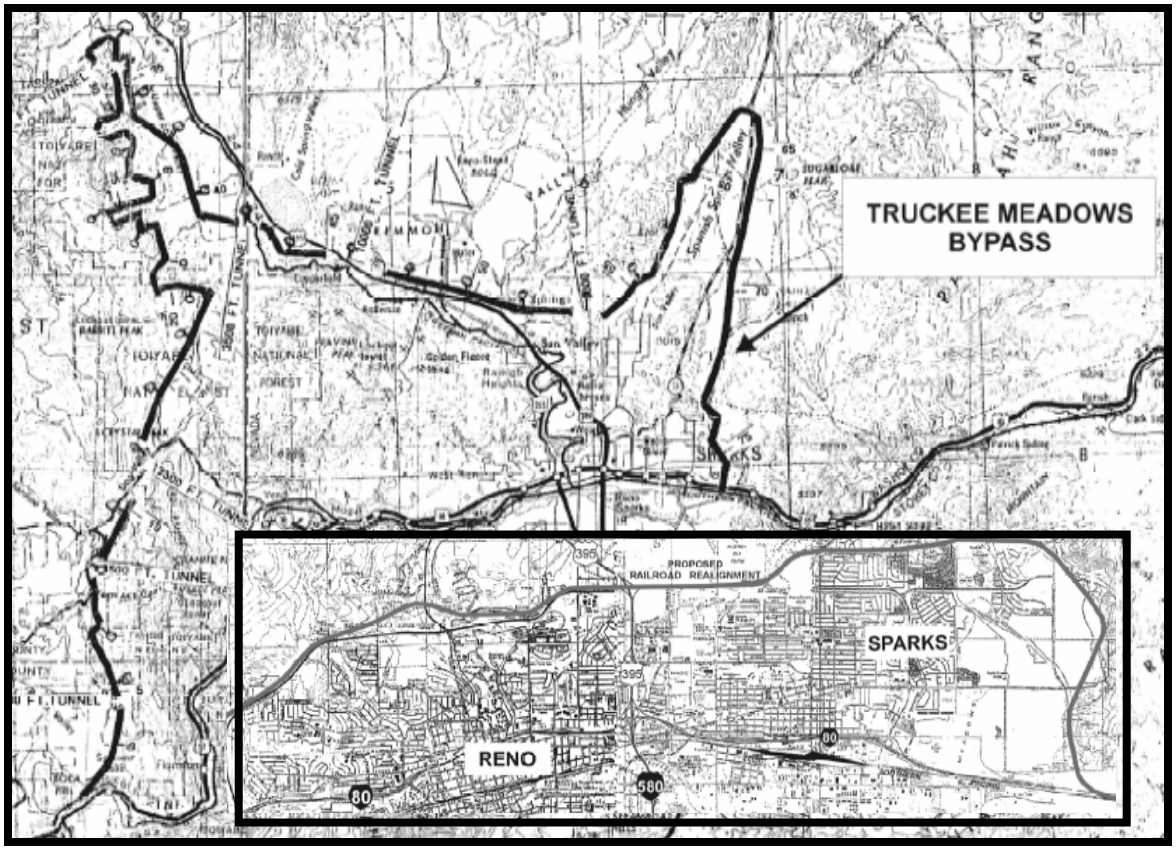
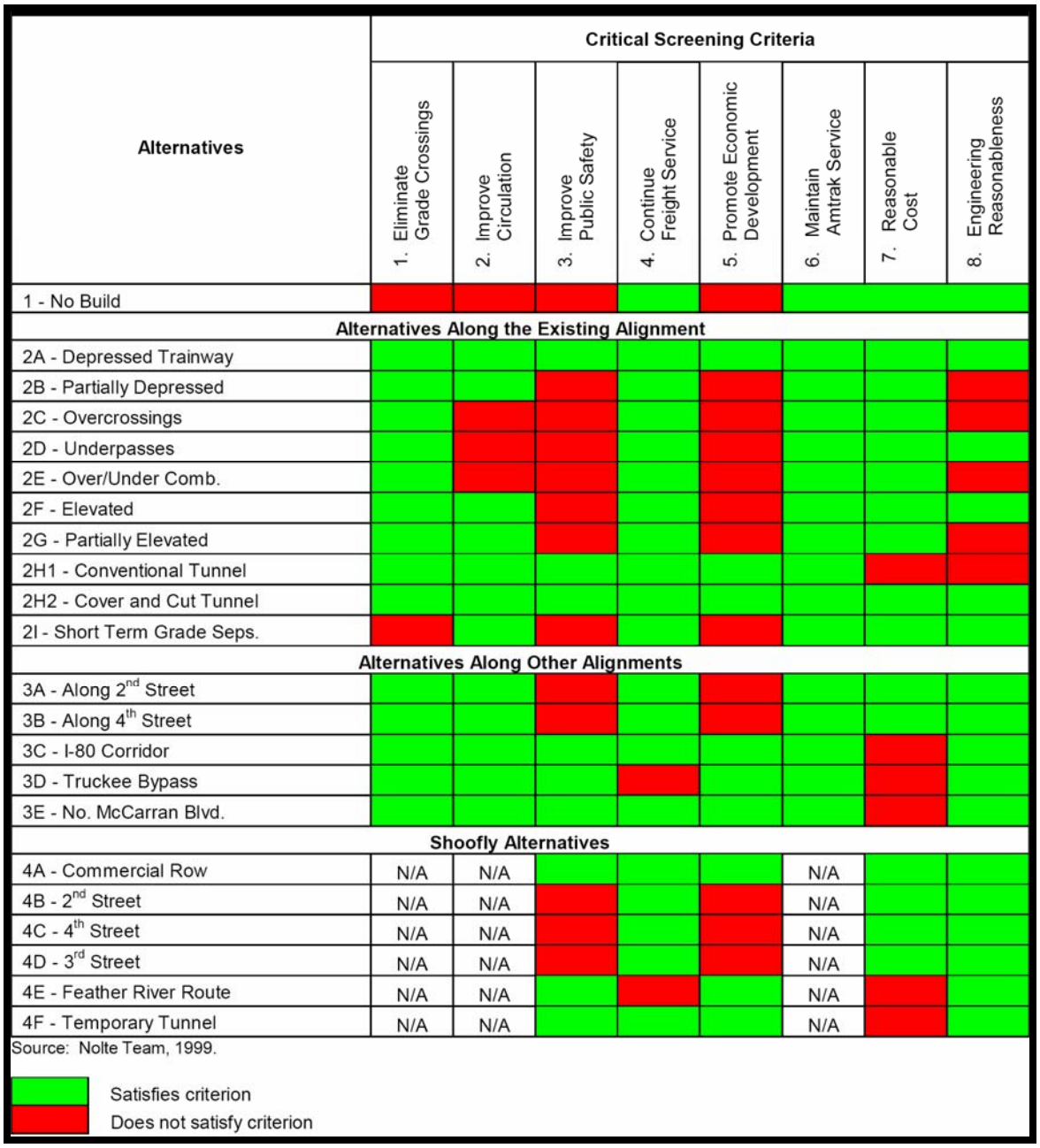


Figure 21. Truckee Meadow Bypass and McCarran Boulevard Bypass (inset) *(29)*.

During the initial decision process, eight broad metrics were used to discriminate between alternatives. Each alternative was evaluated based upon the following questions:

- Would it eliminate grade crossings?
- Would it improve vehicle traffic circulation downtown? (based on Level-of-Service [LOS] analysis and future demand volumes)
- Would it improve public safety? (reduction of rail/vehicle/pedestrian conflicts, effect on emergency service access, increased/decreased risk from derailments)
- Would it maintain freight service to existing rail customers?
- How does it affect economic development potential? (noise, aesthetics, business access)
- Does it allow for continued Amtrak service?
- Does it have a reasonable cost? (defined as <$400 million)
- What is this option's engineering feasibility? (*29*)

The projects were evaluated as either passing or failing each criterion listed above. The No Build Alternative failed four of the eight criteria for the primary reason that the criteria were devised assuming that one of the build alternatives would be implemented; essentially, it does not fulfill the purpose of the project. A simple decision matrix (seen in Figure 22) was constructed to illustrate the process.



Alternatives	Critical Screening Criteria							
	1. Eliminate Grade Crossings	2. Improve Circulation	3. Improve Public Safety	4. Continue Freight Service	5. Promote Economic Development	6. Maintain Amtrak Service	7. Reasonable Cost	8. Engineering Reasonableness
1 - No Build								
Alternatives Along the Existing Alignment								
2A - Depressed Trainway								
2B - Partially Depressed								
2C - Overcrossings								
2D - Underpasses								
2E - Over/Under Comb.								
2F - Elevated								
2G - Partially Elevated								
2H1 - Conventional Tunnel								
2H2 - Cover and Cut Tunnel								
2I - Short Term Grade Seps.								
Alternatives Along Other Alignments								
3A - Along 2nd Street								
3B - Along 4th Street								
3C - I-80 Corridor								
3D - Truckee Bypass								
3E - No. McCarran Blvd.								
Shoofly Alternatives								
4A - Commercial Row	N/A	N/A				N/A		
4B - 2nd Street	N/A	N/A				N/A		
4C - 4th Street	N/A	N/A				N/A		
4D - 3rd Street	N/A	N/A				N/A		
4E - Feather River Route	N/A	N/A				N/A		
4F - Temporary Tunnel	N/A	N/A				N/A		

Source: Nolte Team, 1999.

Satisfies criterion

Does not satisfy criterion

Figure 22. Decision Matrix for Alternatives to Include in EIS *(29)*.

Based on the decision matrix, the following alternatives were recommended for inclusion in the FEIS. The alternative listings previous to the description are the decision matrix designations. The alternative listings that appear in parentheses after the description are the designations carried forward in the FEIS.

- Alternative 1 - No Build (Alternative 1)

- Alternative 2A - Depressed Trainway; with Alternative 4A (Commercial Row Shoofly): A depressed trainway would provide for seven at-grade bridges and four overpasses. (Alternative 2)
- Alternative 2A1 – Extended Depressed Trainway (a variation of Alternative 2A) with Alternative 4A (Commercial Row Shoofly): This alternative is 1300 feet longer than Alternative 2 and would accommodate all 11 north-south streets on at-grade bridges. (Alternative 3)
- Alternative 2H2 – Cover-and-Cut Tunnel; with Alternative 4A (Commercial Row Shoofly) (easterly from West Second Street to Arlington Avenue and again from Evans Avenue to east of Sutro Street): The length of this alternative is the same as that of Alternative 3 so as to accommodate at-grade road crossings. (Alternative 4)
- Modified Extended Depressed Trainway: Similar to Alternative 3, all streets would be accommodated at-grade, but the trench would only be extended 250 ft beyond the length provided in Alternative 2. (Alternative 5)

Alternative 5 was not originally considered but is a combination of the positive aspects of Alternatives 2 and 3. Alternative 5 thus became the favored design.

SELECTED PROJECT

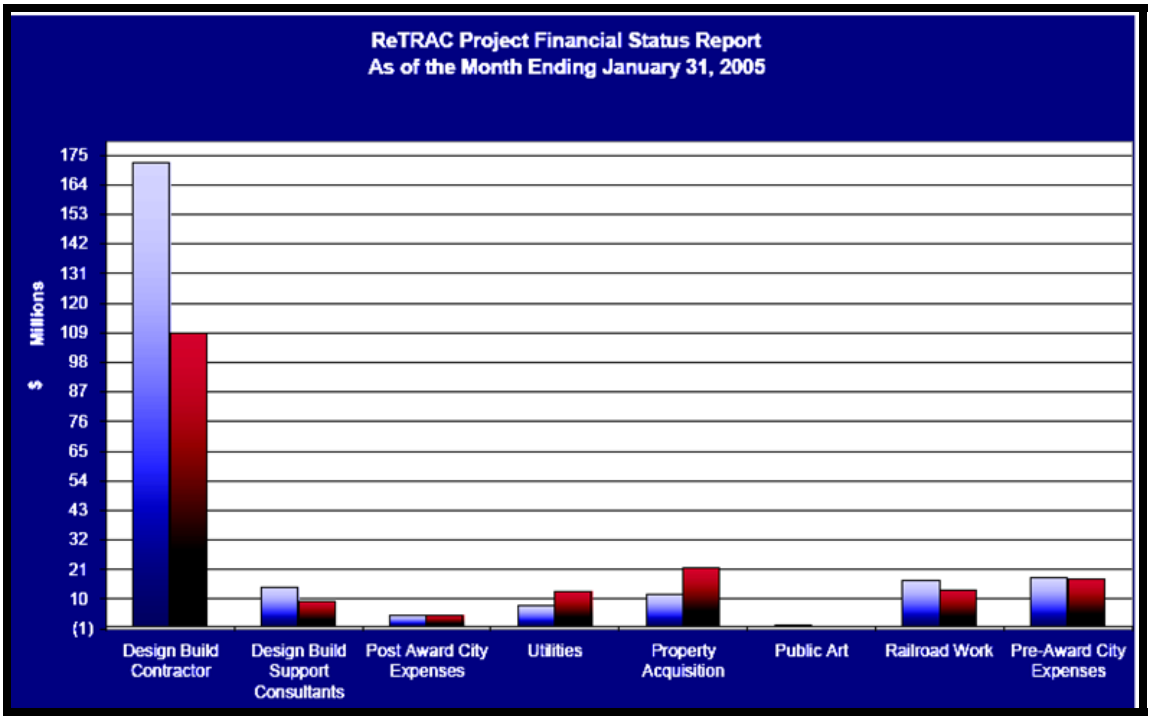
The project's Record of Decision, which was released on February 23, 2001, designated Alternative 5 (Modified Extended Trainway) as the selected project as the result of using a comparative evaluation process *(30)*. Alternative 1 (No Build) was rejected, as stated previously, because it did not satisfy the purpose and need for the project. Alternative 4 was eliminated because it presented overwhelming and unacceptable problems for both Amtrak and UP. Passenger comfort in the enclosed below-grade station platform necessitated by the tunnel configuration could not be guaranteed due to problems such as excessive heat build-up and high noise levels from operating ventilation equipment. The heat would also create a condition that would prevent UP from operating two trains in the ReTRAC project corridor at the same time.

Alternatives 2 and 3 remained viable alternatives in the Draft Environmental Impact Statement (DEIS). After receiving public comments on the DEIS, the positive features of alternatives 2 and 3 were combined to create Alternative 5 which became the preferred alternative in the FEIS. In summary, Alternative 5 was selected for the following reasons:

- it would result in fewer property acquisitions for right-of-way purposes;
- it would have the least adverse effect on the profile of the local street system;
- it would have a reduced amount of trench excavation and wall construction; and
- with regard to factors other than those outlined above, it would have equivalent or identical environmental effects as the other alternatives being considered.

COSTS

The project, at completion, was programmed to cost $282 million, of which $264 million was for construction and $26 million for financing bond issues. As of January 31, 2005, Reno had used 71 percent of their budget and completed 63 percent of the work. Key areas that were over budget were: ROW and property acquisition, city utility payments, administration and personnel, and rail work. Those areas that were under or on budget were the design-build contract, consulting/environmental/legal, business relocation costs, and public art (see Figure 23).



Note: Red represents to-date expenditures. Blue is the budgeted amount.

Figure 23. ReTRAC Financial Status through January 2005 *(31)*.

To facilitate such a large public works project, many levels of government became involved. The key funding technique that made this project possible was a loan from the federal Transportation Infrastructure Finance and Innovation Act (TIFIA) program authorized in the TEA-21, which was passed in 1998. Additionally, grant funding specifically for the ReTRAC project was also provided by a TEA-21 earmark. In its financial plan for the project, Reno secured commitments of $73.5 million from the TIFIA loan program and $21 million in federal grants from TEA-21 (*32*). The total TIFIA obligation of $73.5 million was bundled into three parts. The first TIFIA loan was financed at 5.66 percent and payments had originally been established to be between $1.3 and $7.5 million per year. The loan's term was 35 years, making it due in June 2041 (*33*). However, the sales and room tax initiatives (described below) that were implemented to fund the $50.5 million loan were found in May 2006 to be performing as they had been projected, at which time the city paid off both the principal and accrued interest, thereby closing the first TIFIA loan (*32*).

The other two planned TIFIA loans were a $5 million loan backed by lease income from Union Pacific property transfers and $18.5 million, which was backed by a downtown assessment district on the properties adjoining the project corridor. Neither of the last two planned loans of the total TIFIA loan package was ever closed. Recently, the City of Reno has stated to FHWA that it does not plan to further pursue those loans at this time (*32*).

Project funding was derived from several sources. The first of these sources were tax increases at the state and local government levels. The City of Reno levied an additional 1 percent hotel tax, over and above what statutes then allowed, since the hotels and casinos were major promoters, drivers, and beneficiaries of the project. State and local governments also worked together to implement an additional local 1/8th cent sales tax increase in the local area to fund the project. Anticipated proceeds from these taxes backed the first federal TIFIA loan described earlier. Union Pacific agreed to make $58 million in total contributions, which included land, lease revenue, air rights, and construction material. To cover the remaining portion of the project costs, Reno issued $113.2 million in municipal revenue bonds and paid $2 million directly in cash. Reno's Downtown Benefit Assessment District contributed $18 million to be used for sound and congestion improvements (*34*). The breakdown of funding sources and funding method are shown in Figure 24.

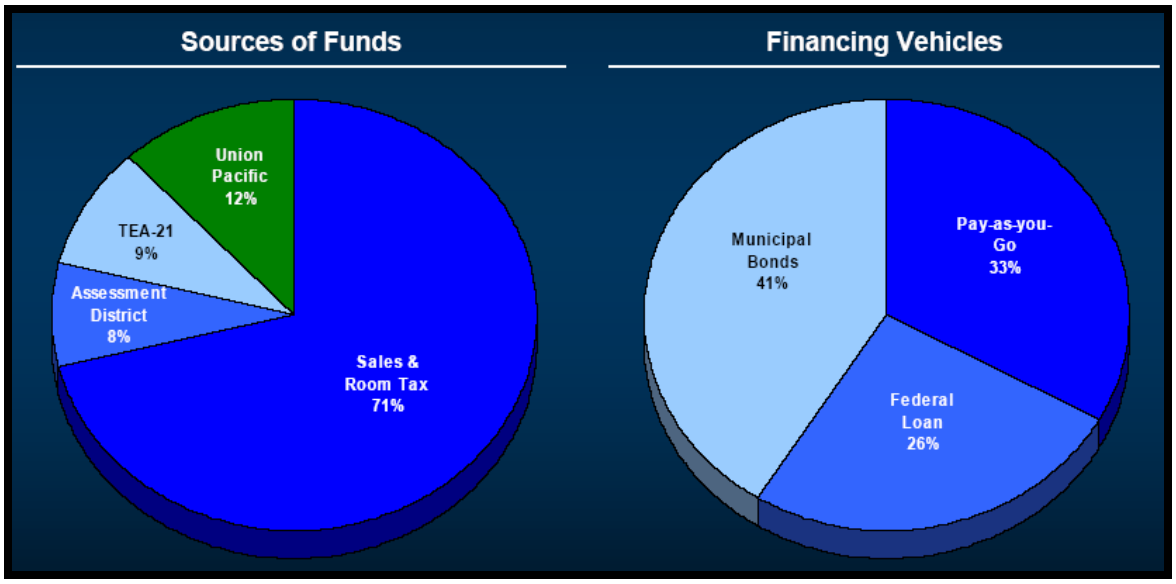


Figure 24. Planned Funding Breakdown by Source and Vehicle for ReTRAC (*35*)**.**

BENEFITS

The speed of rail operations through downtown Reno was increased from 20 miles per hour when it was at-grade to 60 miles per hour through the trench. The trench also was designed to accommodate a new connection to the North Reno branch, which connects UP's (former SP) Overland Route at Reno and the UP Feather River Route to the north. By staying in the same general corridor, the route continues to connect with the existing crew change point in Sparks, Nevada, while grade separating the 11 existing crossings along the corridor. Noise levels for adjacent businesses and public safety improvements were also significant benefits of the project.

PROBLEMS ENCOUNTERED

Design and accommodation for utilities in the construction of the rail trench was extensively considered in the project FEIS. Electric, water, cable, and gas lines were moved to cross the trench on the new road bridges. In addition, several storm drains, which empty into the Truckee River, had to be moved and modified. From the north side of the river, there were originally six outlets, which were reduced to only one during construction. Drainage channels in the trench now direct runoff to pumps.

Most of the shoofly put in place during construction was double track and built along Commercial Row, directly adjacent to the construction zone for most of its length. Temporary

crossing gates and signals were installed. Accommodations for continued economic activity had to be made for businesses affected by the shoofly during construction.

Compared to other alternatives considered, the land acquisitions required for this route were minor. Much of the land acquired by the city was included in the 77 parcels donated as part of its deal with Union Pacific, a significant benefit to using the existing right of way. In addition to the needed railroad right-of-way, a 50-ft easement on either side of the trench was granted for installation of requisite trench wall tiebacks. Both temporary and permanent land acquisitions were made, displacing people from approximately 30 residences and affecting, but not displacing, approximately 550 others.

The ReTRAC project underwent significant hydrological review because of its proximity to the Truckee River and the storm drain modifications that were necessitated by it. Pre-construction water quality was, in general, not in violation of federal or state standards; however, some groundwater showed evidence of hydrocarbon contamination, which had to be cleaned up. Noise was an important issue raised by the hotels proximate to the railroad right of way. By depressing the tracks, all grade crossings in the area were eliminated, which also eliminated associated horn and warning device noise. To further reduce street level noise from railroad activity, acoustic shielding was installed with the effect of reducing noise levels by a further 15 decibels.

The Reno-Sparks area is in an existing non-attainment area. To assess the impacts to local air quality, a study was done on locomotive and vehicle emissions based on assumed operating characteristics of the new corridor. It was determined from the study that air quality was expected to improve primarily because of increased train speed and decreased vehicle idling at rail crossings (FEIS). Because federal funds were used for ReTRAC, the project could not contribute to new instances of non-attainment, as guided by Environmental Protection Agency (EPA) rules at 40CFR Vol. 14, Part 93, §93.109-93.117.

It is of note that the rail traffic volume predictions for travel through Reno following the UP/SP merger were inaccurate, in the short term at least. The number of trains per day experienced a marginal decline (as of November 2005) when the corridor was opened. Much of the east-west and west-east traffic increase has been in the form of intermodal unit trains to or from the Port of Oakland. Due to clearance restrictions on the Overland Route between Roseville, California, and Reno, all double stack trains have been moved over the Feather River

Route. Both routes are shown in Figure 25. It is, however, reasonable to expect that in the future the Overland Route clearances will eventually be increased to accommodate larger traffic as the Feather River Route is more susceptible to flooding and is much longer (*36*).

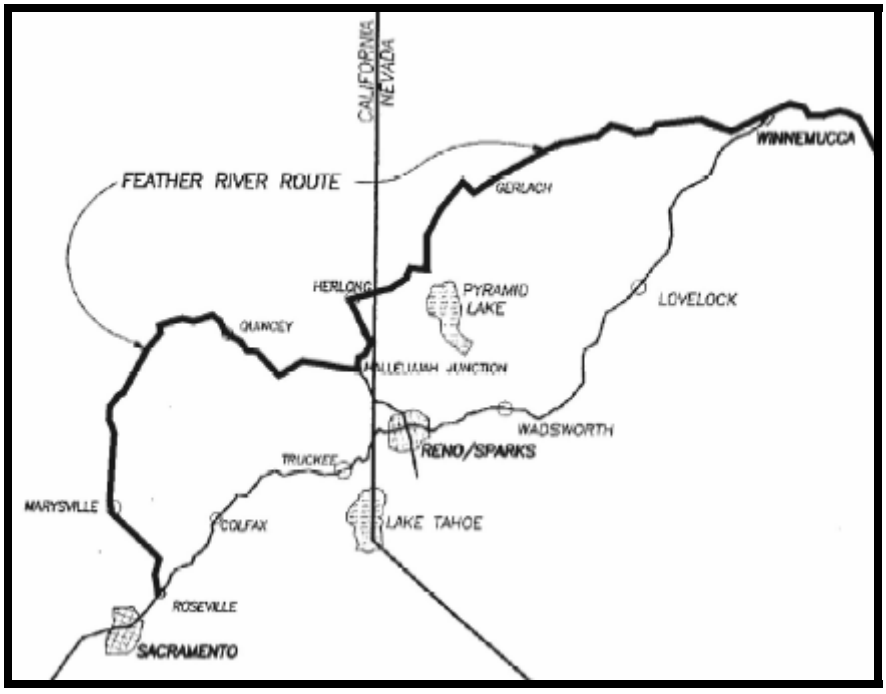


Figure 25. Feather River and Overland Routes (*29*)**.**

LESSONS FOR TEXAS

- **Maximize the use of federal loan programs when possible.** The TIFIA loan used to finance part of this project was an excellent way to increase the total amount of funding available to the project by leveraging hotel and sales taxes into a much greater amount. Once these federal funds were committed to the project, ReTRAC project officials were able to negotiate and finance other project debt (revenue bonds) at the lowest possible Revenue Bond Index (RBI) rates. Once the receipts from the special tax initiatives were proven to be performing as forecast, the City of Reno was able to repay its TIFIA loan early and with interest in May 2006—only six months after the project began operations.
- **Work closely and in good faith with the railroad(s).** During this project, the City of Reno allowed the railroad company to have considerable power in the decision-making process. This act was an important factor to the project's success, positively affecting both project financing (i.e., funding provided by UP, reduced land

acquisition costs, etc.) and the continued ability of the railroad to serve its customers in the downtown area. Maintaining the connection to UP's division office, crew change point, and yard facilities in Sparks, Nevada, directly adjacent to Reno on its east side, were important to preserve to avoid added costs. Throughout construction, both contractors and the City of Reno worked closely with the railroad to ensure their support. There were regular Friday teleconferences with Union Pacific to make sure that each party's expectations were being upheld.

- **It may be desirable to maintain existing freight and passenger service routes and grade separate an entire corridor rather than to geographically relocate train service.** The selection of a depressed train-way seems to have been a good alternative in the case of Reno, since it simplified property acquisition and did not add length to the existing route. Support from the business sector (largely the hotel and casino industry) for a project of this type had existed for many years prior to the UP/SP merger. However, the merger caused businesses already negatively affected by the rail corridor to have increased concern. The decision to make a trench within the existing corridor had many temporary drawbacks during the construction period; however, there was broad support for the project in general, as businesses and residents perceived that the result would end up favorably affecting the downtown area.
- **Keep the public involved by maintaining a robust public information program.** One of the major lessons learned from the ReTRAC project was the importance of a robust public involvement process. In the case of Reno, public participation activities were well organized and were structured to promote open access to project information via the Internet. Some residents had expressed concerns about the selected alternative that was outlined in the FEIS; but, as FHWA noted, "The City's approach to the controversy surrounding ReTRAC was to treat all stakeholders as partners and to provide them with continuous, accurate, and up-to-date mitigation monitoring information" (*37*).

  The most important media for information dissemination to the pubic was the project website (www.ReTRAC.info). Posted on the project website were compliance reports, notices and clarifications, and non-compliance reports (of which

only one was issued). The city felt that this forum was an important means of both garnering public support and keeping a good working relationship with its construction contractors. Through the process of developing the website, NDOT and the City of Reno learned that:

- Estimates of the number of people seeking project information are necessary to evaluate information distribution system effectiveness. City officials note that it would have been useful to know how many people were attempting to access this type of information before the system was in place.
- The project website could be adapted to solicit comments from the public. For example, when an Environmental Impact Statement is put online for public review, providing an option to submit comments on the EIS from the same site would gain greater public feedback.
- The success of the website may encourage agencies and stakeholders to develop communications partnerships on future projects (*37*).

CHAPTER 5:
SALT LAKE CITY, UTAH, GATEWAY PROJECT

PROJECT DESCRIPTION

Salt Lake City's Gateway District consists of approximately 650 acres of land on the west side of downtown, extending a few blocks west of Main Street to Interstate 15 (I-15), shown in Figure 26. This area had served as the center of freight and passenger rail service to the city for the past century, with rail yards operating among maintenance facilities, heavy industry, salvage yards, and warehouses (*38*). Over time, the Gateway District became an area of urban blight, fraught with crime, homelessness, and perceived large-scale land contamination. Imposing overhead viaducts and the possibility of acquiring contaminated property discouraged potential investors from redeveloping the area. Plans to revitalize the old commercial and industrial area extend back to 1978 when the city first envisioned the establishment of the Gateway District as the point where:

- travelers coming from the regional highway system or the Salt Lake City International Airport would be welcomed to the city;
- visitors arriving by car or transit would become oriented to the city and impressions of the city would first be formed;
- connections to regional and city destinations would be made via a new transportation hub serving buses, trains, commuter rail, light rail, pedestrian, and bicycle networks; and
- residential and work opportunities would materialize in conjunction with transit-oriented services, distinctive streets, and open space networks.

In addition to the desire for a revitalized Gateway District, redevelopment of this area west of the central business district area took on greater importance following changes in the mid-1990s to city zoning ordinances that cut off further commercial development to the west (*38*). Subsequently, efforts by the Salt Lake City Planning Division to redevelop the Gateway District resulted in the 1998 Gateway Development Master Plan, which is comprised of the Creating an Urban Neighborhood Plan, identifying guiding principles and establishing an implementation strategy, and the Gateway Specific Plan, offering guidance on decision-making processes regarding growth and development. Together, these components of the master plan

were prepared to transform the Gateway District into an urban area where residents of Salt Lake City could work, live, learn, and relax in close proximity to downtown.

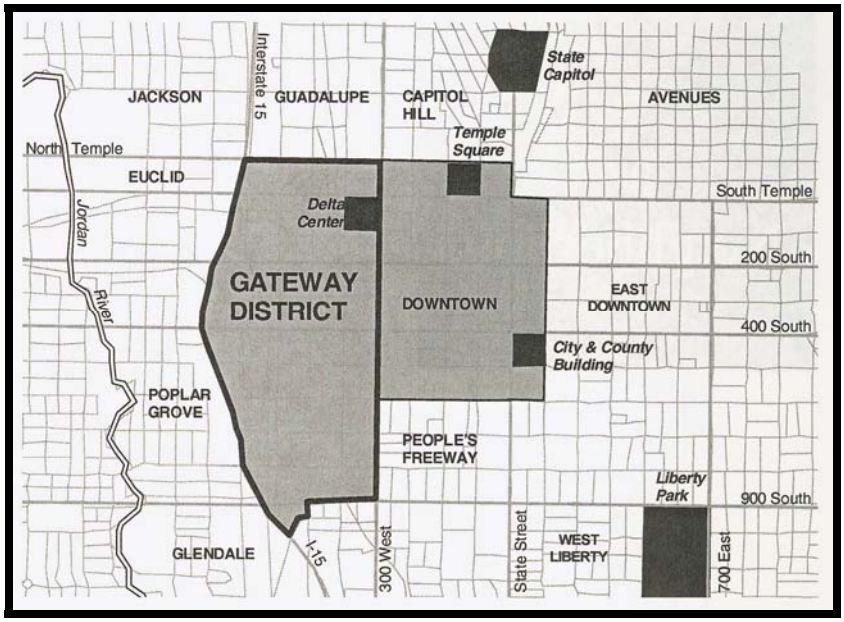


Figure 26. Gateway Area (*39*)**.**

City planning documents divide the Gateway District into the five subdivisions shown in Figure 27. The focus element of the UP sub-district is the UP Depot, which was built in 1908 and now serves as an entrance to the redeveloped area (see Figure 28). Likewise, the focus element of the Rio Grande sub-district is the Rio Grande Depot, shown in Figure 29, which had served as the city's Amtrak station since the 1970s and has housed the Utah State Historical Society since 1980. Historically, both the UP and Rio Grande Depots served passenger rail customers since 1910 and prior to the rail lines becoming devoted mainly to freight traffic decades later.

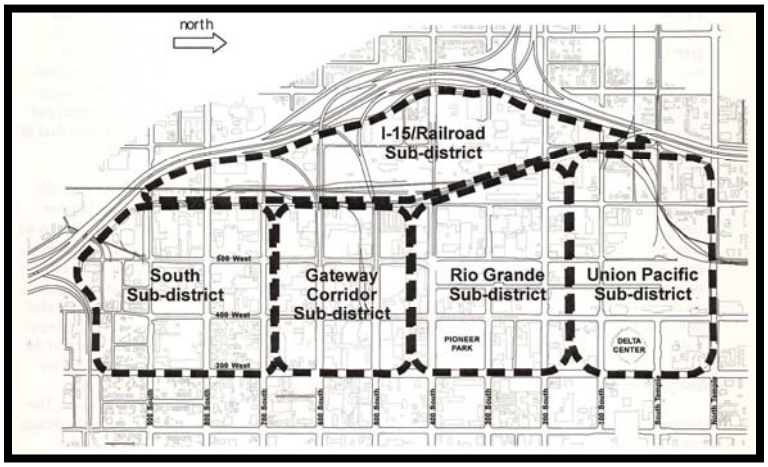


Figure 27. Divisions of the Gateway District *(39)*.

Figure 28. Restored Union Pacific Depot.

Figure 29. Rio Grande Depot.

Rationale for the Consolidation of Rail Lines

Though the SP and Rio Grande railroads merged in 1988, SP was not acquired by UP until 1996, one year after Salt Lake City won the bid to host the 2002 Winter Olympics. Each of these railroad companies had constructed rail lines through the Gateway District, as shown in Figure 30. SP's original track (nearest I-15 in Figure 30) served as the company's north-south mainline through the city and connected with the 400 South Yard, essentially providing the closest railcar switching and storage capacity to the downtown area. Southern Pacific's 500 West Spur originally served as the Rio Grande mainline and accommodated passenger travel to and from the Rio Grande Depot. Passenger service at the UP Depot, though terminated in the 1970s, was accommodated by a mainline that became the company's 400 West Spur (Figure 30). Following the termination of passenger service at the depot, UP began using the adjacent rail yard (South Yard) as storage for:

- cars pulled from or awaiting delivery to local industries,
- maintenance-of-way and wrecking train cars,
- occasional passenger cars (UP business cars), and
- circus trains.

Viaducts extending over the three rail lines presented a major impediment to the revitalization of the Gateway District. The 400, 500, and 600 South Street viaducts extended from I-15 to the downtown area on the east side of UP's 400 West Spur, as illustrated in Figure 31. As can be seen in Figure 31, the existence of these overhead structures limited visibility and mobility within the Gateway District and made it unattractive to developers, explaining why little improvement to the area was made during the last several decades.

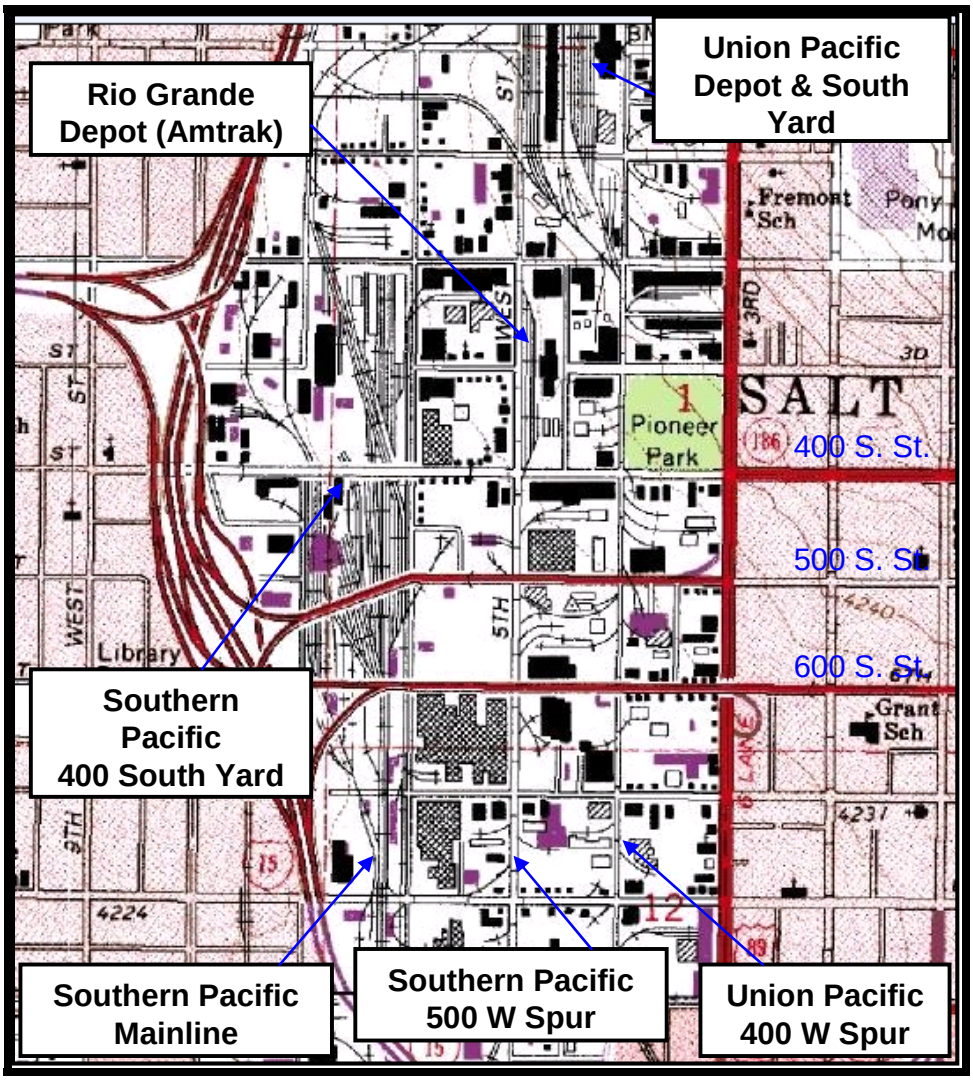


Figure 30. Railroad Salt Lake City Rail Infrastructure Prior to Redevelopment *(40)*.

Figure 31. Viaducts at the 400 West Spur *(41)*.

UP's purchase of Southern Pacific eliminated any conflicts that would have otherwise existed in attempts to consolidate separate railroad entities onto a single line. With the designation as an Olympic Games host city shortly before the railroad merger, public officials were virtually provided undisputable cause for appropriating funds to transform the Gateway District into an urban showcase befitting of an Olympic legacy. These events coincided with the Utah Department of Transportation's need to upgrade I-15, which itself would require modification of the 400, 500, and 600 South Street viaducts.

Overall, events in the rail industry affecting Salt Lake City were an important component of efforts to transform the Gateway District into a thriving urban center. However, the initiation of work on the project occurred through the combination of many events, namely:

- changes in city zoning ordinances that restricted commercial development on the east side of the central business district,
- upcoming reconstruction of I-15 adjacent to the Gateway District,
- opportunity to consolidate rail lines following Union Pacific Railroad's purchase of the Southern Pacific Railroad, and
- Salt Lake City's selection as host of the 2002 Winter Olympics.

Railroad Consolidation Plan

Salt Lake City officials considered the coincidence of plans to reconstruct I-15 and the opportunity to consolidate Union Pacific's three rail lines a once in a lifetime opportunity to redevelop the Gateway District. Inasmuch, the Utah Department of Transportation required significant evidence that rail consolidation would in fact occur so that plans for shortened viaducts could be integrated into the structural and geometric designs. Plans to complete the railroad consolidation process were prepared by a consultant team in consultation with the project steering committee, with implementation to occur in the five phases described below.

Phase 1A

Removal of the 500 West spur and 400 West spur was a top priority of the project steering committee. Consolidation of all rail operations onto the mainline would allow the overhead viaducts to touch down west of 500 West Street but would also disrupt rail service to companies dependent upon these lines. Consequently, plans were made to relocate private

businesses (cement, packaging, and food product services) and the Amtrak service that had operated out of the Rio Grande depot. This phase called for Amtrak service to be relocated to a new multimodal hub adjacent to the mainline tracks near I-15, as shown in Figure 32. This new site along the mainline track was deemed feasible since shippers at the location were subject to month-to-month leases and, by nature of their businesses, would involve relatively small relocation expenses.

- Estimated Cost: $15.7 million
- Anticipated Funding Sources: Utah Department of Transportation, Federal Transit Administration (Intermodal Grant), Salt Lake City

Figure 32. Site of the Multimodal Hub in Relation to the Rio Grande Depot (*41*)**.**

Phase 1B

This phase involved the reconfiguration of a connection between an east-west viaduct at the southern boundary of the Gateway District with 400 West Street following the elimination of the 400 West spur. The reconfiguration of this intersection would eliminate two additional shipping facilities (newsprint and steel drums) that could have otherwise continued to be served by a shortline railroad via a remaining section of the 400 West spur south of the Gateway District.

- Estimated Cost: $1.5 million
- Anticipated Funding Sources: Salt Lake City, Utah Department of Transportation

Phase 2A

Prior to the elimination of the 400 West spur through the Gateway District, local switch engines would move rail cars between Union Pacific's North Yard and the South Yard (adjacent to the Union Pacific Depot), where these cars, maintenance-of-way equipment, and passenger cars would be stored or delivered to local industry. Therefore, completion of Phase 1A, which removes the 400 West spur and relocates affected businesses, eliminates the need for the South Yard, as shown adjacent to the Union Pacific Depot in Figure 33. Accordingly, Phase 2A calls for the removal of South Yard track, opening up approximately 55 acres of land for redevelopment.

- Estimated Cost: $6.6 million
- Anticipated Funding Sources: Union Pacific Railroad

Figure 33. Union Pacific South Yard and Vicinity Prior to Redevelopment.

Phase 2B

Elimination of the 400 West and 500 West spurs and the creation of a new multimodal hub along the mainline tracks near I-15 heightened the need for eliminating grade crossings on the mainline at 300, 400, and 500 North Streets, immediately north of North Temple (the northern boundary of the Gateway District). Therefore, Phase 2B called for the elimination of grade crossings at 300, 400, and 500 North Streets, in conjunction with the construction of a single grade separation at 300 North Street. This phase would also eliminate yard lead tracks

adjacent to the mainline to shorten the grade separation structure; these lead tracks would become obsolete with the retirement of the Southern Pacific 400 South Yard (Phase 3).

- Estimated Cost: $4.0 million
- Anticipated Funding Sources: Salt Lake City, Union Pacific Railroad, Utah Department of Transportation (Railroad Safety Funds)

Phase 3

This phase called for the removal of any remaining non-mainline track east of I-15 and the Southern Pacific 400 South Yard track, which would result in the elimination of railcar switching and storage capacity in the downtown area. The relocation of necessary yard capacity to other Union Pacific facilities made another 21 acres of land available for redevelopment near the proposed multimodal transportation hub.

- Estimated Cost: $2.9 million
- Anticipated Funding Sources: Salt Lake City, UP

Environmental Considerations

The EPA defines brownfields as real property whose expansion, redevelopment, or reuse may be complicated by the presence of a hazardous substance, pollutant, or contaminant (*42*). Considering the financial risk to potential developers for cleanup and reuse of these sites, the Small Business Liability Relief and Brownfields Revitalization Act amended Section 104 of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (42 U.S.C. 9604) to include provisions for brownfields revitalization funding (*43*). In its effort to attract new investment in the Gateway District, Salt Lake City was successful in being selected as an EPA Brownfields Pilot Project in 1996 (*38*). This designation provided funding from the EPA for use by the city to perform the following tasks throughout the Gateway District:

- Task 1 – establish an inventory of environmental risks and site conditions; provide an overview of current site conditions, and review available databases and files.
- Task 2 – Analyze the extent and degree of contamination, including on-site field sampling of soil and groundwater in selected areas; categorize the principle types of contamination, and prioritize sites based on potential land uses and contamination types.

- Task 3 – prototype corrective, risk-based, site-specific action plans for each contamination category in order to estimate costs of remediation.
- Task 4 – Model site-specific remediation designs assuming available technologies in order to consider the influence of geology (i.e., soil, clay, and water table depths).
- Task 5 – Begin to implement remediation designs under the Utah Department of Environmental Quality's Voluntary Clean-Up Agreement in order to demonstrate to the owner a realistic picture of how site issues are resolved.
- Task 6 – Elaborate the alternatives available for funding environmental site assessments and clean-up, and describe the process of obtaining funding from the public and private sectors (*44*).

Clearing the Path to Redevelopment

The tasks above were fulfilled in part with the completion of the Gateway District Preliminary Environmental Conditions Report and with the report, Brownfields Development in the Gateway District: An Overview of Liability, Development, and Funding Issues (*44*). The results of these works enabled the public and private sectors to distinguish between real and perceived contamination, and to identify the risks associated with redevelopment of the sites.

Salt Lake City was one of 10 cities selected in 1996 as an EPA Brownfields Pilot Project, securing $200,000 for preliminary environmental assessments of the Gateway District. An additional $400,000 was obtained as a result of the city being named a Brownfields Showcase Community, whereby the EPA seeks to promote environmental protection, economic redevelopment, and community revitalization through the assessment, cleanup, and sustainable reuse of brownfields (*45*).

Results of the environmental assessment indicated that contamination in the Gateway District was actually rather modest and confined to relatively shallow surfaces. For example, the topsoil along existing rail lines was mostly contaminated with oil, gas, and creosote products, which were easily removed for soil remediation during a 40-ft excavation for a parking garage. Methylene chloride, arsenic, benzopyrene, barium, chromium, lead, and selenium were also detected at the site, but at levels not considered significant enough to warrant full remediation (*46*).

Property Ownership and Land Title Searches

The complexity of methods involved in conveying real property interests in the U.S. prevents the title to land from being proven by a single document. For example, each state follows a doctrine of constructive notice, whereby a record conveying an interest in real property must be placed in the public record in order to be binding on the public. However, these recording statutes do not offer a comprehensive account of ownership due to the existence of actual notice, in which real property is conveyed through adverse possession, prescription, implied easements, or estoppel easements (*47*). Although none of these claims to property appear in the public record, actual notice carries the same force as constructive notice when the claim is "open, continuous, and apparent to all who examine the property." Consequently, a full title search is necessary to construct a chain of title from the earliest point of record to the current owner to complete the sale of property (*47*).

In the case of the Gateway District development project, Salt Lake City's hopes for a revitalized urban area hinged upon Union Pacific's transfer of land ownership to suitable developers. The title search of property required for this transfer proved that a railroad's land use history may be more complex than first expected (*48*). In particular, the title company contracted by Union Pacific to verify its land ownership had to consider the following issues:

- Easements – A railroad may not hold title to the land on which they operate, so proof of ownership had to be established.
- City Ordinances – city streets were closed to create the rail corridor, so an examination had to be performed to determine if the streets had been eliminated or merely closed.
- Existing Contracts – Utilities had contracted with Union Pacific for the right to lay fiber optic cables on railroad right-of-way.
- Corporate Ownership – Mergers, reorganizations, and name changes throughout history multiplied the documentation process exponentially.
- Historic Records – Railroad records are not indexed similar to other documents, and conveyances were made prior to Utah's development of tract indices.

In addition to the above challenges in locating and deciphering land records, the process required to resolve ownership and usage issues had to be repeated 99 times since the railroad originally pieced together as many parcels of land to build the rail corridor (*48*).

Urban Redevelopment Perspective

As an historic railroad hub, the economic potential of the Gateway District diminished over time due to a decline in rail activity and because of the stigma of environmental contamination associated with past rail operations. Selection of the site as an EPA Regional Brownfields Pilot Project effectively served to mitigate the financial risk to potential developers in relation to the unknown environmental remediation costs of acquired land. Thereafter, findings from the environmental assessment encouraged the private sector to join with the public sector's redevelopment efforts.

Through the implementation of the state's Voluntary Cleanup Program, the absence of environmental liability allowed parcels of land to be put to taxable and economic use. As a result, under the leadership of the Salt Lake City Redevelopment Agency, the Gateway Plan will culminate in a transformation of the Gateway District from a blighted industrial area to a more balanced community composition featuring seven different types of land use:

- civil and cultural,
- residential,
- commercial,
- retail,
- support commercial,
- parks and open space, and
- intermodal transportation.

Investment in New Urban Facilities

In addition to financing for rail consolidation in the Gateway District, public and private entities invested considerable money in new development and supporting infrastructure, as Table 8 shows.

Table 8. Financing Sources for Redevelopment of the Gateway District.

Funding Source	Purpose	Amount ($ million)
The Boyer Company	Retail and residential development	375
Artspace	Affordable housing and office space	12
Salt Lake City Agencies	Public utilities and infrastructure	16
U.S. Dept. of Housing and Urban Development	Public utilities and streets	2
U.S. Dept. of Transportation (TEA-21 funds)	Intermodal Transit Hub	45
Economic Development Administration	Rail yard conversion to green space	1.25

The conversion of the Rio Grande Depot rail yard, as contrasted (before and after) in Figure 34 and Figure 35, reflects the degree to which a rail facility can be redeveloped into open space as an attraction to retail and residential development.

Figure 34. Rio Grande Depot Rail Yard Prior to Redevelopment.

Figure 35. Conversion of the Rio Grande Depot Rail Yard.

Included in the Gateway Development Master Plan was the linkage of the Rio Grande and Union Pacific depots via pedestrian-oriented corridors for the purpose of preserving the city's railroad legacy and to establish an underlying theme for redevelopment. In addition, the Master Plan included accommodations for light rail, commuter rail, and bus operations.

Figure 36 shows how the Union Pacific Depot was integrated into the Gateway District's light rail network, which is delineated in Figure 37. Plans are underway for regional commuter rail service to operate out of the new intermodal station currently under construction, as described under Phase 2B of the Railroad Consolidation Plan.

Figure 36. Light Rail at the Union Pacific Depot.

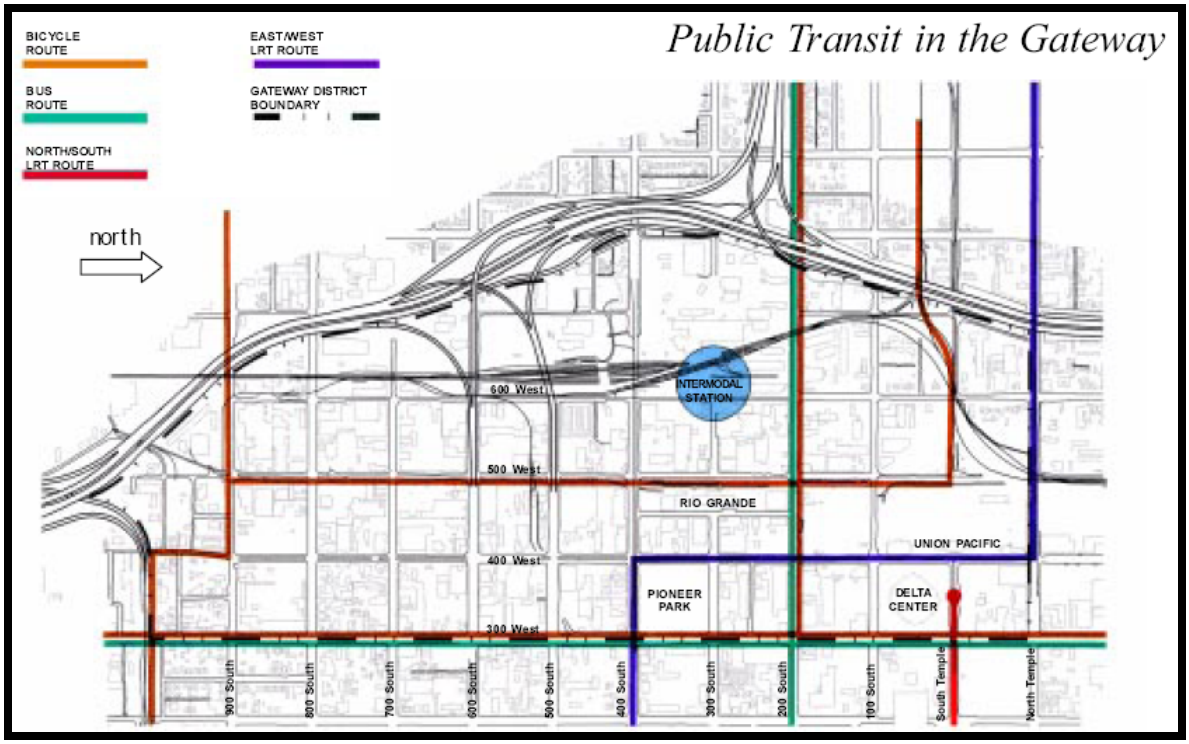


Figure 37. Proposed Transit Routing and the New Intermodal Center (*39*)**.**

Tax Revenue Benefits

The general distribution of sale and property tax revenues in Utah are outlined in Table 9. However, a true measure of additional tax revenue created through redevelopment of the Gateway District is tax increment revenue – the net increase in property tax attributable to revitalization of the area. According to the city treasurer, tax increment revenue from the Gateway District is approximately $2.0 million per year. The area also generates incremental sales tax revenue, though state law prohibits disclosure of sales tax receipts. All tax increment revenue is directed to the Redevelopment Agency of Salt Lake City for redistribution to other public agencies for additional redevelopment activities.

Table 9. Distribution of Tax Revenues in Utah

Beneficiary	Sales Tax Distribution (%)	Property Tax Distribution (%)
State of Utah	82	13
Salt Lake City	12	31
Salt Lake County	-	21
Salt Lake Schools	-	27
Other	6	8

LESSONS FOR TEXAS

- **Urban redevelopment can serve as the main public benefit behind a rail consolidation project.** The driving force behind this project and its relatively short time frame for implementation was largely the private sector redevelopment aspects. The ability of the railroad company to sell its excess properties in the urban area for redevelopment, the desire of real estate developers to build retail and housing projects on the land, and the economic benefits to be accrued from improving the area prior to the upcoming Olympic Games were all motivators for quick actions regarding rail relocation. Had these factors not been in place, the railroad relocation projects likely would have taken much longer to occur.
- **Unique sequences of events may create narrow windows of opportunity.** Although redevelopment of the Gateway Area had been studied for years, it was a confluence of several events that led to action on the project, which allowed the railroad relocation efforts to take place. The planned I-15 viaduct project, the UP/SP railroad merger resulting in excess rail facilities and property in the downtown area, and the selection of Salt Lake City to host the Olympic Games all played a role in making this project happen. Although a major event such as the Olympics may not be expected in many of the Texas cities contemplating railroad relocation at this time, remaining abreast of other potential local and regional projects that could be cooperatively developed to augment the overall benefits of a railroad relocation project is important for planners.

CHAPTER 6:
COLORADO FRONT RANGE RAILROAD INFRASTRUCTURE RATIONALIZATION PROJECT

PROJECT OVERVIEW

The *Public Benefits and Costs Study* (the Study) released in May 2005 is an analysis of a series of rail infrastructure improvements proposed by BNSF and UP entitled the *BNSF/UP Front Range Railroad Infrastructure Rationalization Project* (the Project) (*49*). The main focus of the Project is to remove significant through-freight rail movements from traveling through the Front Range urban corridor, which consists of communities such as Denver, Colorado Springs, and Pueblo. In addition, improvements to the urban rail infrastructure and strategic placement of highway-rail grade separations would significantly improve rail and vehicular mobility in the urban areas, particularly Denver. Coordinating the freight rail changes with existing passenger rail and mobility improvement planning activities may also provide additional travel options for Front Range commuters.

The stated Project objectives include:

- Facilitate Front Range freight movement and increase commuter options.
- Minimize through-freight operations in major population centers along Front Range.
- Remove or minimize through-freight operations movements in the center city in Denver.
- Minimize rail/vehicle conflicts.
- Concentrate through rail freight operations in a limited number of corridors.
- Make available rail corridors for light or heavy rail transit and other economic development.
- Create economic development opportunities in Colorado (*49*).

The main focus of the Study is to "determine whether there are sufficient benefits to the general public to warrant consideration of the investment of public dollars in the Project" (*49*). The Study concludes that the citizens of Colorado accrue sufficient benefit to warrant investment.

PROPOSED RAILROAD PROJECT ELEMENTS

This section provides the objectives originally proposed by UP and BNSF, a table including the evaluated elements, and a description of the expected outcome as a result of implementing the project elements. The UP/BNSF joint proposal, including the project objectives, operating plan, and the requirements necessary to achieve the objectives and operating plan, is outlined in the *Technical Memorandum No. 2 Study Approach Statement* (*50*). The full detailed operating plan and projects are listed in Appendix B. The following is a brief listing of the railroad project operating plan objectives.

1. Consolidate UP and BNSF freight operations in Denver into one freight corridor.
2. Relocate freight terminals to outside Denver center city.
3. Construct a freight bypass around Denver (95 miles of new construction).
4. Remove through-freight trains from Denver-area rail lines (while a high level of local freight service to Colorado rail customers continues to be provided by the current owning carrier).
5. Place freight and commuter passenger service on common line Palmer Lake to Crews.

The UP/BNSF proposed projects identified to achieve the proposed operating plan were classified into 14 separate project elements and provided unique element identifications. Two of the 14 projects were eliminated for consideration from the Study due to their focus on improvements necessary for passenger rail along the Front Range. The project team added an additional two projects. Table 10 provides the list of project elements considered during the *Public Benefits & Cost Study*, including the two projects (K & L) removed from consideration and the two added projects. These projects consist of major new rail line infrastructure, significant infrastructure and operational improvements, and considerable new rail terminals located outside the Denver central city. The cost analysis of these project elements is discussed later.

Table 10. Build Option Project Elements (*51*).

ID	Description
A	Double Track Connection between UP Moffat Tunnel Subdivision and Belt Line Main Line at Utah Junction
B	Grade Separate BNSF Switching Lead from UP North Yard to Belt Junction Main Line
C	Double Track with centralized traffic control (CTC) UP's Utah Junction to Belt Junction – Grade Separate or Close All Road Crossings
D	Rebuild and Double Track with CTC Denver Rock Island (DRI)/COE Line between Belt Junction and Sandown Junction – Grade Separate or Close All Road Crossings
E	Remove BNSF-UP Crossing at Sandy Creek; Replace with Power-Operated Cross-Overs, Including Double Track on UP's Greeley Subdivision M.P. 4.0 to M.P. 7.0
F	New Double Track Connection in the Northeast Quadrant between UP's Greeley Subdivision (M.P. 634.2) and the Current DRI Line
G	Add Sidings or Sections of Double Track with CTC on UP's Limon Subdivision between Sandown Junction (M.P. 634.2) and Watkins (M.P. 612.0), Including Necessary Grade Separations of Road Crossings
H	Add 9300-ft Sidings with CTC on UP's Limon Subdivision between M.P. 612.0 and Aroya
I	New 60-Mile Line with CTC between Aroya and BNSF Boise City Subdivision at Los Animas
J	Add a Second Track with CTC on UP Moffat Tunnel Subdivision between Utah Junction and Prospect Junction
K	*CTC and Additional Sidings as Necessary on the UP-BNSF Freight Line between South Denver and Palmer Lake (Removed from consideration)*
L	*Additional Capacity as Needed on UP-BNSF Joint Line between Palmer Lake and Pueblo (Removed from consideration)*
M	Freight Terminal Facilities at or near Irondale (BNSF) and Watkins (UP) to Replace Facilities in the Denver City Area
N	Construct 35-Mile Connection between BNSF (Omar, CO) and UPRR (Peoria, CO)
-	Infrastructure improvements from Omar to Union
-	Infrastructure improvements from Palmer Lake to Pueblo

Expected Outcome

Implementing the project elements significantly changes the rail movement dynamics along the Front Range. The major north-south movements would travel over the two new rail line segments instead of traveling through the city centers along the Front Range corridor. Figures 38 and 39 display the rail infrastructure within Colorado and the Denver area, along with the trains per day values for the 2004 existing data, 2030 No-Build scenario, and 2030 Build scenario. Figure 38 displays the primary UP/BNSF rail lines located in Colorado, the two

proposed bypass routes east of the Front Range communities, and identification of the railroad subdivisions identified in the project elements list. According to the 2030 Build scenario predictions, the bypass routes will experience trains per day values of 37 trains per day on the northern section and 25 trains per day on the southern section. This new infrastructure reduces the number of trains along the Front Range route from a predicted 44 trains per day between Denver and Colorado Springs for the 2030 No-Build scenario to a predicted value of 16 trains per day for the 2030 Build scenario. Those values reduce from 34 trains per day to 14 trains per day between Colorado Springs and Pueblo for the No-Build and Build scenarios, respectively.

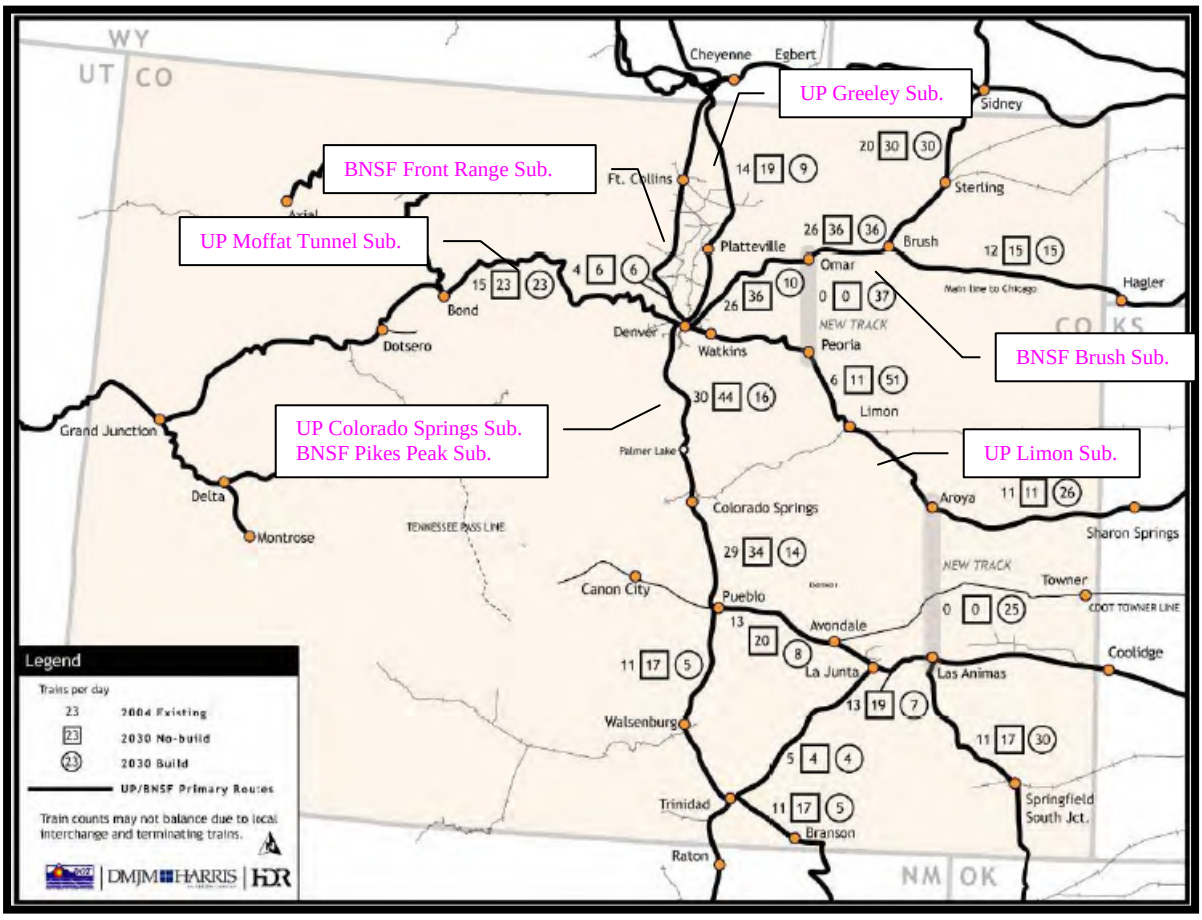


Figure 38. Trains per Day – Colorado (*49*)**.**

Figure 38 displays the Denver-area rail infrastructure according to the Build scenario, along with the 2004 existing train activity levels, the 2030 No-Build scenario trains levels, and the 2030 Build scenario train levels. The implementation of the bypass routes east of Denver is reflected by the greatly reduced train levels that come into Denver from the northeast. Those levels reduce from a predicted 45 trains per day to 18 trains per day for the Build scenario, which is

also significantly lower than the existing 32 trains per day. East-west train movements show little change in daily train volumes but move through Denver more efficiently with the proposed infrastructure upgrades and changes. It is also notable that implementing operations over the Denver Rock Island line greatly improves efficiency over the previous route, which went from the Belt Junction down to the Pullman Yard junction before traveling over to the Sandown Junction. The previous route would experience limited daily train activity, which provides the opportunity to implement passenger rail operations over a portion of those segments. Figure 39 also shows several of the identified urban rail yards to be relocated to new terminals located outside of Denver and the route segments designated for through-train movements.

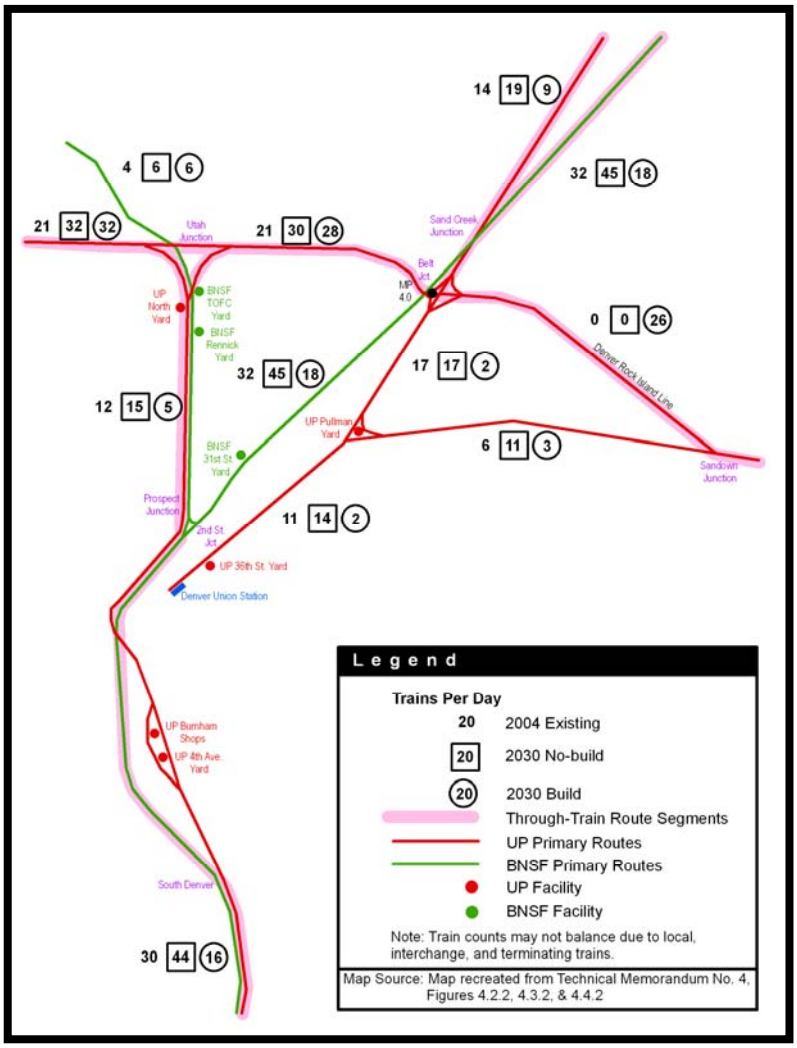


Figure 39. Trains per Day – Denver *(51)*.

The following section provides the detailed cost analysis of the project elements included in the Study.

PROJECT COSTS

The project cost analysis consisted of the project team evaluating the project elements contained in the *Proposed BNSF/UP Front Range Railroad Infrastructure Rationalization Project*. As stated previously, two projects were eliminated from the original list because of their need only if passenger rail is implemented. Although of interest in the region, guaranteed passenger rail service was not included as part of the Study. The remaining Project elements, along with two additional components, represent the Build Option studied within the *Public Benefit & Cost Study*. Table 11 includes the comparison of the railroad's cost estimate and the project team estimate. The project team consultants only slightly changed the values provided by the railroads in most cases, and actually calculated a lower overall total cost of $1.17 billion.

The Study consultants considered three cost scenarios for the Build Option: low, mid, and high-range. The estimated project cost presented in Table 11 represents the Mid-range scenario. The low-range scenario equals the mid-range scenario reduced by 10 percent, and the High-range scenario equals the Mid-range scenario increased by 30 percent. Therefore, the projected capital costs in 2004 dollars for the three scenarios are as follows:

- Low-range scenario: $1.05 billion
- Mid-range scenario: $1.17 billion
- High-range scenario: $1.52 billion

The Study compared the project benefits against the $1.17 billion mid-range total project cost.

Table 11. Capital Cost Summary Comparison (51).

Railroad Project ID	Project Component Summary	Railroad's Estimate	Consultant's Recommended Estimate
Major Front Range Improvements			
I + N	New Track (95 miles)	$287,967,000	$288,600,667
M	New UP Freight Terminal	$208,024,000	$208,024,000
N/A	New BNSF Freight Terminal	$259,280,000	$259,280,000
G + H	UP Limon Subdivision Track Improvements	$144,223,000	$150,568,000
Various Front Range Improvements			
A	Utah Junction	$43,832,000	$51,042,000
D	North Yard to Belt Junction	$30,000,000	$39,000,000
C	Utah Junction to Belt Junction	$40,193,000	$41,836,000
D	Denver Rock Island Line	$78,204,000	$92,828,000
E	Sand Creek	$15,546,360	$15,882,000
F	Greeley Subdivision to DRI	$7,983,000	$8,036,000
J	Utah Junction to Prospect Junction	$6,679,000	$6,980,000
N/A	Omar to Union	$5,293,000	$5,293,000
K	Sidings etc. South Denver to Palmer Lake	$20,000,000	$0
N/A	Sidings etc. Palmer Lake to Pueblo	$79,526,000	$0
TOTAL		$1,226,750,360	$1,167,369,667

PROJECT BENEFITS

This *Public Benefits & Cost Study* measured benefits accrued to both the public and private stakeholders affected by the Project. The evaluation focused on the benefits of implementing the Build Option, but it also contrasted against the No-Build Option where appropriate. The No-Build Option is not a Do-Nothing Option, but it represents the Year 2030 conditions if the Build Option is not undertaken. The reality is that rail infrastructure and operational improvements would be undertaken by the railroads under this scenario, whereas, a Do-Nothing Option would not reflect necessary improvements.

The Study project team indicates that both direct and indirect benefits result from implementing either the Build Option or No-Build Option and aggregated these benefits into six primary and two secondary benefit classifications. The benefit classifications evaluated include:

- Primary Benefit Classifications
  - Transportation benefits
  - Economic development and land use benefits
  - Safety and security benefits
  - Environmental benefits
  - Quality of life benefits
  - Passenger rail facilitation benefits
- Secondary Benefit Classifications
  - Statewide job creation or "expanded" benefits
  - Additional project and freight carrier benefits.

As part of the analysis, the study team identified benefit components that are not quantifiable, therefore discussing these important benefits qualitatively within the Study.

The benefit analysis results in total project benefits, direct and indirect, by scenario net present value (NPV) of:

- Low-range scenario: $2.35 billion
- Mid-range scenario: $5.17 billion
- High-range scenario: $16.34 billion

Table 12 displays the detailed breakdown of the benefit categories and the estimated benefits.

Transportation Benefits

The transportation benefit categories analyzed include railroad efficiencies, highway-rail grade separations, vehicular delays, emergency vehicle delays, and trucking operations. The Build Option infrastructure and operations improvements are expected to provide increased railroad efficiencies in Colorado. The new bypass routes reduce the miles traveled by coal trains headed south and southeast by 96 miles, which equates into a time savings of 2.8 hours. Additional time savings are expected in the Denver area with the operational improvements gained by improving the infrastructure at Utah Junction and the use of the Denver Rock Island line, both of which assist the east-west train movements. The Build Option provides an estimated $639.9 million in benefits related to gained railroad efficiency.

Table 12. Project Benefits Summary through 2030 (Mid-Range Scenario).

	Total net benefit, present value ($1 mil)	Net increase in jobs
DIRECT BENEFITS		
Transportation Net Benefits		
Railroad operating efficiency gains	$693.9	
Avoided capital costs for new grade-separated crossings	$51.9	
Reductions in travel delay at railroad crossings	$332.4	
Economic Development and Land Use Benefits		
Western Colorado		
Coal industry	$188.1	
Front Range		
New economic growth from better rail facilities	$470.3	
Redevelopment of urban rail yards	$31.9	
Eastern Colorado		
New economic growth from better rail access	$34.6	
Benefits to gain producers	$29.4	
Safety and Security Net Benefit		
Reduced number of train-auto accidents	$9.6	
Environmental Net Benefit		
Air Quality benefits	$244.8	
Property value benefits due to noise reduction	$86.7	
Energy reductions for autos	$21.0	
Quality of Life	----	
Capital cost savings to future passenger rail	$178.3	
Total Direct Benefits	$2,302.8	
Indirect Benefits		
Economic Development and Land Use Benefits		
Western Colorado – Job-related net income	$560.8	558
Front Range – Job-related net income	$1,923.8	3400
Eastern Colorado – Job-related net income	$130.6	282
Construction – Job-related net income	$211.9	1728
Total Indirect Benefits	$2,862.5	5966
Total Benefits	$5,165.3	5966
Totals, excluding temporary construction benefits	$4,953.5	4240

The Study project team evaluated the possibility of reducing the number of grade separations needed if the number of trains is reduced through the Front Range communities. The

results of the analysis indicate there are 27 likely candidates for grade separations for the study time period: 18 specific candidates and 9 non-specific candidates. Below is how these 27 crossings are expected to be affected by the Build Scenario:

- 18 Specific Candidates Identified
  - –8 Impacted by Railroad Project → 5 unlikely under Build Option, 2 likely under Build Option, and 1 reconstruction facilitated under Build Option
- 9 Non-Specific Candidates
  - – 4 Impacted by Railroad Project → 3 unlikely under Build Option and 1 likely under Build Option

The grade separation analysis concludes that "the total estimated savings from grade-separated crossings that will not be needed over the project lifetime (2030) is estimated at $60 million" *(49)*.

One of the major benefits of the Build Option is reduced delays at highway-rail grade crossings with the relocation of the through-freight train movements to the east of the Front Range communities. As displayed earlier, daily train levels are expected to reduce from 30 trains per day to 16 trains per day between Denver to Colorado Springs and from 29 trains per day to 14 trains per day between Colorado Springs to Pueblo. Utilizing an hourly value of time for both passenger vehicles and trucks, the total estimated benefits to accrue in the Build Option is $332.4 million over the life of the project.

The effects of the Build Option on emergency vehicle delay and trucking operations were not quantified but are major considerations. Grade separating the roadways and rail lines, along with reducing the number of trains operating in the urban areas along the Front Range should positively affect emergency vehicle response. However, any at-grade crossing located where increased train traffic will occur in Eastern Colorado could negatively affect emergency vehicle response. In terms of the effects on trucking operations, several considerations are identified:

- There may be an increased need for trucking services from economic development associated with the Project.
- There may be longer travel distances and travel times to reach relocated intermodal facilities.
- There could be a mode shift in grain transportation as more grain is moved by rail.
- There will likely be reduced delay times at highway-rail grade crossings *(49)*.

Combined, the transportation benefits accrued with the implementation of the Build Option represents the highest level of benefits of any category, totaling almost $1.1 billion.

Economic Development and Land Use Benefits

The economic development and land use benefits are an extremely important consideration and benefit both the public and private sectors. The Study simply states that the economic development benefits are "derived from the net increase in economic activity generated by the Build Option" (*49*). Land use benefits primarily focus on the redevelopment of the urban rail yards that would be relocated outside the Denver central city. Table 13 provides the urban yards to be relocated and how the future use of the land will likely increase the land value and increase annual tax revenue.

Table 13. Urban Rail Yard Redevelopment Benefits (*52*).

Railroad Yard	Approximately Area (acres)	Current Value	Estimated Future Value	One Time Capital Gain	Increase in Annual Tax Revenue
UP Pullman Yard, 40th & York	68	$6,812,784	$19,253,520	$12,440,736	$231,622
UP Rolla	120	$12,022,560	$15,681,600	$3,659,040	$68,124
UP 36th and Wazee	30	$3,005,640	$3,920,400	$914,760	$17,031
UP Burnham	60	$6,011,280	$15,681,600	$9,670,320	$180,042
BN Trailer-on-Flat-Car (TOFC)	55	$5,510,340	$7,187,400	$1,677,060	$31,224
BN Rennick	117	$11,721,996	$15,289,560	$3,567,564	$66,421
Totals	450	$45,084,600	$77,014,080	$31,929,480	$594,463

The economic development analyses examined economic development benefits for Western Colorado, Front Range, and Eastern Colorado. Western Colorado economic development focuses on the potential level of increased coal mining; Front Range economic development primarily focuses on the new intermodal facilities, along with the redevelopment of the old terminals; and Eastern Colorado economic development focuses on multiple areas including the benefits to grain producers. The combined economic development and land use benefits are estimated at $684.3 million over the life of the project.

Safety and Security Benefits

Safety and security benefits focus on vehicle-train collisions, pedestrian-train collisions, hazardous materials transport, and terrorism risk. Only vehicle-train collisions were evaluated quantitatively, while the other areas were evaluated qualitatively. Relocating the majority of Front Range train traffic onto the eastern bypass routes greatly reduces the number of trains traveling through the populated Front Range communities. This relocation results in greater safety levels for transporting hazardous materials, reduces the exposure to a terrorist attack, and reduces the conflict between trains and vehicles or pedestrians. Reducing the exposure of trains to vehicles at highway-rail grade crossings reduces the predicted number of accidents at those crossings. This reduction in the number of train-vehicle accidents results in an estimated benefit of $9.6 million over the project life.

Environmental Benefits

The environmental benefits analysis undertaken for the Study represents a cursory look at the benefits on the environment as a result of the Build Option. The areas evaluated in the Study include:

- the natural and built environment, archaeological and historic resources, special status plant and animal resources, major creeks and rivers, wetlands, and other surface water resources, hazardous and contaminated materials sites, demographics, and other resources and potential constraints;
- noise and vibration;
- air quality benefits;
- energy usage reductions; and
- visual benefits to the Front Range.

The three areas evaluated quantitatively are noise and vibration, air quality, and energy usage. The benefits associated with noise and vibrations include increased property values near routes with reduced train traffic. Reducing or eliminating vehicular delays at grade crossings greatly improves air quality and reduces the amount of fuel used by delayed vehicles. The combined environmental benefits are estimated at $352.5 million over the project life.

Quality of Life Benefits

The perceived impact of the Project on the quality of life for the potentially affected citizens is a significant consideration in the benefit analysis. Quality of life considerations are a combination of many of the areas identified in other categories, such as effect on accident rates, air quality, and travel delays. This category was only evaluated qualitatively.

Passenger Rail Facilitation Benefits

The Build Option provides an opportunity for passenger rail services to use existing or newly acquired right-of-way, with the benefit created from the savings of millions in acquisition costs. The Study used five previously completed studies related to potential passenger rail service in the Denver area and along the Front Range. The results indicate that three corridors will be impacted by the Build Option versus the No-Build Option. The availability of these three corridors for passenger service in the Build Options results in an estimated $178.2 million.

Secondary Benefits

The secondary benefits primarily focus on statewide job creation and additional railroad and freight carrier benefits. Quantifiable job creation benefits were primarily calculated as part of the economic development analysis. The estimated indirect benefits from job creation total over $2.8 billion over the life of the project.

PROJECT COST-BENEFIT ANALYSIS

The rationale of further action toward implementing the Build Option depends on the comparison of the benefits to the costs. The major focus of the Study is to determine the value of investing public money into the Project. The Study indicates that based on the results, a strong case can be made for the Project. Table 14 displays the benefit-cost ratio for the three evaluated scenarios. All scenarios demonstrate that implementation of the Project provides more benefits than the cost. The mid-range scenario indicates there will be four times more benefits accrued than it will cost to implement the project, while utilizing the most pessimistic assumptions results in a benefit-cost ratio of 1.5.

Table 14. Summary of Project Benefit-Cost Ratios by Scenario (*53*).

Project Totals	Low-Range	Mid-Range	High-Range
Total Benefits (NPV $ mil)	$2349	$5165	$16,335
Total Costs (2004 $ mil)	$1544	$1188	$1069
Benefit-Cost Ratio	1.5	4.3	15.3

Table 15 provides the benefit-cost ratio when the indirect public benefits are removed from the total benefit value. This removal significantly reduces the overall benefits of the Project but still accrues a benefit-cost ratio of 2.0 when only considering the direct benefits.

Table 15. Mid-Range Project Benefits Summary (*53*).

	Direct Public Benefits	Indirect Public Benefits	Total Public Benefits
Benefits in Billions	$2.30	$2.86	$5.17
Benefit-Cost Ratio	2.0	2.4	4.4

In an effort to determine likely support by the different stakeholders, the Study project team evaluated the benefit-cost ratio based on the stakeholder sector, where the public and private sectors consist of the following:

- public sector – general public and public transportation;
- private sector – rail industry, coal industry, economic development, and grain industry.

Table 16 contains the breakdown of the benefits by the different sectors. It shows that the public sector receives 73 percent of the benefits, while the private sector, receives the remaining 27 percent. The benefits slightly exceed the costs for the private sector with a benefit-cost ratio of 1.2. The public sector accrues a benefit-cost ratio of 3.2.

Table 16. Summary of Project Benefit-Cost Ratios by Sector (*49*).

Sector	NPV in Millions	Percent of Benefits	Benefit-Cost Ratio
Private Sector	$1378	27%	1.2
Public Sector	$3787	73%	3.2
Total Benefits	$5165	100%	4.3

The ability to find funding sources and financing to implement the Project also requires the benefits to exceed the project costs.

FUNDING AND FINANCING

As part of a preliminary study, the study team examined funding and financing of other similar magnitude projects across the country to develop a menu of possible funding and financing options. The menu provides a multitude of options that might be applicable to this project, but the preliminary nature of the project does not allow identifying the specific avenue to fund and finance the proposed project. They do, however, indicate that "it is expected that if the Build option is chosen, the financing and funding for the Project will depend on a mix of private and public investments" *(49)*. Appendix B includes tables containing the reviewed projects and the menu of funding and financing options.

"To assure equitable cost-sharing, Project development costs have been allocated among major public and private stakeholders based on the relative level of benefits that are expected to accrue to these stakeholders from 2004 through the year 2030" *(49)*. As seen above, the public sector receives 73 percent of the benefits, while the private sector receives the remaining 27 percent. Therefore, the development costs would be allocated between the public and private sectors at those same percentages.

Within the Study, the project team identifies several funding and financial challenges:

- funds are scarce for transportation projects;
- institutional barriers exist between the public and private sectors and between modal carriers;
- project benefits spread beyond the two railroads involved;
- using public funds for private projects;
- different regions of the state will experience different impacts and receive different benefits from the Project;
- funding programs generally rely on a small number of sources; and
- development costs occur in the first few years of a project while benefits build over the life of the project *(49)*.

Another significant challenge revolves around ownership of the infrastructure, which results in four possible ownership scenarios:

1. The infrastructure and facilities may be owned by the BNSF and UP railroads on an individual basis.
2. The infrastructure and facilities may be jointly-owned by the BNSF and UP railroads, particularly the new shared-access rail line.

3. The infrastructure and facilities may be jointly-owned by the principal public funding agency or agencies and the BNSF and UP railroads.
4. The infrastructure and facilities may be owned outright by the principal public funding agency or agencies *(49)*.

The Study indicates the most likely scenario will involve the railroads jointly owning the infrastructure, which leaves BNSF and UP alone to negotiate the terms of the joint ownership.

PROJECT UPDATES AND NEXT STEPS

The Study includes an addendum indicating that UP implemented the planned improvements at the Utah Junction with its own funding. As a result, the "implementation of the Utah Junction improvements is recognized as a private investment toward this project that will be accounted for as appropriate as part of future negotiations as it related to implementation of additional improvements defined in the Study. With the implementation of the Utah Junction improvements by the UP earlier than anticipated, the private/public benefits accrue to the project earlier without materially affecting the cost/benefit analysis of the overall project" *(49)*.

Subsequent to the Study, the UP railroad moved forward to acquire the DRI line between Belt Junction and Sandown Junction. As indicated previously, this line segment will greatly enhance UP's operations between those two junctions when fully upgraded. According to the Surface Transportation Board decision on March 24, 2005, UP states that, "although this rerouting may not take place for several years, it wants to acquire the line and have the line available if needed" *(54)*. The Surface Transportation Board granted the exemption, subject to standard labor protective conditions.

The Study represents an initial evaluation of the infrastructure improvements proposed by BNSF and UP along the Colorado Front Range. For a project of this magnitude to occur, more in-depth cost and benefit analysis, design, and environmental reviews are required. According to Colorado Department of Transportation (CDOT), the next step is to develop a strategy for conducting environmental clearances *(55)*. To assist in advancing the Project, the CDOT received a $2 million earmark through from the U.S. Congress to help with the next phase of work *(55, 56)*.

LESSONS FOR TEXAS

Based on the preliminary evaluation of the proposed railroad infrastructure improvements, several lessons should be considered:

- **Coordinate freight-rail projects with other transportation-planning activities, such as plans for passenger rail, to potentially benefit both activities.** Several proposed commuter and light rail projects plan to either use existing rail infrastructure or right-of-way. The Study examines how these projects might benefit from implementation of the Project, including no longer needing to purchase right-of-way next to an existing rail line and no longer needing to separate freight and light rail operations via the construction of a grade-separated structure. At the same time, a freight rail-specific project might benefit from passenger rail plans that incorporate infrastructure improvement components or that might provide additional funding mechanisms not otherwise available.
- **Examine all direct and indirect ways the project may benefit both the public and private sectors.** The evaluation for the Front Range project included both direct and indirect benefits, with indirect benefits representing over 50 percent of the total project benefits. A significant challenge is quantifying benefits that are typically qualitative in nature.
- **Expect for the project to continue to any new phases; all public and private stakeholders must agree on the findings of the previous stage and the allocation of benefits and costs amongst stakeholders.** This expectation can be a very difficult undertaking, possibly requiring alterations to project components and/or scope. Unfortunately, altering the project to satisfy all the public and private stakeholders may degrade the overall project benefits and cause the project to head in a direction outside the original goals and objectives.
- **Achieving financial and operational equitability amongst the railroads is very challenging.** The railroad companies involved are competitors with specific, independent operational and financial goals and needs. Unbalanced benefits may cause one railroad to reduce participation or outright balk on further involvement, especially if they are expected to contribute financially for additional study.

CHAPTER 7:
ADDITIONAL RAIL RELOCATION PROJECT SUMMARIES

OVERVIEW

This chapter includes two additional rail relocation projects requested as part of this report. The Brownsville-Matamoros Rail Relocation Demonstration Project demonstrates a large-urban area relocation to move freight rail operations out of the city core and to more efficiently serve the seaport. The Chicago Regional Environmental and Transportation Efficiency Project demonstrates the Chicago-region efforts to more effectively move freight and people through the complex Chicago rail system.

BROWNSVILLE DEMONSTRATION PROJECT

The recently completed Brownsville-Matamoros Rail Relocation Demonstration Project was one of 12 Railroad Demonstration Projects selected by the U.S. Congress as part of the Federal-Aid Highway Act of 1973. This legislation provided for the relocation of rail lines from within the city to outlying areas having considerably fewer highway-rail conflicts. The Brownsville Navigation District served as the local sponsor on this project and thereby accepted responsibility for producing engineering and construction contracts, processing payments, and securing payment from all funding sources (*57*).

Project Purpose

The ultimate intent of this project was to modify the existing rail network by constructing a rail loop around the downtown areas of Brownsville and Matamoros, the rationale for which was to:

- reduce conflicts between urban rail systems and vehicular traffic; and
- demonstrate the economic, environmental, and social benefits of relocating the existing rail facilities away from the Brownsville urban area.

Particular benefits identified by the Final Environmental Impact Statement included:

- reduction in the number of train/vehicle accidents from the 1992-1995 rate of 0.087 accidents per crossing (versus the national average of 0.26);
- reduction in travel time delay by 144 hours per day;

- reduction in area-wide train exhaust emissions by 35-40 percent and automobile exhaust emissions by 97 percent;
- lowering of rail noise levels to below 70 decibels;
- reduction in vehicle-operating costs;
- reduction in energy consumption attributable to rail-switching operations;
- creation of land development opportunities following the relocation of railyard facilities and, therefore, increase the local tax base; and
- elimination of rail tracks from in front of the federal and county courthouses (*58*)

Project Components

Figure 40 notes the key components of the plans to relocate rail lines around the City of Brownsville. Of these, the West Rail Relocation was not included in the final scope of the demonstration project but is actively being pursued as a project for implementation in the future. In total, the following tasks were performed.

Segment I (1992-1993)

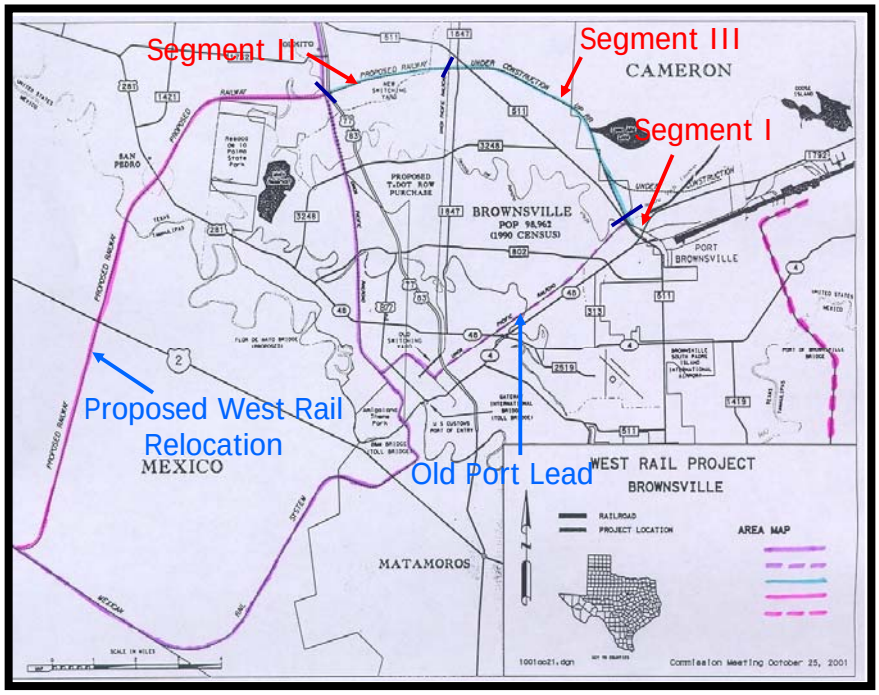
This first segment involved the construction of a grade separation on State Highway 48 (SH 48) over the railroad port lead near Farm-to-Market 511 (FM 511).

Segment II (2001-2003)

Segment II was the last segment to be undertaken and involved the construction of a UP mainline connecting the UP westerly line at Olmito to the newly constructed rail extending from the port and terminating at UP's easterly line (i.e., Segment III). Segment II also involved the construction of a new rail yard at Olmito, yard administrative offices, and a grade separation on US 77.

Segment III (1996-1997)

This segment was undertaken following the completion of Segment I and involved the construction of UP mainline from the port to UP's easterly line (formerly the SP line) near the confluence of FM 511 and FM 1847, grade separations on both FM 511 and FM 1847, and a new switching yard (*59*).



(Color notations added by the Texas Transportation Institute)

Figure 40. Components of the Brownsville Rail Relocation Project (*60*).

Funding

The Federal Aid Highway Act of 1973 called for the federal government to fund 95 percent of the total project cost. However, the early years of this project were spent structuring the necessary funding and by 1991, ISTEA had reduced the federal government's share of project funding from 95 percent to 80 percent. Since neither the City of Brownsville nor Cameron County was interested in serving as the local sponsor, the Brownsville Navigation District assumed responsibility for any funding shortfalls. However, each of these entities, as well as Union Pacific Railroad, did contribute to the financing of this project, as outlined in Table 17 (*57*).

Table 17. Financing Sources for the Brownsville Rail Relocation Project.

Source of Funds	Funding Amount ($)	Contribution (%)
Federal	38,940,300	75.04
State	8,488,000	16.35
Union Pacific Railroad	3,421,700	6.60
Brownsville Navigation District	350,000	0.67
City of Brownsville	350,000	0.67
Cameron County	350,000	0.67
Totals	51,900,000	100.00

Findings

The completion of Segments I through III of the Brownsville-Matamoros Rail Relocation Demonstration Project allow train traffic to and from the Port of Brownsville to be routed along the new branch line to the northeast of the city rather than through the city and along the port lead. Consequently, operations on the port lead have been discontinued, and trains no longer travel in front of the federal and county courthouses. Even though this project was successfully completed, project participants were faced with some noteworthy obstacles.

Impact of Funding Allocation Constraints

Funds for this demonstration project were allocated by the Federal Highway Administration in stages, resulting in the project being divided into three independently usable segments, each making use of the available funds. The grade separation on SH 48 (Segment I) was undertaken first because of its minimal land requirement and small construction cost. New track linking the port and the former Southern Pacific line (Segment III) was constructed next since the Brownsville Navigation District owned half of the required land, which minimized the time and cost of acquiring right-of-way.

Archeological and Environmental Constraints

Final plans for the alignment of Segment III deviated from the preferred alignment due to the existence of the Palo Alto Battlefield Historic Park, which required the project team to perform studies necessary to obtain permitting from the Texas Historical Commission. Construction plans were also modified to protect the habitat of two endangered species within the project limits. Accommodations were made for the jaguarundis (the "Mexican lion") by including 60-inch culverts in the water-level crossing over the Resaca del Rancho Viejo so that these animals could cross underneath the tracks. Also, construction schedules were adjusted to accommodate the aplomoado falcon's nesting season. In terms of south Texas' swampy terrain, culverts were installed under the new mainline to allow water that had been pushed inland by high storms to drain back into the Gulf of Mexico rather than be trapped behind the earthen structures (*61*).

Railroad Industry Consolidation

The 1996 merger of the UP and SP Railroads coincided with the implementation of Segment III of this project. Prior to the Surface Transportation Board's approval of the merger, and throughout the negotiating period, plans for rail relocation in Brownsville had to suit each company's separate operational objectives. Once the merger was enacted, new construction plans had to be drawn to provide a more effective single-owner operating plan (*61*).

The West Rail Relocation Plan

Without the commitment of Mexican entities to construct a rail loop around Matamoros, plans for the completion of the West Rail alignment around Brownsville cannot be implemented. The lack of commitment to a rail loop around Matamoros is due, in part, to downturns in the Mexican economy, and partly to some Mexican stakeholders not wanting the railroad to bypass their urban area. Nevertheless, plans for relocation of the north-south UP mainline to the west of Brownsville remains under consideration as the West Rail Relocation depicted in Figure 40 shows. Although U.S. rail traffic to and from the Port of Brownsville on the UP mainline can now be routed over the new branch line to Olmito, international rail traffic currently must still move through the city and over the Brownsville-Matamoros (B & M) International Bridge.

Feasibility

A primary alternative to implementing the West Rail Relocation Plan is to construct a series of grade crossings along the existing Union Pacific mainline, as has been outlined in the City of Brownsville's Transportation Improvement Plan and Long Range Plan. However, the construction of six grade crossings at critical locations in the city has been estimated to cost $43.0 million, while the estimated cost of the proposed West Rail Relocation project is $17.8 million, as shown in Table 18 (*60*).

Table 18. Estimated Costs of the West Rail Relocation Project.

Task	Cost ($ million)
West Rail Construction	8.8
B & M Bridge Replacement	5.0
U.S. 281 Overpass	3.5
Presidential Permit and Environmental Assessment	0.5
Total	17.8

Project Benefits

The Brownsville-Matamoros Rail Relocation Demonstration Project essentially relocated port-related rail traffic away from downtown Brownsville, while all international traffic continues to pass through the city. The construction of a west bypass would eliminate rail operations through residential and downtown areas of Brownsville, and would result in benefits comparable to those of the demonstration project. The implementation of this project is presumed to eliminate 17 existing grade crossings in Brownsville, having a combined total 100,000 vehicle crossings per day; reduce train travel times between Brownsville and Monterrey, Mexico, by two hours; and eliminate existing time restrictions on train operations over the Brownsville-Matamoros International Bridge. Furthermore, the relocation of rail mainline away from the city would provide right-of-way for a new corridor capable of increasing the area's existing roadway system capacity by 24,000 vehicles per day *(60)*.

CHICAGO REGIONAL ENVIRONMENTAL AND TRANSPORTATION EFFICIENCY (CREATE) PROJECT

Chicago represents the major hub of rail activity in the U.S. with six major U.S. and Canadian freight railroads operating in the area, and with over 500 freight and 700 passenger train movements and 78 yards, including 21 intermodal terminals. The CREATE program is a project involving the six freight railroads, the commuter rail operator, and local, state, and federal agencies to improve the transportation flow (freight trains, passenger trains, and roadway vehicles) through the Chicago region. The $1.5 billion program focuses on five corridors in order to:

- build 25 highway-rail grade separations,
- build six passenger-freight rail grade separations,
- improve train control systems,
- construct 50 miles of new track on existing right-of-way,
- install 364 new switches, and
- automate 14 interlockings *(62)*.

The five corridors are displayed in Figure 41.

Figure 41. CREATE Rail Corridors (*62*)**.**

CREATE Costs and Benefits

The overall CREATE program consists of over 70 discrete projects designed to improve freight and passenger rail operations and reduce conflicts between roadway vehicles and trains. The cost estimates represent values based on conceptual engineering and include the estimated costs of environmental assessment and remediation, acquisition of third-party properties required for the project, and provision for project management, inflation, and contingencies (*63*). Table 19 provides the aggregated costs for the CREATE program projects.

Table 19. CREATE Project Component Costs (*64*)**.**

Program Component	Cost
Railroad projects	$406.3 million
Highway-rail grade separations	$397.6 million
Rail-rail grade separations	$356.0 million
Viaduct improvements and safety	$60.0 million
Technology	$40.0 million
Property, relocation, environmental mitigation	$23.7 million
Contingencies and inflation	$250.0 million
Total Costs	*$1.533 billion*

Some of the beneficial local and regional impacts of the program include less congestion, fewer delays, increased safety, improved commuter rail service, cleaner air, stronger economy, and increased lakefront land use. As indicated in Table 20, the estimated regional public benefits are $3.9 billion, with the major benefits coming from air quality improvements ($1.12 billion) and construction ($2.19 billion) *(64)*.

Table 20. Regional Economic Benefits of the CREATE Program *(65)*.

Benefit Category	Benefits
Rail Passenger Service	
Commuters' time saved	$190 million
New highway construction reduced	$77 million
Motorists	
Reduced delays at grade crossings	$202 million
Safety	
Highway accidents reduced	$94 million
Grade crossing accidents reduced	$32 million
Construction	
Wages, materials, and other purchases (including 16,217 employee-years)	$2194 million
Air Quality	
Emission reductions (valued at Congestion Mitigation and Air Quality Program [CMAQ] grant levels)	$1120 million
Additional Benefits	
Improved rail freight service to Chicago region	
Enhanced delivery of emergency services	
Lakefront land use increased	
Facilitate reduced "rubber tire" interchanges	
Energy conservation	
Total Benefits	*$3.909 billion*

The following sections describe some of the specific costs associated with the CREATE project.

Rail Line Capacity Improvements

Most of the individual projects reflect infrastructure improvements necessary to increase train fluidity over the five major corridors. The improvements include double- or triple-tracking, improving connections, and improving signaling, along with six projects to grade separate intersecting rail lines. Table 21 demonstrates several of the representative projects included in the CREATE program to improve rail line capacity.

Table 21. Select CREATE Program Project Descriptions (*63*).

Project Identifier	Preliminary Purpose & Need	Description of Proposed Work/Improvements	Construction Cost
B8	To increase train speeds and capacity between control point (CP) Argo and CP Canal	Install Traffic Control System (TCS) signaling	$4 million
B9/EW1	To provide new East-West Corridor for through trains at Clearing Yard and improves connection to Beltway Corridor at CP Argo	Create a double track connection between the Belt Railway of Chicago (BRC) and CSX at Argo by installing new crossovers and upgrading lead tracks. Construct two new main tracks (~35,000 ft of total new trackage) around Clearing Yard between Hayford and CP Argo.	$31 million
P5	To reduce congestion and delays by eliminating passenger and freight train conflicts at Brighton Park.	Construct a double-tracked bridge to carry Canadian National (CN) Joliet Subdivision/Metra Heritage Corridor over the Western Avenue Corridor and proposed Central Corridor (five tracks). Includes associated signal and bridge work.	$50 million

Total costs for the railroad projects total $406.3 million.

Highway-Rail Grade Crossing Improvements

The CREATE program includes 25 highway-rail grade separations. During the preliminary evaluation, an estimated $15 million per grade separation was used for most of the crossings. The uniquely priced grade separations were:

- $17 million – Grade separation structure at the Belt Railway Company crossing of 63rd Street;
- $68 million – Grade separation structure at the NS crossing of Torrence Avenue and 130th Street; and
- $33.6 million – Grade separation structure at the UP crossing of Roosevelt Road.

The total costs for the grade-separated structures are estimated at $397.6 million, with expected benefits of $202 million for reduced motorists delays and $1.12 billion for emission reduction.

CHAPTER 8:
LESSONS FOR TEXAS RAIL PLANNING

REVIEW OF CASE STUDY LESSONS

The purpose of performing the case studies of example projects that have appeared in the preceding six chapters was to glean lessons that could be applied as TxDOT and local planners begin to actively consider rail relocation projects throughout the state. Each of the case study chapters ends with a detailed section, "Lessons for Texas Rail Planning." These sections give further details regarding each of the statements summarized in Table below.

GENERAL RAIL RELOCATION PLANNING LESSONS FOR TEXAS

Based upon the lessons summarized in Table 22 and the other lessons identified throughout the study, the research team was able to discern lessons in five main areas to recommend that TxDOT consider in future rail-planning activities. These five areas are:

- project goals;
- partnering;
- project financing;
- public involvement; and
- relocation and subsequent development.

The lessons from each of these areas are summarized in Table 23.

Table 22. Summary of Lessons for Texas Rail Planning from Case Study Chapters.

Case Study	Lessons for Texas Rail Planning
Marysville	• Seek projects that address more than one goal when possible. • Seek projects where private partners also benefit. • Seek multiple project partners. • Project work can be split among partners by expertise areas. • Multiple project elements can proceed simultaneously if work is properly phased.
Lafayette	• Leverage available federal demonstration project funding. • Railroad relocation projects can be divided into independent phases and implemented over an extended period. • Establish working relationships with railroad companies early in the project. • The implementing agency must work to maintain continued public, legislative, and financial support over the life of the project.
Reno	• Maximize the use of federal loan programs when possible. • Work closely and in good faith with the railroad(s). • It may be desirable to maintain existing freight and passenger service routes and grade separate an entire corridor than to geographically relocate train service. • Keep the public involved by maintaining a robust public information program.
Salt Lake City	• Urban redevelopment can serve as the main public benefit behind a rail consolidation project. • Unique sequences of events may create narrow windows of opportunity.
Colorado Front Range	• Coordinate freight-rail projects with other transportation planning activities, such as plans for passenger rail, to potentially benefit both activities. • Examine all direct and indirect ways the project may benefit both the public and private sectors. • Expect for the project to continue to any new phases; all public and private stakeholders must agree on the findings of the previous stage and the allocation of benefits and costs amongst stakeholders. • Achieving financial and operational equitability amongst the railroads is very challenging.

Table 23. General Rail Relocation Planning Lessons from Study.

Lesson areas	Lessons
Project Goals	• Multiple goal projects are often easier to achieve because benefits and funding opportunities often increase. • Rail relocation can be part of a much larger project to achieve diverse goals such as urban redevelopment, economic development, flood control, grade crossing safety improvements, and development of passenger rail or other transportation-related improvements. • Involving other goals as part of a rail relocation project increases the number of project partners that can bring legislative and administrative support as well as expertise to the project.
Partnering	• Lead public sector agencies should develop memoranda of understanding with all private sector parties early in the project. • Rail relocation projects should be beneficial to both the public sector and the private railroad company or companies involved. • Partners must jointly determine the benefits to be accrued by each party. • If a public sector agency is the lead agency for the rail relocation project and multiple railroad companies are included in the project; each railroad's interests and benefits/costs of pursuing the project should be evenly considered. • Projects need legislative support throughout the life of the project, often partners can be instrumental in aiding the public sector agency in maintaining legislative support and/or identifying legislators who are likely to support the project.
Project Financing	• Although it may result in an overall delay in completion, phasing of projects into segments of independent utility is often vital for project implementation to spread the total costs over several legislative cycles. • At other times, the urgency of the project due to a special event or circumstances may dictate that the project be devised and planned in such a way that it can be implemented quickly to avoid the consequences of long-term development. • Use of available federal funding (TIFIA loans, grants, private activity bonds, etc.) should be maximized to implement rail relocation projects. • Once the project is completed and planned revenues are proven, federal loans can potentially be retired early and replaced by commercial loans at even more attractive rates. • Local funding for matching federal funds can be derived from a variety of sources depending upon the laws in place in the area of the rail relocation project, such as local sales tax revenue, hotel taxes, local income tax revenues, or per car fees for use of the new facility. • State DOTs can apply additional federal funds to rail relocation projects by designating discretionary funds, such as Enhancement Program funds, to benefit the project. • Creativity in identifying and applying funds from new and diverse sources, such as economic development funds and money from private developers, is often key to project completion.

Table 23. General Rail Relocation Planning Lessons from Study (continued).

Lesson areas	Lessons
Public Involvement	• Demonstrate the public benefits of the project from the beginning. Show that the project is not only benefiting the private railroad companies. • Maintaining contact with the public through many different methods is necessary to keep support levels high. • Project websites, public meetings, and published materials that both inform and influence the public to the long-term project benefits can overcome opposition to delays during project construction or to stopping the project prior to full implementation. • Public sector agencies should maintain and develop relationships with local media outlets so that project information can be quickly disseminated or false statements by project opponents can be refuted. • Support of key public officials is often dependent upon individual support created by systematic and thorough public information and outreach efforts to their constituents.
Relocation and Subsequent Development	• Public agencies planning rail relocation projects must work closely with the private railroad company or companies to limit the impacts that any new route (from either relocation to a new corridor or consolidation to an adjacent existing corridor) may have upon rail operations or that would greatly increase the shipment costs due to increased distances traveled or increased grades that must be encountered. • Overall movement of freight and passengers across the regional rail system must be taken into account before deciding to relocate any single segment. • In certain instances, the location of existing rail facilities (yards, division offices, crew change points, etc.) may dictate that vertical separation (elevating or trenching an entire segment) in the existing corridor is preferable to moving the line to a new route. • Strategic use of grade separations and crossing closures should be considered as an alternative prior to the consideration of rail relocation. • Public sector agencies should seek to put into place development restrictions along newly relocated rail corridors that call for compatible land uses and restrict residential encroachment along the corridor.

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APPENDIX A:
TABLE OF U.S. RAILROAD RELOCATION PROJECTS

Table A-1. Small Urban Relocation Projects.

Project	State	Type	Status	Description	Project Details
Anoka	MN	Small Urban	Complete/ Under Construction	replaced 4-track grade crossing with a 3 track grade-separated structure	- $3.1M - begin 1973 - 1973 Demonstration Project
Carbondale	IL	Small Urban	Complete/ Under Construction	wanted significant grade separation; got one underpass	- $95.6M - begin 1973 - complete 2005 - 1973 Demonstration Project
E. St. Louis	IL	Small Urban	Complete/ Under Construction	grade separations in seven locations; at least two were completed	- $28.1M - begin 1973 - 1973 Demonstration Project
Elko	NV	Small Urban	Complete/ Under Construction	relocate 2 RRs from downtown to a combined, grade-separated corridor on edge of town	- $42.6M - begin 1973 - complete 1983 - 1973 Demonstration Project
Franklin Park	IL	Small Urban	Complete/ Under Construction	consolidate two heavily used N-S rail lines in suburban Chicago to one corridor and create an underpass	- $44M - begin 2002 - expected 2007
Greenwood	MS	Small Urban	Complete/ Under Construction	eliminate in-town interchange by constructing new interchange track outside town	- $4M - begin 1999 - complete 2006
Marysville	KS	Small Urban	Complete/ Under Construction	move heavily used mainline outside of city to reduce grade-crossing delays	- $87M - begin 1973 - complete 2006 - 14 yrs to implement
New Albany	IN	Small Urban	Complete/ Under Construction	redesign of an approach to a major river bridge that would bypass street trackage	- $2.6M - begin 1973 - 1973 Demonstration Project
West Bend	WI	Small Urban	Complete/ Under Construction	remove yard from downtown; make room for redevelopment; part of development plan	- $1.5M + - begin 2003
Blue Island	IL	Small Urban	Studied - Terminated	proposed to construct an overpass of two mainlines; funding was cut in 1985	- $5.9M - 1973 Demonstration Project
Burlington	VT	Small Urban	Studied	relocate yard to more accessible location, and add container and transloading facilities	- 2003 study

Table A-1. Small Urban Relocation Projects (continued).

Project	State	Type	Status	Description	Project Details
Claremore	OK	Small Urban	Studied	grade separate BNSF over highways to relieve delay and spur growth	- $30M - 2003 study
Dolton	IL	Small Urban	Studied - Terminated	grade separation of two mainlines	- funding cut in 1985 - 1973 Demonstration Project
Fairbanks-North Pole	AK	Small Urban	Studied	remove mainline from Eielson AFB and Ft. Wainwright	- $20-85M
Galesburg	IL	Small Urban	Studied	relocating the BNSF line around the community and produce an action report	- 2004 Study
Grand Island	NE	Small Urban	Studied - Terminated	reroute rail line around downtown	- $150M - project too costly
Greenville	TX	Small Urban	Studied	consolidate two mainlines into one corridor	- $12.6M- 1973 Demonstration Project
Greer	SC	Small Urban	Studied	consolidate 7 miles of track, eliminating 26 crossings	- $24M - 1999 study
Heartland Corridor - Portsmouth Relocation	VA WV OH	Small Urban	Studied	increase tunnel clearances; enhance intermodal operations; eliminate grade crossings in Portsmouth	- $266M ($60M for relocation)
Highway 12 Reconstruction - Orono	MN	Small Urban	Studied	realign BNSF in coordination with Hwy 12 improvements, and eliminate RR crossings	- railway moved laterally for hwy project - completed 2006
Morehead City	NC	Small Urban	Studied	reroute rail around city to eliminate grade crossings, improve rail service and stimulate development	- 2007 study
Rutland	VT	Small Urban	Studied	move rail yard outside of town and expand its capacity	- $100M - 1999 study - begin 2006
Sherman	TX	Small Urban	Studied - Terminated	withdrawn from demonstration project	- 1973 Demonstration Project
Tupelo	MS	Small Urban	Studied	relocate rails from midtown and downtown	- $9M + - 2006 study
Wasilla	AK	Small Urban	Studied	move Alaska Railroad (ARR) from downtown	- ARR is federally funded
Wheeling	WV	Small Urban	Studied - Terminated	relocate rail line from central area	- $35M - 1973 Demonstration Project

Table A-1. Small Urban Relocation Projects (continued).

Project	State	Type	Status	Description	Project Details
Winona	MN	Small Urban	Studied - Terminated	relocate Chicago, Milwaukee, St. Paul, and Pacific Railroad (MILW) tracks	- project too expensive
Moses Lake	WA	Small Urban	Considered	relocate RR from downtown and connect the line to the port	- $2M +
Orangeburg	SC	Small Urban	Considered	relocate 18 miles of NS from town	- $120M
Pierre	SD	Small Urban	Considered	alternate route to bypass the city upon expansion of Dakota, Minnesota, and Eastern Railroad (DM&E) to the Powder River Basin	

Notes:
- Small urban cities have populations less than 50,000
- Price quotes are not in constant dollars
- Dates in the future are best estimates

Table A-2. Large Urban Relocation Projects.

Project	State	Type	Status	Description	Project Details
Alameda Corridor - Los Angeles	CA	Large Urban	Complete/ Under Construction	consolidate port access to one grade-separated, high speed/capacity line	- $2.4B - complete 2002
Brownsville	TX	Large Urban	Complete/ Under Construction	maintain port and international rail bridge connectivity, while moving mainline from center of town	- $33.1M - 1973 Demonstration Project - complete
Columbia	SC	Large Urban	Complete/ Under Construction	consolidate multiple mainlines in a 1.5 mi depressed trainway and improve development prospects	- $56.5M - 1979 study - begin 1983 - complete 1987
Erie	PA	Large Urban	Complete/ Under Construction	remove 15 grade crossings	- $29M - begin 2000 - complete 2002
Lafayette	IN	Large Urban	Complete/ Under Construction	remove 5mi of track from street in central business district (CBD)	- $187.5M - begin 1973 - complete 2003 - 1973 Demonstration Project
Lincoln	NE	Large Urban	Complete/ Under Construction	consolidate mainlines in multiple areas and construct a yard bypass	- $43.3M - 1973 Demonstration Project
Olathe	KS	Large Urban	Complete/ Under Construction	grade separate double track mainline over four roads	- $31M - expected 2007
Pine Bluff	AR	Large Urban	Complete/ Under Construction	consolidation of two parallel mainlines through town (completed) and a further bypass of northern suburbs by one line (not completed)	- $11M - begin 1976 - 1976 Demonstration Project
ReTRAC - Reno	NV	Large Urban	Complete/ Under Construction	depress existing rail corridor to eliminate grade crossings	- $282M - begin 1996 - complete 2006
Salt Lake City Gateway	UT	Large Urban	Complete/ Under Construction	consolidate three corridors into one and redevelop land	- complete 2002
Springfield	IL	Large Urban	Complete/ Under Construction	consolidate 5.9 mi of SP & NS track	- $238.6M - complete

Table A-2. Large Urban Relocation Projects (continued).

Project	State	Type	Status	Description	Project Details
Augusta	GA	Large Urban	Studied - Terminated	relocation of rail lines to eliminate grade crossings	- $110M - no funding - 1973 Demonstration Project
Cleveland	OH	Large Urban	Studied	relocate rail lines from waterfront to make room for redevelopment	- $68-142M
CREATE - Chicago	IL	Large Urban	Studied	a collection of interchange, capacity and grade separation projects that together amount to a major systemic overhaul benefiting both freight and passenger mobility	- $1.5B - moving toward initial projects
Fresno	CA	Large Urban	Studied	relocate BNSF to UP corridor and close 40+ grade crossings	- $400M - 1993 study
Gary/Chicago Airport	IL	Large Urban	Studied	relocate Elgin, Joliet and Eastern Railway (EJ&E) to provide adequate room and clearances for runway extension	- $9.5M - 2006 study
Hammond	IN	Large Urban	Studied	various grade separations	- $63.5M - 1974 Demonstration Project
Harlingen	TX	Large Urban	Studied	move rail line from CBD	- $35M - 2005 study
Macon	GA	Large Urban	Studied	relocate NS to open up riverfront to redevelopment and improve accessibility	- 2000 study
Metairie RR Corridor	LA	Large Urban	Studied	address problems with grade crossings on the Back Belt: various alternatives	- $153M - 1995 study
Port of Newark/Elizabeth	NJ	Large Urban	Studied	expand capacity of ports by modifying bottlenecks and double tracking; also included are grade separations	- $80M + - 2003 study
Sioux Falls	SD	Large Urban	Studied	relocate downtown switching yard	- $40M - 2002 study - begin 2007 - complete 2009
Terre Haute	IN	Large Urban	Studied	construct overpass of one mainline	- $7.4M - begin 1977 - 1977 Demonstration Project

Table A-2. Large Urban Relocation Projects (continued).

Project	State	Type	Status	Description	Project Details
Washington	D.C.	Large Urban	Studied	study alternatives to CSX line through downtown in order to divert hazardous waste	- 2005 study
Columbus	OH	Large Urban	Considered	new suburban intermodal yard with light rail system expansion	- $501M - 2003 study

Notes:
- Large urban cities have population greater than 50,000
- Price quotes are not in constant dollars
- Dates in the future are best estimates

Table A-3. Extra-Urban Relocation Projects.

Project	State	Type	Status	Description	Project Details
Bridging the Valley	WA ID	Extra-Urban	Studied	consolidate UP & BNSF to one corridor between Napa Jct, WA, and Athol, ID; eliminate 51 grade crossings	- $252M - 2002 study - begin 2007 - expected 2009
Colorado Front Range	CO	Extra-Urban	Studied	improve connections, consolidate operations, relocate urban yards	- $1.17B - 2005 study
CSX A&S Line	FL	Extra-Urban	Studied	relocate around Orlando; move freight from CSX A-Line to S-Line, to accommodate commuter service	- $283M-1.3B - 2005 study - 2006 Florida, CSX deal
CSX Gulf Line	MS	Extra-Urban	Studied	remove/relocate rail line and make road	- $700M - 2003 EIS, unfinished

Notes:
- Extra-urban routes lie outside urban areas
- Price quotes are not in constant dollars
- Dates in the future are best estimates

APPENDIX B:
APPENDICES RELATED TO COLORADO FRONT RANGE PROJECT (TAKEN DIRECTLY FROM THE 2005 COLORADO FRONT RANGE REPORT)

1. **Proposed Railroad Operating Plan**
2. **Summary of Major Transportation Infrastructure Funding and Financing Programs**
3. **Menu of Possible Funding Strategies**
4. **Menu of Possible Financing Strategies**

Table B-1. Proposed Railroad Operating Plan for the Colorado Front Range *(66)*.

I. Railroad Project Operating Plan

1. Consolidate UP and BNSF freight operations in Denver into one freight corridor
2. Relocate Freight Terminals to outside Denver center city
   a. BNSF Globeville, Rennick, and Denver Intermodal
   b. UP 36th and 40th Streets
   c. UP Burnham and Rolla Automobile Distribution
3. Construct a freight bypass around Denver (95 miles of new construction)
   a. New 35-mile line Omar to Peoria
   b. UP Limon Subdivision Peoria to Aroya (84 miles)
   c. New 60-mile line Aroya to Las Animas
4. Remove through-freight trains from following lines (while a high level of local freight service to Colorado rail customers continues to be provided by the current owning carrier)
   a. BNSF Front Range Subdivision Fox Jct. to Loveland
   b. BNSF Brush Subdivision Fox Jct. to Sand Creek
   c. BNSF Pikes Peak Subdivision South Denver to Sedalia
   d. UP Colorado Springs Subdivision 19th Street to South Denver; Sedalia to Palmer Lake
   e. UP Boulder Branch Sand Creek to Boulder
   f. UP Greeley Subdivision Sand Creek (Mile Point 4.0 or M.P. 4.0) to Denver Union Terminal (DUT)
   g. UP Limon Subdivision Pullman Jct. to Sandown Jct.
5. Freight and commuter passenger service on common line Palmer Lake to Crews

II. Requirements to Achieve the Railroad Project Operating Plan

1. Estimated New Construction Requirements
   a. Double track connection between UP Moffat Subdivision and Belt Line at Utah Junction
      – Grade Separation at Pecos Street
   b. Grade separate BNSF Front Range Subdivision and switching lead from UP North Yard to Belt Junction Main Line
   c. Double track with Centralized Traffic Control (CTC) UP's Utah Junction to Belt Junction Line
      – Grade separate or close all road crossings
   d. Rebuild and double track with CTC Denver Rock Island line between Belt Junction and Sandown Junction
      – Grade separate or close all road crossings

Table B-1. Proposed Railroad Operating Plan for the Colorado Front Range (*66*) (cont.).

e. Remove BNSF-UP crossing at Sand Creek; replace with power operated crossovers, including double track on UP's Greeley Subdivision M.P. 4.0 to M.P. 7.0.

f. New track connection in the northeast quadrant between UP's Greeley Subdivision (M.P. 4.3) and the current DRI line.

g. Add sidings or sections of double track with CTC on UP's Limon Subdivision between Sandown Junction (M.P. 634.2) and Watkins (M.P. 612.0), including necessary grade separation of road crossings

h. New 35-mile line with CTC between Omar (BNSF Brush Subdivision) and Peoria (UP Limon Subdivision)

i. Add 9300-ft sidings or sections of double track with CTC on UP's Limon Subdivision between M.P. 612.0 and Aroya

j. New 60-mile line with CTC between Aroya and BNSF Boise City Subdivision at Las Animas

k. Add 9300-ft sidings or sections of double track on BNSF Brush Subdivision between Union and Omar

l. Add a second track with CTC on UP Moffat Subdivision between Utah Jct. and Prospect Jct.

m. CTC and additional sidings as necessary on the UP-BNSF freight line between South Denver and Palmer Lake

n. Additional capacity (sidings, double track, CTC) as needed on UP-BNSF joint line between Palmer Lake and Pueblo

o. Accommodate both freight and commuter passenger operations on a common line

p. Potential freight terminal facilities at Hudson, the Rocky Mountain Arsenal, and/or Watkins to replace facilities in the Denver center city area

2. Proposed Trackage Rights

a. BNSF overhead trackage rights on UP

- Aroya to Peoria
- Sand Creek to Belt Junction
- Belt Junction to Utah Junction
- Utah Junction to Prospect Junction

b. UP overhead trackage rights on BNSF

- Omar to Union
- Las Animas to Pueblo

c. BNSF and UP trackage rights on new bypass

- Omar to Peoria

Table B-1. Proposed Railroad Operating Plan for the Colorado Front Range (*66*) (cont.).

– Aroya to Las Animas

3. Potential Agreements between BNSF and UP
   a. Co-located dispatching office in Denver
   b. Joint venture for commuter rail service between Denver and Palmer Lake/Colorado Springs/Pueblo
4. Potential conveyances of ROW (such as easements, line sales, and/or track use agreements) in lieu of condemnation to CDOT, Denver Regional Transportation District (RTD) or other public entity with BNSF or UP retaining exclusive local service rights
   a. BNSF Front Range Subdivision Loveland to Fox Jct.
   b. BNSF Brush Subdivision Sand Creek to Fox Jct.
   c. BNSF Pikes Peak Subdivision South Denver to Sedalia
   d. UP Colorado Springs Subdivision 19th Street to South Denver; Sedalia to Palmer Lake
   e. UP Boulder Branch Sand Creek to Boulder
   f. UP Greeley Subdivision M.P. 4.0 to DUT
   g. UP Limon Subdivision Pullman Jct. to Sandown Jct.
   h. UP right-of-way for Air-Train Sandown Jct. to Pena Blvd.
   i. BNSF Globeville, Rennick and Denver Intermodal Yard
   j. UP 36th Street Yard, 40th Street Intermodal Yard and Burnham Yard

Table B-2. Summary of Major Transportation Infrastructure Funding and Financing Programs.

Characteristics	Alameda Corridor	CREATE	Denver T-REX	Reno ReTRAC	Bridging the Valley	Texas SR 130 Toll Highway
Location	Southern California	Chicago Metropolitan Area	Denver Metropolitan Area	Downtown Reno	Spokane Metropolitan Area	Austin Metropolitan Area
Sponsor	Transportation Corridor Authority	Illinois DOT, Chicago DOT, Metra, and 6 railroads.	Colorado DOT and Denver Regional Transportation District	City of Reno	Spokane Regional Transportation Council	Texas Turnpike Authority - Texas Department of Transportation
Type	Depressed Railroad Cargo Expressway	Urban Railroad System Rationalization	Highway Corridor Expansion and Transit Corridor (LRT) Extension	Depressed Railroad Corridor	Upgrade Railroad Corridor through Consolidation	Toll Highway By-Pass *
Size	20 Rail Miles	Upgrade 6 railroad corridors, 25 highway/rail grade crossings, 6 rail/rail flyovers, track/switch replacement, and train control systems	25-mile highway corridor expansion 19-mile LRT extension	2.3 Rail Miles	42 Rail Miles	65 Road Miles
Cost	$2.4 Billion	$1.5 Billion	$1.7 Billion (53% Highway -47% LRT)	$0.3 Billion	$0.3 Billion	$3.6 Billion
Opening	2003	To Be Determined (TBD)	2006	2006	2009	2007
Project Delivery Approach	Design-Build	TBD	Design-Build	Design-Build	TBD	Design-Build

Table B-2. Summary of Major Transportation Infrastructure Funding and Financing Programs.

Characteristics	Alameda Corridor	CREATE	Denver T-REX	Reno ReTRAC	Bridging the Valley	Texas SR 130 Toll Highway
Funding Sources	Railroad Tolls – 65% Ports of LA and Long Beach Funds - 16%	Public Funds - 85% Railroad Benefits and Costs - 14%	Federal Highway Funds - 36% Federal Transit Funds - 31%	City General Revenues - 1% Federal and State Transportation Funds - 8%	Federal Railroad Relocation Funds – TBD Washington State Freight Mobility Strategic Investment Board - 16%	Highway Tolls - 65% Private ROW - 15%
	Metropolitan Transportation Authority Funds - 14% State/Federal Funds - 5%	Metra - 1%	Local Transit Sales Tax - 19% Local Sales and Use Tax - 12% Local Funds - 2%	UP Railroad ROW and Leases - 33% Downtown District Tax, Hotel Room Tax, and Local Sales Tax - 58%	BNSF and UP Railroads - Remainder TBD	TxDOT Funds - 20%
Financing Strategies	Toll Revenue Bonds - Taxable - 21% Toll Revenue Bonds - Tax-Exempt - 27% TIFIA Loan - 16%	TBD	Grant Anticipation Revenue Vehicles (GARVEE) Bonds (grant anticipation notes) Highway - 36% GARVEE Bonds - Transit - 19%	Municipal Bonds - 37% TIFIA Loan - 28%	None foreseen	Toll Revenue Bonds - 34% Bond Anticipation Notes - 25% TIFIA Loan - 1%

* TTI Note: The SH-130 toll highway route has also been designated as a potential future rail relocation corridor/segment between the Austin and San Antonio urban areas.

Table B-3. Menu of Possible Funding Strategies.

Funding Source Options	Potential Sources	Advantages	Disadvantages
Federal Railroad Program Funds ▪ Proposed Rail Relocation Grant (RRG) Program ▪ Rail Rehabilitation and Improvement Fund (RRIF Program)	▪ Federal Government – Federal Railroad Administration	▪ RRG is a proposed grant program that would be dedicated to railroad relocation projects like this.	▪ Proposed RRG program not yet authorized by Congress – may be dropped by sponsors in current budget debate.
Federal Highway Trust Funds ▪ Earmarks ▪ Grants ▪ Pilot projects ▪ Capital program ▪ Renewal program ▪ Congestion/emission reduction (CMAQ) program ▪ State Infrastructure ▪ Bank (SIB) program	▪ Federal Government-Federal Highway Administration	▪ Large highway-focused program with some discretion for intermodal projects and projects that reduce congestion and emissions in non-attainment areas.	▪ Major competition for available funds with needs far exceeding available funding. ▪ Focused on highway uses - not railroad relocations except where highway facilities are directly impacted (grade separations/crossings). ▪ SIBs have not received additional federal funding since 1997.
State Transportation Program Funds ▪ Program funds ▪ Project funds	▪ State Government-Colorado Department of Transportation (TTI note: or other state DOTs)	▪ Potentially large pool of transportation-related funds. ▪ CDOT has wide latitude in using excess sales tax revenues for various transportation-related purposes, when available, as provided by Senate Bill 1.	▪ High competition for available funds. ▪ State highway funds are limited to use on State Highway System by policy and legislation. ▪ Economic conditions since 2002 have reduced Senate Bill 1 proceeds to zero.
Regional Transportation Program Funds ▪ New Starts Program funds for commuter rail initiatives ▪ FasTracks Program funds.	▪ Regional Transit Agency-Regional Transit District	▪ Local pool of transportation-related funds. ▪ Might be eligible for FasTracks funds if program approved by voters this November.	▪ High competition for available funds.

Table B-3. Menu of Possible Funding Strategies (continued).

Funding Source Options	Potential Sources	Advantages	Disadvantages
Local Transportation Funds ▪ State transportation funds allocation ▪ General funds ▪ Regional Transportation District funds	▪ Local Government ▪ Cities ▪ Counties	▪ Local pool of transportation-related funds	▪ High competition for available funds. May be limited to use on state and local highways and roads. ▪ Legislation to permit formation of regional transportation districts still being debated by the State Legislature.
State Taxes ▪ Sales tax revenues, ▪ Incremental sales tax revenues above 6% growth rate	▪ State Government	▪ Large statewide pool of general funds that applies to both residents and visitors. ▪ Significant revenue potential when state's economic conditions are favorable. ▪ High discretion for using incremental sales tax revenues for transportation purposes, when available.	▪ High competition for state sales tax receipts. ▪ Funds generally committed to other uses. ▪ Revenues subject to economic conditions, which can vary significantly.
Local Taxes ▪ Sales tax ▪ Property tax increment ▪ Special assessment district	▪ Local Government	▪ Wide variety of funding instruments possible (e.g., E-470 funding program)	▪ Limited state and local budgets create high competition for limited funds. ▪ Current political environment nationwide makes tax increases highly unlikely.
Private Company Contributions ▪ Money ▪ Right-of-way ▪ In-kind services	▪ Railroads ▪ Coal Companies ▪ Development Community	▪ Access to capital markets and internal funds for projects that offer high competitive returns. ▪ Private sector players need to realize benefits commensurate with their contributions.	▪ High competition for available funds. ▪ Project must produce a higher rate of return than typical for the public sector.

Table B-3. Menu of Possible Funding Strategies (continued).

Funding Source Options	Potential Sources	Advantages	Disadvantages
Joint Development ▪ Public-private partnership	▪ Development Community, Railroads ▪ State Government ▪ Local Government	▪ Significant opportunity to leverage scarce resources by combining public and private resources and interests. Major emphasis by leadership of US DOT and FHWA.	▪ Requires careful balancing of project risks, returns, and responsibilities among project partners. Potential loss of control over public assets by the public sector.
User Fees ▪ Tolls ▪ Shadow tolls ▪ Access fees	▪ Railroads, Development Community ▪ State Government	▪ Provides direct linkage between the users of the facility and its funding. ▪ Provides a long-term cash flow stream to support bond financing methods. ▪ Colorado has favorable legislation for development of tolled highways. ▪ One option is for the private sector to pay for the construction costs and then be reimbursed by the public sector through use-based shadow tolls. This would encourage greater use of the relocated facilities by the private sector, which would increase the level of benefits produced over time.	▪ Uncertainty over user willingness to pay the fees and the level of utilization of the facility when user fees are applied or adjusted over time.
Other Sources ▪ Utility easements ▪ Right-of-way sale ▪ Land development ▪ Trackage rights	▪ Utility Companies ▪ Power ▪ Pipeline ▪ Cable/Phone ▪ Developers ▪ Regional or Shortline Railroads	▪ Additional sources of funding to augment primary funding sources.	▪ Revenue levels may be limited by scope of project. ▪ Right-of-way likely to be owned by private railroads, who would likely determine its concurrent use.

Table B-4. Menu of Possible Financing Strategies.

Funding Source Options	Potential Sources	Advantages	Disadvantages
Direct Project Grants or Contributions ▪ Funds ▪ Rights-of-way ▪ In-kind services	▪ Public Sector ▪ US DOT ▪ CDOT ▪ State Infrastructure Bank (SIB) ▪ RTD ▪ Private Sector ▪ State and Local Governments ▪ Railroads ▪ Coal Companies ▪ Developers	▪ Avoids costs of debt and need to pursue voter approval due to Colorado Taxpayer Bill of Rights (TABOR) Law requirements. ▪ Provides funds up front when project capital costs are highest.	▪ None – except for scarcity of these kinds of funds, particularly in times of economic distress. ▪ SIBs have not received additional federal funding since 1997.
Revenue Bonds	▪ Public Infrastructure Finance Markets	▪ Allows funds to be made available up front to pay for capital costs of project and then paid off over time.	▪ Needs defined user-fee or other direct revenue source, which is unlikely for this Project. ▪ Costs of debt service over term of bonds.
State Bonds	▪ State Government ▪ CDOT	▪ High credit rating of state due to lower risk of default.	▪ TABOR Law requiring voter approval of referendum authorized by legislative action to allow state to incur debt represents significant roadblock to state support of debt for the Project.
Municipal Bonds	▪ Local Government ▪ Cities ▪ Counties	▪ Ability to issue tax-exempt bonds at relatively low rates.	▪ Reluctance or inability of local jurisdictions to incur debt for railroad infrastructure.

Table B-4. Menu of Possible Financing Strategies (continued).

Funding Source Options	Potential Sources	Advantages	Disadvantages
Private Bonds	▪ Companies	▪ Uses creditworthiness of corporate entity to gain access to private bond markets for financing up-front project costs.	▪ Typically taxable debt, which significantly raises the cost of borrowing for the project.
Private Activity Bonds (PABs)	▪ Financial Markets ▪ Railroads ▪ Developers ▪ Other private companies	▪ Tax exempt bonds for private investment in public use transportation infrastructure with favorable rates to sponsor entity. ▪ Currently available for intercity passenger rail infrastructure.	▪ Federal permission for transportation-related PABs contingent on reauthorization legislation now being developed by Congress. ▪ PAB limitation to public use infrastructure may limit use for private railroad facilities.
Anticipation Notes	▪ FHWA ▪ GARVEES ▪ SIB	▪ Expedites the availability of federal and state funds for needed projects.	▪ Commits state to pledge future federal highway program funds until GARVEE is paid off, including debt service. ▪ Not a direct source of funding. ▪ SIBs have not received additional federal funding since 1997.

Table B-4. Menu of Possible Financing Strategies (continued).

Funding Source Options	Potential Sources	Advantages	Disadvantages
Loan and Credit Support	▪ FHWA ▪ TIFIA Program ▪ Railroad Rehabilitation-Improvement Financing Program ▪ State Infrastructure Bank (SIB)	▪ Leverages available federal resources by lowering the cost of borrowing up to a third of the cost of large projects (over $100 million). ▪ RRIF Program lowers cost of debt by providing credit enhancement for railroad capital improvement projects that involve intermodal or rail equipment or facilities.	▪ No down side, except where the sponsors cannot incur debt for the project. ▪ Not a direct source of funding. ▪ SIBs have not received additional federal funding since 1997.