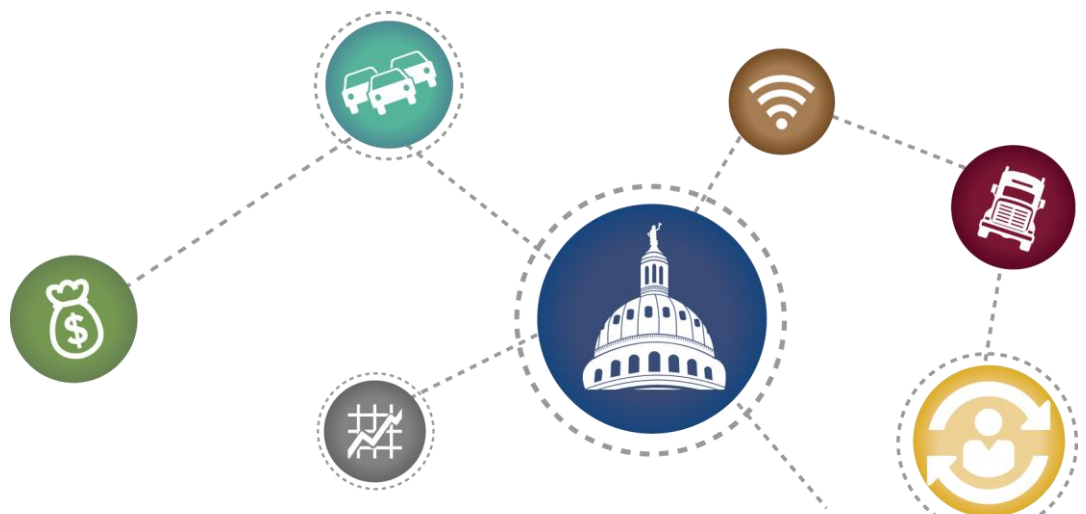


# Public Use of Rail Right-of-Way in Urban Areas

## *Final Report*

PRC 14-12 F



# Public Use of Rail Right-of-Way in Urban Areas

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## Executive Summary

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According to the U.S. Census, Texas' total population increased by 76.7 percent, going from about 14.2 million to more than 25 million between 1980 and 2010. This trend is expected to continue, with an expected population of 41.3 million by 2050. A growing population combined with a growing economy is resulting in increased passenger travel demand in Texas. In addition, freight movements are expected to continue increasing as Texas remains the number one export state in the nation. Key elements of the Texas transportation system are reaching capacity, resulting in congestion, increased travel times, and safety and air quality concerns.

Diverting both passenger and freight traffic to rail transport is often seen as a key component of a greater intermodal solution to reduce roadway congestion and associated societal and environmental costs within existing transportation corridors. Two options exist for providing passenger rail capacity in existing rail corridors. One option is to negotiate with the freight railroads to allow passenger rail service, particularly commuter rail, on existing tracks or within existing rail right-of-way (ROW). A second option is to work with railroad companies to relocate rail yards and mainline tracks to new locations outside of densely populated urban areas, thereby freeing existing corridor capacity for passenger rail service or other alternative transportation uses.

The Texas A&M Transportation Institute (TTI) conducted this study to update and expand previous work conducted by the Center for Transportation Research at The University of Texas and TTI. The previous study examined the idea of commuter rail using existing freight tracks or existing ROW, and the relocation of rail yards and mainline tracks outside of densely populated urban areas, thereby freeing key corridors for public use.

The research team conducted 10 U.S. case studies, six pertaining to commuter rail sharing existing freight tracks or ROW and four pertaining to the relocation of rail yards and mainline tracks. The team researched a Texas example in the Dallas-Fort Worth metropolitan area where two transit agencies are evaluating the introduction of commuter rail service over a former freight rail line, now owned by one of the transit agencies. Currently, the rail line is leased to a short-line railroad for local freight rail service. The research team also interviewed all three Class I freight railroads currently operating in Texas.

This report highlights several shared-use agreements that have been executed, the negotiation issues and concerns, the benefits of passenger rail sharing freight infrastructure, and the benefits of relocating rail yards and mainline tracks outside of densely urban areas.

## Sharing Rail Infrastructure

### *Three Scenarios for Sharing Rail Infrastructure*

Different types of sharing agreements allow the freight railroads and public agencies operating commuter rail systems to use existing rail track and/or ROWs. As described by the Federal

Railroad Administration (FRA), commuter rail and freight railroads can share rail infrastructure in three general scenarios:

- **Shared track**—Freight rail and commuter rail use the same track.
- **Shared ROW**—Freight and commuter tracks are separated by less than 25 feet between track centers.
- **Shared corridor**—Freight and commuter track centers are separated by more than 25 feet between track centers but are less than 200 feet apart.

The first scenario, *shared track*, can further be divided into different categories based on who owns the infrastructure and who is responsible for operating the commuter service:

- In the first model, the transit agency/commuter operator owns the track, dispatches the trains, owns the equipment, and employs the workers. Continued freight service in the corridor is generally provided by a private freight railroad that pays the transit agency for access to the track. This has the advantage of allowing the public agency to handle dispatching and might result in more reliable service.
- In the second model, the commuter operator owns the commuter equipment, employs the commuter rail workers, and contracts with a freight railroad for dispatching and track access.
- The third model is termed *purchase of service*. In this case, the transit agency pays the freight railroad a fee to operate the commuter rail service. The commuter operator may or may not supply the equipment and contracts with the freight railroad to staff and operate commuter trains on freight-railroad-owned tracks.

The research team found that the most prevalent type of track shared-use agreement is one in which the transit agency pays a fixed fee in exchange for operating a specified number of commuter trains on freight track during specified time windows. In most cases, the freight railroads have tied shared use to specific investments to improve a corridor's capacity. Most transit agencies interviewed recommended that this type of agreement include the conditions for expanding service if the demands rise. The agencies also recommended that an agreement in which freight railroads control dispatching should contain incentives for on-time performance.

In the second and third scenarios, *shared ROW* and *shared corridor*, the ROW acquisition agreement means that the transit agency will buy land from the freight company (i.e., shared ROW) or other land owner (i.e., shared corridor) adjacent to the freight tracks. The transit agency can then construct its own tracks in the ROW. The agreement in this scenario is mainly concerned with coordinating signals, establishing how freight shipments will reach clients on the other side of the commuter tracks, and how commuters will cross freight track to reach stations on the opposite side of the freight track. Both the purchase-of-service agreement and the ROW

acquisition agreement will generally be preferred when the corridor is very busy (approximately 45 trains per day or more).

### *Shared-Use Agreement Components*

A negotiated shared-use agreement between a transit agency and a freight railroad company addresses the following questions regarding how the rail ROW and infrastructure will be shared:

- Who is responsible for operations (i.e., maintenance, running of the trains, and dispatching rules)?
- Who pays for capital investments to add additional track capacity for commuter trains?
- How will maintenance costs be shared, and how will they be calculated?
- How will trackage fees be calculated?

### *Freight Railroad Company Perspectives*

The research team found that the Class I railroads in Texas want to be part of the intermodal solution in Texas but believe their focus should be moving freight. They believe that this is the best use of existing freight rail infrastructure and corridors and how they best contribute to the Texas economy. Therefore, as profit-making corporations, they will only allow the use of their tracks for commuter rail services under the following conditions:

- The freight railroads are assured that it is safe.
- The freight railroads are fully reimbursed for all costs incurred.
- There is no negative impact on the quality of their freight service; i.e., commuter rail cannot impede freight transit time and operations.
- Liability issues can be resolved in good faith, and legal liability can be held to a manageable level.

Additionally, the freight railroads interviewed noted the following:

- In many cases, capital investments will be required to ensure that the freight railroad's capacity or future ability to operate is not compromised by commuter operations. The public-sector partner will be responsible for capacity improvements to accommodate commuter rail, as well as the long-term maintenance and inspection of the additional infrastructure capacity required. The track required for commuter rail is often a higher-class track that is more expensive to install and maintain than the track required for freight trains.
- Freight railroads do not want to begin negotiations until a certain level of capital funding is in place. A commuter rail agency should identify funding for capacity improvements and infrastructure before beginning negotiations for access to freight ROW.

- Funding flexibility is required because freight rail system infrastructure investments may be needed outside the commuter service area to allow capacity for improved service in a downtown area. For the public agency, capital investments in rail infrastructure—yard improvements or bypass routes—could total millions of dollars and might be well outside the agency’s official boundaries.

### *Keys to Negotiating Successful Shared-Use Agreements*

The research team conducted six rail infrastructure sharing case studies representing various types of shared-use agreements. The following summarizes the techniques that the transit agencies interviewed used to successfully negotiate with the freight railroads:

- **Find common goals and objectives**—To create an effective partnership, the transit agency and freight railroad should work to understand each other’s business goals and needs. Clearly defined goals and objectives allow both parties to leverage their respective strengths toward reaching common goals. Examples of common goals include increasing capacity, increasing train speed, reducing travel time, improving reliability, ensuring on-time performance, optimizing maintenance costs, and improving ROW conditions.
- **Build a trusting relationship**—Local governments do not have the authority to seize, regulate, or assert control over rail facilities used in interstate commerce if doing so will unreasonably burden the ability of the railroad to fulfill its common carrier obligation in interstate commerce. Freight railroads typically start off in a position with leverage in negotiations because they control the resources that a public agency wants to access. Good communication and a trusting relationship are critical to the negotiation of successful shared-use agreements.
- **Cover the freight railroads’ costs**—Much of the difficulty surrounding rail infrastructure and ROW sharing centers on determining an amount that is considered fair compensation for the use of the railroad track or ROW, and for the additional costs imposed by commuter trains when applicable. The fundamental information needed for fair compensation comes from determining which costs should be considered and how the costs should be shared. In the end, all parties must have a clear understanding of the full costs and who is paying for what items over time. The public agency should approach the freight railroads with enough funding in hand to address all the likely impacts of commuter service on the freight franchise. Recognizing this from the beginning will instill confidence in the freight railroad that the public agency understands the freight railroad’s perspective and is serious about reaching an agreement.
- **Secure on-time performance**—Transit agencies value on-time performance and reliability because these factors influence ridership levels. At the same time, freight railroads are increasingly facing demands for faster and more reliable schedules. Dispatching becomes more complicated when commuter and freight trains share ROW and track. It is critical to establish clear service expectations that can be met. Shared-use

agreements, for example, can be structured so that commuter trains have priority during rush hours when on-time performance is critical to ensure targeted ridership levels. This can be accomplished by negotiating exclusive time windows each day. Alternatively, the transit agency can specify penalties for failing to meet on-time performance targets (or incentives for meeting on-time performance targets) in shared-use agreements.

- **Preserve time for scheduled track maintenance**—The rigid schedules of commuter trains require that maintenance work be scheduled so that it does not impact commuter services. An incremental hourly wage differential can be negotiated with a labor organization performing maintenance to allow for work to be done at night, but the increased cost will have to be covered by the transit agency.
- **Address service expansion**—It is essential that the shared-use agreement allow for service expansions. Agreements should be flexible enough to allow additional trains without necessitating renegotiation of the entire agreement. In most cases, service expansion will be tied to specific compensation or specific capital improvements.
- **Address safety concerns**—In many instances, safety concerns drive decisions about shared operations. Safety regulation for all commuter, intercity, and freight rail lines operating over the national rail system falls under the jurisdiction of FRA. When commuter and freight trains share tracks, there is always a risk of collision, derailment, or damage caused by a load that shifted. Similarly, when commuter and freight trains share ROW or a corridor, each operator must mitigate the risks that a derailment on one of the tracks can impose on the other. Highway-rail grade crossing safety should also be considered before implementing any shared-rail operations within a corridor.
- **Address liability**—The Class I railroads will not take on any additional liability and will not negotiate on liability/insurance requirements. In 1997, Congress passed the Amtrak Reform and Accountability Act, which limited the aggregate overall damage liability to all passengers from a single incident to \$200 million. This limit also applies to commuter rail operations. To cover such a large liability, commuter rail agencies must acquire insurance coverage. Annual premiums vary but tend to be between \$1 million and \$2 million. However, the \$200 million limit does not apply to non-passengers, which has been untested in court. The freight railroad companies stated that the contract must have full faith and credit indemnification, so paying for comprehensive insurance helps demonstrate that the transit agency is willing to work cooperatively with the freight railroad.

Although the issue was not identified as a key negotiation issue, the research team did note that in all the case studies, the states' departments of transportation (DOTs) participated to varying degrees in the establishment of the commuter rail services and participates in ongoing negotiations on rail investments. For example, in the case of the Virginia Railway Express (VRE), a task force composed of the senior management from VRE, the Virginia DOT, and the

freight railroads identifies bottlenecks in the network, identifies capital improvements, and decides how capital improvement costs will be apportioned between VRE and the freight railroads. Similarly, the Chicago Regional Environmental and Transportation Efficiency (CREATE) Program is considered a national model for public-private partnerships to address rail bottlenecks that affect both passenger (including Metra) and freight rail service. The CREATE Program is a public-private partnership between the six Class I railroads operating in Chicago, the Chicago DOT, the Illinois DOT, Metra, and Amtrak.

## **Rail Infrastructure Relocation**

Another option for the public sector is to work with railroad companies to relocate some or all of their freight activity away from existing rail corridors. For example, the through-freight rail traffic not being delivered to local customers could potentially be rerouted to another existing, nearby rail corridor or to a newly constructed rail line. Constricted rail yard operations within an urban area could also be moved to another area outside of the city with more room for expansion or where present/future land use is more compatible.

### *Benefits of Infrastructure Relocation*

Pursuing a rail relocation strategy could achieve several potential benefits. Original rail corridor ROW and infrastructure could be repurposed for high-capacity commuter rail operations. Existing freight rail customers along the line that are unable to relocate could move freight at off-peak periods, as long as public-private agreements include provisions for accommodating those clients.

Freight railroads could benefit from newer infrastructure design, addition of more rail capacity, and/or the construction of larger, more efficient yards outside the urban area. Depending on their scope, projects may encourage truck-to-rail diversion of freight, thereby increasing freight rail revenues and creating additional public benefits by reducing the number of trucks on area highways.

Finally, former urban rail yard locations and adjacent rail facilities not required for public commuter rail operations could be redeveloped to complement urban land uses.

### *Challenges to Infrastructure Relocation*

Rail relocation raises several challenges, including:

- Rail relocation is generally a very costly and time-consuming process.
- Substantial public-sector investment to achieve a rail relocation project could raise objections as an unfair advantage to the relocated railroad(s).
- Rail relocation project benefits accrue over the long term, complicating benefit-cost analyses for the project.

- Brownfield redevelopment issues (e.g., sites with potential contamination concerns) related to yard re-use may be costly.
- Operations over the new route may or may not be beneficial to freight railroad operations.

## **Benefits and Impacts of Commuter Rail**

Transportation investments, in general, improve the efficiency of the transportation system (measured in terms of reductions in travel time and vehicle operating costs, and increases in reliability and accessibility), enhance safety, reduce emissions, and improve agency cost savings. These benefits are considered direct benefits and are typically quantified and compared to the costs of the investment in a benefit-cost analysis framework to determine the societal feasibility of a planned transportation investment. The following subsections describe the direct benefits that can accrue from a commuter rail system.

### *Travel Time*

Generally, traffic congestion relief is a goal in developing a new commuter rail service. Commuter rail can impact travel times and traffic patterns within a transportation network as follows:

- Commuters will divert to rail if they have a similar or faster commute. However, some commuters may switch because of other considerations such as cost, comfort, or reliability.
- As commuters divert from automobiles to commuter rail, highways along the corridor have the potential to become less congested, so automobile users that decide to keep driving will also benefit from less delay.
- However, if the main arterials were operating at capacity, additional traffic might have spilled over onto minor roads. Therefore, when the commuter rail starts, any vehicles removed from the main arterials will merely be replaced by vehicles from the minor roads. The end result could be no congestion reduction along the main arterials. It is possible in this scenario that the vehicles diverting from the minor roads will have some time savings and the rail commuters' time will be unaffected, but the total amount of time saved by all users of the corridor, particularly among drivers, could be significantly reduced.

### *Vehicle Operating Costs*

In general, vehicle operating costs are reduced if a transportation investment (e.g., a commuter rail line) alleviates the stop-and-go traffic situation experienced on congested facilities by diverting some automobile users to the commuter rail line. Typically, vehicle operating cost calculations consider the cost of fuel, oil, tires, and maintenance. These costs vary considerably depending on the traffic conditions (average speed, number of stops, and accelerations and



decelerations required), the vehicle characteristics (model and maintenance record), and driver characteristics.

### *Safety*

Commuter rail can impact safety within a transportation network as follows:

- **Accidents along the corridor**—To determine the number of accidents along a highway, it is critical to understand the relationship between traffic speed and accident risk. According to the literature, accident rates tend to increase in congested traffic conditions (high traffic densities), but the severity of the accidents tends to be less. Considerable evidence exists that higher traffic speeds are associated with fewer but more severe accidents. Thus, reducing congestion on a highway by diverting commuters to rail could potentially reduce the number of accidents, but the accidents could be more severe.
- **At-grade crossings**—Increasing the number of trains using a rail track increases the risk of at-grade crossing accidents. Increasing the number of trains going through at-grade crossings represents a cost. However, if implementation of the commuter rail line involves upgrading at-grade crossings to separate at-grade crossings, there could actually be an overall safety benefit.
- **Accidents along the rail line**—Increasing the number of trains using a rail track increases the probability of accidents involving trains only. These include derailments, collisions between trains, and accidents involving pedestrians on the tracks.

### *Air Pollution*

Commuter rail systems are generally assumed to offer air pollution benefits over automobile usage. However, the amount of emissions reduced is a function of the expected utilization of the commuter rail service. At a certain level of rail utilization, enough vehicles will be removed from the roadway to achieve a net reduction in emissions. The exact number of vehicles that need to be removed varies based on the type of locomotive used (electric or diesel) and which pollutant is being analyzed. Tri-Rail calculated that its commuter rail system results in a net reduction of 16,000 tons of greenhouse gases, 1,200 tons of carbon monoxide, and 122 tons of oxides of nitrogen.

### *Other Environmental Impacts*

On the other hand, a commuter rail service can also generate environmental impacts along its route in the form of noise and vibration. When approaching an at-grade crossing, trains (either commuter or freight trains) are required to warn vehicles by sounding their horns. Given the schedules of commuter trains, it is possible that this safety requirement may disrupt people's sleep as the commuter train passes through neighborhoods. FRA has the authority to designate quiet zones where trains are not required to sound their horns except in emergencies. To receive this designation, FRA requires that each crossing be improved with raised medians, crossing gates, and other measures to ensure that the overall safety in a corridor is not reduced. The quiet

zone applies to both commuter and freight trains, which could translate into a reduction in noise in the existing rail corridor.

Perhaps more important than noise pollution is the vibration that a train creates. This vibration can be destructive over time to structures located near the rails, although the effect is much greater for heavy freight trains than for relatively light commuter rail trains.

### *Agency Cost Savings*

An important consideration for the implementation of a commuter rail system is future capacity along a corridor. One highway lane theoretically can move up to 2,400 people per hour, while a commuter rail line can potentially move many more people, depending on the headways (frequencies). Implementing a commuter rail system can provide additional people-moving capacity in a relatively smaller footprint and at potentially lower capital costs than providing additional highway lane-miles.

The maintenance cost benefits of diverting automobile users to commuter rail systems is typically relatively low. In fact, care must be taken to ensure that the commuter rail does not impact the freight service negatively and thereby cause a diversion from freight rail to truck, which would result in an increase in highway maintenance costs.

### *Economic Development Impacts*

Decision makers are also interested in the economic development impacts (e.g., employment creation, increased incomes and property values, and business activity) associated with a transportation investment. When using a traditional benefit-cost analysis framework to evaluate the societal benefits of a proposed investment, the inclusion of economic development impacts in the calculations can result in double counting that skews results. The argument is that transportation investments that produce cost savings will result in an increased demand for transportation. The induced demand benefit can be considered a proxy for regional development impacts because the stimulation of the economy associated with a transportation improvement will be reflected in increased traffic. That said, the economic development impacts are often easier to communicate to the public and are often used to garner support for a commuter rail system.

The economic development impacts that can accrue from a commuter rail system include changes in land-use patterns and job creation.

### *Land-Use Patterns*

Commuter rail can change urban land-use patterns and bring about increases in value and density. For example, when a new commuter rail station is opened, the property near the station can be redeveloped, especially if the city decides to pursue transit-oriented development.

Commuter rail also increases a community's access to recreational and productive opportunities, which in turn can have a positive effect on that community's livability. These land-use changes can also improve regional equity by making areas more accessible to the poor or disabled.

Businesses near commuter rail stations also benefit from increased worker productivity and the ability to attract different types of workers. These benefits stem from, among other factors, less stressful commutes and the growing trend among young professionals (those approximately 25 to 35 years old) to forego driving.

### ***Job Creation***

Investment in a commuter rail system will result in temporary job increases and, by improving travel conditions and access along the corridor, a shift in the number and types of jobs available. Any investment in the rail infrastructure to implement a commuter rail route will add construction jobs along the corridor. Whether the investment actually increases employment or merely diverts construction jobs from other activities depends on the local unemployment levels. From an economic development perspective, adding the commuter rail service increases the supply of travel available to commuters, which lowers the cost (i.e., time) of travel. This will in effect increase the labor pool that businesses have access to within a given area.

## **Conclusions**

Despite the number of case study examples of shared-use agreements and freight rail track relocations included in this study, the research team found that accommodating commuter rail on freight rail track is becoming more difficult, even with significant investments in rail capacity and even in cities with well-established commuter rail service (e.g., Chicago). In part, this stems from changing economic conditions in the rail industry. Currently, freight rail business is growing, and the freight railroads are challenged to meet freight rail demand within their current capacity. This business climate makes it difficult to negotiate for shared capacity on freight rail corridors. Freight railroads have also learned through experience that selling off excess infrastructure capacity may provide some capital in the short run, but it greatly reduces flexibility in changing or expanding future freight operations.

Finally, one freight railroad also raised the question of whether rail corridors are optimal for commuter rail because freight rail corridors tend to primarily serve industrial areas rather than employment centers. Highway corridors, on the other hand, tend to serve employment centers (including centers that grew alongside the highways) and may be better suited for accommodating commuter rail. This needs to be further explored.

## Project Overview

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According to the U.S. Census, Texas's total population increased by 76.7 percent, going from about 14.2 million to more than 25 million between 1980 and 2010. This trend is expected to continue, with an expected population of 41.3 million by 2050 (1). A growing population combined with a growing economy is resulting in increased passenger travel demand in Texas. In addition, freight movements are expected to continue increasing as Texas remains the number one export state in the nation. Key elements of the Texas transportation system are reaching capacity, resulting in congestion, increased travel times, and safety and air quality concerns.

Diverting both passenger and freight traffic to rail transport is often looked upon as a key component of a greater intermodal solution to reduce roadway congestion and associated societal and environmental costs within existing transportation corridors (3, 4). Two options exist for providing passenger rail capacity in existing rail corridors:

- One option is to negotiate with the freight railroads to allow passenger rail service, particularly commuter rail, on existing tracks or within existing rail right-of-way (ROW).
- A second option is to work with railroad companies to relocate rail yards and mainline tracks to new locations outside of densely populated urban areas, thereby freeing existing corridor capacity for passenger rail service or other alternative transportation uses.

The latter option could, in principle, enhance freight rail operations as well by providing improved operations and additional capacity.<sup>1</sup> In cases where existing freight rail customers cannot

*The American Public Transportation Association defines **commuter rail** as a mode of transit service (also called metropolitan rail, regional rail, or suburban rail) characterized by an electric or diesel propelled railway for urban passenger train service consisting of local short distance travel operating between a central city and adjacent suburbs. Service must be operated on a regular basis by or under contract with a transit operator for the purpose of transporting passengers within urbanized areas, or between urbanized areas and outlying areas. Intercity rail service is excluded, except for that portion of such service that is operated by or under contract with a public transit agency for predominantly commuter services. Most service is provided on routes of current or former freight railroads (2).*

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<sup>1</sup> Information obtained from an interview with Indianapolis's freight railroad relocation project in Indiana.

relocate to be served by the new tracks, it is often possible to continue freight rail operations overnight when commuter rail operations are not present in the corridor.<sup>2</sup>

This report highlights the negotiation considerations and concerns regarding commuter rail sharing freight infrastructure and ROW, as well as the benefits and challenges associated with relocating rail lines.

This report first presents the various types of sharing arrangements that have been used in other states. The report then discusses the freight railroad companies' perspectives, including the conditions under which they would consider a partnership with a public entity. This discussion draws on examples from 10 case studies that were conducted as part of the research. The report also highlights the benefits and impacts associated with commuter rail and concludes with a Texas example where the transit agency is in the process of negotiating access to freight track in Dallas. Information for this research report was primarily obtained through interviews with the Class I railroads that operate in Texas and representatives of the various public transit agencies that have entered into a sharing arrangement or relocation agreement with a freight railroad.

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<sup>2</sup> Information obtained from an interview with FrontRunner in Salt Lake City, Utah.

# Sharing Rail Infrastructure

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## Three Scenarios for Sharing Rail Infrastructure

This section details different types of sharing agreements that allow the freight railroads and public agencies operating commuter rail systems to use and share existing rail track and/or ROWs. As described by the Federal Railroad Administration (FRA), commuter rail and freight railroads can share rail infrastructure in three general scenarios (5):

- **Shared track**—Freight and commuter rail use the same track.
- **Shared ROW**—Freight and commuter tracks are separated by less than 25 feet between track centers.
- **Shared corridor**—Freight and commuter track centers are separated by more than 25 feet between track centers but are less than 200 feet apart.

The first scenario, *shared track*, can further be divided into different categories based on who owns the infrastructure and who is responsible for operating the commuter service (6):

- In the first model, the transit agency/commuter operator owns the track, dispatches the trains, owns the equipment, and employs the workers. Continued freight service in the corridor is generally provided by a private freight railroad that pays the transit agency for access to the track.
- In the second model, the commuter operator owns the commuter equipment, employs the commuter rail workers, and contracts with a freight railroad for dispatching and track access.
- The third model is termed *purchase of service*. In this case, the commuter operator may or may not supply the equipment and contracts with the freight railroad to staff and operate commuter trains on freight-railroad-owned tracks.

Table 1 summarizes the shared-use agreements used by the six transit agencies interviewed by the research team. Appendix A contains detailed information for each of the six case studies that were conducted.

**Table 1. Case Study Shared-Use Agreements.**

System	Shared Track			Shared Corridor
	Agency Owns	Freight Railroad Owns	Purchase of Service	
FrontRunner (Salt Lake City, UT)		✓		✓
Metra (Chicago, IL)	✓	✓	✓	
Metrolink (Los Angeles, CA)	✓	✓		
Sounder (Seattle, WA)		✓		
Tri-Rail (Miami, FL)	✓			
Virginal Railway Express (VRE) (Washington, DC, and northern Virginia)		✓		

Table 1 shows that the most prevalent type of agreement is one in which the transit agency pays a fixed fee in exchange for operating a specified number of commuter trains on freight track during specified time windows. Most transit agencies contacted during this study recommended that this type of agreement should also specify the conditions for expanding service should it become needed. In most cases, the freight railroads have tied service expansion to specific investments to improve a corridor's capacity.

Table 1 also shows cases where the public agency purchased the freight tracks. In these cases the freight railroad typically maintains an easement during parts of the day. This has the advantage of allowing the public agency to handle dispatching and might result in more reliable service. Only Tri-Rail in Miami purchased the freight railroad track up front and did not opt to negotiate access to rail track owned by a freight railroad. But even Tri-Rail is currently in the process of negotiating track access with a Class II railroad in an effort to expand its service.

In the purchase-of-service agreement, the transit agency pays the freight railroad a fee to operate the commuter rail's service. In some cases, the transit agency may provide the commuter rail equipment (i.e., rolling stock). The freight company is then responsible for operating the commuter rail service, including the crew for the commuter trains.

Finally, the ROW acquisition agreement (i.e., shared corridor) means that the transit agency will buy land from the freight company adjacent to the freight tracks. The transit agency can then construct its own tracks in the ROW. The agreement in this scenario is mainly concerned with coordinating signals, establishing how freight shipments will reach clients on the other side of the commuter tracks, and determining how commuters will cross freight track to reach stations on the opposite side of the freight track. Both the purchase-of-service agreement and the ROW acquisition agreement will generally be preferred when the corridor is very busy (approximately 45 trains per day or more).

Shared track operation requires adherence to FRA safety regulations governing maintenance and inspection of the track and also governing the strength of the passenger equipment. Passenger trains can operate simultaneously with freight traffic only if the vehicles are FRA compliant; compliance pertains to the vehicle's ability to withstand a high-speed crash with another freight or passenger rail vehicle meeting FRA crash standards. Rail vehicles that do not comply with

FRA standards require strict temporal separation from freight rail operations in the same corridor. For example, light rail transit (LRT) vehicles are typically not FRA compliant; therefore, LRT vehicles may only be operated within an active freight corridor when no operations of other FRA-compliant vehicles are taking place. FRA also designates three types of shared minor facilities associated with various types of crossings and bridges. New commuter rail operations almost always share track infrastructure with freight railroads rather than sharing rail ROW or operating within the same corridor. This is because the equipment is typically FRA compliant, and jointly used track allows a more efficient use of the existing or improved track resource by commuter and freight rail (7).

Typically, a separated shared ROW or shared corridor arrangement is only used when rail equipment is not fully FRA compliant. This is most common in heavy rail (e.g., Washington Metro) or light rail (e.g., Dallas Area Rapid Transit) urban rail transit service areas (8). An exception is Utah's FrontRunner commuter rail system, which operates in the same corridor as the Union Pacific Railroad (UP) mainline but on separate tracks that were constructed on ROW that the Utah Transit Agency (UTA) purchased from UP. FrontRunner's trains are FRA compliant, and there is a short segment where FrontRunner trains operate with freight trains over the UP mainline. FrontRunner negotiated this operating arrangement because the number of freight trains on UP's mainline would have severely restricted commuter rail service if UTA had opted for the more conventional shared track access arrangement. The one segment that UTA did negotiate track access to is on the northern segment of FrontRunner's route, where UP operates fewer trains and the agency only operates four trains per day.<sup>3</sup>

## Considerations for Sharing Rail Infrastructure

A negotiated shared-use agreement between a transit agency and a freight railroad company addresses the following questions regarding how the rail ROW and infrastructure will be shared (5):

- **Who is responsible for operations (i.e., maintenance, running of the trains, and dispatching rules)?** Freight railroads generally prefer to maintain their own infrastructure, but commuter rail agencies may be responsible for rail infrastructure maintenance on tracks dedicated to commuter use. Since freight railroads are responsible for dispatching trains over hundreds of miles of track, they are typically less concerned about the minute-by-minute progress of trains. Time-sensitive commuter rail operations may require a dedicated dispatcher for commuter trains to ensure on-time performance and special handling. Agreements typically include incentives or penalties to ensure that commuter trains are able to meet on-time performance levels. Typically, transit agencies are responsible for the costs associated with ensuring on-time dispatching.

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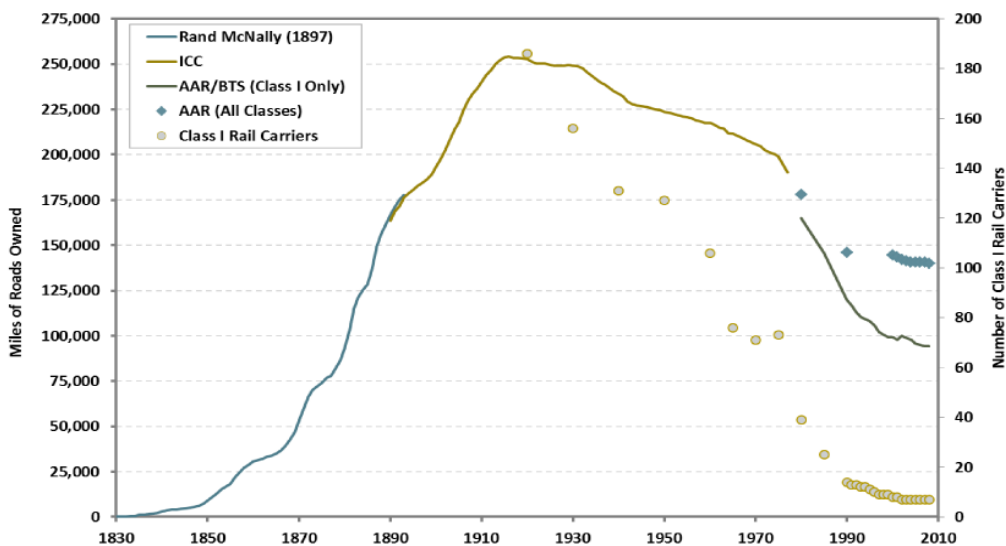
<sup>3</sup> Information obtained from an interview with FrontRunner in Salt Lake City, Utah.



- **Who pays for capital investments to add additional track capacity for commuter trains?** Transit agencies will typically be required to fund track capacity, signaling, or speed improvements that are required beyond those needed to operate freight trains at the speed preferred by the host railroad. Some agreements, such as VRE's and several of Metra's, apportion capital costs according to the relative benefits that the freight companies and the transit agencies will receive.
- **How will maintenance costs be shared, and how will they be calculated?** For example, maintenance correlates to the number of train-miles for commuter trains because they are of a fixed length and lightweight, while for freight, maintenance better correlates to the number of ton-miles or car-miles.
- **How will trackage fees be calculated?** These may include maintenance, capacity replacement, and dispatching costs if they are not paid for individually. Sometimes trackage fees will be a flat fee for a certain period of operations (e.g., Sounder), or the agency might be charged on a per-train-mile basis (e.g., FrontRunner).

## Challenges to Sharing Rail Infrastructure

In the late 1980s, freight railroads saw a shift in their business structures. Some railroads went bankrupt, and many rail lines were sold or abandoned. Figure 1 shows how the number of railroad track-miles in the United States changed over time, as well as the decrease in the number of Class I railroads (those railroads with revenue of at least \$459 million in 2014 dollars) (9).



Note: Colors correspond to different accounting methods.

Source: (9)

**Figure 1. Historical Rail-Miles and Rail Carriers in the United States.**

The total number of miles of rail line in the United States today is as low as it was in 1890, and there have never been so few Class I railroads since that classification was created. Most of the track reductions occurred in the 1980s, which allowed several transit agencies to procure this surplus rail capacity inexpensively. In recent years, railroads have been responding to increases in demand.

They hauled nearly seven times as many ton-miles of freight in 2009 as they did in 1920, when they had twice as many miles of track (9). Parts of the freight rail network, therefore, have no spare capacity. Many of these locations are in or around urban areas, complicating the implementation of a commuter rail service that does not affect a freight railroad's ability to serve its customers.<sup>4</sup>

*Freight railroads hauled nearly seven times as many ton-miles of freight in 2009 as they did in 1920, when they had twice as many miles of track.*

Freight railroads have become more hesitant to accommodate commuter rail on their infrastructure because allocating train capacity to commuter rail could adversely affect their operations now and in the future. For example, Metra, Metrolink, and VRE all noted during interviews that implementing their systems today would be nearly impossible because of the changing business climate for freight railroads. Freight railroads have also learned through experience that selling off excess infrastructure capacity may provide some capital in the short run, but it greatly reduces flexibility in changing or expanding future freight operations. Traffic patterns have changed dramatically over time, and freight railroads now understand the value of holding on to infrastructure capacity to preserve future flexibility. Loss of capacity on existing track and use of ROW limits future growth and the ability to expand operations.<sup>5</sup> In any case, any revenues that might accrue from commuter rail operations to the company typically comprise a very small percentage of a freight railroad company's overall revenue.

In creating a shared-use agreement, it is important for the commuter operator/transit agency to understand the needs of the freight railroad company. Those needs are outlined in the [“Freight Railroad Company Perspectives”](#) portion of this report.

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<sup>4</sup> Information obtained from an interview with Burlington Northern Santa Fe.

<sup>5</sup> Information obtained from an interview with Union Pacific.

## Rail Infrastructure Relocation

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Another option for the public sector is to work with railroad companies to relocate some or all of their freight activity away from existing rail corridors. For example, the through-freight rail traffic not being delivered to local customers could potentially be rerouted to another existing, nearby rail corridor or to a newly constructed rail line. Constricted rail yard operations within an urban area could also be moved to another area outside the city with more room for expansion or where present/future land use was more compatible.

In either case, the new rail infrastructure could be designed or existing rail infrastructure improved in a manner that would benefit the freight railroad company's overall operations and/or increase mobility for travelers in the region.<sup>6</sup> The original rail line could also be available for development of commuter rail or other transportation alternatives following the rail relocation to the new or nearby corridor. If track remains in place, local freight rail customers can continue to be served at night or during other periods when commuter rail operations are not taking place along the original corridor, according to an agreement between the entities.<sup>7</sup>

## Benefits of Infrastructure Relocation

Pursuing a rail relocation strategy could achieve several potential benefits. Original rail corridor ROW and infrastructure could be repurposed for high-capacity commuter rail operations. Existing freight rail customers along the line that are unable to relocate could move freight at off-peak periods, as long as public-private agreements include provisions for accommodating those clients.

Freight railroads could benefit from newer infrastructure design, the addition of more rail capacity, and/or the construction of larger, more efficient yards outside the urban area. Depending on their scope, projects may encourage truck-to-rail diversion of freight, thereby increasing freight rail revenues and creating additional public benefits by reducing the number of trucks on area highways and the potential for auto/truck conflicts, which would reduce the number of vehicular crashes (10).

Finally, former urban rail yard locations and adjacent rail facilities not required for public commuter rail operations could be redeveloped to complement urban land uses.<sup>8</sup>

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<sup>6</sup> Information obtained from an interview with Indianapolis' freight railroad relocation project in Indiana.

<sup>7</sup> Information obtained from an interview with FrontRunner in Salt Lake City, Utah.

<sup>8</sup> Information obtained from an interview with the Lafayette Railroad Relocation Project in Indiana.

## Challenges to Infrastructure Relocation

Rail relocation raises several challenges (11):

- **Rail relocation is generally a very costly and time-consuming process.** Even before new rail operations begin, public planners can incur significant costs associated with reaching an agreement among the parties, performing the required route analysis and environmental studies, acquiring the ROW, and performing the new construction. As a result, many relocation projects are necessarily segmented into phases, all of which may take several decades to complete. For example, the Lafayette Rail Relocation Project in Lafayette, Indiana, (further described as part of Appendix A) took nearly three decades to complete (8).
- **Substantial public-sector investment to achieve a rail relocation project could raise objections as an unfair advantage to the relocated railroad(s).** Other railroads not able to use the publicly funded new rail line may criticize the relocation project. Maintaining the existing competitive relationship between and among the railroad companies and not benefiting one company over another should be a consideration of the public sector in relocating a single company's rail line or yard.
- **Rail relocation project benefits accrue over the long term, complicating benefit-cost analyses for the project.** The direct, socioeconomic, and environmental benefits associated with a project would need to be quantified up front and monitored after implementation. Many of those perceived benefits might only be shifted to the new location, while commuter rail operations would still impact grade crossing delay and safety in the original corridor.
- **Brownfield redevelopment issues related to yard re-use may be costly.** Soil contamination accruing after years of rail yard activity often requires costly and prolonged remediation efforts. Aside from the direct amelioration costs, freight railroad companies can be wary of the publicity they would receive at the start of such projects.<sup>9</sup>
- **Operations over the new route may or may not be beneficial to freight railroad operations.** Potential drawbacks may include longer route mileage, more required locomotive power due to a new route with more elevation changes, or more required fuel for longer and/or graded routes.

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<sup>9</sup> Information obtained from an interview with Sound Transit in Seattle, Washington.

## Freight Railroad Company Perspectives

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Interviews with the Class I railroads operating in Texas affirmed that they are in the business of moving freight and that they want to be part of the *intermodal freight solution in Texas*. Therefore, as profit-making corporations, they will only allow the use of their tracks for commuter rail services under the following conditions (5):

- The freight railroads are assured that it is safe.
- The freight railroads are fully reimbursed for all costs incurred. There are no significant profits to the Class I railroads in accommodating commuter rail because the transit agencies pay for or replace the capacity that they are using.
- There is no negative impact on the quality of their freight service. Commuter rail, therefore, cannot impede freight transit time and operations.
- Liability issues can be resolved in good faith, and legal liability can be held to a manageable level. The freight railroads will not negotiate on liability/insurance requirements. Issues around liability are usually the most complex to resolve in commuter rail agreements with freight railroads because the total cost of liability is largely unknown and is problematic to quantify.

The principles or guidance under which the Class I railroads would consider passenger/commuter rail over their track/corridor are provided in Appendix C.

Additionally, the freight railroads interviewed noted the following concerns:

- In many cases, capital investments will be required to ensure that the freight railroad's capacity or future ability to operate is not compromised by commuter operations. The public-sector partner will be responsible for capacity improvements to accommodate commuter rail, as well as the long-term maintenance and inspection of the additional infrastructure capacity required. The track required for commuter rail is often a higher-class track that is more expensive to install and maintain than the track required for freight trains.
- Freight railroads do not want to begin negotiations until a certain level of capital funding is in place. A commuter rail agency should identify funding for capacity improvements and infrastructure before beginning negotiations for access to freight ROW.
- Funding flexibility is required because freight rail system infrastructure investments may be needed outside the commuter service area to allow capacity for improved service in a downtown area (12). For the public agency, capital investments in rail infrastructure—yard improvements or bypass routes—could total millions of dollars and might be well outside the agency's official boundaries.

As mentioned previously, a freight railroad will not consider a downgrade in the service it provides to customers or the loss of opportunities in the future for business expansion. In interviews, freight railroad companies said scheduled commuter trains could impact their business operations in several ways (5):

- If commuter trains travel at higher speeds than freight trains in a corridor, they may overtake or meet them, requiring the freight trains to wait in adjacent rail sidings.
- The demands of commuter train schedules could impose a substantial financial burden on railroads. On many commuter lines, the track may not be available to freight trains for six to eight hours per day. Temporal separation (in which commuter rail and freight rail operate on the same track at different times of the day) works well if the freight trains can operate at night and shippers are able to adjust to night service. If not, temporal separation can impose significant costs to the freight railroad in terms of delays and lost business.
- The rigid schedules of commuter trains can interfere with rail maintenance scheduling. Freight railroads are also often concerned about successful commuter rail operations confining freight trains and work crews to ever-smaller time windows on their ROW. Freight railroads, as the owners of the track, will want well-defined times for maintenance.
- Dispatcher attempts to avoid financial penalties for delaying commuter trains can result in increased delays to freight trains.

The following provisions, included in two memorandums of understanding between the State of Texas and both UP and Burlington Northern Santa Fe Railway (BNSF), serve as examples of the kinds of public-private rail considerations that can arise during negotiations:

- Cooperation on projects must be voluntary between the state and the railroad company.
- The source of public funds should not come from a rail user charge, additional taxes, or new fees levied on the rail industry in the state.
- Projects must maintain competitive balance; railroads do not want public investment to unfairly improve the competitive landscape of rival railroads.
- The level of financial participation by the private railroad companies would be commensurate with the benefits derived by the railroad. Public funding would be commensurate with the benefits derived by the public.
- The public must understand that benefits produced by the project may not rank sufficiently high compared to other capital projects, or meet the railroad's internal capital investment or timeframe thresholds, resulting in lower priority.

Finally, one Class I railroad commented that commuter rail lines should be built where people want to go. In general, freight rail track goes to ports and industrial areas in urban areas. Highway corridors, on the other hand, go where people want to go. Thus, a better option may be to operate commuter rail in highway corridors. Two examples exist:

- New Mexico's Rail Runner service, where a portion of the route goes down the middle of I-25.
- Metrolink's San Bernardino Line, where a portion of the route goes down the middle of I-10.

## Keys to Negotiating Successful Shared-Use Agreements

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This section describes some of techniques that the interviewed transit agencies used to successfully negotiate with the freight railroads. These principles could be applicable to an agency considering a new commuter rail service. More details on the case studies can be found in Appendix A.

### Find Common Goals and Objectives

To create an effective partnership, the transit agency and freight railroad should work to understand each other's business goals and needs. Common goals and common needs should be identified early in the planning process to accommodate commuter services on freight corridors and to facilitate a productive and cooperative working relationship. Clearly defined goals and objectives allow both parties to leverage their respective strengths toward reaching common goals.<sup>10</sup> Examples of common goals include (5):

- Increasing capacity.
- Increasing train speed and reducing travel time.
- Improving reliability and ensuring on-time performance.
- Optimizing maintenance costs.
- Improving ROW conditions.

Transit agencies should not set a goal of securing trackage rights as a means of using private property for public purposes (8). Instead, the public agency should think in terms of working out a business deal from which both parties stand to gain. Freight railroads do have interests in expanding capacity, improving safety, and securing funding for track improvements. These are areas in which a public agency may provide something the freight railroad needs in exchange for access to tracks.

### Build a Trusting Relationship

Local governments do not have the authority to seize, regulate, or assert control over rail facilities used in interstate commerce if doing so will unreasonably burden the ability of the railroad to fulfill its common carrier obligation in interstate commerce (13). Thus, freight railroads typically start off in a position with leverage in negotiations because they control the resources that a public agency wants to access. Good communication and a trusting relationship are critical to the negotiation of successful shared-use agreements. Good communication and a trusting relationship can be facilitated by (5):

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<sup>10</sup> Information obtained from an interview with Sound Transit in Seattle, Washington.



- Bringing interested stakeholders together in a stakeholder meeting.
- Establishing consistent contact between the freight railroad and the public agency in the form of regularly scheduled meetings since new personnel continually join either side.
- Preparing progress and follow-up reports to ensure that information is communicated often.
- Involving high-level participation and accountability to ensure effective communication.
- Conducting joint capacity studies and developing realistic cost estimates. Railroads have an industry-vetted set of tools (e.g., simulation models) for evaluating line capacity. A consultant hired by a local planning agency or transit authority may use an entirely different set of models that results in outcomes that railroads may not trust. Joint capacity studies might resolve this problem.

Several agencies interviewed (e.g., Sound Transit and FrontRunner) noted that they still maintain daily contact with the freight railroad companies they work with. In the case of FrontRunner, representatives from the freight railroad are housed in the agency's headquarters.<sup>11, 12</sup>

## **Cover the Freight Railroads' Costs**

Much of the difficulty surrounding rail infrastructure and ROW sharing pertains to determining an amount that is considered fair compensation for the use of the railroad track or ROW and for the additional costs imposed by commuter trains when applicable. The fundamental questions in determining fair compensation are which costs should be considered and how the costs should be shared. Examples include:

- Overhead or administrative costs, which a freight railroad incurs for supporting commuter service that it would otherwise not have to incur.
- Freight yard costs and station costs.
- Track costs (i.e., track maintenance costs).
- Signal or dispatching costs.
- Fuel/additional locomotive power requirements for a longer or steeper route on a relocation corridor.

A discussion on wear and tear highlights the complexities involved in deciding how costs should be shared. Wear and tear on track is the largest infrastructure cost element for a freight railroad. However, a number of factors influence the calculation of the wear and tear imposed on rail track. All other things being equal, the heavier a rail car, the more stress it places on the track.

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<sup>11</sup> Information obtained from an interview with FrontRunner in Salt Lake City, Utah.

<sup>12</sup> Information obtained from an interview with Sound Transit in Seattle, Washington.

By the same token, the faster a train operates, the greater the dynamic load on the track. High-speed commuter trains impose higher track maintenance costs than would be required if commuter trains operated at the same speed as freight trains. Cost impacts specific to each major track component are as follows (5):

- The additional super-elevation (the vertical difference between the two tracks on a curve) required for higher speeds means that commuter and freight traffic operate at different levels of unbalance on curves. This can result in excessive wear on the low rail in curves when freight trains operate at less than balancing speed, or alternatively excessive wear on the high rail if the super-elevation is not increased for the faster trains. The greater the speed differential between commuter and freight trains, the higher the cost.
- FRA track standards imply higher track maintenance costs for tracks that move higher-speed commuter trains in terms of more frequent rail inspections, more frequent replacement of rail and ties, and more frequent surfacing cycles. For example, all track used by commuter trains must be inspected twice per week, while moderate-density freight track needs only one inspection per week.
- Ties carry transmitted rather than direct loads, but the differences between freight and commuter operating speeds can result in extra load on either the low or high side of the ties in curves, reducing tie life.

Track maintenance is also impacted by environmental factors (rust and decay). At relatively low traffic levels, rail component degradation may be largely or wholly due to environmental factors. At a certain traffic density, mechanical wear and rail component degradation become the determinants of track component life, and environmental factors become negligible. In other words, the variable or incremental costs of additional traffic on a light-traffic rail line will be almost zero (since environmental factors, rather than traffic, account for most of the consumption of the track). By contrast, the incremental cost on a busy mainline is high and linear with traffic (5).

In the end, the public agency should approach the freight railroads with enough funding in hand to address all the likely impacts of commuter service on the freight franchise. Recognizing this from the beginning will instill confidence in the freight railroad that the public agency understands the freight railroad's perspective and is serious about reaching an agreement. In exchange, the public agency will have the long-term rights to run commuter trains on the freight track. This was the approach that Sound Transit used to implement the Sounder service in a relatively short time period.<sup>13</sup>

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<sup>13</sup> Information obtained from an interview with Sound Transit in Seattle, Washington.

## **Secure On-Time Performance**

Transit agencies value on-time performance and reliability because these factors influence ridership levels. At the same time, freight railroads are increasingly facing demands for faster and more reliable schedules. Dispatching becomes more complicated when commuter and freight trains share ROW and track. Therefore, it is critical to establish clear service expectations that can be met.

If the transit agency cannot obtain dispatching control over its entire service area, care should be taken to ensure that shared-use agreements are appropriately structured so that commuter trains have priority during rush hours when on-time performance is critical to ensure targeted ridership levels. This can be accomplished by negotiating exclusive time windows each day. To encourage on-time performance, the transit agency can also specify penalties for failing to meet on-time performance targets (or, alternatively, incentives for meeting on-time performance targets) in shared-use agreements. Incentives often consist of payments based on on-time performance. Sound Transit, for example, pays BNSF a variable monthly maintenance fee that depends upon on-time performance. Above 95 percent, BNSF can make a profit on the maintenance fees, and at 100 percent, Sound Transit pays BNSF a \$7.05-per-train incentive.<sup>14</sup> This can help ensure that the freight railroads and the rail transit agencies have the same objectives with regard to the dispatching of commuter trains (5).

## **Preserve Time for Scheduled Track Maintenance**

The rigid schedules of commuter trains, especially during commuter rush hours, require that maintenance work be scheduled so that it does not impact commuter services. An incremental hourly wage differential can be negotiated with a labor organization performing maintenance to allow for work to be done at night, but the increased cost will have to be covered by the public agency (5).

## **Address Service Expansion**

It is essential that the shared-use agreement allow for service expansions. Agreements should be flexible enough to allow additional trains without requiring renegotiation of the entire agreement. In most cases, service expansion will be tied to specific compensation or specific capital improvements.

## **Address Safety Concerns**

In many instances, safety concerns drive decisions about shared operations. Safety regulation for all commuter, intercity, and freight rail lines operating over the national rail system falls under the jurisdiction of FRA. FRA currently defines nine track classes, with Class 1 as the lowest and

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<sup>14</sup> Information obtained from an interview with Sound Transit in Seattle, Washington.

Class 9 as the highest. Specific geometry and condition standards are established for each class of track, and the respective speed limits of passenger and freight trains are defined. In general, Amtrak operates at speeds only moderately higher than freight trains, while commuter trains generally operate no faster than Amtrak. However, when commuter and freight trains share tracks, there is always a risk of collision, derailment, or damage caused by a shifted load (14). Similarly, when commuter and freight trains share ROW or a corridor, each operator must mitigate the risks that a derailment on one of the tracks can impose on the other.

Highway-rail grade crossing safety should also be considered before implementing any shared-rail operations within a corridor. If rail traffic and train speeds are increased along a corridor with the implementation of commuter and/or higher-speed passenger rail services, collisions and fatalities at grade crossings may increase. Grade separations ensure a high level of safety but can be very costly. On the other hand, the closing of certain grade crossings (access management) in an effort to address safety concerns will affect roadway access and adjacent property owners, which could result in community opposition (5).

## **Address Liability**

In 1997, Congress passed the Amtrak Reform and Accountability Act, which limited the aggregate overall damage liability to all passengers from a single incident to \$200 million. This limit also applies to commuter rail operations. To cover such a large liability, commuter rail agencies must acquire expensive insurance coverage. Annual premiums vary but tend to be between \$1 million and \$2 million. However, the \$200 million limit does not apply to non-passengers, which has been untested in court (12). The freight railroad companies stated that the contract must have full faith and credit indemnification, so paying for comprehensive insurance helps demonstrate that the transit agency is willing to work cooperatively with the freight railroad (15).<sup>15, 16</sup>

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<sup>15</sup> Information obtained from an interview with Burlington Northern Santa Fe.

<sup>16</sup> Information obtained from an interview with Union Pacific.

## Benefits and Impacts of Commuter Rail

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Transportation investments, in general, improve the efficiency of the transportation system (measured in terms of reductions in travel time and vehicle operating costs, and increases in reliability and accessibility), enhance safety, reduce emissions, and save agency costs. These direct benefits should be quantified and compared to the cost of the investment to determine the societal feasibility of a planned transportation investment.

Decision makers are, however, also interested in the economic development benefits associated with a transportation investment. Improved access can bring about significant economic development benefits in the form of employment creation, increased incomes and property values, and business activity attributable to savings in transportation costs. When a traditional benefit-cost analysis framework is used to evaluate the societal benefits of a proposed investment, the inclusion of economic development impacts in the calculations can result in double counting that skews results. Transportation investments that produce cost savings will result in an increased demand for transportation. The induced demand benefit can be considered a proxy for regional development impacts because the stimulation of the economy associated with a transportation improvement will be reflected in increased traffic.

This section summarizes the benefits that typically accrue from a commuter rail system. Appendix B gives more details.

### Benefits

#### *Travel Time*

Generally, traffic congestion relief is a goal in developing a new commuter rail service.<sup>17</sup> Commuter rail can impact travel times and traffic patterns within a transportation network as follows:

- Commuters will divert to rail if they have a similar or faster commute. However, some commuters may switch because of other considerations, such as cost, comfort, or reliability.
- As commuters divert from automobiles to commuter rail, highways along the corridor have the potential to become less congested, so automobile users that decide to keep driving will also benefit from less delay (16).
- However, if the main arterials are operating at capacity, additional traffic might spill over onto minor roads, so when the commuter rail starts, any vehicles removed from the main

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<sup>17</sup> There is still some debate about commuter rail's effectiveness at relieving congestion due to the issue of latent demand, but congestion relief is still normally listed as a motivating factor. The Massachusetts Bay Transportation Authority website ([http://www.mbtta.com/about\\_the\\_mbtta/news\\_events/?id=10890](http://www.mbtta.com/about_the_mbtta/news_events/?id=10890)) and *The Telegraph* website (<http://www.nashuatelegraph.com/news/statenewengland/1029204-469/rail-options-generate-interest.html>) provide examples.

arterials will merely be replaced by vehicles from the minor roads. The end result could be no congestion reduction along the main arterials. It is possible in this scenario that the vehicles that divert from the minor roads will have some time savings and the rail commuters' time will be unaffected, but the total amount of time saved by all users of the corridor, particularly among drivers, could be significantly reduced (17).

Time savings (positive and negative) are assigned values based on the value of travel time saved. The value of travel time (measured in dollars per hour) varies by individual and by mode. For example, time spent driving costs commuters more than time spent on a train because the train time can be used productively (e.g., working on a notebook computer).

The U.S. Department of Transportation (USDOT) recommended a value of travel time of \$12.98 per hour in 2013 (\$13.28 in 2014 dollars) (18). Because commuter rail can move large numbers of commuters, the total travel time benefit can be significant. For example, a proposed improvement to Austin's Capital Metrorail was estimated to reduce travel time along the route by five minutes, translating into an estimated net benefit of \$34.7 million (19).

### *Vehicle Operating Costs*

In general, vehicle operating costs are reduced if a transportation investment like a commuter rail line alleviates the stop-and-go traffic situation experienced on congested facilities by diverting some automobile users to rail use. Typically, vehicle operating cost calculations consider the cost of fuel, oil, tires, and maintenance. These costs vary considerably depending on the traffic conditions (average speed, number of stops, and accelerations and decelerations required), the vehicle characteristics (model and maintenance record), and driver characteristics.

### *Safety*

Commuter rail can impact safety within a transportation network as follows:

- **Accidents along the corridor**—To determine the number of accidents along a highway, it is critical to understand the relationship between traffic speed and accident risk. Accident rates tend to increase in congested traffic conditions (high traffic densities), but the severity of the accidents tends to be less. Considerable evidence exists that higher traffic speeds are associated with more severe accidents. Therefore, reducing congestion on a highway by diverting commuters to rail could possibly reduce the number of accidents, but the accidents may be more severe.
- **At-grade crossings**—Increasing the number of trains using a rail track increases the risk of accidents at at-grade crossings. Increasing the number of trains going through at-grade crossings represents a cost (20). However, if implementation of the commuter rail line involves upgrading at-grade crossings to separate them, there could actually be an overall safety benefit.

- **Accidents along the rail line**—Increasing the number of trains using a rail track increases the probability of accidents involving trains only. These include derailments, collisions between trains, and accidents involving pedestrians on the tracks.

USDOT published standard values for different types of accidents, ranging from property-damage-only accidents to fatal accidents, that can be applied to the estimated number of accidents that will be reduced (18). These standard values range from \$3,900 for a property-damage-only accident to \$9.2 million for a fatal accident.

### *Environment*

Commuter rail systems are generally assumed to offer environmental benefits over automobile usage. However, the amount of emissions reduced is a function of the expected utilization of the commuter rail service. At a certain level of rail utilization, enough vehicles will be removed from the roadway to achieve a net reduction in emissions. The exact number of vehicles that need to be removed varies based on the type of locomotive used (electric or diesel) and which pollutant is being analyzed. For example, a typical commuter train only needs a few dozen passengers to achieve a net reduction in volatile organic compounds (VOCs) generated, while several hundred might be necessary to reduce the particulate matter (PM) generated (21). On the other hand, investments in the rail system to accommodate commuter trains may have the added benefit of reducing emissions from faster-moving freight trains. Reduced emissions from freight trains represent \$4.13 million of the benefits in Oakland’s rail improvement project (discounted at 3 percent; \$2.71 million at 7 percent) (10).

To illustrate the emissions benefits associated with commuter rail, Tri-Rail calculated the difference in emissions per passenger mile for personal vehicles and commuter trains to find that the commuter rail system results in a net reduction of 16,000 tons of greenhouse gases, 1,200 tons of carbon monoxide (CO), and 122 tons of oxides of nitrogen (NOx).<sup>18</sup>

### *Other Environmental Impacts*

Air pollution is not the only environmental consideration when analyzing a commuter rail service. A commuter rail service can also generate environmental impacts along its route in the form of noise and vibration. When approaching an at-grade crossing, trains (either commuter or freight trains) are required to warn vehicles by sounding their horns in two long blasts followed by a short one and then a final long one. Given the schedules of commuter trains, the first commuter train might leave very early in the morning on a weekday. It is possible that this safety requirement may disrupt people’s sleep as the commuter train passes through neighborhoods. FRA has the authority to designate quiet zones where trains are not required to sound their horns except in emergencies. For a segment of track to receive this designation, FRA requires that each crossing be improved with raised medians, crossing gates, and other measures to ensure that the overall safety in a corridor is not reduced. While this can be costly, the quiet zone applies to both

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<sup>18</sup> Information obtained from an interview with Tri-Rail about operations and the future.



commuter and freight trains, which would translate into a reduction in noise in any corridor with existing freight service.<sup>19</sup> The longest quiet zone in the country was created as part of the implementation of the FrontRunner commuter rail service in Utah. FrontRunner shares a corridor with UP freight trains.

Finally, perhaps more important than simple noise pollution is the vibration that a train creates. This vibration can be destructive over time to structures located near the rails, although the effect is much greater for heavy freight trains than for relatively light commuter rail trains (22).

### *Agency Cost Savings*

An important consideration for the implementation of a commuter rail system is future capacity along a corridor. One highway lane theoretically can move up to 2,400 people per hour, while a commuter rail line can potentially move many more people, depending on the headways (frequencies) (16). Implementing a commuter rail system can provide additional people-moving capacity in a relatively smaller footprint. The capital cost of the rail investment should be compared with the cost of providing additional highway lane-miles.

The maintenance cost benefits of diverting automobile users to commuter rail systems is typically relatively low. In fact, care must be taken to ensure that the commuter rail does not impact the freight trains negatively and thereby cause a diversion from freight rail to truck, which would result in an increase in highway maintenance costs (23).

## **Economic Development Impacts**

As mentioned previously, an increase in demand is considered a proxy for regional development impacts in the benefit-cost analysis framework because the stimulation of the economy associated with a transportation improvement will be reflected in increased traffic. That said, the economic development impacts are often easier to communicate to the public and are often used to garner support for a commuter rail system. This subsection summarizes information about the economic development impacts that can accrue from a commuter rail system. More detailed information and examples can be found in Appendix B.

### *Land-Use Patterns*

Commuter rail can change urban land-use patterns and bring about increases in value and density. For example, when a new commuter rail station is opened, the property near the station can be redeveloped, especially if the city decides to pursue transit-oriented development. A number of examples are found in the literature that support changes in land use in and around commuter rail stations. For example, Capital Metro in Austin reported that since its commuter rail (the Red Line) opened in 2008, significant development has occurred around its stations. Much of this new development includes affordable housing units, with some stations seeing as much as 38 percent affordable housing (19).

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<sup>19</sup> Information obtained from an interview with FrontRunner in Salt Lake City, Utah.



Commuter rail also increases a community's access to recreational and productive opportunities, which in turn can have a positive effect on that community's livability (24). These land-use changes can also improve regional equity by making areas more accessible to the poor or disabled (24). Businesses near commuter rail stations also benefit from increased worker productivity and the ability to attract different types of workers. These benefits stem from, among other factors, less stressful commutes and the growing trend among young professionals (those approximately 25 to 35 years old) to forego driving (25). Metra noted that there has been a growing trend for businesses to locate closer to Metra stations and that the commuter rail system has resulted in several companies coming to Chicago from outside the region, thereby growing the economy.

### *Job Creation*

Investment in a commuter rail system will result in temporary job increases and, by improving travel conditions and access along the corridor, a shift in the number and types of jobs available. Any investment in the rail infrastructure to implement a commuter rail route will add construction jobs along the corridor. Whether the investment actually increases employment or merely diverts construction jobs from other activities depends on the local unemployment levels. At high levels of unemployment, the investment can help to stimulate the local economy by putting people back to work temporarily (17). Furthermore, from an economic development perspective, adding the commuter rail service increases the supply of travel available to commuters, which lowers the cost (i.e., time) of travel. This will in effect increase the labor pool that businesses have access to within a given area (26). Table 2 provides a summary of the benefits and impacts associated with implementing a commuter rail system.

**Table 2. Commuter Rail Benefits and Impacts.**

Category		Problem Description	Commuter Rail Effect	Examples
Commuter Effects	Vehicle operating costs	Driving requires fuel, insurance, fees, vehicle maintenance, and vehicle financing	The commuter rail option allows riders to save significant amounts of money	Tri-Rail in south Florida saves riders \$70 million per year
	Roadway travel time	Each vehicle increases the density and contributes to the delay for every other vehicle	Reduced congestion benefits people who still use the roadways	The Chicago Regional Environmental and Transportation Efficiency (CREATE) Program to improve rail service in Chicago saves commuter rail passengers and personal vehicle users a combined \$10.9 million per year in time savings
	Commuter rail travel time	There is a cost to the time spent in commutes	Time spent driving is more costly than time spent riding, so there is generally a net benefit for those who switch to commuter rail	
Safety	Roadway accidents	High vehicle densities increase the probability of all crash types	Diverting commuters away from personal vehicles and trucks from highways leads to substantial benefits	The Port of Oakland's rail improvement project will divert a substantial number of trucks from highways around the city, translating into \$2 million dollars in safety benefits (over the 20-year life of the project at a 3 percent discount rate or \$1.3 million at a 7 percent discount rate)
	Railway trespassing	Individuals put themselves at risk by going on tracks	Adding trains to the corridor increases the risk of accidents and the opportunities for suicide, both net costs	FrontRunner in Utah built fences and funds a police force to help prevent trespassing incidents
	Rail-rail accidents	Increasing congestion of the rail network will lead to a higher risk of accidents	Commuter rail contributes to rail network congestion, so there is some cost to implementation service	FrontRunner installed sensors where its track was near the UP mainline to reduce the risk of accidents

Category		Problem Description	Commuter Rail Effect	Examples
Safety (Cont.)	Road-rail at-grade intersections	Risk of serious collisions between rail and road vehicles	Adding trains to intersections makes them more dangerous, but extra safety measures for passenger trains might lead to net safety improvements at some intersections where there was already heavy freight rail traffic	Chicago's CREATE Program converts many at-grade intersections to grade-separated intersections, leading to annual safety benefits in excess of \$86 million
	Accidents along the rail line	Risk of accidents involving trains only	Increasing the number of trains using a rail track increases the probability of accidents involving trains only; these include derailments, collisions between trains, and accidents involving pedestrians on the tracks	
Environment	Air pollution	Carbon dioxide (CO <sub>2</sub> ) greenhouse gas	Commuter rail systems have generally resulted in substantial net reductions in emissions of these pollutants, leading to a significant benefit even with low ridership	Tri-Rail in Miami saves \$640,000 in annual greenhouse gas emissions.
		CO (health hazard), VOCs (health hazard; helps form ground-level ozone), NOx (greenhouse gas and health hazard; helps form ground-level ozone and acid rain), oxides of sulfur (SO <sub>x</sub> ) (health hazard; forms smog and acid rain), and PM (health hazard; forms smog)	At very low levels of ridership, there might be a net increase in NOx emissions, but moderate to high levels of ridership generally lead to net reductions, so there may be a benefit or a cost	Chicago's CREATE Program leads to annual emissions benefits of \$2.7 million excluding climate change effects
	Noise	Added trains can disturb nearby neighborhoods	The reduced noise from reducing personal vehicular traffic is insignificant, so this is normally a net cost	FrontRunner in Utah implemented quiet zones, preventing the service from adding much noise pollution and reducing the noise of freight trains

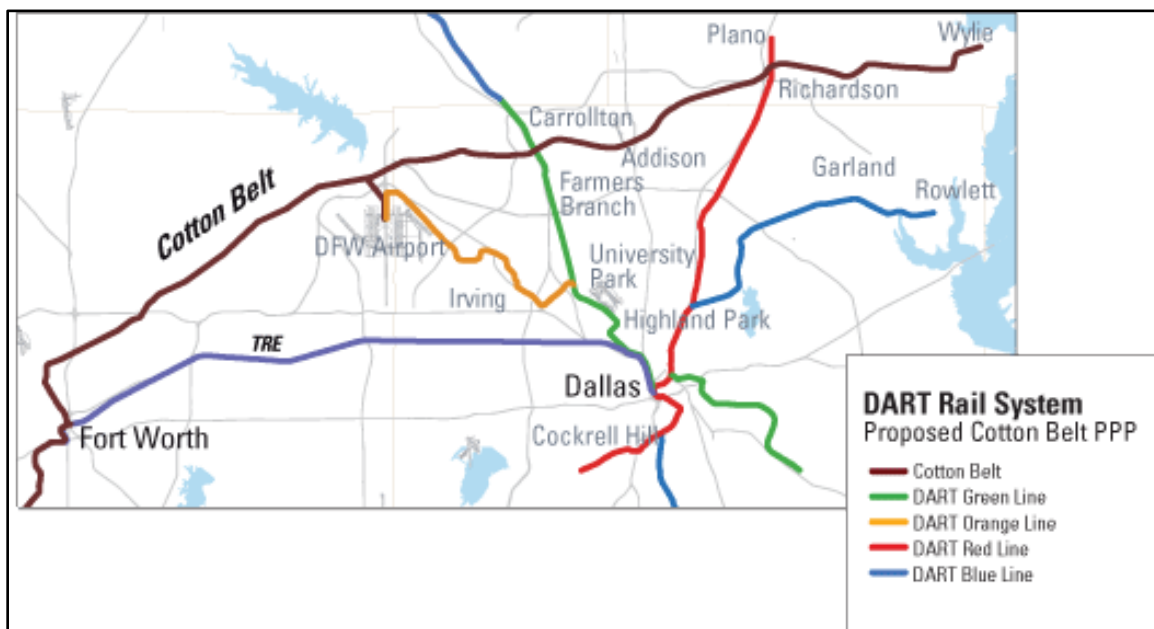
Category		Problem Description	Commuter Rail Effect	Examples
Agency Cost Savings	Roadway maintenance	Traffic causes wear and tear on roadways, which have to be repaved	Trucks cause substantial damage to roadways, so commuter rail improvements that also increase freight rail capacity have significant benefits	The CREATE Program in Chicago has brought about \$1.1 million in annual road maintenance savings
Economic Development	Land use		Commuter rail allows more efficient or beneficial land-use patterns	The Red Line of Capital Metro in Austin has brought about \$370 million in private transit-oriented development investment
	Job creation		Commuter rail both directly creates jobs and encourages new businesses to come	Capital investments on Miami's Tri-Rail system are projected to bring the region 48,000 jobs over the next five years
	Freight system	Freight systems face congestion issues	Commuter rail by itself might restrict freight rail movements, but capital investments for the commuter system might result in a net improvement for the freight system	Rail system improvements in Oakland will lead to \$10.3 million in annual benefits to freight shippers in the Bay Area

## A Texas Case Study

### Cotton Belt Corridor Overview

The Cotton Belt Corridor stretches between Fort Worth and Wylie through portions of Collin, Dallas, and Tarrant Counties in the Dallas-Fort Worth (DFW) metropolitan area. The 60-mile corridor was purchased by Dallas Area Rapid Transit (DART) in 1990 to preserve it for future passenger rail service. The St. Louis Southwestern Railway, also known as the Cotton Belt, was the original owner of the line, which was ultimately acquired by UP. Freight rail operations continue on the line through trackage rights between DART and the Fort Worth and Western Railroad (FWWR); Dallas, Garland and Northeastern Railroad; UP; and Kansas City Southern Railway.

Figure 2 shows a map of the full Cotton Belt Corridor between Fort Worth and Wylie. Also displayed on the map are the other existing passenger rail lines, with the legend delineating the existing DART light rail lines. The Trinity Railway Express (TRE) provides commuter rail service between downtown Fort Worth and downtown Dallas. The other commuter rail line in the region, the Denton County Transportation Authority A-train, extends from the end of the DART Green Line in Carrollton north to the city of Denton.



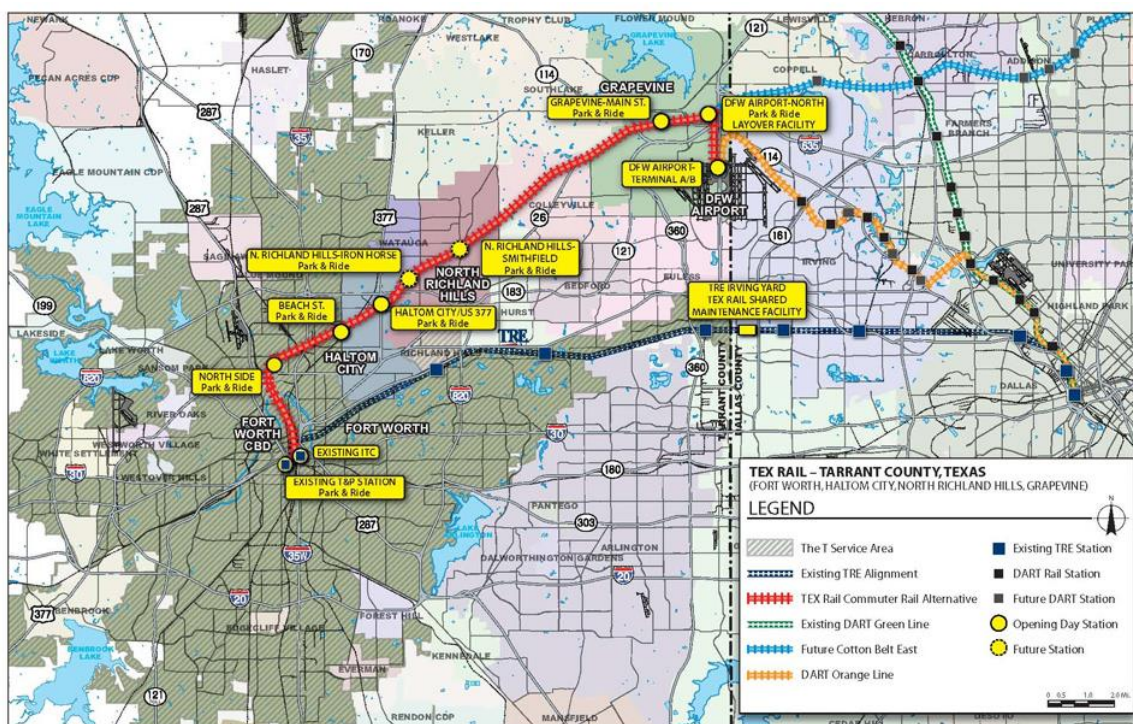
Source: DART

**Figure 2. Map of the Cotton Belt Corridor in Relation to Existing Passenger Rail Lines.**

For passenger rail service planning, the Cotton Belt Corridor has been divided into the western segment between Fort Worth and the DFW International Airport (DFWIA)—controlled by the Fort Worth Transportation Authority (The T)—and the eastern segment between the DFWIA and Plano—controlled by DART—where it connects with the DART Red Line.

## Cotton Belt Corridor Western Segment—TEX Rail

In 2005, The T initiated planning for passenger rail service that would use the Cotton Belt Corridor between Tower 60 in north Fort Worth, where DART ownership begins just north of the DFWIA. The proposed new commuter rail service, now known as TEX Rail, is shown in red in Figure 3.



Source: TEX Rail

**Figure 3. Map of the TEX Rail Line between Downtown Fort Worth and the DFWIA.**

On March 3, 2014, The T received notification that TEX Rail was included in the U.S. president's budget as a Federal Transit Administration (FTA) recommended project (27). The \$50 million grant award is meant to cover future construction costs but could be used for reimbursements for expenses already incurred (28). The Final Environmental Impact Statement (FEIS) for TEX Rail was provided for public comment on May 19, 2014, with the closing of comments occurring on June 20, 2014. The federal Record of Decision, signaling the formal federal approval of the Environmental Impact Statement, was received September 29, 2014 (29). This approval permits The T to contract with an engineering services firm to advance engineering and to begin acquiring property necessary for stations and other property along the rail corridor, according to the official news release.

Previous action by The T's board unanimously authorized its president to sign agreements to run the TEX Rail line on the tracks owned by DART, to sign agreements with DART (to lease the ROW) and with FWWR (concerning continued freight operations over the line). The board's actions applied only to DART-owned lines, not to the segment of the lines controlled by UP



(from the Stockyards area near Tower 60 north of Fort Worth to the downtown Fort Worth stations) (30).

The following resources provide more information about the TEX Rail project:

- TEX Rail website, including the FEIS (May 2014): <http://www.texrail.com/>.
- TEX Rail Record of Decision (September 2014): <http://www.texrail.com/ResourceLibrary/RecordofDecision.aspx>.
- NCTCOG Regional Rail Corridor Study (2005): <http://www.nctcog.org/trans/transit/planning/rccs/index.asp>.

## Cotton Belt Corridor Eastern Segment

Although the eastern portion of the Cotton Belt Corridor was not included in the 2005 NCTCOG Regional Rail Corridor Study, in 2006 it was designated as the preferred alignment for east-west service between the DART Red Line and the DFWIA in the DART 2030 Transit System Plan (31). It has been added to additional planning documents since then, and was further investigated in April 2010 NCTCOG and 2011 DART studies, which posed the possibility of accelerating development of the line as part of a public-private partnership project. Figure 3 displays the Cotton Belt Corridor between the DFWIA and Plano. It would interface with the DART Red Line in Plano, cross the DART Green Line at the downtown Carrollton station, and meet at the DFWIA with the DART Orange Line and TEX Rail.



Source: (32)

**Figure 3. Map of the Cotton Belt Corridor between the DFWIA and Plano.**

Plans designate completion of the passenger rail service by 2030, but at this point no funding source has been identified. With no funding source identified, an August 25, 2014, news article indicated that DART is expressing interest in examining the option to develop dedicated bus-

only roads along the eastern Cotton Belt rail corridor (similar to the CTfastrak project, which is described in a case study in Appendix A). The article highlights that this bus rapid transit (BRT) “could be the agency’s fastest option for providing an east-west connection in an area with large gaps in rail service,” but many question spending the money to build BRT where a rail line already exists (33).

The following resources provide more information about the Cotton Belt Corridor:

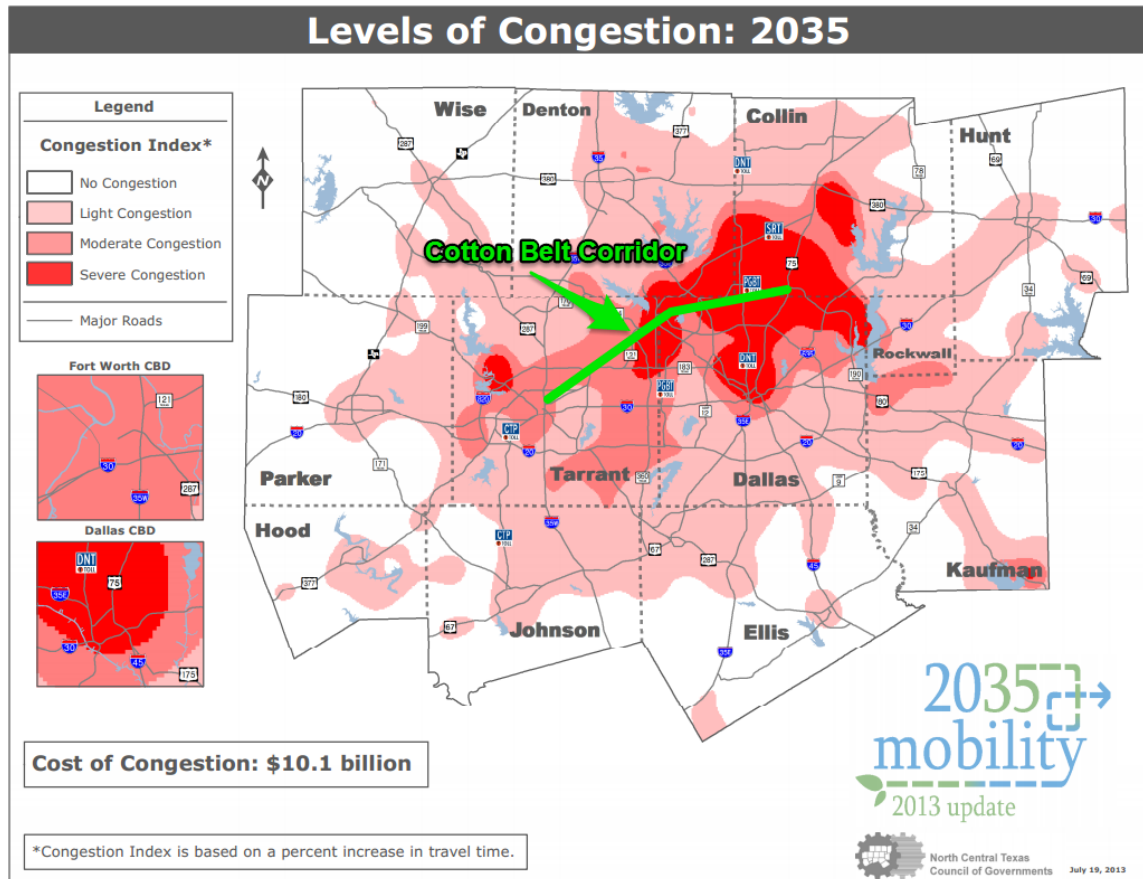
- DART and the Cotton Belt Regional Rail Corridor, which includes the *Cotton Belt Corridor Regional Scoping Summary Report* (April 2011):  
<http://www.dart.org/about/expansion/cottonbelt.asp>.
- NCTCOG’s *Cotton Belt Corridor: Conceptual Engineering and Funding Study* (April 2010):  
<http://www.nctcog.org/trans/spd/TransitRail/CtnBlt/Cotton%20Belt%20CE&FS%20042210.pdf>.

## **Benefits of Passenger Rail in the Cotton Belt Corridor**

The major purpose of the development of the Cotton Belt Corridor for passenger service is to provide improved mobility, mitigate congestion, and improve air quality through connections with major population, employment, and activity centers among some of the fastest-growing communities in the country. The corridor interfaces with many of the already developed and planned passenger rail corridors throughout the region and provides an additional east-west mobility option for those not interested in traveling along congested roadways and having access to the DFWIA.

In examining the need for development of the Cotton Belt Corridor, many planning reports highlight the expected growth in population and employment levels in the Dallas-Fort Worth region. The TEX Rail FEIS projects that between 2005 and 2035, population levels will increase by 55 percent and employment levels will increase by 49 percent within the TEX Rail study area (western segment) (34). This growth poses a major challenge to the roadway transportation network. Figure 4 shows the projected levels of roadway congestion in the NCTCOG counties in 2035. The Cotton Belt Corridor is sketched on the map to show its relationship to these projected congestion levels. It aligns with many of the worst-congestion-level areas projected in the region, demonstrating its potential to provide another mobility option.





Source: (35)

**Figure 4. Map of Levels of Roadway Congestion Expected in 2035.**

## Lessons Learned from the Cotton Belt Corridor Project

In comparing the Cotton Belt Corridor planning efforts to many of the issues and processes discussed earlier in this report, several lessons learned for using urban rail ROWs can be identified. This subsection discusses the most significant ones.

### *Public Ownership or Control of a ROW May Not Extinguish or Shorten Existing Freight Operating Agreements*

Another important issue with public purchase or use of a freight rail ROW could be the status and extent of the existing freight rail operating rights over a former freight rail line that is being converted to passenger use. Often the rights to operate a freight business over the line under specified guidelines were a condition of the original sale to a public agency or agreement to allow passenger operations. These rights may have been retained by the previous owning freight rail operator, transferred to a short-line railroad operating company, or preserved for resumption at some point in the future when the need for freight traffic might increase. Negotiating with freight operators to operate in a smaller time period (i.e., at night or on weekends) may prove more difficult, costly, and time consuming than first presumed. Even though a public agency

may purchase and own the physical ROW, care must be taken to ensure that freight rail operating agreements are fully known and acceptable to all parties. A freight railroad does not want to relinquish future growth possibilities, especially if it does not have other options for servicing existing customers along a given corridor.

### *Liability Is the Leading Concern for Freight Railroads in Shared Use*

Ultimately, release from liability for accidents that might take place involving passenger rail operations on freight rail ROWs or infrastructure is the foremost concern for freight rail companies. In almost all cases, including Amtrak operations on the national scale, the freight railroad must be given indemnification (held harmless) in case of an accident. Generally, assuming this liability is often unexpected for some public agencies undertaking commuter rail or intercity service projects. Freight operational concerns are also important, but concern about liability is primary because the costs involved with a passenger accident could severely impact the finances of a large railroad or put a small railroad out of business completely.

### *Negotiations and Development of Commuter Rail Service Often Take Much Longer than Originally Expected*

The timeline for negotiation of an agreement for shared use or ownership of a rail ROW can vary greatly and take much longer than anticipated. As noted above, there are often detail items, such as labor agreements or continued freight rail operations agreements, that take much longer to reach a decision and/or consensus on. As a result, the public sector must be patient in working with railroads, regulatory agencies such as the U.S. Surface Transportation Board, and even labor unions at times to effect proper transfer and use of any ROW. In the case of the Cotton Belt Corridor, this line was included in DART's original regional rail plans in 1983 and was purchased by DART in 1990. Rail service along the western part of the corridor will likely begin 25 years after purchase of the line, and service on the eastern part of the corridor (either rail or BRT) may take even longer.

### *Multiple Parties Mean Multiple Issues and Interests*

Negotiation of an agreement between a single railroad and a single public agency for purchase or shared use of a ROW is a complex activity. When multiple railroads, public agencies, and/or Amtrak become involved, the complexity and need to accommodate the interests of all parties involved increase exponentially. Public agencies must often identify long-term champions that can commit to being involved in the negotiation process over a long period of time and/or represent several interested public agencies' interests. Over time, relationships with railroad company officials and an understanding of their concerns can aid in finding common solutions as issues are discussed.

### *Neglected and/or Unconsidered Details in Agreements Can Be Significant Hurdles*

Public purchases of rail ROWs or shared-use agreements with freight rail operators are fraught with many details that may seem insignificant or that may be considered easily handled by public-sector officials when a project is begun. One example of this would be the intricate labor

agreements under which freight rail and Amtrak employees work. Changes in rail service that might impact labor rules can become an unforeseen—but formidable—obstacle in completing a project. Other similar secondary or tertiary factors can often emerge as important issues. For this reason, each project must be examined thoroughly, and all potential factors must be taken into account from the outset.

## Conclusions

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The Texas A&M Transportation Institute (TTI) conducted this study to update and expand previous work conducted by the Center for Transportation Research at The University of Texas and by TTI on commuter rail using existing freight tracks or operating in existing ROW, and on relocating rail yards and mainline tracks outside of densely populated urban areas, thereby freeing key corridors for public use. This report highlights several shared-use agreements that have been executed, the negotiation issues and concerns, and the benefits of passenger rail sharing freight infrastructure and the relocation of rail yards and mainline tracks outside of densely urban areas.

The research team reported that the most prevalent type of shared-use agreement is one in which the transit agency pays a fixed fee in exchange for operating a specified number of commuter trains on freight track during specified time windows. Most transit agencies contacted during this study recommended that this type of agreement also specify the conditions for expanding service should the demands rise. In most cases, the freight railroads have tied shared use to specific investments to improve a corridor's capacity. In some cases, the public agency purchased the freight tracks on the condition that the freight railroad maintains an easement during parts of the day. This has the advantage of allowing the public agency to handle dispatching and might result in more reliable service. Most agencies recommended that an agreement in which freight railroads control dispatching should contain incentives for on-time performance.

Two other agreement types worth noting are the purchase-of-service agreement and the ROW acquisition agreement. In the purchase-of-service agreement, the transit agency pays the freight railroad a fee to operate the commuter rail's service. In some cases, the transit agency may provide the commuter rail equipment (i.e., rolling stock). The freight company is then responsible for operating the commuter rail service, including the crew for the commuter trains. The ROW acquisition agreement means that the transit agency will buy land from the freight company adjacent to the freight tracks. The transit agency can then construct its own tracks in the ROW. The agreement in this scenario is mainly concerned with coordinating signals, establishing how freight shipments will reach clients on the other side of the commuter tracks, and how commuters will cross freight track to reach stations on the opposite side of the freight track. Both the purchase-of-service agreement and the ROW acquisition agreement will generally be preferred when the corridor is very busy (approximately 45 trains per day or more).

The research showed that it is very important for a public transit agency to understand that freight railroads are in the business of moving freight and that freight railroads want to be part of the intermodal freight solution. Freight railroads will not agree to a shared-use agreement that will:

- Compromise safety.
- Diminish their ability to serve their clients.

- Not adequately compensate them for providing access to their assets, and for any expenses they will be exposed to as a result of the public use.
- Not exempt them from liability for any accidents that happen on their property involving the commuter rail service.

Respecting these three conditions can be expensive, but it is necessary in order to conduct successful negotiations with a freight railroad. The high cost of meeting these conditions is offset by transit service benefits, including substantial time savings, vehicle operating cost savings, safety and environmental benefits, and agency cost savings.

Despite the number of case study examples of shared-use agreements and freight rail track relocations included in this study, the research team found that accommodating commuter rail on freight rail track is becoming more difficult, even with significant investments in rail capacity and even in cities with well-established commuter rail service (e.g., Chicago). This in part stems from changing economic conditions. Currently, freight rail business is growing, and the freight railroads are challenged to meet freight rail demand within their current capacity. This business climate makes it difficult to negotiate for shared capacity on freight rail corridors.

Finally, freight railroads also raise the question of whether rail corridors are optimal for commuter rail because freight rail corridors tend to primarily serve industrial areas rather than employment centers. Highway corridors, on the other hand, tend to serve employment centers (including centers that grew alongside the highways) and may be better suited for accommodating rail. This needs to be further explored.

## Appendix A—Public Use of Rail Right-of-Way Case Studies

### FrontRunner (Salt Lake City, Utah)

#### Overview

Weekday Ridership	14,700
Weekday Trains	64
Number of Stations	16
Number of Lines	1
Total Route Length (km)	142

The FrontRunner project began construction in 2005—roughly 10 years after discussions with UP began—with a 38-mile route from Ogden south to Salt Lake City. The track was constructed along the same corridor as the UP mainline. It opened for revenue service in April 2008. Later that same year, service was extended from Ogden to Pleasant View by sharing UP's track for roughly 6 miles (36).

Only a few months after service began on the Ogden to Salt Lake City route, UTA began work on a 44-mile southern extension from Salt Lake City to Provo, Utah's third largest city. Service along this route began in 2012. As with most of the northern route, the southern extension parallels the UP mainline. Financing for the project came from a 0.25 percent sales tax increase approved with nearly a two-thirds majority (64 percent) by voters in Salt Lake County.

#### Stakeholders Involved

Public agencies:

- UTA.

Freight companies:

- UP.

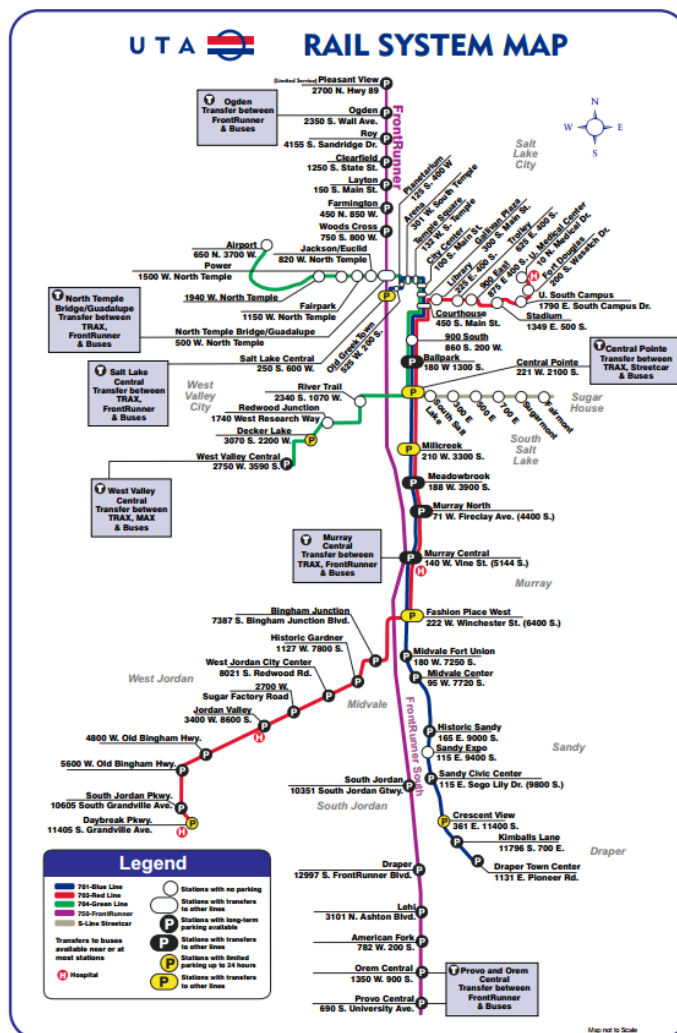


Figure 5. Map of UTA Rail System.

### *Nature of Agreement*

UTA entered into a construction agreement, an operating agreement, and a maintenance agreement with UP. These agreements specify how the commuter rail is built, operated, and maintained, as well as the working relationship between UTA and UP.

UP agreed to sell portions of its ROW to UTA for the purpose of implementing the FrontRunner commuter rail system but stipulated that its ability to service its clients along the corridor could not be diminished. UTA entered into a purchasing agreement with UP to acquire the ROW. The typical cross section of UP's corridor was roughly 100 feet wide. UTA purchased a 20-foot segment (sometimes more) of UP's corridor, as well as land from adjacent property owners in sections where the corridor narrowed or where more than 20 feet was required for sidings or stations. Overall, 175 miles of trackage and ROW were purchased for \$175 million in 2002 (translating into \$231 million in 2014 dollars). In addition to the segments that were to be used to build FrontRunner, a portion of the old Denver and Rio Grande Western Railroad mainline between Ogden and Salt Lake City was purchased. This portion is currently being used for the Rails to Trails program as a paved bicycle and pedestrian pathway.

UTA also had to find creative methods to ensure that its parallel line could provide adequate service to the community, while still allowing shipments to reach UP clients located on either side of the corridor. To minimize the impact on UP's clients, UTA and UP decided that the northern portion of the FrontRunner would be constructed on the east side of the UP mainline, and that a crossover would be built south of Salt Lake City so that freight trains could cross over to the western side. According to Clayton Gilliland, a project manager who worked on the project, "The alignment itself was an engineering challenge because you're trying to fit it in between the existing mainline and fit it on the right-of-way" (37).

This would still cut off several of UP's shippers, so it was very important for UTA to understand the freight railroad's business and develop mitigating strategies. UTA worked with the shippers and UP on a case-by-case basis. Examples of the mitigation strategies include:

- UP contracts with a short-line railroad to move full tanker cars into an oil refinery located just north of Salt Lake City. Empty tanker cars are removed during the day. UTA paid for improvements to the facility that would allow empty tanker cars to be stored during the day so that all of the movements could take place at night when FrontRunner is not running.
- A flourmill along the route received shipments twice a day, one at noon and one at midnight. UTA bought a switcher engine that the mill operates to allow for both shipments to be handled at midnight.
- Shipments to an automotive unloading facility near Clearfield were considered time sensitive because of potential vandalism if the vehicles are not moved quickly through



the facility to auto dealers. UTA bought the 70-acre facility and helped the client acquire a new site to allow for more efficient loading and unloading.

The \$175 million to acquire the route did not include the cost of these strategies. Approximately \$612 million in New Starts grant funds from FTA was invested in the northern segment between Salt Lake City and Pleasant View (north of Ogden). Of that, \$70 million was spent on track improvements, including shifting segments of UP's track to improve the alignment. Drainage improvements were also made along the corridor. Much of UP's tracks had originally been built in the 1870s and did not have adequate capacity to drain the storm water runoff caused by a century of development.

In general, the centerlines between the commuter rail tracks and the UP tracks are 25 feet apart. There are, however, some sections where the ROW was constrained by a freeway, resulting in a 15-foot separation between the commuter rail and freight rail tracks. This required the placement of sensors that shut down both lines if a derailment occurs (37). These sensors consist of bollards placed between the tracks at roughly 75-foot increments. If a derailment occurs, the bollards break and red lights activate along the corridor, signaling train operators to stop.

North of Ogden, much less freight rail traffic (between five and seven trains per day versus 45 to 60 for the rest of the corridor) moves on UP's mainline, so UP agreed to provide FrontRunner access to its tracks for a fee of \$6 per train-mile. This is a 6-mile segment, and with FrontRunner's current schedule (i.e., two UTA commuter trains in the morning and two commuter trains in the evening), this amounts to around \$90,000 per year.

UTA is responsible for operating and dispatching its commuter trains on its track, but UP dispatches the shared section between Ogden and Pleasant View. The latter means that FrontRunner locomotives have to be equipped with a second radio system to contact UP's dispatchers in Omaha, Nebraska. Finally, UTA is responsible for maintaining the crossing signals on its side of the corridor, while UP is responsible for maintaining the crossing signals on its side of the corridor where UP and UTA share the corridor.

### *Concerns Raised*

FRA requires trains to sound their horns in a series of four blasts (two long blasts, one short blast, and a final long blast) as they approach an at-grade road crossing. Because FrontRunner has 68 commuter trains traveling on the corridor on any given weekday, concerns emerged during the environmental impact assessment over the noise that the project would create, particularly near at-grade crossings. FrontRunner successfully petitioned FRA for a waiver, i.e., a quiet zone, on condition that the safety measures at each grade crossing would be improved. This required upgrading most of the 47 at-grade crossings between Salt Lake City and Ogden. UTA reconstructed many of the at-grade crossings, installing raised medians to prevent personal vehicles from going around crossing gates and purchasing new signal bungalows for the corridor. Trains can still sound their horns in emergencies in a quiet zone, but the general requirement to do so is removed. Because freight trains would also be affected by the quiet zone regulations,



UTA upgraded UP's crossing signals and synchronized UP's signals with those of FrontRunner to avoid situations where a personal vehicle might be stuck between the two tracks in the corridor.

UTA has noted a substantial change in the number of incidents per train given the upgrades at the at-grade crossings. Most incidents involve vehicles moving forward after a train has passed but before the crossing gates have time to fully rise. UTA has the maintenance personnel to quickly repair crossing gates, but UP, as a national company, takes longer to repair its signals. This sometimes leads to lower-speed operations.

Aside from concerns over its ability to continue serving its clients, UP also wanted to ensure that it would not be liable for the commuter rail system. At FrontRunner's platforms, chain-link fences were erected between the UTA and UP tracks to prevent commuters from trespassing onto the UP track. These fences extend around 200 feet past the end of the platform. At the Farmington station, the park-and-ride lots are on the UP side of the corridor, so UTA built a pedestrian overpass with stairs and elevators for commuters to access the platform without encroaching on UP ROW. UTA's police force works with UP's security teams to monitor high-trespass locations along the corridor. About 30 percent of the trespassing incidents are suicide attempts. UTA reported that the new requirement for positive train control (PTC) will also improve safety.

### *Realized Benefits*

UTA estimates that FrontRunner and the other transit services it operates have reduced daily vehicle-miles traveled by 851,000. A quarter of all home-based work trips to downtown Salt Lake City are conducted by transit. Transit use in Utah accounts for an estimated net annual reduction in criteria pollutant emissions (i.e., NO<sub>x</sub>, VOCs, CO, SO<sub>x</sub>, and PM) of more than 2,000 tons (38).

Specifically, FrontRunner's weekday ridership of 15,000 people represents the equivalent of nearly two additional traffic lanes on I-15.

### *Political/Social Context*

Utah is among the fastest-growing states in the country (it ranks third, only narrowly behind Texas), and transportation planners and residents have recognized the congestion problem this growth may cause. Although there has been some opposition to the expansion of transit in Utah, most of the region felt strongly about the need for commuter rail, as evidenced by the vote for a tax increase in Utah County to help finance the project. According to the governor, public support has allowed the project to begin service 15 years earlier than originally planned. Ridership has far slightly exceeded projections.

When negotiations first began with UP in 1995, the company was strongly opposed to commuter rail services in its corridor or on its track. Only political pressure from the governor and the threat of legislative action convinced UP to make concessions for the project to move forward.

### *Future Issues*

Moving forward, UTA is planning to double-track more of its segments to allow for an increase in commuter service frequency. Currently, about 70 percent of the route is single-tracked with passing sidings, resulting in one train every 30 minutes during peak hours. The goal is to eventually provide 15-minute headways (i.e., a train every 15 minutes) during peak periods. In addition to service frequency, UTA also wants to improve train speed. This may require electrification, and UTA is consulting with CalTrain on the best way to proceed. One of the key concerns is the crossover, where any electrical system would be installed on top of UP's mainline.

Finally, some locations along UTA's line are starting to require major track maintenance work. Increased maintenance activities (e.g., switching rail track) will impact UP's operations.

### *Lessons Learned*

FrontRunner was faced with several challenges in negotiating the shared corridor/ROW agreements with UP. UP was concerned that building along its corridor might restrict its access to clients. UTA invested in the side of the corridor and built a crossover to ensure that the commuter service would be on the opposite side of most of UP's clients. UTA also worked with UP's remaining clients that were impacted by the commuter service on mitigating strategies. UTA made a point of working directly with UP instead of going through intermediaries to develop win-win solutions so that UP would not see a degradation of service. This helped build a strong working relationship between UTA and UP. Since it was very important for UTA to "talk rail," UTA staff became involved with the same organizations as UP, such as the American Railway Engineering and Maintenance-of-Way Association. UTA did consult with experts who have worked with UP, but according to the agency, the single most important step was visiting UP's corporate headquarters in Omaha because there was a myriad of issues that UP's local office did not have the authority to negotiate. UTA mentioned that it is also very important for the transit agency to have realistic plans. Finally, the freight railroad does not want to be liable for anything that concerns the commuter rail service. The freight railroads are beholden to their shareholders and cannot take on additional risk without being compensated for it.

UTA noted that UP has been a great partner for UTA. To help continue strong coordination and collaboration, their operations teams communicate with each other daily.

## Metra (Chicago)

## Overview

Weekday Ridership	305,200
Weekday Trains	703
Number of Stations	241
Number of Lines	11 (2 planned)
Total Route Length (km)	785

Source: (39)

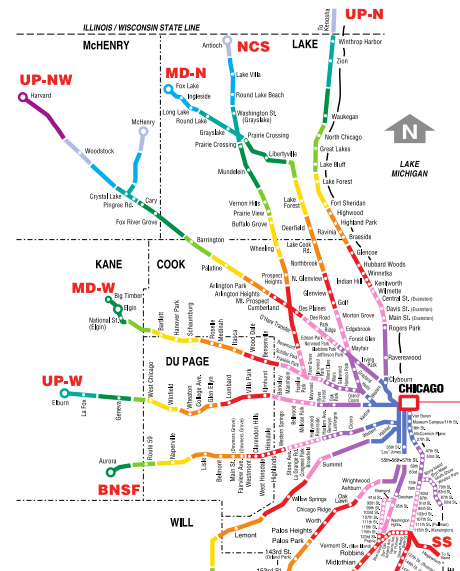
Chicago has a long rail history and has had a very well-established public transportation system, which includes commuter rail. At first, private freight rail companies operated much of the commuter rail system, but it became increasingly publicized as the freight railroads went into insolvency. The Regional Transportation Authority (RTA), established in the mid-1970s, faced financial difficulties and went through reorganization in the early 1980s. The Commuter Rail Service Board was created in 1984 as part of this reorganization. The Commuter Rail Service Board was rebranded as Metra the following year (40). Over the past three decades, Metra has expanded its commuter rail service and upgraded its stations, rolling stock, and routes through extensive capital investments.

The result of this rail history is that the existence of commuter rail services is not in dispute, and established relationships exist between rail operators. However, as Metra seeks to expand its service on freight rail track, it must negotiate with freight railroads to come to a mutually beneficial arrangement. In this regard, Metra is no different from a new start commuter rail service (41).

### Stakeholders Involved

Public agencies:

- RTA.
- Metra.
- City of Chicago.
- Cook County.
- Five collar counties—DuPage, Kane, Lake, McHenry, and Will Counties.
- Amtrak.
- Northern Indiana Commuter Transportation District.



Note: The 11 current routes (some have branches) extend from Chicago with the various fare zones displayed.

**Figure 6. Map of Metra System.**

Freight companies:

- BNSF—operates one line under a purchase-of-service agreement.
- UP—operates three lines under a purchase-of-service agreement.
- Canadian National (CN)—provides trackage rights for two lines.
- Canadian Pacific (CP)—provides dispatching for two lines.
- Norfolk Southern (NS)—leases one line to Metra to operate service.

### *Nature of Agreement*

To provide commuter rail service, Metra has entered into various forms of sharing agreements depending on who owns the track. Table 3 shows the ownership of the rail track on which Metra provides/procures commuter rail service. Most of the Metra-owned ROW was acquired as the result of freight railroad bankruptcy or by direct purchase. On this ROW, Metra shares or allows access to its track under various agreements with several freight railroads. The Rock Island line is an example of an arrangement in which the Metra-owned corridor is shared with a freight railroad. In this corridor, Metra crews operate Metra equipment under the control of Metra dispatchers, but freight service is also operated on the line. Metra also has ROW on which no freight railroad operates. The Metra Electric Service line is an example in which Metra owns and maintains the track. Metra also operates and dispatches Metra commuter trains and dispatches South Shore Commuter Trains (operated by the Northern Indiana Commuter Transportation District) on its route.

**Table 3. Ownership of Metra's Routes.**

Track Owner	UP	BNSF	Amtrak	CN	NS	Metra
Number of routes	3	1	5	2	1	6
Route miles	162.3	36.8	2.9	75.8	33.3	188.8
Percent of total	33.3%	7.5%	0.6%	15.5%	6.8%	36.2%

Metra also uses a second type of arrangement in which commuter trains operated by Metra run on freight railroad tracks. On track owned by CN, Metra operates its commuter trains with its own crews. Dispatching and track maintenance are, however, provided by the freight railroad. This type of arrangement has been common in metropolitan areas, especially where new-start commuter rail service is introduced in environments in which freight railroads are well established. The maintenance costs are usually factored into the fee that the commuter agency pays to access the freight rail line. One exception is Metra's SouthWest Service line, which Metra operates on NS track. As part of that arrangement, Metra is responsible for maintenance of the line. Dispatching is done by Metra and NS on different portions of the track.

There are also modified versions of the above arrangements. On Metra's two Milwaukee District lines, Metra owns the track and operates the commuter service, but CP is responsible for dispatching. The SouthWest Service and Milwaukee District lines all host freight trains in addition to commuter rail (Amtrak also runs in one instance).

The most unusual of Metra's operations is on tracks owned by UP and BNSF. In both cases, the railroads had historically operated commuter trains on high-volume freight rail corridors. When approached by Metra's predecessor, the freight railroads were interested in relieving themselves of loss-making commuter rail services but were unwilling to relinquish operating control over strategically important freight rail lines. The result was a purchase-of-service agreement in which Metra reimburses the two freight railroads for the direct expenses associated with operating the commuter trains with their equipment and crews. With the passage of time, Metra purchased new equipment and provided it for commuter use to the freight railroads, which continue to operate the commuter trains with their own crews and maintain the track and equipment.

Metra may be the only commuter agency that has entered into such a wide variety of operational agreements. Most other public agencies, operating commuter service on shared ROW, have one or at most two types of shared-use agreements. The fact that Metra, an agency with significant experience running freight trains in a region that embraces commuter services, has so many different types of operating arrangements demonstrates that there is no single agreement that will serve all situations. Circumstances may dictate a particular arrangement to be the only option for achieving shared use. It may not be ideal from either the freight railroad or the public agency's perspective, but it may be the only means by which both services can be accommodated in a particular rail corridor.

The CREATE Program is considered a national model for public-private partnerships to address rail bottlenecks that affect both passenger and freight rail service. The CREATE Program is a public-private partnership between the six Class I railroads operating in Chicago, Chicago department of transportation (DOT), Illinois DOT, Metra, and Amtrak. Metra's commuter services, specifically the Southwest Service, will benefit greatly from CREATE if and when funding will be secured for the proposed investments. The CREATE Program aims to improve five rail corridors for a faster and more efficient rail system, eliminate the waiting times for motorists at 25 at-grade crossings through grade separations, and build six rail-to-rail flyovers. As opposed to the freight railroads making investment decisions based on their individual needs, the freight railroads will be making investment decisions that are considered best for the overall rail network under CREATE. The freight railroads will pay for the benefits they receive, and the city, state, and federal governments will pay for the public benefits generated by the investments.

### *Concerns Raised*

In shared-use negotiations, commuter agencies have to recognize that the revenues realized from commuter services on freight ROW typically represent a small percentage of the freight railroad's business. From the freight railroad's perspective, freight railroads are in the business of moving freight and cannot afford any degradation in freight service because of commuter services. The freight railroads have to be ensured that they will be able to operate as efficiently after allowing commuter services as before. In many cases, capital investments will be required to ensure that the freight railroads' capacity or future ability to operate is not compromised.

In addition to capital investments, operational issues must also be considered during negotiations. Issues such as signal design and spacing that impose operational limitations on specific segments of track, speed limits, and other operational limitations should be recognized. These issues can result in bottlenecks, which may need to be targeted for capital investments. An experienced railroad expert can help identify where capital investments need to be made and address potential issues for mutual benefit. In addition, involving an outside consultant with both freight railroad and commuter expertise was also recommended by Metra.

### *Overhead and Administrative Costs*

Compensation for overhead or administrative costs, which a freight railroad incurs for supporting commuter rail service that it would otherwise not have to incur, could be a potential issue. From the commuter agency perspective, it was argued that structuring the shared-use agreement should be done carefully so that there is a limit on overhead or administrative costs. Metra recommended payments based on what is actually attributable to commuter rail service or a flat or predetermined rate. This would protect the commuter agency from increased overhead or administrative costs if a freight railroad reorganizes its administrative structure. Metra felt that these costs should be controlled and managed through well-structured agreements. From the freight railroad perspective, all costs associated with allowing commuter rail services on its track, including overhead and administrative costs, have to be covered. Public agencies, however, tend to have easier access to capital funds than operating funds. Although capital investments can benefit both the commuter and freight rail services, the freight railroad will ensure that all costs (i.e., capital, operating, overhead, administrative, as well as profit) are covered in the negotiated operating agreement.

### *Allowing for Service Expansion*

Metra noted that regardless of the type of agreement that is negotiated, it should be structured to allow for service expansion. At a minimum, the process for service expansion should be stipulated in the agreement.

In Metra's case, capacity investments are normally the responsibility of the party that needs the additional capacity. In other words, if the freight railroad needs more capacity, the freight railroad pays for the investments, while Metra pays for capacity if it needs to expand service. If both benefit, the cost is shared. In the last few years, a \$140 million project was undertaken in which Metra and UP divided the cost evenly. It has, however, become more difficult to accommodate commuter rail on the freight rail network in the Chicago area. Metra pointed out that only modest expansions (i.e., one new line and a few small extensions) have been implemented in the past 30 years.

### *Realized Benefits*

The literature review revealed few studies that have attempted to quantify the benefits of commuter rail service on freight railroad track, but it is widely believed that the public benefits are significant.



According to information gathered during its rider survey, Metra carries approximately 50 percent of work trips to downtown Chicago in each of the major expressway corridors. It is estimated that “it would take twenty-nine additional expressway lanes to accommodate Metra riders” (39).

Over 90 percent of Chicago’s transportation related greenhouse gas emissions are from automobiles, while Metra accounts for just over 3 percent. Given the number of daily Metra commuters and the fact that Metra produces less than one-third the emissions per passenger-mile than automobiles, it is clear that the Chicago region is realizing significant air quality benefits from the Metra commuter rail service (42).

Finally, Metra has observed a trend for businesses in the Chicago region to relocate their corporate offices closer to Metra’s main station. Enhanced access to quality employees has even caused some businesses from outside the region to locate in Chicago, thereby growing the regional economy.

### *Political/Social Context*

Commuter rail is part of the Chicago culture and the benefits that the commuter rail service provides to the greater Chicago community are well recognized. Metra’s most recent rider survey shows widespread satisfaction with the Metra service in general (43). The familiarity that Chicago area residents have with commuter rail helps to reduce opposition to the service. There is much less uncertainty about usage of the service, whereas other transit agencies might have to contend with arguments that potential riders may be unwilling to switch from personal vehicles to public transit. To the contrary, public pressure has on occasion been a major factor in bringing the commuter agency and the freight railroads back to the negotiation table.

Coordination is sometimes complicated because of the number of stakeholders involved with Metra. The commuter rail network extends beyond Chicago into the surrounding counties so many different local governments are involved in addition to the various freight railroads. There are always some political struggles between different communities over new routes or upgrades to existing routes, but having an extensive network helps to demonstrate that every area will eventually benefit. Additionally, a significant part of Metra’s funding is provided by the state government of Illinois. Although there is one station in Wisconsin, only Illinois provides operational or capital funding for Metra.

Some of the challenges that Metra faces in working with the freight railroads today stem from changing economic conditions. When Metra was formed, the freight railroads were faced with a prolonged contraction in business and they were selling many of their corridors. Currently, freight rail business is growing, and the freight railroads are challenged to meet demand with their current capacity. In the Chicago region, oil and gas shipments (primarily from North Dakota and the rest of the upper plains) are driving this increased rail demand. This business climate makes it difficult to negotiate for shared capacity on the freight rail corridors, as the freight railroads refuse to negotiate terms that would diminish their rail freight services. Metra

noted that if it had to initiate the development of their commuter rail system today it would be impossible to implement a system comparable to the one currently in place.

### *Lessons Learned*

Several important lessons can be learned from Metra's experience working with the freight railroads. First, Metra's wide variety of shared-use agreement structures indicates that there is no single agreement that is appropriate in all circumstances. Second, Metra highlighted the need for commuter agencies to be aware of the details in shared-use agreements, specifically with regard to compensation, operations, and service expansion. Third, commuter agencies will be expected to contribute significant funding for capital investments to facilitate negotiations with the freight railroads and to ensure that freight rail service is not diminished.

Metra clearly benefits from having an established working relationship with the freight railroads in the Chicago region. Moving forward, Metra has identified 35 corridors where existing commuter lines could be expanded or new lines could be implemented. The freight railroads are not excited about some of the identified projects, but Metra believes through careful coordination some of the identified projects can be implemented to meet growing commuter rail demand in the Chicago area. Metra is committed to maintain a good relationship with its freight partners through constant communication and dialogue.



## Tri-Rail (Miami)

### Overview

Weekday Ridership	14,300
Weekday Trains	50
Number of Stations	17
Number of Lines	1
Total Route Length (km)	114

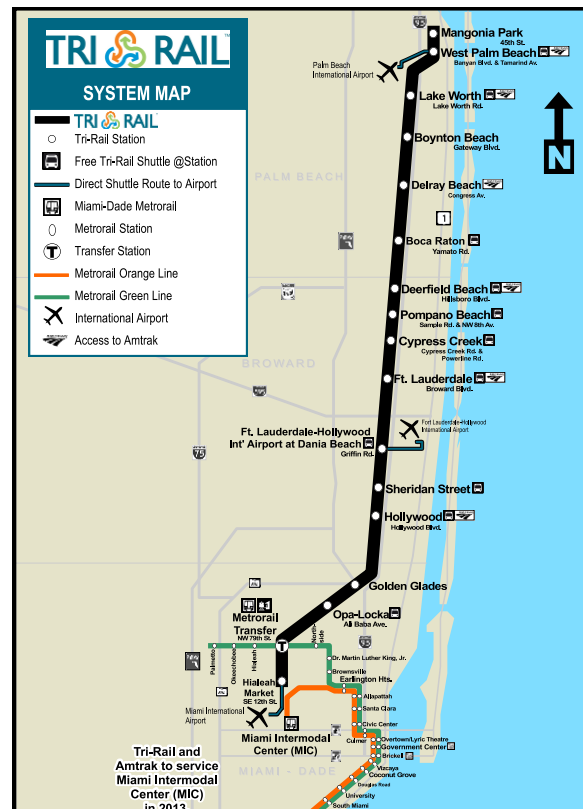
Tri-Rail operates on and uses some of the same stations that were built for private passenger rail service in the 1920s by the Seaboard All-Florida Railway. This service was eventually discontinued, and the Seaboard System Railroad merged with the Chessie System Railroad to form CSX Transportation (CSX). A 1983 feasibility study recommended commuter rail service to provide temporary congestion relief while local highways were being expanded.

In 1988, the Florida Department of Transportation (FDOT) purchased the track and facilities from CSX and commuter rail service started in 1989 between West Palm Beach Station and Hialeah Market Station (the old Miami Airport Station). Since then the commuter rail line has been extended to a new Miami Airport Station in the south and Mangonia Park in the north. Tri-Rail is currently negotiating with the Florida East Coast (FEC) Railroad, a large regional railroad, to implement a second route, called the Coastal Link, parallel to the current route on the east side.

### Stakeholders Involved

Public agencies:

- South Florida Regional Transportation Authority.
- Miami-Dade, Broward, and Palm Beach Metropolitan Planning Organizations.
- FDOT.



*The existing route is shown in black; the proposed secondary route, dubbed the Coastal Link, would be east of the current line, near the coast. Miami's other rail services are shown in the southern portion of the map.*

**Figure 7. Map of Tri-Rail System.**

Freight companies:

- CSX.
- Florida East Coast Line.

### *Nature of Agreement*

The original agreement that FDOT was negotiating with CSX would have granted Tri-Rail full authority over dispatching, but would have also made Tri-Rail responsible for track maintenance and given CSX the authority to approve residential development along the corridor and the ability to operate additional midday trains. Tri-Rail, which was not involved in the negotiations, rejected the agreement, citing that the midday freight trains would make future service expansion difficult, that residential developments were necessary for its long-term goal of transit-oriented development, and that the agency did not have enough funding to take control of track maintenance (44).

When FDOT purchased the tracks from CSX in 1988, it was agreed that CSX would be responsible for maintenance and dispatching. In exchange, CSX was granted the exclusive right to continue using the tracks for rail freight. Tri-Rail and CSX since agreed to specific time windows (i.e., peak commuter travel times) during which commuter trains receive priority.

In 2000, Tri-Rail received an FTA full funding grant to expand the commuter rail system. The grant funding was used to double track the line. Double tracking has improved on-time performance, capacity, and the frequency of the rail service. Since double tracking of the line was completed in 2006, there has been a transition of control of the corridor. CSX will still have track access, but Tri-Rail will have full control of the corridor by the end of this year (2014). This means that, while CSX will still move freight rail along the corridor, Tri-Rail will dispatch all of the rail traffic and be able to ensure that there is a high level of on-time performance for commuter trains. Tri-Rail will also be responsible for the maintenance of the corridor by the end of 2014.

For the new Coastal Link line, Tri-Rail is currently negotiating commuter rail operations on track that belongs to the FEC Railroad. In the 1980s, it was believed that the FEC railroad had a better route than CSX for the commuter rail service, but the regional railroad refused to allow commuter trains along its corridor. The situation changed roughly 10 years ago, and the FEC railroad is now receptive to the idea. The FEC railroad operates on a relatively local level compared to CSX and its trains have more of a fixed schedule. Both of these aspects make it easier to incorporate the new Coastal Link along the FEC's corridor. South Florida Regional Transportation Authority (SFRTA) is currently working with FEC on rail simulations to determine the needed capacity to accommodate commuter rail. Tri-Rail commented that Class I railroads are often uncomfortable with sharing their proprietary information and for allowing it to become public record. SFRTA has found that the FEC is much less reluctant about this than the Class I railroads.

### *Concerns Raised*

Dispatching control and on-time performance have been the two most problematic areas in Tri-Rail's shared-use arrangement with CSX. Tri-Rail experienced dramatic drops in on-time performance, from 85 percent to 47 percent, when CSX was not prioritizing Tri-Rail's commuter trains (45). Tri-Rail believes that transit agencies implementing new-start commuter rail services should seek dispatching control from the beginning, because having control over dispatching ultimately means having control over the on-time performance of commuter trains. If a transit agency does not have dispatching control, the agency should ensure that commuter trains have priority during peak hours when on-time performance is critical to reaching targeted ridership levels.

Tri-Rail noted that its shared-use agreement could have been better structured with regard to construction projects. In the current agreement, CSX has the right to review all construction projects on the state-owned track. This right has delayed project delivery and has impacted Tri-Rail's overall planning process.

Having experienced railroad experts available during negotiations can significantly improve the efficiency of the negotiation process and outcome, although difficulties and impasses may occur regardless of the capabilities of the negotiators. Additionally, high staff turnover rates can have a negative impact on negotiations. For example, during the nearly 30 years between acquiring the corridor and taking control of it, Tri-Rail has had to work with different state governors, different secretaries of transportation, different members of its board, and different staff members at CSX. Finally, CSX operates a large national rail network and it was at times difficult to get the railroad to focus on one small section of its Florida network.

### *Realized Benefits*

Tri-Rail moves about the same number of people per day as one lane on I-95 and provides more than a lane's capacity during the peak hours. Additionally, Tri-Rail entered into a contract with Brookville Equipment Company in 2011 for new locomotives that meet the EPA's tier III emissions standards (46). According to SFRTA, Tri-Rail currently eliminates 16,000 tons of greenhouse gasses, 1,200 tons of carbon monoxide, and 122 tons of NOx every year.

In addition, there are currently 60,000 jobs within a half-mile of a Tri-Rail station and capital investments over the next five years are projected to bring another 48,000 jobs to the region. Each trip on Tri-Rail saves commuters an average of \$16.50 compared to driving. The Tri-Rail service translates into annual savings of \$70 million in total driving expenses.

Tri-Rail has worked with CSX in utilizing the freight railroad's lobbying powers to secure funding for the region. Tri-Rail has also capitalized on the freight railroad's leverage to purchase equipment, maintenance, and materials. CSX can purchase at a lower price than a public agency because of the large volumes it purchases on a regular basis. Finally, CSX and Tri-Rail have also cooperated on testing advanced signal systems for higher-speed operations (45).

### *Political/Social Context*

Originally the Florida Legislature wanted to require a 60 percent fare-box recovery for Tri-Rail, meaning that fare revenues would cover 60 percent of its operating expenses. It soon became clear that this would be unachievable (few commuter rail services reach 30 percent), and the requirement was reduced to 25 percent before operations began (47). Despite the foreknowledge that full fare-box recovery would be unattainable, the subsidies required to make-up the difference have been criticized, particularly by Florida's Governor Rick Scott who has pointed to the commuter rail system's subsidies as a reason for avoiding the implementation of high speed rail in the northern part of the state (47). Inadequate funding has led to service cuts at points in Tri-Rail's history.

### *Lessons Learned*

The concerns relating to the on-time performance of the commuter trains were ultimately resolved through cooperation between CSX and SFRTA. It was pointed out to CSX that Tri-Rail experienced poor on-time performance during periods that were critical in making its planned service schedules when the track was shared with freight trains. CSX eventually agreed to a six-month trial period in which Tri-Rail was given exclusive time windows each day for operating its commuter trains without freight movements on the corridor. The trial results were reviewed periodically (45). This arrangement, in which no freight movements occur during peak commute hours, continues to be in place currently and has allowed Tri-Rail to significantly improve its on-time performance.

SFRTA stated that the operation of the commuter rail has definitely benefited the freight railroad, because the segment was being operated with capacity constraints. Tri-Rail found, paradoxically, that capacity constraints along the corridor actually helped negotiations. When the freight railroad needed to expand, they were more willing to work with the SFRTA than they might have been had they had excess capacity. The commuter rail provided funding to expand capacity in the corridor. Since double tracking of the line was completed, CSX has had more capacity to work with, and relations with the freight railroad have dramatically improved.

Tri-Rail acquired its route 30 years ago, but the agency only now has enough funding to take control. Tri-Rail feels that this delay has made it more difficult for the commuter agency to establish itself or put it in a position in which it can expand.

SFRTA agrees that freight rail corridors are not necessarily the best corridors for commuter rail, but it is often the only ROW that is available and it is easier to work with the freight railroads than to negotiate individual property rights.

## Metrolink (Los Angeles)

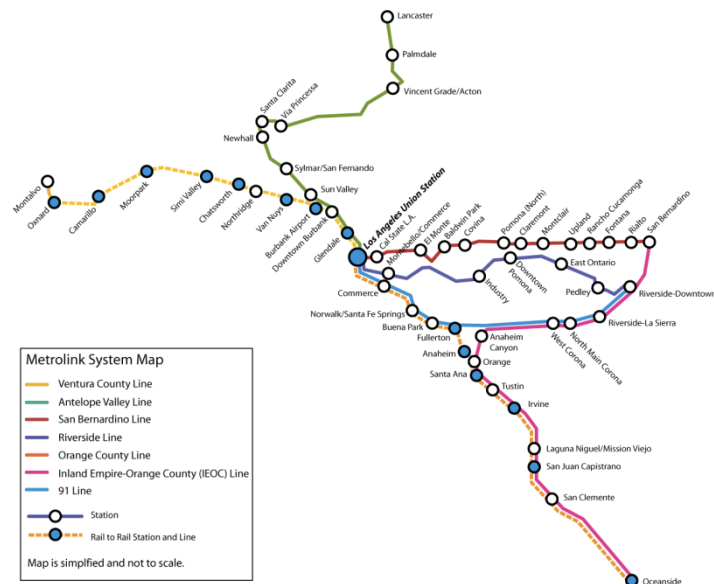
### Overview

Weekday Ridership	42,265
Weekday Trains	169
Number of Stations	55
Number of Lines	7
Total Route Length (miles)	512

Between 1988 and 1990, residents of Riverside County, San Bernardino County, Los Angeles County, and Orange County approved half-cent sales tax measures to finance rail improvements in Southern California. In 1990, California

residents voted in favor of State Propositions 108, 111, and 116 that authorized the sale of nearly \$3 billion in general obligations bonds designated for rail, including commuter rail services (48). In 1990, the Los Angeles County Transportation Commission, the San Bernardino Associated Governments, and Ventura County Transportation Commission purchased 173 miles of rail ROW from the Southern Pacific Railroad for \$450 million. A separate \$17 million agreement was entered into with UP in 1991 for the purchase of four miles of UP ROW and the right to operate on UP's track from Los Angeles to Riverside. In addition, the agreement required \$33 million for ROW for a second track and the construction of a number of rail sidings. Finally, after lengthy and difficult negotiations, the three county agencies purchased 336 miles of track from the Atchison, Topeka, and Santa Fe Railway and reached a \$500 million operating agreement in 1992. In addition, the agreement required \$80 million in capacity improvements (48).

In 1991, the Southern California Regional Rail Authority (SCRRA) was formed to govern the commuter rail agency. The SCRRA is a joint powers authority that is composed of the following member agencies: Los Angeles County Metropolitan Transportation Authority (Metro), Orange County Transportation Authority (OCTA), Riverside County Transportation Commission (RCTC), San Bernardino Associated Governments (SANBAG), and Ventura County Transportation Commission (VCTC). The SCRRA created the brand Metrolink and started revenue service in 1992 (48). Over the following decade, commuter rail service expanded, and in 2002, the seventh and most recent line opened. Currently, the agency owns 52 engines and leases three more. Some of the expansion was undertaken by the purchase of additional tracks, while



**Figure 8. Map of Metrolink System.**

other routes rely on agreements with the freight railroads to use their track. Although the SCRRA includes five counties, more than half of the system is in Los Angeles and Orange Counties.

### *Stakeholders Involved*

Public agencies:

- SCRRA.
- Amtrak.
- Metro.
- OCTA.
- RCTC.
- SANBAG.
- VCTC.

Freight companies:

- BNSF.
- UP.

### *Nature of Agreement*

Metrolink owns nearly two-thirds of its routes and charges the freight railroads a fee for the use of their track. Similarly, the freight railroads charge Metrolink for the use of their tracks. The track owner is responsible for dispatching on their track.

Metrolink's agreements with UP and BNSF are long-term, and they specify the terms for service expansion. The agreements state that growth in service is conditional upon capacity improvements. The capacity improvements are the responsibility of the party that wants to expand service and therefore requires additional capacity. If freight volume exceeds a prespecified level, the freight railroad will fund capacity improvements, while the SCRRA is responsible for the capacity improvements needed to run additional commuter trains. For example, the new Perris Valley Line began construction in 2013. The new route is along track that has been owned by the Riverside Transportation Commission for some time. The route, however, connects to Union Station, which requires travel along one of the segments that Metrolink currently shares with BNSF. The addition of this route represents an increase in the number of trains that Metrolink will run along that BNSF segment, which requires the SCRRA to pay for needed capacity improvements. Track usage fees are currently calculated on a train-mile basis using an Association of American Railroads cost index.

Metrolink also has an agreement with Amtrak called the Rail2Rail program, which allows holders of monthly passes to ride Amtrak's Surfliner trains within Metrolink's Orange and Ventura County corridors. The agreement also allows some Amtrak ticket holders to use Metrolink.

### *Concerns Raised*

Metrolink has had significant issues with on-time performance on tracks that are owned and dispatched by the freight railroads. Metrolink attributes this to inexperienced dispatchers being employed during the evening peak hours, and the sharing agreement with the railroads not specifying any penalties for poor on-time performance. Metrolink is always concerned about schedule reliability and the ability of the freight railroads to accommodate their trains and schedules.

Metrolink has in the past advocated to change the method for calculating maintenance expenses. Metrolink argued that ton-miles rather than train-miles would yield a more representative apportionment of maintenance expenses imposed by freight trains since the typical freight train causes far more wear and tear to the tracks than commuter trains. BNSF conceded that ton-miles would be a more accurate measure for track maintenance costs, but pointed out that certain expenses, such as signaling, still depended primarily on train-miles. Currently, train-miles are used in the maintenance expense calculation.

### *Realized Benefits*

For its 20th anniversary, Metrolink reported various metrics to illustrate the benefits of the commuter rail service. Metrolink estimated that, on a typical weekday:

- 87 percent of riders would otherwise drive/carpooled.
- Up to 22 percent of car trips are removed from parallel freeways during the peak period (49).
- 94,140 fewer metric tons of CO<sub>2</sub> are emitted into the atmosphere.
- 18,000 vehicles are removed from the roads (48).

The agency also estimates that "...Metrolink trains provide the same capacity as adding two new freeway lanes on adjacent freeways during peak commute times" (48). This amounts to roughly \$4 billion of highway construction that would otherwise have been required (50).

The SCRRA's report also notes various ancillary benefits that Metrolink has provided, including installing electric vehicle (EV) charging units at its stations, which reduce the emissions from park-and-ride commuters and generally help to promote EVs in the community (48).

### *Political/Social Context*

Los Angeles is historically known for relying heavily on automobile usage. While there was a fairly comprehensive public transportation system in place in the 1920s, this was quickly replaced as personal automobiles became popular. Many were skeptical that Metrolink would be worth the investment, as they did not believe that enough people would be willing to give up their cars on their daily commutes.



Despite this skepticism, many in Southern California have shown a willingness to use commuter rail services, but now there is much less funding available; the state is facing a budget shortfall. The situation for the freight railroads has also changed. In the early 1990s, the freight railroads were underutilized, and the companies were looking for ways to sell off segments of their ROW with excess capacity. The situation has changed dramatically since then with rail freight volumes surging. The freight railroads have become very hesitant to sell any capacity and will only entertain commuter rail service if the commuter rail agency makes significant capacity investments. This change in climate makes expanding Metrolink through shared use of ROW difficult. Any agreement with the freight railroads must fit into the railroads' corporate priorities and business models, or there will be little progress in the negotiations.

### *Lessons Learned*

Metrolink was in a position to negotiate permanent shared-use agreements in the 1990s, which reduces uncertainty introduced by the need for renegotiating agreements at certain time intervals. The agreements also include a process for service expansion. Although there have been concerns about on-time performance in the past due to poorly defined/incentivized dispatching responsibilities, it seems that these have been largely resolved with currently reported on-time performance exceeding 93 percent (48). Overall, Metrolink has been very successful and proves that commuter rail sharing is an effective transportation solution even in large metropolitan areas with high levels of personal vehicle dependence.

Finally, Metrolink noted their relationship with the freight railroads is cordial, neutral, and business-like. The agency and the freight railroads work well together on initiatives such as the implementation of PTC, but tension can exist when working to ensure on-time performance of both freight and commuter rail service.



## Sounder Commuter Rail (Seattle)

### Overview

Weekday Ridership	11,702
Weekday Trains	28
Number of Stations	9 (3 under construction)
Number of Lines	2
Total Route Length (km)	132

Source: <sup>20</sup>

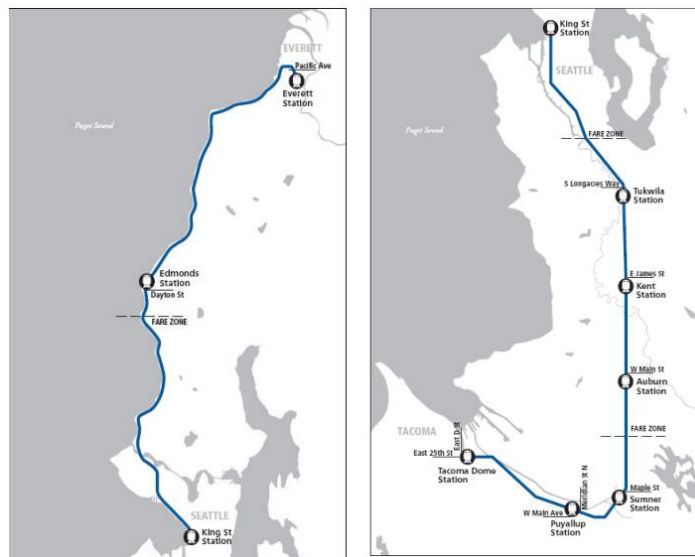
The Puget Sound Council of Governments put forth several high-profile bonds in the late 1960s and early 1970s to fund a rail transit system. These measures failed to receive the 60 percent support required, but there was enough support to conduct feasibility studies, which eventually led to a detailed evaluation of transit in the 1980s.<sup>21</sup> The Regional Transit Authority, which would later be renamed Sound Transit, was created in 1993.

In 1996, voters approved a large bond, as well as provisions for Sound Transit to receive funding for commuter rail from an increase in the

motor vehicle excise and local sales taxes. In 1997, negotiations began with the BNSF Railroad to operate the commuter rail service along its tracks. Sound Transit and BNSF reached an agreement in April 2000 for 18 trips per day between Tacoma and Seattle with an option for additional midday trips. Revenue service began in September of that year. In 1998, discussions began to operate commuter rail on BNSF track between Seattle and Everett. The agreement concluded in December 2003 after a year of intensive negotiations.<sup>20</sup>

### Stakeholders Involved

Public agencies:



*Northern route between Seattle and Everett on left; southern route between Seattle and Tacoma on right.*

**Figure 9. Map of Sounder Commuter Rail.**

<sup>20</sup> Information obtained from an interview with Sound Transit in Seattle, Washington, 2014.

<sup>21</sup> Information obtained from an interview with Sound Transit in Seattle, Washington, 2007.

- Sound Transit.
- King County.
- Pierce County.
- Snohomish County.

Freight companies:

- BNSF.
- UP.<sup>22</sup>

### *Nature of Agreement*

During negotiations, Sound Transit and BNSF agreed on access for commuter rail on specific segments of the rail corridor, as well as the prerequisite improvements (project by project) for access to be granted along a segment. Therefore, ROW access for commuter trains on the freight track segments became tied to specific capital improvements, including double tracking, turnouts, and control systems. In other words, upon completion of the agreed capital improvement funded by Sound Transit, the commuter agency obtains the right to operate its commuter service on the improved segment of the ROW. The freight railroad is ensured that adequate capacity exists to accommodate both the commuter and freight services in a manner that would not compromise the on-time performance of the freight trains. Negotiations proceeded relatively quickly on the Tacoma-Seattle corridor, with commuter rail service beginning less than three years after negotiations began in 1997. Negotiations on the Everett-to-Seattle corridor began in 1998, but got contentious in 2001. Negotiations resumed after political intervention and an agreement was signed in December 2003. The cost of the capital improvements on the southern route totaled \$350 million. For the northern route, Sound Transit made a perpetual easement payment of \$258 million (phased over four years) to BNSF.

Several amendments have been made to the original agreement for commuter rail service on the Seattle-to-Tacoma corridor. The first amendment in 2003 allowed Sound Transit to structure its payments to BNSF based on well-defined level of service criteria. The second in 2007 added terms for positive train control so that Sound Transit would meet FRA regulations. The third amendment in 2010 allowed for four additional perpetual easements so that Sound Transit could increase the number of trains it runs. Currently, a fourth amendment is under negotiation, which will cover BNSF's obligations in terms of an 8-mile service extension. These amendments have built on one another; each addresses the next logical step in the relationship between BNSF and Sound Transit.

On the Seattle-to-Tacoma corridor, BNSF owns and maintains the track, and also operates and dispatches the commuter trains. In terms of the agreement, Sound Transit has the right to use the BNSF track for 40 years, during which time BNSF will operate the commuter trains. Sound

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<sup>22</sup> BNSF dispatches on 6.2 miles of UP track that crosses the BNSF Mainline on the Seattle-to-Tacoma corridor.

Transit only has a perpetual easement for four trips. On the Seattle-to-Everett corridor, BNSF owns and maintains the track. Sound Transit has the right to operate four round trips on this corridor in perpetuity. BNSF has been operating the commuter trains and will do so until 2015, when a three-year extension option takes effect.

### *Concerns Raised*

Sound Transit came to the bargaining table at a disadvantage because negotiations only began after the public had approved funding for the commuter rail service. BNSF therefore knew exactly the amount of funding approved for the commuter rail service. Additionally, the public's expectation that commuter rail service will continue and be expanded means that, when the agreement has to be renewed, Sound Transit will continue to be at a disadvantage. Agreements for shared use in perpetuity can avoid this problem, but they come at a premium because freight railroads are wary of the risks that such agreements can expose them to.

The success of a commuter rail service depends upon on-time performance, which requires the commuter trains to have priority during certain time windows. Sound Transit provides incentives to ensure on-time performance. On-time performance is measured monthly and determines BNSF's revenue and profit from operating the commuter rail service. For example, Sound Transit pays BNSF \$7.05 per train-mile for that month if 100 percent on-time performance is achieved. The rate per train-mile reduces as on-time performance decreases. As a result, on-time performance routinely exceeds 95 percent.

BNSF's primary concern was that it would not have any diminished capacity. The freight railroads also understand risk and will want to minimize that risk. Finally, railroads want to be compensated for costs incurred, both capital costs and operating costs. Sound Transit contracted with national experts that modeled the capacity improvements needed on the corridor. The experts worked with BNSF to determine the exact improvements that would allow Sound Transit trains to run without diminishing BNSF's service.

### *Realized Benefits*

Sound Transit estimates that, along with its rapid bus service and the Link Light Rail, the Sounder will help remove 339 million vehicle-miles from area roadways by 2030. This represents 40 million hours of time saved for commuters.<sup>23</sup> By BNSF's estimate, Sounder alone is responsible for removing a full freeway lane of traffic from the regional system.

Sounder Commuter Rail is projected to accrue a 23 percent fare box recovery rate.<sup>24</sup>

### *Political/Social Context*

Interested stakeholders came together to contribute and discuss their goals for, views of, and interests in the region, which aided the initial agreements between the new-start transit agency

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<sup>23</sup> Information obtained from an interview with Sound Transit in Seattle, Washington, 2007.

<sup>24</sup> Information obtained from an interview with Sound Transit in Seattle, Washington, 2014.

and the freight operators on the congested rail corridor. The 1995 roundtable meeting, which was attended by approximately 25 people representing the Washington Department of Transportation, the Port of Seattle, the freight railroads, and commuter rail, facilitated a relationship among the regional stakeholders and initiated a dialogue that benefited the eventual negotiations. The participants agreed on regional mobility objectives and recognized the key contribution of freight movements to the economic vitality of the region. The meeting helped conceptualize a guiding plan for the region and ensured that freight growth would not be compromised. This stakeholder meeting helped to lay the groundwork for the cooperative agreements between Sound Transit and the freight railroads. There was substantial political support for the project. Specifically, the support of Senator Patty Murray helped to get BNSF back to the table to negotiate with Sounder on the Seattle-to-Everett Corridor when negotiations got difficult in 2001.

### *Lessons Learned*

The mechanics of the freight corridor and the impact that commuter service would have on freight movements were well understood. Sound Transit also used the same legal counsel as the freight railroads and had a very experienced lead negotiator. Furthermore, Sounder was able to obtain federal funding for components of the project that were eligible (stations, for example). Sounder also pointed out that contract clauses, specifically the price adjustment clause, need to be reviewed carefully as minor price adjustments can add up greatly over time.

To create an effective partnership between organizations with different objectives, it is critical to ensure open dialogue and to establish an open relationship between the parties. The open dialogue created through frequent and regular contact between Sound Transit and BNSF resulted in a trusting relationship. Additionally, Sound Transit ensured that the turnaround for BNSF's invoices on the Seattle-to-Tacoma corridor was remarkably short, often about three days. This helped maintain a good-faith relationship. Finally, freight railroads are concerned and aware of their public image and will want to project a positive image to the public. They are also sensitive to environmental issues and possible environmental exposure to Brownfield sites, and the responsibility for clean-up needs to be discussed up front.

Sounder noted a positive, respectful, and professional working relationship with BNSF that has been on-going for 15 years. This has been aided by the fact that BNSF has two staff members with offices at Sounder.

## Virginia Railway Express

### Overview

Weekday Ridership	19,000
Weekday Trains	30
Number of Stations	18
Number of Lines	2
Total Route Length (km)	145

Source: (51)

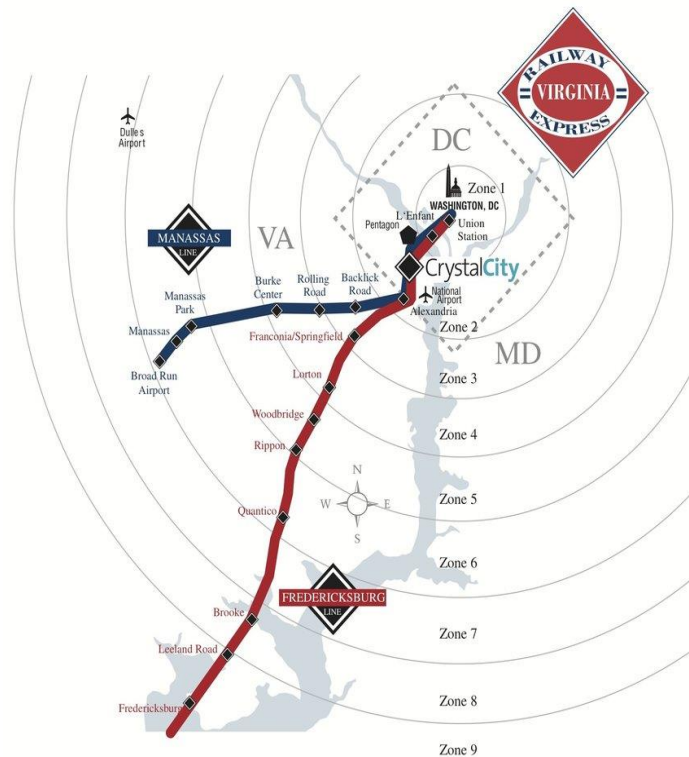
The Northern Virginia Transportation Commission was created in 1964, and the Potomac and Rappahannock Transportation Commission was created in 1986 for the purpose of establishing commuter rail service between northern Virginia and Washington, D.C. A 2 percent motor fuels tax was used to fund the commissions' joint endeavors, and the Virginia Railway Express Operations Board was established in 1988. A formula was agreed upon whereby the various jurisdictions involved with either of the two commissions (five counties and four cities in total) would support the commuter rail service based on population and ridership numbers. Since its founding, several additional cities have either joined the commissions or agreed to contribute based on the formula without formally joining (52).

### Stakeholders Involved

Public agencies:

- VRE.
- Northern Virginia Transportation Commission.
- Potomac and Rappahannock Transportation Commission.
- Amtrak.

## Virginia Railway Express Map



*The two routes connect northern Virginia with the District of Columbia.*  
**Figure 10. Map of Virginia Railway Express.**

Freight companies:

- Norfolk Southern.
- CSX.

### *Nature of Agreement*

VRE entered into shared track agreements with the freight railroads in 1992 that allow VRE to use the freight tracks in exchange for capacity improvements. Initially, VRE also entered into an agreement with Amtrak to operate the commuter rail service, but the agency decided to contract with the French company Keolis when the contract expired in 2010. VRE still maintains a strong working relationship with Amtrak, who provides help with locomotive maintenance. Dispatching along the routes is under the purview of the track owner, the freight companies for most of the routes, and Amtrak on the approach to Union Station in Washington. VRE has negotiated operating windows in which the freight railroads give priority to commuter rail except for a few urgent freight trains. VRE pays the freight railroads an annual access fee to use the freight railroad track. The funding comes primarily from the state (Commonwealth of Virginia) and from the Surface Transportation Program.

The original shared track agreements with the freight railroads included an agreed upon process to identify and fund capital investments. This process currently consists of a task force composed of the senior management from VRE, the Virginia DOT, and the freight railroads, which identifies bottlenecks in the network, identifies capital improvements, and decides how capital improvement costs will be apportioned based on the amount that each entity benefits. To identify the bottlenecks, the task force starts with collaboratively created simulations. Agreement on the capital investments required and how the cost is shared is critical to the success of the partnership and the expansion of commuter rail service.

Currently, work expanding the freight corridors is under-way in a three-phase, \$2.68 billion plan that extends until 2040. This plan, which is currently in the first phase, will allow additional capacity for both the freight companies, and for the VRE. In particular, the plan addresses system bottlenecks such as the Long Bridge over the Potomac River (53). The three phases include the following improvements:

- Phase 1 (\$285 million).
  - Add over 4,000 parking space for the park-and-rides.
  - Extend platforms to allow for longer trains.
  - Third track along CSX RF&P line.
  - Station and rail yard upgrades.
- Phase 2 (\$1,750 million).
  - Extension to Haymarket.
  - Begin third track along additional CSX lines.
  - Replace Long Bridge.

- Acquire additional cars and locomotives.
- Additional Parking, rail yard, platform, and station improvements.
- Phase 3 (\$690 million).
  - Finish third track along CSX lines.
  - Acquire additional cars and locomotives.
  - Additional parking, rail yard, platform, and station improvements.

The plan will allow weekday ridership, which currently averages 19,000 commuters but regularly spikes above 20,000 commuters, to more than double to 43,000 commuters. Additionally, a small amount of weekend service will be introduced. VRE and its local jurisdictions will be responsible for roughly \$1.19 billion of the plan, with the remainder coming from the freight railroads or the federal government (54).

VRE has a Cross Honor Agreement with MARC, a commuter rail service that operates in the Baltimore-Washington area. This allows fares to transfer between services, providing more-complete coverage to riders without the agencies having to duplicate each other's routes. VRE has an agreement in place with Amtrak as well. VRE purchases seats on specific Amtrak trains for \$10 per seat. VRE riders with valid multi-day passes can then purchase these seats for \$3 (of the remaining \$7 comes, \$5 comes from the Commonwealth of Virginia as a subsidy, and \$2 is a temporary subsidy during expressway construction). Since VRE operates at capacity, this arrangement provides riders a few more seats, and it provides more flexibility as Amtrak operates outside of VRE's peak times.

### *Concerns Raised*

When the service began, there were issues with on-time performance. In particular, along the CSX tracks, train dispatchers were located in Jacksonville, Florida (CSX's headquarters), and the dispatchers did not have enough familiarity with the northern Virginia area to keep all of the traffic moving efficiently. After many requests, dispatching moved from Jacksonville to Baltimore in 2008 so that dispatchers more familiar with the area would handle the system (52). On-time performance did significantly improve after the switch, but it is difficult to say whether the improvement was due to the change in dispatching, as there were also several capacity improvements that occurred at the same time. On-time performance is currently consistently around 96 percent. The agreements in place with the freight companies do not include on-time incentives or penalties, although Keolis does receive a bonus when on-time performance surpasses 90 percent.

As mentioned previously, VRE operates at capacity. A major challenge is to get the agency's needs for commuter rail services met in the time windows allocated by the freight railroads. Even more difficult will be to add trains that need to operate outside of those time windows and to get the freight railroads to assign priority to those commuter trains. These discussions have only recently been initiated.



### *Realized Benefits*

According to the 2014 VRE System Plan Summary, the system "...today provides critical capacity (the equivalent of 150 lane miles of highway) in the I-95/395 and I-66 corridors, with less pollution, energy consumption, and accident cost from highway operation." According to VRE analysis various service expansions, investments in the commuter rail system, on a unit per-mile basis, has provided double the peak-hour capacity increase at almost a fourth of the cost (53).

### *Political/Social Context*

After New York City and the San Francisco Bay Area, Washington, D.C., has the highest public transportation mode share in the country. This acceptance of transit has perhaps assisted the VRE to become as successful as it is.

Finding a way to put the multitude of municipal and county governments involved delayed implementation of the service by over a quarter of a century, with the creation of a second transportation commission necessary to incorporate some of the entities. Despite this, the service was able to get started before most other commuter rail systems in the country, and it now provides an important link in the capital's transportation network.

### *Lessons Learned*

VRE shows that a system can be established relatively quickly once all of the stakeholders demonstrate a willingness to proceed. It is also very important to recognize that moving freight is the freight railroads' primary concern. Planning for capacity improvements can help the commuter rail system and the freight industry alike, and it might be more beneficial in the long run than mere usage fees. Maintaining a good relationship with the freight companies over 20 years has helped; VRE believes that, if a similar commuter rail service was initiated today, it would be far more challenging to come to an agreement with the freight railroads than it was in 1992. VRE stated that maintaining daily communication and demonstrating a commitment to safety and efficiency in the corridor have helped establish its strong working relationship with the freight railroads at all levels.



## **Salt Lake City Gateway Project Rail Consolidation and Urban Redevelopment**

### *Project Description*

This project in Salt Lake City, Utah, redeveloped a blighted urban area near a UP yard near 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 derived from the redevelopment aspects. This project shows the potential for reconfiguring rail lines within an urban area after a merger or abandonment. State, local, or private purchase of rail corridors and continued freight service were the result.

### *Rationale for Consolidation*

Salt Lake City's Gateway District consists of about 650 acres of land on the west side of downtown, extending a few blocks west of Main Street to I-15. For the past century, this area served as the center of freight- and passenger-rail service to the city, with rail yards operating among maintenance facilities, heavy industry, salvage yards, and warehouses. Over time, the Gateway District became an area of urban blight. 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 the 1970s, when city leaders first envisioned the Gateway District as a focal point for travelers entering the city, a regional transit destination with intermodal connections. It was to be a pedestrian-oriented, mixed-land-use community, where residents could work, live, learn, and relax in close proximity to downtown. Events in the rail industry were important catalysts in transforming the Gateway District into a thriving urban center. However, many other events also played a role in facilitating the project, including:

- Changes in city zoning ordinances restricting commercial development on the east side of the central business district.
- Upcoming reconstruction of I-15 adjacent to the Gateway District.
- The opportunity to consolidate rail lines following UP's purchase of the Southern Pacific Railroad.
- The selection of the site as an Environmental Protection Agency Regional Brownfields Pilot Project.
- Salt Lake City's selection as host of the 2002 Winter Olympics.

The project consolidated three rail lines into a single corridor and eliminated redundant rail yards, opening additional land in the Gateway District for urban redevelopment.

### *Project Benefits*

In addition to financing rail consolidation in the Gateway District, public and private entities invested considerable dollars in new development and supporting infrastructure, as shown in Table 4. The revitalization efforts resulted in the redevelopment of two rail depots (see Figure 11) connected via pedestrian-oriented corridors. The UP depot was integrated into the Gateway District's light rail network, with plans for regional commuter-rail service to operate out of the new intermodal station constructed on the site of eliminated rail spur tracks.

**Table 4. Financing Sources for Redevelopment of the Gateway District.**

<b>Funding Source</b>	<b>Purpose</b>	<b>Amount (\$ Million)</b>
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
USDOT (TEA-21 funds)	Intermodal transit hub	\$45
Economic Development Administration	Rail yard conversion to green space	\$1.25

One measure of financial benefits created through redevelopment of the Gateway District is *tax increment revenue* (i.e., the net increase in property tax derived from revitalization of the area). The city treasurer estimated tax increment revenue from the Gateway District at approximately \$2 million per year, with additional incremental sales tax revenue also being generated.



**Figure 11. Redeveloped Rail Depots.**

### *Lessons Learned*

The Salt Lake City railroad relocation project shows that urban redevelopment can serve as the main public benefit behind a rail consolidation project. Private-sector development was the driving force behind this project and its relatively short time frame. Motivators for quick actions regarding rail consolidation included:

- The railroad company's ability to sell its excess properties in the urban area for redevelopment.
- The desire of real-estate developers to build retail and housing projects.
- The reconstruction plans of I-15 adjacent to the Gateway District.
- The economic benefits of improving the area prior to the Olympic Games.

Had these factors not been in place, the project would likely have taken much longer.

### *For More Information*

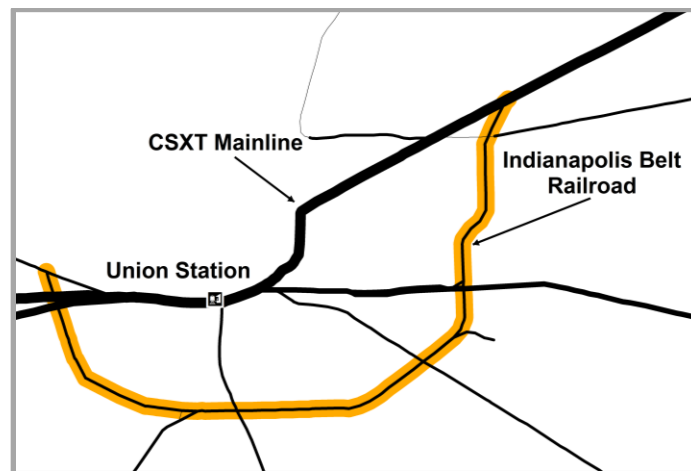
Texas Transportation Institute, *Rail Relocation Projects in the U.S.: Case Studies and Lessons for Texas Rail Planning*, TxDOT Research Project Report 0-5322-1, College Station, Texas, March 2007. Available: <http://tti.tamu.edu/documents/0-5322-1.pdf>.

## Indianapolis Freight Rail Relocation

### *Project Description*

The relocation of freight rail mainline movements from the east-west route running through downtown Indianapolis to the southern belt bypass improves safety and security along the route. The relocated mainline passes in close proximity to many downtown businesses, the convention center, and sports arenas, and allows the old corridor to be used for other purposes (see Figure 12). A 2004 feasibility study found the option to be viable, with the potential of an Environmental Impact Statement to further explore the option based on present conditions.

The project calls for the reconstruction of the Indianapolis Belt Railroad (IBR) main track, construction of a new second main track, new track connections with the current east-west CSX mainline and other intersecting lines, new signal systems, and grade separation of all major roadways along the route. Upgrading the IBR to 40 mph operations essentially maintains the current running time for through CSX freight trains despite the added 10 miles of travel distance.



**Figure 12. Map of Project Rail Lines.**

### *Project Benefits*

Previously documented benefits of relocating the freight rail movements to the IBR include safety, security, and mobility. Additionally, freight rail operations would not be compromised due to the diversion to a longer route. Improved connections from the IBR and multi-track operations may enhance operations to customers in the Indianapolis area and provide a relatively equal running time through Indianapolis. The following benefits were identified in the *Downtown Indianapolis Railroad Relocation Feasibility Study* (55).

#### ***Safety***

Current through freight rail movement in downtown Indianapolis passes immediately adjacent to businesses, offices, the Indiana Convention Center, Lucas Oil Stadium, and Bankers Life Fieldhouse. Relocating these movements to the bypass route reduces the exposure to hazardous

material release or other rail incidents. Additionally, all significant at-grade highway-rail crossings along the project route would be separated or closed resulting in an 86 percent reduction in grade crossing accident exposure.

### ***Mobility***

Train-related delays at highway-rail grade crossings result in more than 84,000 person-hours of delay annually based on the 2003 analysis period. The value of time associated with this delay equates to \$681,000.

### ***Emissions***

The separation or closure of highway-rail grade crossings also improves air quality by reducing vehicle emissions caused by trains. The resulting emission reductions equate to 1.3 million grams VOC, 21.1 million grams CO, and 384,000 grams of NO<sub>x</sub>.

### ***Current Status***

Utilizing the findings from the *Downtown Indianapolis Railroad Relocation Feasibility Study* (55), the Indianapolis Metropolitan Planning Organization (MPO) applied for an FRA grant under the Program for Capital Grants for Rail Line Relocation and Improvement Projects (76 FR58334). In March 2012, they were awarded an FRA grant of \$896,949. In July 2012, the MPO released a Request for Proposals to perform a preliminary engineering/environmental assessment, with a contractor selected to perform the study. FRA later determined that the project calls for an environmental impact statement (EIS), a more thorough environmental assessment. As a result of this ruling, the new scope of work calls for a doubling of the expected study costs. With FRA grant at a set level, the extra funds would have to come from additional local match funds. The status of these funds should be determined in September 2014. Without sufficient local match funds, the EIS could not proceed.

### ***Potential Corridor Uses***

The section of rail line passing through downtown holds the potential for a wide array of potential future uses.

### ***Passenger Rail/Transit***

At one point, regional transit plans included commuter rail lines that would use existing rail corridors to access downtown Indianapolis Union Station. The investigation of the northeast corridor, known as the Green Rapid Transit Line, called for the use of a portion of the CSX corridor to Union Station. Recent events and planning efforts have eliminated Union Station as the downtown transit hub and have designated a downtown transit hub that is located away from the target rail line. This eliminates the need to use Union Station for the Green Rapid Transit Line. The *Downtown Indianapolis Railroad Relocation Feasibility Study* (55) highlights that the corridor could still be preserved in a manner to accommodate other transit rail systems that

require smaller footprints than commuter rail, but the recent decision to locate the transit hub elsewhere in downtown Indianapolis seems to lessen the transit possibilities.

Since Amtrak currently uses Union Station as the Indianapolis station, any option that completely removes rail service along the line creates the need to relocate Amtrak service and develop a new station. The *Downtown Indianapolis Railroad Relocation Feasibility Study* (55) indicates that the development of a new Amtrak station, potentially at the airport, could also be used for high-speed rail, providing connectivity for the airport, Amtrak service, and high speed rail service. The newly developed EIS scope includes the examination of new Amtrak stations, provided that rail service to Union Station is no longer available.

### ***Redevelopment***

Elimination of rail service opens up a significant amount of valuable land and potentially removes a physical barrier to development or redevelopment of areas along the line. Several east side neighborhoods are experiencing positive redevelopment. The elimination of rail operations improves the quality of life within the neighborhoods with the removal of the conflict between trains and vehicles at grade crossings and noise from train horns.

Additionally, elimination of the line provides the opportunity for existing facilities in the downtown area to expand or for the construction of new facilities. The corridor could also be redeveloped as a multipurpose pathway. In May 2013, the 8-mile Cultural Trail opened creating a link between the six Cultural Districts in and around downtown Indianapolis (Figure 13). Additionally, the Monon Rail-Trail extends over 10 miles north from Downtown Indianapolis, providing a multipurpose pathway for recreation and commuter use. The success of these pathway systems could propel the use of the rail corridor for similar development. One interesting aspect of the corridor is the elevated section downtown. Creation of a multipurpose pathway over the elevated section could rival the concept of the New York High Line project that created park space over the elevated High Line currently one mile in length.



Source: <http://indyculturaltrail.org/>

**Figure 13. Map of Cultural Trail in Downtown.**

### *Lessons Learned*

The examination of relocating freight rail operations in Indianapolis from downtown to a belt bypass emphasizes that these major projects require examination over the course of many years and studies, and usually require a wide range of study funding partners and flexibility. With the current study effort, the original concept was to perform a Preliminary Engineering/Environmental Assessment study, but that was revised by an FRA ruling that the study instead be a full Environmental Impact Statement. This increased environmental scrutiny also comes with an increased financial commitment from local stakeholders to perform the study, one that was not originally planned.

Additionally, the benefits for such a major project should be wide-reaching, not depending on one particular benefit. The original concept considered the available downtown track for commuter rail, but with the decision to locate the downtown transit hub along a major transit corridor and away from Union Station virtually eliminates the benefits of commuter rail from the equation. However, it does open up the corridor for other potentially worthwhile options.

### *For More Information*

The following resources provide information related to this project description:

- Indianapolis MPO: <http://www.indympo.org/>.
- Indiana State Rail Plan, November 2011:  
[http://www.in.gov/indot/files/Rail\\_JanFinal\\_Report\\_011712.pdf](http://www.in.gov/indot/files/Rail_JanFinal_Report_011712.pdf).
- FRA Grant Application:  
[http://www.indympo.org/News/Documents/Final\\_Belt\\_FRA\\_appl.pdf](http://www.indympo.org/News/Documents/Final_Belt_FRA_appl.pdf).
- *Downtown Indianapolis Railroad Relocation Feasibility Study*, February 10, 2004:  
[http://www.indympo.org/News/Documents/Belt\\_RR\\_Relocation\\_Study.pdf](http://www.indympo.org/News/Documents/Belt_RR_Relocation_Study.pdf).
- Indianapolis Cultural Trail: <http://indyculturaltrail.org/>.
- Monon Rail-Trail:  
<http://www.indy.gov/eGov/City/DPR/Greenways/Pages/Monon%20Trail.aspx>.
- New York High Line: <http://www.thehighline.org/>.

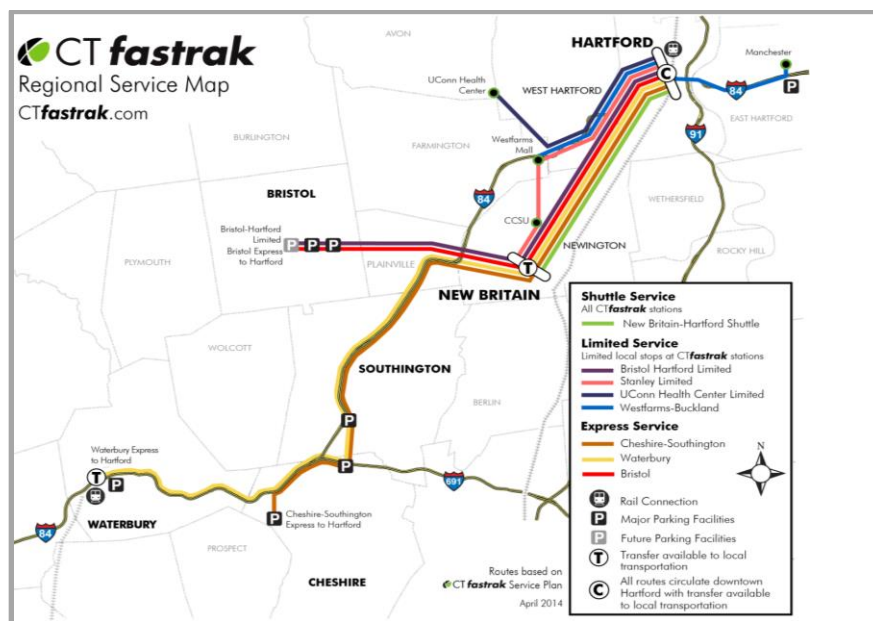


## I-84 Congestion Relief Project on and along Parallel Abandoned/Active Rail Corridors

### *Project Description*

Connecticut DOT (ConnDOT) is constructing a \$570 million, 9.4-mile BRT busway project between New Britain and Hartford paralleling the highly congested I-84 corridor. The ROW being used for the CTfastrak project consists of 4.4 miles of abandoned, state-owned rail ROW and 5 miles of ROW adjacent to an active Amtrak corridor. Figure 14 shows the New Britain to Hartford busway corridor and the transit connections to other local traffic generators and towns beyond the guideway on existing roadways that the use of bus service provides.

BRT was selected after a 1997 major investment study examined several potential options to relieve I-84 congestion through central Connecticut. These options included highway widening, high occupancy vehicle lanes, commuter rail, and light rail service. The selection of BRT service in the abandoned ROW and along the active rail corridors allowed ConnDOT to avoid the costs of widening the I-84 corridor, which were estimated to be well over \$1 billion in the highly urbanized area. More than 80 percent of the cost of the CTfastrak system (\$455 million) is being funded by FTA through both new starts funding and a discretionary grant.



**Figure 14. Map of CTfastrak and Connections.**

The CTfastrak project calls for the construction of a 32-foot wide, two-lane busway in the abandoned rail corridor segment. At the northern end, along the active Amtrak line, the busway is being constructed over an existing dirt service road along and adjacent to the tracks, which will be replaced by ConnDOT through construction of a one-lane service road for Amtrak's use on the opposite side of the tracks. A 45-inch high concrete barrier topped with fencing is also being built to separate the busway ROW from the active rail line where Amtrak trains travel up

to 95 mph. In addition, several major roadway grade separation structures along the corridor are required to fully separate the busway from crossing roadway traffic. CTfastrak will use a fleet of low-emission, hybrid diesel-electric buses of varying lengths equipped with Wi-Fi to provide service along the corridor.

### *Project Benefits*

#### ***Mobility***

The CTfastrak guideway and its connecting services are expected to carry up to 16,000 riders per day by 2030, decrease fuel usage caused by congestion in the area on I-84, provide connections to local and intercity rail service, and reduce vehicle miles traveled by local commuters by over 17 million miles per year. CTfastrak use in the 9.4-mile busway corridor is expected to reduce direct travel time between New Britain and Hartford from more than 45 minutes to about 20 minutes. The following are all expected to improve commute times for regional travelers: use of the guideway (or segments of the guideway) by other existing express buses; newly added circulator bus routes that will provide direct one-seat (non-transfer) service to and from major employers, universities, malls, and other traffic generators nearby and along the corridor; and reconfiguration of the existing transit system to interconnect with the new stations. In addition, a 5-mile long multi-use trail will be constructed along the southern end of the corridor allowing for new bicycle and pedestrian options in the area, as shown in Figure 15.



**Figure 15. Rendering of CTfastrak with Multi-use Trail.**

#### ***Economic Development***

Stimulation of economic development opportunities around the 10 new station locations along the corridor is anticipated. Based upon the experience of other BRT systems in the United States, this could come in the form of transit-oriented development and businesses providing services to CTfastrak riders and the major employment areas served.

#### ***Current Status***

Construction for the CTfastrak busway is well underway with completion and beginning of passenger service expected in early 2015. Construction of stations and roadway overpasses along

the corridor are in various stages. Figure 16 shows construction progress as of late November 2013 under Broad Street in downtown Hartford.



(Source: CTfastrak)

**Figure 16. Construction of the CTfastrak Guideway under Broad Street in Hartford.**

### *Lessons Learned*

Abandoned and active rail ROWs in parallel with existing highways should be examined as one of the possible means to address congestion and improve mobility in travel corridors with existing roadways approaching capacity. In this case, an existing, state-owned abandoned corridor was in the urban area as well as an existing Amtrak-owned corridor. Solutions to potential barriers to implementation of the project, such as operating adjacent to an active rail corridor and replacing the existing service road for the rail line were able to be overcome through negotiation between the parties. Engineering solutions to grade separating the facility for its entire length provide for better traffic flow in addition to allowing busway construction.

Overall, this case study illustrates how creative use of rail ROW solutions can address a variety of transportation issues. While BRT was eventually chosen in this case due to several traffic generators (e.g., universities, hospitals, malls, and major employers) being dispersed along the busway, but not directly on the abandoned/existing ROW, commuter rail, or light rail service might be selected in another corridor if transportation needs/traffic generators are more fixed and linear along the existing/planned ROW. Alternatively, a new limited-access highway or tollway might be constructed in an abandoned rail corridor (if conditions warrant) rather than a rail/BRT fixed-guideway type solution. Locating roadways and/or recreational trails along active freight lines is less likely due to safety and liability concerns but might be negotiated through proper planning and/or land swaps as exemplified by the maintenance/service road in this case. In all circumstances, safety and security measures must be implemented to remove or eliminate potential for accidents or interference with existing rail business operations.

### *For More Information*

The following resources provide information related to this project description:

- CTfastrak Homepage and Links: <http://www.ctfastrak.com/>.
- CTfastrak Project Video Animation: <http://www.ctfastrak.com/visuals/animated-tour>.
- CTfastrak Overview:  
[http://www.ctfastrak.com/files/2014\\_February\\_CTfastrak\\_Project\\_Overview.pdf](http://www.ctfastrak.com/files/2014_February_CTfastrak_Project_Overview.pdf).
- ASCE Civil Engineering Magazine feature story:  
<http://www.asce.org/CEMagazine/Article.aspx?id=25769808656#.U9pLAE10zX7>.

## **Lafayette Railroad Relocation Project**

### *Project Description*

Between 1974 and 2003, the Lafayette Railroad Relocation Project consolidated four railroad tracks through downtown Lafayette, Indiana, into a single, grade-separated, triple-tracked rail corridor. Rail operations along two urban streets were relocated to a route along the Wabash River, and a historic rail station was relocated and restored to improve Amtrak service. Overall, the project removed 42 at-grade crossings in the city, facilitating improved mobility for automobiles and trains. The project was completed in several major phases and included:

- Construction of several new highway bridges/grade separations.
- Movement and restoration of the historic rail depot.
- ROW swaps between the city and the railroads.
- Construction of access roads to serve existing rail maintenance facilities.
- Movement of rail operations into the new consolidated corridor.

### *Parties Involved*

The City of Lafayette created a railroad relocation office to coordinate project activities and provide overall leadership. Others involved were the two Class I railroad companies (NS and CSX Transportation and their predecessors) the Indiana DOT, Federal Highway Administration (FHWA), and other federal funding/oversight agencies.

### *Concerns/Issues Raised*

The project's primary goals were to improve traffic safety and reduce rail-related congestion by removing rail operations in and along city streets. Other benefits are discussed below.

### *Implementation Timeline*

Full implementation of the project took over 29 years from project designation to completion. Several studies of different railroad relocation alternatives had occurred prior to the project becoming eligible for federal funding. Rail lines operated in or adjacent to Lafayette's streets as

early as the 1850s. Efforts by the city to relocate them elsewhere began as early as 1926. Modern efforts to relocate the railroads began with a study in 1969. Though Lafayette was not originally included in the 1973 Federal Aid to Highways Act Railroad-Highway Crossings Demonstration Program, an amendment to the original act added the project to the program in 1974. The city established its railroad relocation project office in August 1975 to oversee the project until its completion in August 2003.

### *Project Funding*

The total cost of the project was over \$185 million. Four major federal transportation funding allocation bills specifically directed funds to this project. An additional \$29 million in federal discretionary funds were contributed by the State of Indiana under these bills for a total of \$140 million. This amount ultimately provided 76 percent of the project funding (see Table 5). Another 7 percent of project costs (\$13 million) were covered by federal funds not specifically allocated to the rail relocation project.

### **Funding Sources**

**\$185M**—total cost

**\$153M**—federal contribution, which includes

**\$29M**—Indiana’s contribution of *federal discretionary funds*

**83%**—federal funds

**4%**—state funds (*non-federal only*)

**13%**—local funds

State funds accounted for only 4 percent of the total project funding, and local funds accounted for 13 percent. State-level decisions directing discretionary funds are included in the federal percentage, but if these state-allocated federal funds were considered in the “state funding percentage,” the state’s contribution would grow to approximately 19 percent of the total project costs.

**Table 5. Funding for Lafayette Railroad Relocation Project.**

<b>Federal Transportation Bill Allocations for Lafayette Railroad Relocation Project/Federal Funding Source</b>	<b>Amount</b>
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

### *Project Phasing*

During the mid-1980s, the decision was made to fund the project in segments. Federal and state legislators communicated to Lafayette’s mayor that funding the project in independent, usable segments represented a more conservative approach, rather than attempting to secure the needed



\$70–80 million in a single request. This decision extended the project completion date by approximately 12 years and more than doubled the total cost. However, the strategy was ultimately viewed by the city as a successful policy because it helped gain the necessary federal support to complete all of the planned project phases.

### *Railroad Involvement*

The railroads' participation consisted mainly of exchanging their ROW in the existing rail corridors for ROW and rail infrastructure previously built by the project on city-owned lands along the new, consolidated riverfront ROW. As the project entered its final phase in 1999, NS loaned the city approximately \$9.6 million (which otherwise would have been spent on upgrades to the existing corridor) in order to speed up the implementation process. During the term of the project, this loan was repaid by the city using federal funds that had already been allocated, but not yet appropriated, in TEA-21 (enacted in 1998). This enabled completion of the project's final phase four years ahead of schedule.

*Much of the Lafayette Rail Relocation Project's success is owed to leveraging federal demonstration and discretionary funding and—through continued commitment—gaining future federal funding allocations.*

### *Project Benefits*

The City of Lafayette realized the following benefits from the relocation project:

- Increased traffic safety by removing 42 at-grade crossings in the city.
- Consolidated rail traffic through the city into a single corridor.
- Conversion of a highway bridge into a bicycle-pedestrian bridge over Wabash River.
- Construction of several new grade-separated highway bridges.
- Movement and restoration of a historic rail station to serve as a multimodal terminal/event plaza.
- Opening of the downtown area for redevelopment.

### *Lessons Learned*

Much of the Lafayette Rail Relocation Project's success is owed to leveraging federal demonstration and discretionary funding and—through continued commitment—gaining future federal funding allocations. Cooperative state and local funding decisions also aided the project's success. Railroad participation through land swaps and a loan to the city at a critical time allowed the project to move more quickly to completion.

*For More Information*

Texas Transportation Institute, *Rail Relocation Projects in the U.S.: Case Studies and Lessons for Texas Rail Planning*, TxDOT Research Project Report 0-5322-1, College Station, Texas, March 2007. Available: <http://tti.tamu.edu/documents/0-5322-1.pdf>.

## Appendix B—Benefits of Commuter Rail

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Transportation investments, in general, improve the efficiency of the transportation system (measured in terms of reductions in travel time and vehicle operating costs, and increases in reliability and accessibility), enhance safety, reduce emissions, and produce agency cost savings. These direct benefits are typically quantified and compared to the cost of the investment to determine the societal feasibility of a planned transportation investment. Decision makers are, however, also interested in the economic development benefits associated with the improved access associated with a transportation investment. Improved access can bring about significant economic development benefits in the form of employment creation, increased income, property values, and business activity attributable to a saving in transportation costs. When using a traditional benefit-cost analysis (BCA) framework to evaluate the societal benefits of a proposed investment, the inclusion of economic development impacts in the calculations can result in double counting that will skew the results. This results from the fact that a transportation investment that produces cost savings will result in an increase in the demand for transportation. In other words, assuming a more efficient rail link, commuters will divert some of their trips from private automobiles to rail because of the savings in transportation costs—diverted traffic. Some commuters will make more trips, because the transportation cost is reduced—induced traffic. The induced demand benefit is considered a proxy for regional development impacts, because the stimulation of the economy associated with a transportation improvement will be reflected in increased traffic. This appendix details the benefits that accrue from a commuter rail system. It also provides information about calculating the values of those benefits.

### Commuter Rail Benefits

#### *Travel Time*

Generally, congestion relief is a consideration in developing a new commuter rail service.<sup>25</sup> This section discusses how commuter rail can impact travel times and traffic patterns within a transportation network.

Time is typically treated as a commodity and assigned a monetary value in the BCA framework. The primary reason why travel time is assigned a value is because of lost productivity; time spent in traffic is time not spent working or doing activities that bring about utility. Complications, however, arise not only in determining the amounts of time saved or lost, but also because different travelers have different values of time.

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<sup>25</sup> There is still some debate about commuter rail's effectiveness at relieving congestion due to the issue of latent demand, but congestion relief is still normally listed as a motivating factor. The Massachusetts Bay Transportation Authority website ([http://www.mbta.com/about\\_the\\_mbta/news\\_events/?id=10890](http://www.mbta.com/about_the_mbta/news_events/?id=10890)) and *The Telegraph* website (<http://www.nashuatelegraph.com/news/statenewengland/1029204-469/rail-options-generate-interest.html>) provide examples.



### ***Travel Time Effects for Rail Adopters***

For a new commuter rail system, the time saved is relative to the mode that the commuter would have used otherwise. It is assumed that most rail commuters will have similar or faster commutes, because they would have little incentive to make the switch otherwise. For example Metra found that its proposed SouthEast Service commuter rail line would save commuters a total of 5,240 hours on a typical weekday or an average of 17 minutes per rider (56). However, some commuters may switch even if they have faster commutes by their previous mode, because of other considerations such as, cost, comfort, or reliability. The value of any travel time saved for the rail commuters will depend on the type of commuter (e.g., income level) that the service attracts and how productive the commuter rail service allows its users to be (57). Subsequent improvements to an existing commuter rail system will benefit existing users of the service, as well as new adopters. For example, a proposed improvement to Austin's Capital Metrorail commuter rail line would reduce travel time along the route by five minutes and would result in an estimated net benefit of \$34.7 million (19). Similarly, improvements to the Metra system in Chicago as part of CREATE will save an estimated 323 train-hours per day for both freight and passenger trains. This yields a benefit of \$102.4 million per year at a 7 percent discount rate (\$161.6 million at a 3 percent discount rate) for passengers and motorists. The CREATE projects will save Metra commuters and Amtrak passengers 39,540 and 18,900 hours per year, respectively (58).

Reliability is a benefit/impact related to travel time. The reliability of a mode refers to how dependable that mode is. A trip that averages 40 minutes and always takes less than 45 minutes is more reliable, for example, than a trip that averages 30 minutes, but occasionally takes an hour. While the latter mode is faster on average, a commuter with time constraints (e.g., a work shift they cannot be late for) would have to budget more time for that mode than for the more reliable mode. The literature shows a travel reliability value of roughly 17¢ to 26¢ per minute of standard deviation in travel time. Work trips and trips by higher income individuals, however, tend to have a higher value (59).

### ***Travel Time Effects for Road Users***

As commuters divert from automobiles to commuter rail, highways along the corridor have the potential to become less congested so that automobile users that decide to keep driving will also benefit from faster commutes (16). However, if the main arterials were operating at capacity, additional traffic might have spilled-over onto minor roads, so that, when the commuter rail starts, any vehicles removed from the main arterials will merely be replaced by vehicles from the minor roads. The end result could be no congestion reduction along the main arterials. It is possible in this scenario that the vehicles that divert from the minor roads will have some time savings, the rail commuters' time will be unaffected, but the total amount of time saved by all users of the corridor, particularly among drivers, could be significantly reduced (17). This idea of other drivers filling in the space that the commuter rail system creates on the main arterials is known as latent demand. This latent demand consists of people who decided to forego the main

arterials for minor arterials, people who adjusted their schedules to travel before or after the peak hour, or even people who decided not to travel at all. There is evidence that the latent demand for most transportation networks is fairly high (17).

### ***Valuing Travel Time Saved***

During the planning for a commuter rail service, it is important to have a reliable estimate of the ridership levels. Many of the metrics used to evaluate a project's benefits require ridership estimates. Survey data from established commuter rail services such as Chicago's Metra or Los Angeles's Metrolink imply that most trips by commuter rail would otherwise have been made by personal vehicles (60, 61). On average about 75 percent of Metra trips and 85 percent of Metrolink trips would have been made by a personal vehicle, with the primary reason for the difference<sup>26</sup> being that Chicago has a more extensive light rail and bus system operating in addition to Metra, which means that riders there have more options besides personal vehicles.

Valuing the travel time for a commuter is defined by the time saved by a particular addition to the transportation network (i.e., a commuter rail service) and the value different travelers assign to the time saved. Different travelers have different values of time, because they are traveling for different reasons. The simplest metric is a commuter's wage rate since the time saved could be used for work, but different trip purposes, such as leisure, also need to be accounted for. Time saved on leisure trips are valued much lower than time saved for a business trip, because leisure travelers might not mind a slower journey.<sup>26</sup> The U.S. Department of Transportation's TIGER grant application guidelines provide values for travel time saved (see Table 6) (18). Once the amount of time saved is calculated, these DOT numbers can be used to quantify that time (18). This is a fairly simple method for calculating the value of time saved.

**Table 6. USDOT Recommended Values of Travel Time.**

Recommended Hourly Values of Travel Time Savings* (2013 U.S. \$ per person-hour)	
Personal	\$12.42
Business	\$25.23
Weighted Average	\$12.98

\* Summary of the DOT's suggested values for travel time saved on local trips.

Some have argued that depending on the amenities of a commuter rail line, rail commuters might be able to read, make calls and send emails, or even work from notebook computers. The time spent commuting by rail is not necessarily unproductive because rail commuters are able to do some of the same activities that they might perform at their destination; time spent in transit may not be lost time at all. Therefore time spent commuting by rail should have a lower value than time spent as a personal vehicle commuter. In the value of time calculation, rail commuters

<sup>26</sup> There was also a difference in the questions asked: the Metra survey specifically asked how riders would otherwise make their trips, with the options being personal vehicle, other public transit, or not making the trip. Metrolink's survey only inquired into which other options were available to riders.

switching from personal vehicles may still experience significant monetized time savings even if the commuter rail is not faster (17).

### ***Vehicle Operating Costs***

In general, vehicle operating costs are reduced if a transportation investment (i.e., commuter rail line) alleviates the stop-and-go traffic situation experienced on congested facilities by diverting some automobile users to the commuter rail line. Typically, vehicle operating cost calculations consider the cost of fuel, oil, tires, and maintenance. These costs vary considerably depending on the traffic conditions (average speed, number of stops, accelerations and decelerations required), the vehicle characteristics (model, maintenance record), and driver characteristics. A rider survey of Capital Metro's Red Line in Austin showed that 64 percent of commuters would have used a personal vehicle an average of 16 miles, corresponding to the elimination of 985,000 vehicle miles of travel each year. This equates to an estimated benefit of \$14.1 million over a 21-year period, assuming a driving cost of 55¢ per mile (19). In this case the driving cost per mile included vehicle operating expenses (e.g., fuel and maintenance), the cost of ownership (e.g., financing and depreciation), and other costs, such as registration and inspection fees. A driving cost of 55¢ per mile represents an average for small personal vehicles being driven about 10,000 miles per year.

### ***Safety***

In general, there are three types of accidents:

- *Property damage only* in which no person is harmed.
- *Injury accidents*, which can be further classified based on the severity of the injury (minor injuries to injuries requiring hospitalization to debilitating injuries with long-term effects on productivity).
- *Fatal accidents*, in which someone dies because of injuries sustained during the accident.

When an accident occurs, significant costs can be incurred by both those involved and by society as a whole, but the exact cost varies depending on the type of accident. Property damage only accidents usually are in the thousands to tens of thousands of dollars, while fatal accidents range in the millions to the tens of millions of dollars. Increasing the probability of an accident can be valued as a cost, while decreasing the probability can be valued as a benefit (62).

The following sections outline how commuter rail can influence the safety of the road network, road-rail crossings, and safety along tracks.

### ***Accidents along the Corridor***

To determine the number of accidents along a highway, it is critical to understand the relationship between traffic speed and accident risk. According to the literature, accident rates tend to increase in congested traffic conditions (high traffic densities), but the severity of the accidents tend to be less. At high traffic speeds, considerable evidence exists that higher traffic

speeds are associated with more severe accidents. Reducing congestion on a highway potentially could decrease the probability of an accident occurring, but the accidents may be more severe. Most of the USDOT and FHWA tools, however, express accidents as a function of vehicle miles for simplicity, not accounting for the composition of the traffic or the average speed of the traffic (62).

### ***At-Grade Crossings***

Increasing the number of trains using a rail track increases the probability of accidents at at-grade crossings. Increasing the number of trains going through at-grade crossings represents a cost (20). However, if implementation of the commuter rail line involves upgrading at-grade crossings to separate at-grade crossings, there can actually be an overall safety benefit. The literature, however, suggests that even without accident mitigation measures at at-grade crossings, the increase in accidents at at-grade crossings is lower than the decrease in accidents due to reduced congestion (63).

### ***Accidents along the Rail Line***

Increasing the number of trains using a rail track increases the probability of accidents involving trains only. These include derailments, collisions between trains, and accidents involving pedestrians on the tracks. FRA enforces safety regulations along rail lines. FRA will require a number of mitigation strategies before approving a new commuter rail line, but in general increasing the number of trains using the track will increase the probability of a rail accident occurring (14).

### ***Valuing Safety Impacts***

As mentioned earlier, the USDOT and FHWA tools express accidents as a function of vehicle miles traveled for simplicity. The Bureau of Transportation Statistics (64) publishes crash rates for fatal accidents, injury-causing accidents, and total crashes (see Table 7). These crash rates can be applied to the reduction in vehicle miles traveled resulting from a diversion of traffic from the highway to the commuter rail.

**Table 7. Vehicular Crash Rates.**

Accidents per 100 million VMT	
Fatalities	1.10
Injuries	75.3
Crashes	181

No publicly available models were uncovered to estimate rail incidents on rail lines, although it is believed that these models exist and are used by the freight railroads. Furthermore, existing rail incident models focus on estimating the number of accidents at railroad crossings. Specifically, rail incident models estimate the number of accidents that will be reduced when

constructing a rail-road grade separation. However, what is needed is to estimate the number of at-grade conflicts resulting from increased rail traffic under various assumptions of demand (65).

Furthermore, the cost of an accident might be difficult to determine and making such a determination may carry several moral implications. While property damage accidents merely call for the calculation of the required repair to the property, injury accidents need the placement of a value on the injured person's treatment and their lost productivity, which can be difficult to determine. Valuing fatal accidents and thereby assigning a monetary value to a human life is an ethical and sometimes very controversial issue. For this reason, studies have calculated the value of a life as the amount that society is willing to pay for a reduction in the probability of dying in a traffic accident (65).

The USDOT provided federal guidelines for the cost of different types of accidents for the TIGER grant application process (see Table 8) (18).

**Table 8. Crash Cost by Type of Accident.**

Severity	Crash Cost (\$)
No Injury (PDO)	3,900
Minor	27,600
Moderate	432,400
Serious	966,000
Severe	2,447,200
Critical	5,455,600
Fatal	9,200,000

In addition, the USDOT's TIGER Benefit Cost Analysis Resource Guide provides an aggregate safety cost of 23¢ per vehicle mile traveled (18). This method allows for a simpler calculation of the safety impact of a new commuter rail service, but it assumes a direct correlation between vehicle miles traveled (VMT) and accidents when the actual relationship is much more complicated. For example, planners in Oakland used this calculation in their TIGER grant application to estimate the safety benefits from the Port of Oakland's rail improvement project. This project will divert a substantial number of trucks from highways around the city, translating into a reduction of about 840,000 truck VMT per year and \$2 million dollars in safety benefits (over the 20-year life of the project at a 3 percent discount rate or \$1.3 million at a 7 percent discount rate) (10). This method is not exact. In the Oakland example, it would have been more accurate to consider the fact that the vehicles that were removed were heavy-duty trucks. Trucks have different crash characteristics than the average vehicle. Accidents involving trucks are more likely to result in death or a serious injury, which would translate into a higher safety benefit. This method, however, provides a reasonable starting point and might be all that is necessary depending on the purpose of the calculation.

Another example is the upgrading of 25 crossings as part of the CREATE project in Chicago. These upgrades are projected to reduce 21 fatalities and prevent 84 injuries over a 30-year period. This translates into an overall safety benefit of more than \$222 million (20). Seven of these crossings have been designated by the City of Chicago as *911 critical crossings* meaning that they are along important routes used for emergency response services. Removing impediments on these routes implies further social benefits as first responders will be able to reach their destinations faster and more reliably.

### **Air Quality Impacts**

Air pollution is nearly ubiquitously a side effect of motorized mobility in urban areas. During peak commute hours, congestion causes longer travel times for automobile drivers and results in variable speeds, which may produce higher emissions rates. Commuter rail systems are generally assumed to be environmentally more benign than automobile usage. The amount of emissions reduced is, however, a function of the expected utilization of the commuter rail service. At a certain level of utilization, enough vehicles will be removed from the roadway to achieve a net reduction in the emissions. The exact number of vehicles that need to be removed varies based on the type of locomotive used and which pollutant is being analyzed. For example, a typical commuter train only needs a few dozen passengers to achieve a net reduction in VOC generated, while several hundred might be necessary to reduce the PM generated (21). Furthermore, newer locomotives typically produce fewer emissions since they conform to the most recent EPA standards. Advances in locomotive efficiency allow for less fuel consumption with associated emissions benefits per gallon of fuel consumed (66).

The following section describes several of the most important emissions emitted by commuter rail systems and automobiles. Five of these (i.e., CO, PM, NO<sub>x</sub>, sulfur oxides, and ozone) are among the EPA's six criteria pollutants for which National Ambient Air Quality Standards exist. Lead is the only criteria pollutant that is not discussed, because it is no longer closely related to transportation.

#### *Carbon Dioxide*

Carbon dioxide (CO<sub>2</sub>) is not considered a criteria pollutant by the EPA. In fact, CO<sub>2</sub> is relatively inert and does not directly contribute to poor health. It is also very prevalent. By definition, no combustion can occur without producing CO<sub>2</sub>, even cyclists and pedestrians produce some amount of CO<sub>2</sub>. The main reason CO<sub>2</sub> is of concern is because of global climate change. CO<sub>2</sub> in the atmosphere trap some of the heat, the so-called greenhouse effect, that the earth would normally radiate out into space. This trapped heat marginally raises the average global temperature, eventually leading to extreme weather events, such as droughts in some locations and flooding in others. These changes in climate patterns represent the cost of climate change and, ultimately, emissions of greenhouse gasses such as CO<sub>2</sub>.

The EPA argues that future emissions of CO<sub>2</sub> will have a greater marginal effect on the climate than emissions today. The USDOT's TIGER Benefit Cost Analysis Resource Guide provided values for the social cost of CO<sub>2</sub> (SCC) in specific years (see Table 9) (67).

**Table 9. TIGER Social Cost of Carbon.**

CO <sub>2</sub> Cost from TIGER BCA Resource Guide (per Ton)		
Year	SCC with 3% annual discounting	Non-discounted value
2014	\$44	\$44
2015	\$46	\$48
2016	\$47	\$50
2017	\$49	\$53
2018	\$50	\$56
2019	\$51	\$59
2020	\$52	\$62
2025	\$58	\$81
2030	\$63	\$101
2035	\$68	\$127
2040	\$75	\$162
2045	\$79	\$198
2050	\$86	\$249

The EPA recommends using a 3 percent discount rate for CO<sub>2</sub> regardless of the discount rate used for other components of a project. Using these guidelines, the Port of Oakland rail improvement project produced a CO<sub>2</sub> emissions reduction benefit of \$270,000 over the life of the project (10).

#### *Carbon Monoxide*

CO is produced from combustion in low-oxygen conditions. When inhaled, CO reacts with hemoglobin in the blood to prevent the body's ability to absorb oxygen. Ensuring that there is enough air present to fully oxidize the fuel will reduce the emissions of CO. Relative to other EPA criteria pollutants there have been relatively fewer studies on the health costs of CO emissions (68).

#### *Particulate Matter*

PM does not have a specific chemical composition. Instead it is defined as a mass of particles or molecules that is smaller than a certain size. Particles smaller than 10 microns, such as most bacteria, viruses, molds, fine dust particles, smoke particles, and smog, pose health concerns. Although particles between 2.5 and 10 microns do cause some health issues, they are usually of concern because of their high impact on visibility. From a health perspective, particles between



0.1 and 2.5 microns are of the highest concern, because the human respiratory system has the most difficulty filtering these size particles. Both smaller and larger particles can be filtered effectively. Because the respiratory system cannot remove particles between 0.1 and 2.5 microns, they are likely to penetrate deep into the lungs, causing major health problems, including lung cancer and cardiopulmonary disease. PM is responsible for an estimated 20,000 to 50,000 deaths per year in the United States (69). While PM comes from a wide variety of sources, combustion reactions in personal vehicles do produce a significant amount.

### *Volatile Organic Compounds*

VOCs have high vapor pressures at normal room temperature, which allow them to be found as gases. Hydrocarbons are a subset of VOCs. The primary source of VOCs from personal vehicles is incomplete combustion, which allows unburned hydrocarbons to enter the atmosphere. Incomplete combustion is inefficient, and newer vehicles produce fewer VOCs than older vehicles. VOCs have a high social cost, because of their potential to cause respiratory damage and their contribution to ground-level ozone (69).

### *Nitrogen Oxides*

NO<sub>x</sub> describes the gases that form when fuel is burned at high temperatures. NO<sub>x</sub> have a global warming potential 300 times higher than CO<sub>2</sub>, but the biggest concern related to NO<sub>x</sub> comes from its reaction with VOCs and ammonia. Products of these reactions include nitric acid, ground-level ozone, and various toxic chemicals, which can cause serious damage to respiratory systems (69).



**Figure 17. Smog over Brooklyn Partly Caused by NO<sub>x</sub> from Automotive Exhausts.**

### *Sulfur Oxides*

SO<sub>x</sub> forms from reactions between oxygen and sulfur contained in fuel. Over the past few decades, SO<sub>x</sub> emissions have been reduced by reducing the sulfur content of fuel. However, even



small amounts of SO<sub>x</sub> can be converted to sulphuric acid (H<sub>2</sub>SO<sub>4</sub>) in the atmosphere, which can cause great harm to the environment (69).

### *Ground-Level Ozone*

Ground-level Ozone is extremely reactive and can be very harmful to the lungs, even at small concentrations. Ozone is not directly produced from vehicle emissions, but it is formed by a complex chemical reaction involving VOC and NO<sub>x</sub> in the presence of sunlight and heat. If a region has high levels of one of these pollutants, emissions from the other will result in increasing ozone levels (69).

### **Valuing Emissions Impacts**

Valuing the emissions impacts associated with implementing commuter rail involves calculating the net reduction or increase in VMT by vehicle type. These VMT numbers are then multiplied by the emissions costs by vehicle type. The U.S. EPA provides information about the emissions costs by vehicle type (see Table 10) (21).

**Table 10. Emissions Costs by Vehicle Type.**

<b>Vehicle Type</b>	<b>Non-CO<sub>2</sub> Costs per VMT</b>	<b>CO<sub>2</sub> Costs per VMT in 2014</b>	<b>CO<sub>2</sub> Costs per VMT in 2050</b>	<b>Total Cost per VMT in 2014</b>	<b>Total Cost per VMT in 2050</b>
Light-Duty Vehicle	1.34¢	1.47¢	8.33¢	2.81¢	9.67¢
SUV/Pick-up Truck	1.69¢	2.05¢	11.6¢	3.74¢	13.3¢
Diesel Semi Truck	23.6¢	7.68¢	43.4¢	31.3¢	67.0¢

It is crucial, however, that the added emissions from the commuter rail service be included as a cost in the cost-benefit analysis. The amount of emissions introduced by the commuter rail service will depend on the type of locomotive and the characteristics of the route (route length and number of trains per day). On the other hand, investments in the rail system to accommodate commuter trains may have the added benefit of reducing emissions from freight trains. Reduced emissions from freight trains represent \$4.13 million of the benefits in Oakland's rail improvement project (discounted at 3 percent; \$2.71 million at 7 percent) (10).

To illustrate the emissions benefits associated with commuter rail, Tri-Rail calculated the difference in emissions per passenger mile for personal vehicles and commuter trains to find that, the commuter rail system results in a net reduction of 16,000 tons of greenhouse gasses, 1,200

tons of CO, and 122 tons of NOx.<sup>27</sup> Finally, the CREATE projects in Chicago has a pollution benefit of \$40.8 million over the life of the projects at a 3 percent discount rate (\$25.8 million at a 7 percent rate) (58). These numbers did not account for the reduction in CO<sub>2</sub> emissions, which presents an additional benefit.

### *Other Environmental Impacts*

Air pollution is not the only environmental consideration when analyzing a commuter rail service. A commuter rail service can also generate environmental impacts along its route in the form of noise and vibrations. When approaching an at-grade crossing, trains (either commuter or freight trains) are required to warn vehicles by sounding their horns in two long blasts followed by a short one before a final long signal. Given the schedules of commuter trains, the first commuter train might leave very early in the morning on a weekday. It is possible that this safety requirement may disrupt people's sleep as the commuter train passes through neighborhoods. FRA has the authority to designate quiet zones where trains are not required to sound their horns except in emergencies. For a segment of track to receive this designation, FRA requires that each crossing be improved with raised medians, crossing gates, and other measures to ensure that the overall safety is not reduced. While this can be costly, the quiet zone applies to both commuter and freight trains, which would translate in a reduction in noise in any corridor with existing freight service.<sup>28</sup> The longest quiet zone in the country was created as part of the implementation of the FrontRunner commuter rail service in Utah. FrontRunner shares a corridor with UP freight trains.

Finally, perhaps more important than simple noise pollution is the vibration that a train creates. This vibration can be destructive over time to structures located near the rails, although the effect is much greater for heavy freight trains than for relatively light commuter rail trains (22).

### *Agency Cost Savings*

An important consideration for the implementation of a commuter rail system is future capacity along a corridor. One highway lane theoretically can move up to 2,400 people per hour, while a commuter rail line can potentially move many more people, depending on the headway (16). Implementing a commuter rail system can provide additional people moving capacity in a relatively smaller footprint. The capital cost of the rail investment has to be compared with the cost of providing additional highway lane-miles.

The maintenance cost benefits of diverting automobile users to commuter rail systems is typically relatively low. In fact, care must be taken to ensure that the commuter rail does not impact the freight trains negatively and thereby cause a diversion from freight rail to truck, which would result in an increase in maintenance cost (23).

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<sup>27</sup> Information obtained from an interview with Tri-Rail about operations and the future.

<sup>28</sup> Information obtained from an interview with FrontRunner in Salt Lake City, Utah.

### *Economic Development Impacts*

It is important when quantifying the benefits of a commuter rail service to avoid any double counting. Double counting can occur when an effect falls into multiple categories of benefits and is included in each. For example, it would be inappropriate to count the benefit of a commuter's value of time saved and that commuter's additional income due to being productive for longer periods, as this counts the commuter rail's effect on productivity twice. Similarly, the inclusion of economic development impacts in the BCA calculations can result in double counting that will skew the results. As mentioned earlier, this results from the fact that a transportation investment that produces cost savings will result in an increase in the demand for transportation. This increase in demand is considered a proxy for regional development impacts, because the stimulation of the economy associated with a transportation improvement will be reflected in increased traffic. Having said that, the economic development impacts are often easier to communicate and understand by the public and is often used to use to garner support for a commuter rail system. This appendix details the economic development impacts that can accrue from a commuter rail system.

### *Land Use and Property Value*

Commuter rail can change urban land use and bring about increases in value and density. For example, when a new commuter rail station is opened, the property near the station can be redeveloped, especially if the city decides to pursue transit-oriented development. A number of examples are found in the literature that supports changes in land use in and around commuter rail stations. For example, Capital Metro in Austin reported that since its commuter rail (The Red Line) opened in 2008, \$95 million worth of development has occurred around the stations and another \$285 million is planned or under construction. Much of this new development includes affordable housing units, with some stations seeing as much as 30 percent affordable housing (19). Another example can be found in southern California, where the community of Riverside worked with developers in developing the areas around Metrolink's commuter rail stations to (70):

- Expand the market for downtown services.
- Distinguish the transit village as an employment gateway.
- Maximize the amount of connections and interdependency.

Finally, the city of Alexandria in northern Virginia received a smart growth achievement award from the EPA for the city's ability to use the transit corridor to spur several positive development trends between 1999 and 2002 as follows (71):

- The corridor gained 2,500 apartments and condos.
- 1.5 million square feet of office space were added.
- 379,000 square feet of retail space were developed.

- Five miles of bike lanes were incorporated.
- Roughly half of the residents along the corridor used some form of transit.

Figure 18 shows areas of high-density development that appeared within a quarter to half a mile of the rail stations (71).



**Figure 18. High-Density Development Appeared Close to the Transit Stations in Arlington, VA (71).**

Commuter rail also increases a community's access to recreational and productive opportunities, which in-turn can have a positive effect on that community's livability (24). These land-use changes can also improve regional equity by making areas more accessible to the poor or disabled (24). There is strong evidence that a lack of access to adequate and reliable transportation results in lower quality employment opportunities (72). Businesses nearby commuter rail stations also benefit from increased worker productivity and the ability to attract different types of workers. These benefits stem from, among other factors, less stressful commutes and the growing trend among young professionals (those approximately 25 to 35 years old) to forego driving (25).

Property values typically rise as a result. This directly affects the amount of property taxes paid and the amount for which a property can be sold. Finally, the land-use changes caused by commuter rail could open-up green space, and the clustering around stations might also aid with community cohesion, but these benefits can be difficult to quantify.

### *Job Creation*

Investment in a commuter rail system will result in temporary job increases and, by improving travel conditions and access along the corridor, a shift in the number and types of jobs available. Any investment in the rail infrastructure to implement a commuter rail route will add construction jobs along the corridor. Whether the investment actually increases employment or merely diverts construction jobs from other activities depends on the local unemployment levels. At high levels of unemployment, the investment can help to stimulate the local economy by putting people back to work temporarily (17). Furthermore, from an economic development

perspective, adding the commuter rail service increases the supply of travel available to commuters, which lowers the cost (i.e., time) of travel. This will in effect increase the labor pool that businesses have access to (26).

## Reliability of Cost-Benefit Analysis

In 2001, FTA established a requirement for future new start and small start transit grants (73). All proposed transit projects are required to submit projections for the projects' costs and transportation network effects, among other metrics. Specifically, the capital cost, maintenance and operations costs, ridership levels, and transit network impacts have to be estimated at three different stages: 1) after preliminary engineering, 2) after final design, and 3) after the full-funding grant agreement is awarded. These estimates are then compared to the actual numbers at several intervals after the revenue service begun. This allows FTA to evaluate the results of its grants and it allows transit agencies to test the effectiveness of different estimation methods and ultimately the reliability of the data.

Table 11 shows the results from the before/after studies. A positive value indicates an overestimate, and a negative value indicates an underestimate. The table shows the standard deviations. On average, the costs were underestimated, while the ridership numbers were overestimated. There were, however, several exceptions, which is why there are large standard deviations. The table also shows that the estimates tended to become more accurate as the projects moved forward, but it is important to remember that the decision of whether or not to move forward with the project is made largely based on the preliminary engineering study, which is the least accurate.

**Table 11. Discrepancies in C/B Analyses.**

	<b>Capital Costs</b>	<b>Operations and Maintenance</b>	<b>Ridership</b>
Preliminary Engineering	-27 ± 16%	-8 ± 12%	37 ± 41%
Final Design	-12 ± 16%	-8 ± 9%	40 ± 30%
Full Funding Grant Agreement	-6 ± 14%	-11 ± 10%	12 ± 25%

## **Appendix C—Freight Rail Policies Concerning Commuter Rail**

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### **Burlington Northern Santa Fe**

The following is BNSF's official policy regarding passenger rail:

BNSF is willing to cooperate on commuter rail studies and provide state and local officials with information. Where commuter service is proposed on a minimally used line that BNSF is willing to sell, BNSF shall be paid fair market value for the property. Where commuter service is proposed on a line BNSF intends to continue owning and to be jointly used for commuter and freight use, the following principles apply:

- Any commuter operation cannot degrade BNSF's freight service; negatively affect BNSF's freight customers or BNSF's ability to provide them with service.
- BNSF must be compensated for any and all costs incurred in providing commuter service and make a reasonable return for providing the service.
- Capital investments necessary for commuter service are the responsibility of the public, including investment for future capacity which is potentially more expensive, especially in urbanized areas.
- BNSF will not incur any liability for commuter operations that it would not have but for those operations. These operations are provided by BNSF primarily as a public service; the relatively modest compensation BNSF receives does not begin to justify assuming the significant liability associated with passenger service.
- Studies of how commuter service might be provided must take into account not only the current freight traffic levels, but projected freight traffic growth.
- Investments made for commuter projects must not result in BNSF incurring a higher tax burden. Property improvements should not become part of our tax base; materials used should be exempt from all sales and use taxes, etc. or BNSF must be made whole for any increased tax burden.
- BNSF must retain operating control of rail facilities used for commuter service. All dispatching, maintenance and construction must be done under the control of BNSF. Passenger stations, parking lots and other non-rail facilities may be publicly owned and operated.
- Studies must reflect BNSF's actual operating conditions and cost structures. For example, construction work estimates must reflect our labor contract costs; schedules cannot assume that we will not operate any freight trains during peak commuter periods, etc.
- BNSF will limit commuter operations to the commuter schedules initially agreed upon and for which the capital improvement plan has been designed.

Future expansion will have to undergo the same analysis and provide any required capital improvements before schedules can be altered, service added, or stations added.

- Improvements must include grade crossing protection and intertrack fencing as required to minimize the risk of accidents, due to liability and service interruption concerns.

## **Union Pacific**

The following are UP's guidelines for allowing higher speed passenger trains on its tracks. Not all of these provisions may be applicable to commuter rail:

Union Pacific offers the following information to guide passenger rail planners and agencies in working with Union Pacific to develop new Higher Speed Rail passenger service. Union Pacific defines, "higher speed" as passenger trains that operate in excess of 90mph, but less than or equal to 110mph.

Intercity rail service can provide substantial benefits to the public, including reducing traffic congestion and avoiding expensive highway construction. At the same time, Union Pacific has a responsibility to the nation and to its customers to protect the public benefits of freight transportation- energy efficiency, lower emissions, cost-effective cargo transportation for shippers and consumers, and private investment in the nation's infrastructure.

Union Pacific will consider reasonable proposals for higher speed passenger rail serve that appear to be viable and adequately funded. Future agreements must balance the nation's desire for additional passenger services with Union Pacific's on-going, critical role in carrying freight that otherwise would likely compete for space on the crowded and underfunded highway network.

### **Separate freight and passenger corridors are desired**

- Many critical freight corridors are already full and will require capacity improvements soon. UP will not consider proposals that share tracks with freight trains in such corridors or sell property that would compromise our ability to add capacity in the future. Passenger rail planners should develop a separate right of way for services in these corridors.
- Passenger safety is best protected by separating freight and passenger tracks by 50 feet or more. Despite UP's enormous progress in preventing freight train derailments, derailments will occur and could strike or be struck by passenger trains. Research demonstrates that most freight train derailments will remain within a 100-foot corridor.
- One way to achieve separation is to move the majority of freight trains out of urban corridors entirely. UP will consider publicly funded relocations of freight operations that preserve UP's customer service, competitive position, and access to current and future freight customers.



Where separation or relocation is not feasible, and freight densities are light, UP will consider proposals to share our tracks with higher speed passenger trains. We intend to apply the following principles in evaluating proposals by passenger agencies:

### **Safety**

- As in all our activities, safety must come first.
- Under federal law, all trains and tracks must in the future be equipped with interoperable Positive Train Control systems if passenger trains are present. The passenger operator must fund PTC if UP would not otherwise install it on the affected track, or contribute the operator's share of equipment and wayside costs if UP would install PTC on the affected track.
- Passenger operators should fund all incremental safety requirements attributable to its service, including grade crossing warning signal improvements, new grade separations, and fencing.
- Passenger stations must meet UP and FRA design requirements to protect passengers from nearby freight operations.
- UP will require existing track to be rebuilt, and new track to be built, at the high track construction standards where passenger trains will run at higher speeds. This includes concrete ties.
- Passenger vehicles must, at a minimum, meet FRA crash standards.

### **Service**

- Service to UP's freight customers must also be reliable and protected and should not be compromised by a new passenger service. UP cannot agree to curfews or other restrictions that would impact the quality or reliability of our freight service.
- New infrastructure construction must preserve both the ability to operate freight trains on demand and the opportunity to expand freight capacity.
- New infrastructure design must protect UP's ability to serve existing customers and locate new freight customers on our lines.
- In order to preserve service quality for all types of customers, UP will retain dispatching and maintenance control over its lines. The parties must agree on standards for reliability.
- Passenger operations must provide the flexibility to accommodate efficient track maintenance. This includes a requirement that any new track must be constructed at 20 foot track centers.

### **Liability**

- UP cannot accept to any additional liability associated with allowing higher speed passenger service near our freight tracks that would not exist but for those operations.



- Passenger operators should be prepared to carry and provide evidence of insurance covering liability exposure up to \$200 million, the limit of liability under federal law. UP expects to be indemnified for or protected against any and all liability resulting from the presence of passenger service.

### **Capacity**

- All projections call for rail freight growth to exceed rail capacity in the future. Passenger agencies should understand that existing capacity that UP funded—whether or not now used—is reserved for potential freight growth.
- Passenger agencies therefore must fund all incremental capacity to accommodate higher speed passenger operations, as reflected in a study of capacity requirements and a resulting capacity plan.
- Because new capacity consumes the least expensive capacity opportunities and usually makes the next increment of capacity more expensive, the capacity plan may include additional agency investment at the outset that will leave UP cost-neutral when it needs to invest in additional freight capacity.
- Infrastructure requirements will be determined by UP or a UP-designated and qualified third party.

### **Maintenance**

- Passenger agencies must agree to maintain the incremental improvements necessary for higher speed operation. This includes expenses related to maintenance of safety appliances such as PTC and 2 Quad gates. UP will limit its contribution to maintenance to what would otherwise be necessary for its existing freight operations, generally at FRA Class III or IV.
- Prior to the new service start-up, UP will require execution of a maintenance agreement to allow the public agencies to fund incremental maintenance for the duration of its commitment to operate higher speed passenger service.

### **Compensation**

- The passenger operator should be prepared to pay all costs associated with providing information and studies necessary to develop any higher speed rail proposal, including UP's time and resources.
- To the extent passengers operations use UP assets and property, they must provide UP with a reasonable return on UP's investment.
- UP will seek fair market rates for access. Traditional "incremental cost" formulas are no longer acceptable.
- If UP's tax liabilities (income, franchise, sales and use, property, or any other tax) increase as a result of UP's participation in a passenger project, UP expects to be made whole. This will likely require tax indemnification from the public agency or changes to state law.

## **Kansas City Southern**

Kansas City Southern, the smallest of the three class I railroads operating in Texas, does not have any official guidelines regarding passenger trains operating on its tracks.

## References

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- 1 Potter, Lloyd. (2013). *Office of the State Demographer*. Retrieved August 2014.  
<http://osd.state.tx.us/>.
- 2 American Public Transportation Association. (n.d.). Fact Back Glossary. Available:  
<http://www.apta.com/resources/statistics/Pages/glossary.aspx>.
- 3 Arndt, Jeffrey C., Curtis Morgan, John H. Overman, Terry L. Clower, Bernard L. Weinstein, and Michael Seman. (September 2009). "Transportation, Social and Economic Impacts of Light and Commuter Rail." Texas Transportation Institute, Texas A&M University System.
- 4 Ambler, John, Kristen Rabe, and Susan Green. (Fall 2010). "Commuter Operations: Getting riders on rail, off roads." *BNSF Railway*.
- 5 Dolata, Mat, Jolanda Prozzi, Randy Resor, and Chandra Bhat. (2005). "Passenger Rail Sharing Freight Infrastructure Primer." Center for Transportation Research.
- 6 Allen, J.G. (2000). "Commuter Rail, Freight Railroads, and the Open Access Debate." *Transportation Research Record, Transportation Research Board*, Washington, D.C., Issue 1704.
- 7 Bing, Alan J., Eric W Beshers, Megan Chavez, David P. Simpson, Emmanuel S. Horowitz, and Walter E. Zullig. (2010). *Guidebook for Implementing Passenger Rail Service on Shared Passenger and Freight Rail Corridors*. Washington, D.C.: Transportation Research Board.
- 8 Spitulnik, C.A. and J.P. Rennert. (1999). "Use of Freight Rail Lines for Commuter Operations: Public Interest, Private Property." *Transportation Law Journal*, University of Denver College of Law, Denver, CO, Volume 26, Issue 3.
- 9 Rodrigue, Jean-Paul. (2009). *Rail Track Mileage and Number of Class I Rail Carriers, United States, 1830-2008*.  
<http://people.hofstra.edu/geotrans/eng/ch3en/conc3en/usrail18402003.html>. Accessed June 2014.
- 10 City and Port of Oakland. (2012). "Outer Harbor Intermodal Terminal Rail Access. Tiger 2012 Funding Application." Grant Application, Oakland, CA.
- 11 Morgan, Curtis A., Jeffery E. Warner, Craig E. Roco, Glenn C. Anderson, Leslie E. Olson, and Stephen S. Roop. (2007). *Rail Relocation Projects in the U.S.: Case Studies and Lessons for Texas Rail Planning*. Texas Transportation Institute, College Station, TX: The Texas A&M University System.
- 12 United States General Accounting Office. (2004). "Commuter Rail—Information and Guidance Could Help Facilitate Commuter and Freight Rail Access Negotiations." GAO-02-240, January.
- 13 Surface Transportation Board Finance Docket No. 33466, Sept. 10, 1999.
- 14 Federal Railroad Administration. "Track and Rail and Infrastructure Integrity Compliance Manual." *FRA Website*. January 6, 2014.  
[http://www.fra.dot.gov/eLib/details/L04404#p2\\_z5\\_gD\\_ICM](http://www.fra.dot.gov/eLib/details/L04404#p2_z5_gD_ICM). Accessed August 2014.
- 15 American Public Transportation Association. (2001). *Commuter Rail: New Starts Handbook. Tips and Resources for Planning and Implementing a Successful Commuter Rail Enterprise*.
- 16 Transportation Research Board. (2010). *Highway Capacity Manual*, Fifth Edition.
- 17 Litman, T. (January 2012). *Rail Transit in America; A Comprehensive Evaluation of Benefits*. Victoria Transport Policy Institute.

- 18 U.S. Department of Transportation. "2013 Benefit-Cost Analysis Guidance for TIGER Grant Applicants." 2013.
  - 19 Capital Metropolitan Transportation Authority. (2013). "CMTA TIGER 2013 Grant Application; Improving Multi-Modal Operating Efficiencies to Move Central Texas Forward." Austin, TX, 2013.
  - 20 CREATE. *CREATE Benefits*. (2014). <http://www.createprogram.org/benefits.htm>. Accessed May 2014.
  - 21 U.S. Environmental Protection Agency. (October 2008). Average Annual Emissions and Fuel Consumption for Gasoline-Fueled Passenger Vehicles and Light Trucks.
  - 22 Massachusetts Bay Transportation Authority. *MBTA Greenbush Project Questions and Answers*. [http://www.mbta.com/about\\_the\\_mbta/?id=13749](http://www.mbta.com/about_the_mbta/?id=13749). Accessed August 2014.
  - 23 Federal Highway Administration. (1997). Federal Highway Cost Allocation Study.
  - 24 Litman, T. (2014, April). Evaluating Public Transit Benefits and Costs. Retrieved May 2014, from vtpi.org: <http://www.vtpi.org/tranben.pdf>.
  - 25 Belzer, D., Srivastava, S., Austin, M., Wood, J., Bump, T., and Popuch, E. (2011, May). Transit and Regional Economic Development. Retrieved May 2014, from [reconnectingamerica.org](http://reconnectingamerica.org/assets/Uploads/TransitandRegionalED2011.pdf): <http://reconnectingamerica.org/assets/Uploads/TransitandRegionalED2011.pdf>.
  - 26 Litman, Todd. (2013). "Transportation Cost and Benefit Analysis II." Victoria Transportation Policy Institute.
  - 27 Fort Worth Transportation Authority (The T), "The T's TEX Rail Project Update: Spring 2014." Online. Available: <http://www.texrail.com/Portals/0/Documents/TEXRail%20Fact%20Sheet%20Spr%202014.pdf>. Accessed August 8, 2014.
  - 28 Dickson, Gordon. "TEX Rail gets \$50 million in federal funds." *Fort Worth Star-Telegram*. March 6, 2014. Online. Available: <http://www.star-telegram.com/2014/03/04/5621600/chugging-along-tex-rail-plan-gets.html?rh=1>. Date Accessed March 7, 2014.
  - 29 Fort Worth Transportation Authority. "TEX Rail receives federal Record of Decision to proceed toward construction." *News*. September 29, 2014. Online. Available: [http://www.texrail.com/Portals/0/Documents/News\\_articles/News%20Releases/News%20Release%20-%20TEX%20Rail%20-%20Record%20of%20Decision%20-%202014%2009%2029.pdf](http://www.texrail.com/Portals/0/Documents/News_articles/News%20Releases/News%20Release%20-%20TEX%20Rail%20-%20Record%20of%20Decision%20-%202014%2009%2029.pdf). Accessed October 3, 2014.
  - 30 Dickson, Gordon. "TEX Rail agreements finally reached in principle." *Fort Worth Star-Telegram*. Posted Tuesday, July 22, 2014. Online. Available: <http://www.star-telegram.com/2014/07/21/5985445/tex-rail-agreements-finally-reached.html?rh=1>. Date accessed: July 23, 2014.
  - 31 North Central Texas Council of Governments (NCTCOG). *Cotton Belt Corridor: Conceptual Engineering and Funding Study*. April 2010. Online. Available: <http://www.nctcog.org/trans/spd/TransitRail/CtnBlt/Cotton%20Belt%20CE&FS%20042210.pdf>. Accessed August 26, 2014.
  - 32 Dallas Area Rapid Transit (DART). (January 2011). *Cotton Belt Corridor Regional Rail Scoping Summary Report*.
-

- 33 Formby, Brandon. "DART to consider dedicated bus roads for long-languishing Cotton Belt rail corridor." *Dallas Morning News*. Published: August 25, 2014. Online. Available: <http://www.dallasnews.com/news/transportation/20140825-dart-to-consider-bus-transit-concept-for-long-languishing-cotton-belt-corridor.ece>. Accessed August 25, 2014.
- 34 Fort Worth Transportation Authority (The T). *TEX Rail Final Environmental Impact Statement/Section 4(f) Evaluation*. "Chapter 1: Background, Purpose and Need." May 2014. Online. Available: [http://www.texrail.com/Portals/0/Documents/Final%20Environmental%20Impact%20Statement/2TEX%20Rail\\_FEIS\\_v8\\_Ch\\_1\\_PurposeAndNeed\\_PublicReview.pdf](http://www.texrail.com/Portals/0/Documents/Final%20Environmental%20Impact%20Statement/2TEX%20Rail_FEIS_v8_Ch_1_PurposeAndNeed_PublicReview.pdf). Accessed August 26, 2014.
- 35 North Central Texas Council of Governments (NCTCOG). "Mobility 2035—2013 Update." <http://www.nctcog.org/trans/mtp/2035/index.asp>.
- 36 Utah Transit Authority. (2008, April). FrontRunner Facts. Retrieved May 2014, from [www.rideuta.com](http://www.rideuta.com): <http://rideuta.com/files/FrontRunnerFacts0408.pdf>.
- 37 RTS. (2013, May 20). NRC Rail Construction Project of the Year: Utah Transit Authority FrontRunner South. Railway Track & Structures.
- 38 Utah Transit Authority. (2014, February). Transit and Air Quality. Retrieved May 2014, from [www.rideuta.com](http://www.rideuta.com): [http://www.rideuta.com/uploads/TransitAndAQFactsR9\\_20140205\\_X.pdf](http://www.rideuta.com/uploads/TransitAndAQFactsR9_20140205_X.pdf).
- 39 Metra. (2013, October 14). Metra Passenger Operations. Retrieved April 2014, from [metrarail.com](http://metrarail.com): [http://metrarail.com/content/dam/metra/documents/ridership\\_reports/Passgr%20Ops%20v4%2020131014.pdf](http://metrarail.com/content/dam/metra/documents/ridership_reports/Passgr%20Ops%20v4%2020131014.pdf)
- 40 Metra. (2014). Metra History. Retrieved April 2014, from [metrarail.com](http://metrarail.com): [http://metrarail.com/metra/en/home/about\\_metra/leadership/metra\\_history.html](http://metrarail.com/metra/en/home/about_metra/leadership/metra_history.html).
- 41 Allen, J. G., and Lu, A. (2010, November 11). Organization Regimes for Commuter Rail. Transportation Research Record.
- 42 McGraw, J., Haas, P., Young, L., and Evens, A. (2010, February). Greenhouse Gas Emissions in Chicago: Emissions Inventories and Reduction Strategies for Chicago and its Metropolitan Region. *Journal of Great Lakes Research*.
- 43 Resource Systems Group, Inc. (2012). Regional Transportation Authority Customer Satisfaction Study. January 2013. Available: <http://www.rtachicago.com/CMS400min/uploadedFiles/Metra%20Customer%20Satisfaction%20Report%201.11.13.pdf>.
- 44 Turnbull, M. (2012, January 27). *Tri-Rail wants more control but can't afford it*. Sun-Sentinel.
- 45 Wilkins. (2000). "Lessons Learned about Track Sharing on a Busy Freight Corridor." *Mass Transit*. Cygnus Publishing, Inc. Fort Atkinson, WI, Volume 26, Issue 5.
- 46 U.S. Environmental Protection Agency. (2012, November). Locomotives - Exhaust Emissions Standards. Retrieved April 2014, from U.S. Environmental Protection Agency: <http://www.epa.gov/otaq/standards/nonroad/locomotives.htm>
- 47 Politifact Florida. (2011, February 27). Gov. Rick Scott raps Tri-Rail while rejecting high-speed rail funding. *Tampa Bay Times & Miami Herald*.

- 48 Metrolink. (ND). Sustainability. Retrieved July 30, 1994, from Metrolink :  
<http://www.metrolinktrains.com/agency/page/title/sustainability>.
- 49 Metrolink. (2014). Fact Sheet. Available:  
[http://www.metrolinktrains.com/pdfs/Facts&Numbers/Fact\\_Sheets/Fact\\_Sheet\\_2014\\_Q3.pdf](http://www.metrolinktrains.com/pdfs/Facts&Numbers/Fact_Sheets/Fact_Sheet_2014_Q3.pdf).
- 50 Rails to Trails. (2006). What is the cost of constructing a mile of highway? Retrieved April 2014, Available: railstotrails.org:  
<http://www.railstotrails.org/resources/documents/whatwedo/policy/07-29-2008%20Generic%20Response%20to%20Cost%20per%20Lane%20Mile%20for%20widening%20and%20new%20construction.pdf>.
- 51 Virginia Railway Express. (2012). VRE Chief Executive Officer's Report 2012.
- 52 Taube, R. K. (2008, August 11). Chronology of the Virginia Railway Express. Retrieved April 2014, from Virginia Railway Express: <http://www.vre.org/about/company/VRE-Chronology.pdf>.
- 53 VRE Board. (2014). VRE System Plan Summary.
- 54 Russell, E. (2014, January 30). VRE's future could include off-peak and weekend service. Greater Greater Washington.
- 55 R.L. Banks & Associates, Inc. and Bernardin, Lochmueller & Associates, Inc. (February 10, 2004). *Downtown Indianapolis Railroad Relocation Feasibility Study*.  
[http://www.indympo.org/News/Documents/Belt\\_RR\\_Relocation\\_Study.pdf](http://www.indympo.org/News/Documents/Belt_RR_Relocation_Study.pdf). Washington, D.C.
- 56 AECOM. (2011). Southeast Corridor Alternatives Analysis.
- 57 Litman, Todd. "Evaluating Public Transit Benefits and Costs." *vtpi.org*. Victoria Transport Policy Institute. April 2014. <http://www.vtpi.org/tranben.pdf>. Accessed May 2014.
- 58 Illinois Department of Transportation. (2009). TIGER Grant Application for CREATE Package of Products. Grant Application, Chicago.
- 59 Litman, T. (2013). Transportation Cost and Benefit Analysis II. Victoria Transportation Policy Institute.
- 60 Metrolink. (2010). 2010 Onboard Survey—Summary of Findings.
- 61 Synovate. (2005). 2005 Metra Rider Survey—Final Report. Available:  
[http://metrarail.com/content/dam/metra/documents/ridership\\_reports/2005\\_MetraRiderSurvey-FINALDRAFT.pdf](http://metrarail.com/content/dam/metra/documents/ridership_reports/2005_MetraRiderSurvey-FINALDRAFT.pdf)
- 62 American Association of State Highway and Traffic Officials (AASHTO). *Highway Safety Manual*. (2010). Available: <http://www.highwaysafetymanual.org/Pages/default.aspx>
- 63 Litman, Todd. "Rail Transit in America; A Comprehensive Evaluation of Benefits." Victoria Transport Policy Institute, January 2012.
- 64 Bureau of Transportation Statistics. (2012). Motor Vehicle Safety Data.
- 65 Prozzi, Jolanda; Delgado, Claudia; Walton, Michael. (2004). A Sketch Planning Tool for the Appraisal of Freight Modal Investments.
- 66 Barth, Matthew; Tadi, Ramakrishna. (July 1995). An Automobile/Transit Emissions Evaluation of Southern California's Metrolink.
- 67 U.S. Department of Transportation. (2014). TIGER Benefit-Cost Resource Guide.
- 68 RWDI Air Inc. (2006). South Frasier Perimeter Road Environmental Assessment Application: Regional Air Quality Impact Assessment; Volume 16.

- 69 U.S. Environmental Protection Agency. (August 22, 2012). *EPA Air and Radiation: Air Pollutants*. <http://www.epa.gov/iaq/voc2.html>. Accessed March 2014.
- 70 Gulley, K. (2007, July). From Transit Station to Transit Village; A Summary of Demonstration Projects in Western Riverside County. Retrieved May 2014, from [compassblueprint.org](http://www.compassblueprint.org):  
[http://www.compassblueprint.org/Documents/CBResources/WRCOG\\_Transit%20Village%20Demonstration%20Projects.pdf](http://www.compassblueprint.org/Documents/CBResources/WRCOG_Transit%20Village%20Demonstration%20Projects.pdf).
- 71 U.S. Environmental Protection Agency. (2002). *National Award for Smart Growth Achievement - 2002 Winners Presentation*. 2002.  
[http://www.epa.gov/smartgrowth/awards\\_2002.htm](http://www.epa.gov/smartgrowth/awards_2002.htm). Accessed May 2014.
- 72 Fan, Y., Gunthrie, A., and Teng, R. (2010, June). Impact of Twin Cities Transitways on Regional Labor Market Accessibility: A Transportation Equity Perspective. Retrieved May 2014, from [cts.umn.edu](http://www.cts.umn.edu):  
<http://www.cts.umn.edu/Publications%20ResearchReports/pdfdownload.pl?id=1414>.
- 73 U.S. Department of Transportation Federal Transit Authority. *Before and After Study*. 2013.  
[http://www.fta.dot.gov/12304\\_2613.html](http://www.fta.dot.gov/12304_2613.html). Accessed March 2014.