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16. Abstract
This report documents the analysis of the transportation and economic impacts of Texas short line railroads. Survey invitations were sent to 43 Texas short line railroads and 20 responses were received. The research team completed onsite interviews with 5 railroads and 3 community leaders. The software IMPLAN was used to estimate the economic impact of short line railroads at both county-level and state-level. Transportation impact analysis was conducted to estimate the cost by rail and the cost by diverted truck. Shipping cost, safety cost, maintenance cost, highway congestion cost, and emission cost were calculated in this analysis. The transportation impact analysis results indicate that, on average, the shipping cost of short line railroad is estimated to be 7.5% less than that of truck; the maintenance cost of short line railroad is estimated to be 70.2% less than that of truck; the safety cost of railroad is estimated to be 37.9% less than that of truck; and the emission cost is estimated to be 7.0% less than that of truck. The total transportation cost of railroad is estimated to be 24.3% less than that of truck. Moreover, the estimation shows that the operation of 14 surveyed short lines took 417,177 trucks off Texas highway in 2015. The economic impact analysis results indicate that, at state-level, the operation of short line railroads in Texas contribute approximately 1,476 jobs, $113,769,627 in labor compensation, and $354,443,588 in economic output. At county-levels, the short line railroads contribute 1,136 jobs, $87,799,859 in labor compensation, and $274,959,869 in economic output.

This research also found that short line railroads in Texas have substantial needs in terms of improving their infrastructure. These improvements include better interchange with connecting carriers, more customers or businesses, extra right of way available for expansion/rehabilitation of rail line, infrastructure improvements, and more tracks and yard space. However, these improvement needs are usually beyond their affordable capacity for short line operators. The need for more state funding was mentioned by several railroads during the surveys and interviews. As Texas short lines play a significant role in the local community and the state economy, there is a necessity to establish assistance programs for short lines to help maintain and improve the existing infrastructure. State support strategies for short lines in other states were reviewed and potential funding opportunities were discussed in this report.

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TRANSPORTATION AND ECONOMIC IMPACT OF TEXAS SHORT LINE RAILROADS

by

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Performed in Cooperation with the
Texas Department of Transportation and the
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Disclaimer

This research was performed in cooperation with the Texas Department of Transportation and the U.S. Department of Transportation, Federal Highway Administration. The contents of this report reflect the views of the authors, who are responsible for the facts and accuracy of the data presented herein. The contents do not necessarily reflect the official view or policies of the FHWA or TxDOT. This report does not constitute a standard, specification, or regulation, nor is it intended for construction, bidding, or permit purposes. Trade names were used solely for information and not product endorsement.

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Chapter 1. Background of Research

1.1 Definition of Short Line Railroad

In a recent classification in 2013, a short line railroad, also called class III, is defined as a carrier with annual operating revenues of $37.4 million or less. All switching and terminal carriers regardless of revenues are also considered as Class III carriers (FRA, 2014). Some of the public interest benefits provided by short line railroads include (Babcock et al, 1993):

- Offer alternative rail options
- Offer competitive rates;
- Provide quality and timely service; and
- Provide access to communities and industries.

Additionally, short line railroads play an important role in rural communities, where they are usually the major job providers. Many of these communities only have a few significant industries. If the rail industry fails, the entire community will suffer economically as a result (Llorens et al, 2014).

1.2 Current Short Lines in Texas

According to the American Short Line and Regional Railroad Association (ASLRRA)[1], the Texas Short Line & Regional Railroad Association (TSLRRA)[2], Union Pacific (UP)[3], Burlington Northern and Santa Fe Railway (BNSF)[4], and Kansas City Southern Railway Company (KCS)[5], there are currently 45 short line railroads in Texas (see Table 1 for details). Out of the 45 short lines, 35 are members of ASLRRA, 22 are members of TSLRRA, 34 interchange (IC) with UP, 26 interchange with BNSF, and 8 interchange with KCS. Short line railroads in Texas operate in a variety of roles, from interchanging with Class I carriers to serving at ports and other industrial production and distribution centers. Short lines are often the first or last leg of a longer rail movement. Figure 1 shows the counties served by short line railroad services in the state of Texas.

[1] https://www.aslrra.org/
[2] http://www.tslrra.com/
[3] https://www.up.com/customers/shortline/lines/texas/index.htm
[4] https://customer.bnsf.com/_layouts/Bnsf.SharePoint.Shortline/Shortlines.aspx?stid=44
[5] http://www.kcsouthern.com/en-us/why-choose-kcs/network-map

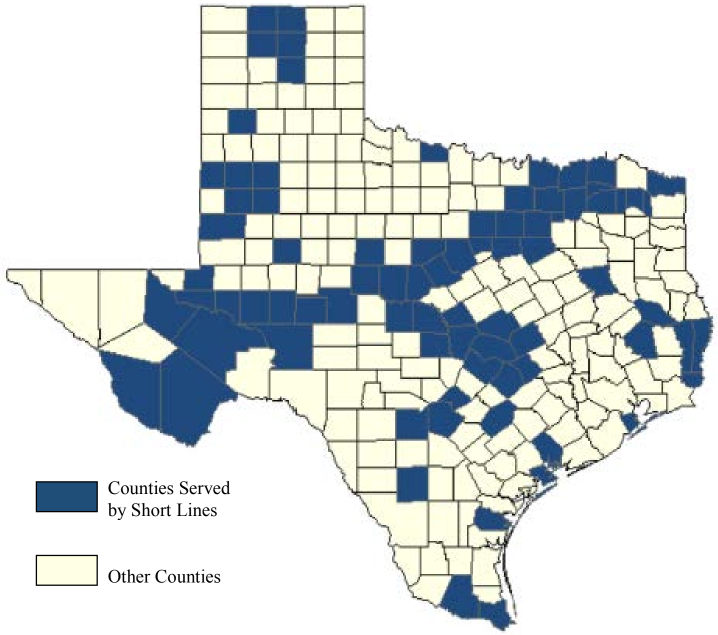

Figure 1 Counties Served by Short Lines in Texas

Table 1 List of Current Short Line Railroads in Texas

No.	Short Line Railroad	Mileage	Headquarters (City and County)	Member of ASLRRA	Member of TSLRRA	IC with UP	IC with BNSF	IC with KCS
1	Alamo Gulf Coast Railroad (AGCR)	3.5	San Antonio, Bexar County, TX	X		X		
2	Alliance Terminal	7	Haslet, Tarrant County, TX	X	X		X	
3	Angelina & Neches River Railroad (ANR)	31	Lufkin, Angelina County, TX		X	X		
4	Austin Western Railroad (AWRR)	154	Austin, Burnet County, TX	X	X	X	X	
5	Big Spring Rail System, Inc. (BSR)	3	West Chester, PA (Chester County)	X		X		
6	Blacklands Railroad (BLR)	80	Sulphur Springs, Hopkins County, TX		X	X		X
7	Border Pacific Railroad (BOP)	32	Rio Grande City, Starr County, TX	X		X		
8	Brownsville & Rio Grande International Railroad (BRG)	45	Brownsville, Cameron County, TX	X	X	X	X	X
9	Central Texas & Colorado River Railway (CTXR)	68	Brady, McCulloch County, TX				X	
10	Corpus Christi Terminal Railroad (CCPN)	42	Corpus Christi, Nueces County, TX	X		X	X	X
11	Dallas Terminal Railway	1	Dallas, Dallas County, TX		X			
12	Dallas, Garland & Northeastern Railroad (DGNO)	168	Richardson, Dallas County, TX	X	X	X	X	X

No.	Short Line Railroad	Mileage	Headquarters (City and County)	Member of ASLRRA	Member of TSLRRA	IC with UP	IC with BNSF	IC with KCS
13	Fort Worth & Western Railroad (FWWR)	276	Fort Worth, Tarrant County, TX	X	X	X	X	X
14	Galveston Railroad (GVSR)	39	Galveston, Galveston County, TX	X		X	X	
15	Gardendale Railroad, Inc. (GRD)	1	Cotulla, La Salle County, TX	X		X		
16	Georgetown Railroad (GRR)	23	Georgetown, Williamson County, TX	X		X	X	
17	Hondo Railway, LLC (HRR)	5	Hondo, Medina County, TX		X	X	X	
18	Kiamichi Railroad Company (KRR)	22	Paris, Lamar County, TX	X	X			
19	Lubbock and Western Railway (LBWR)	148	Brownfield, Terry County, TX	X		X	X	
20	Moscow, Camden & San Augustine Railroad (MCSA)	70	Camden, Polk County, TX	X		X		
21	Orange Port Terminal Railway (OPT)	1.8	Orange, Orange County, TX			X	X	
22	Panhandle Northern Railroad (PNR)	31	Borger, Hutchinson County, TX	X	X		X	
23	Pecos Valley Southern Railway (PVS)	18	Pecos, Reeves County, TX	X		X		
24	Plainsman Switching Co., Inc. (PSC)	18	Lubbock, Lubbock County, TX			X	X	
25	Point Comfort & Northern Railroad (PCN)	14	Lolita, Jackson County, TX	X	X	X		
26	Rio Valley Switching Company (RVSC)	74	McAllen, Hidalgo County, TX	X	X	X	X	
27	Rockdale, Sandow & Southern Railroad (RSS)	4	Rockdale, Milam County, TX	X	X	X		
28	Rusk, Palestine & Pacific Railroad (RPP)	30	Rusk, Cherokee County, TX			X		
29	Sabine River & Northern Railroad SRN	40	Orange, Orange County, TX	X		X	X	X
30	San Antonio Central Railway SAC	4	San Antonio, Bexar County, TX	X		X	X	
31	South Plains Lamesa Railroad (SLAL)	5	Lubbock, Lubbock County, TX	X			X	
32	Southern Switching Company (SSC)	13	Abilene, Taylor County, TX	X		X		
33	Temple and Central Texas Railway (TC)	10	Temple, Bell County, TX	X	X		X	
34	Texas & New Mexico Railway (TXN)	104	Wolfforth, Lubbock County, TX	X		X		
35	Texas & Northern Railway (TN)	42	LoneStar, Morris County, TX	X				X
36	Texas Central Business Lines Corp. (TCB)	18	Midlothian, Ellis County, TX	X	X	X	X	
37	Texas Line (RJCD)	14	Diboll, Angelina County, TX	X		X		
38	Texas North Western Railway (TXNW)	138	Sunray, Moore County, TX	X	X		X	
39	Texas Northeastern Railroad (TNER)	67	Richardson, Dallas County, TX	X	X	X	X	

No.	Short Line Railroad	Mileage	Headquarters (City and County)	Member of ASLRRA	Member of TSLRRA	IC with UP	IC with BNSF	IC with KCS
40	Texas Pacifico Transportation (TXPF)	390	San Angelo, Tom Green County, TX	X		X	X	
41	Texas Rock Crusher Railway (TXR)	8	Brownwood, Brown County, TX		X		X	
42	Texas, Gonzales & Northern Railway (TXGN)	46	Harwood, Gonzales County, TX		X	X		
43	Timber Rock Railroad Inc. (TIBR)	160	Silsbee, Hardin County, TX	X	X		X	X
44	Western Railroad Company (WRRC)	2	New Braunfels, Comal County, TX	X		X		
45	Wichita, Tillman & Jackson Railway (WTJR)	100	Wichita Falls, Wichita County, TX	X	X	X	X	

Chapter 2. Review of Transportation Impact Analysis of Short Line Railroads

In the existing literature, transportation impact analysis of railroad projects focus mainly on comparing rail and truck transport in the following four aspects: traffic, safety, environment, and road infrastructure. Table 2 summarizes the transportation impacts of two scenarios: moving freight by railroad and moving freight by truck.

Table 2 Summary of Transportation Impacts of Railroad

	Moving Freight by Railroad	Moving Freight by Truck
Traffic	• Recurring congestion • Traffic backups at bottlenecks	• Increased truck traffic • Higher Vehicle Miles Traveled (VMT)
Safety	• Crashes at grade crossing • Block routes for emergency vehicle • Heavy Axle Loads (HALs) safety	• Increased crash and fatality probability
Environment	• Higher fuel efficiency and fewer emissions than truck • Secondary air pollution (e.g. emission produced by automobiles waiting in queues at grade crossings) • Noise pollution	• Emission produced by incremental trucks • Noise pollution (truck)
Road Infrastructure	• Poor quality of crossing surface	• Pavement damage by trucks • Higher maintenance cost

Table 3 shows the marginal costs caused by an illustrative vehicle (e.g., truck) to road congestion, pavement maintenance, crash, and noise. This table was developed in the Highway Cost Allocation Studies conducted by FHWA (2000) and have been used in previous studies to estimate the transportation impacts of different transportation projects. For example, TxDOT used the parameters in Table 3 for the transportation impact analysis of the South Orient Rail Line rehabilitation project (TxDOT, 2011). Another study from Washington State University stated that truck axle weight is not the only important factor in assessing road damage (Sage et al., 2015). In this study, Sage et al. (2015) calculated the pavement damage costs by multiplying number of rail carloads with a pavement damage unit cost ($127.50/carload) estimated by ASLRRA. The analysis results indicated that the operation of the short line reduced highway pavement damage by $291,338.

Table 3 Marginal Pavement, Congestion, Crash, and Noise Costs (FHWA, 2000)

2000 Marginal Pavement, Congestion, Crash, and Noise Costs for Illustrative Vehicles Under Specific Conditions					
Vehicle Class/Highway Class	Marginal Costs (cents per mile)				
	Congestion	Pavement	Crash	Noise	Total
Autos/Rural Interstate	0.78	0	0.98	0.01	1.77
Autos/Urban Interstate	7.70	0.1	1.19	0.09	9.08
40 kip 4-axle S.U.T.*/Rural Interstate	2.45	1.0	0.47	0.09	4.01
40 kip 4-axle S.U.T./Urban Interstate	24.48	3.1	0.86	1.50	29.94
60 kip 4-axle S.U.T./Rural Interstate	3.27	5.6	0.47	0.11	9.45
60 kip 4-axle S.U.T./Rural Interstate	32.64	18.1	0.86	1.68	53.28
60 kip 5-axle Comb*/Rural Interstate	1.88	3.3	0.88	0.17	6.23
60 kip 5-axle Comb/Urban Interstate	18.39	10.5	1.15	2.75	32.79
80 kip 5-axle Comb/Rural Interstate	2.23	12.7	0.88	0.19	16.00
80 kip 5-axle Comb/Urban Interstate	20.06	40.9	1.15	3.04	65.15

*S.U.T. – Single Unit Truck; Comb – Combination Truck

2.1 Impact of Short Line Railroad on Congestion

According to Association of American Railroads (AAR, 2015), moving freight by rail is much more efficient and effective than by trucks. If the short line services were not used, a great amount of shipment will be diverted to trucks. Ouellette (1989) found that while a large truck represents 1.7 passenger cars on a level highway, it is equivalent to 8 passenger cars on a steep grade freeway. Sage et al. (2015) estimated the transportation costs for the Tacoma Rail line under two different scenarios: fully moved by rail and fully moved by truck. The estimated cost of movement by truck is ten times more than the estimated costs of movement by rail. Although congestion and traffic delay can be caused by highway-rail grade crossings, for light-density short line railroads, the issue of traffic backups at bottlenecks is less serious compared to Class I railroads.

2.2 Impact of Short Line Railroad on Safety

The level of rail safety can be significantly improved by various effective measures and regulations such as grade separation, monitoring of truck crash ‘hot spots’, and light system upgrades. Data released by Federal Railroad Administration (FRA) shows that the number of short line rail accidents decreased from 318 to 177 from 2004 through 2013 with the rehabilitation of track and maintenance (FRA, 2013).

If the short line services were not used, the diverted trucks will increase the number of truck-related collisions. Study has found that the percentage of trucks on a highway was one of the key factors that contribute to the severe crash probability. Statistics showed that an additional truck volume leads to a disproportionate rise in crash severity (Dong et al., 2013). Statistics released by USDOT also show that 30 percent of the fatalities involve truck movement (USDOT, 2012). Average safety cost per truck-mile is typically used to measure the safety impact on highway.

2.3 Impact of Short Line Railroad on Environment

Short line railroads will cause two significant impacts on local environment: transportation noise and emissions.

2.3.1 Noise

Short line railroads are mainly located in rural areas, where the background noise is about 30 dBA. A freight train can produce 80 dBA at a 49 ft distance (INC, 2015). 70 dBA is the maximum safe noise level for human beings without harmful effects for 24 hours exposure (WHO, 2000). A noise level of 85 dBA or higher can cause permanent damage to hearing sensitivity and even induce hearing loss (NIHL, 2015).

Given that there is only one freight train approaching or leaving a railway station, the noise exposure level (L_{ex}) of the single noise measure from the train is calculated using Equation (1):

$$L_{ex} = L_{eq} + \text{correction for shift length} \qquad (1)$$

where,
L_{ex} = the daily energy-averaged exposure sound level,
L_{eq} = the equivalent steady sound level of a noise energy-averaged over time.

The correction for shift length can be looked up in Figure 2.

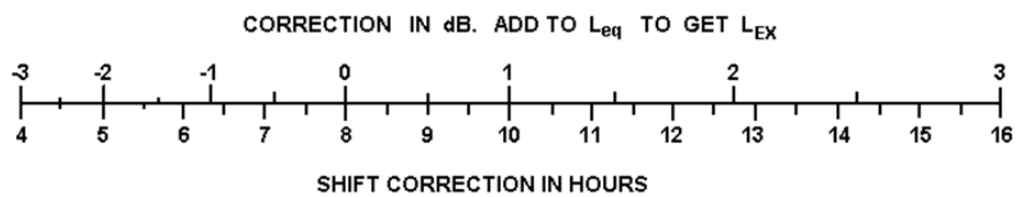

Figure 2 Chart for Shift Time Correction (WorksafeBC, 2015)

In practice, multiple freight trains are usually operating at the same time. The total exposure noises ($L_{ex\,(total)}$) from *n* freight trains can be calculated as below (Equation 2).

$$L_{ex\,(total)} = 10\log\left(\sum_{i=1}^{n} 10^{\frac{L_{ex\_i}}{10}}\right) \qquad (2)$$

where
n = number of trains.
L_{ex_i} = the noise exposure level for the i^{th} train.

2.3.2 Emission

According to the Environmental Protection Agency (EPA, 2009), the primary pollutants from locomotives are sulfur dioxide (SO_2) and carbon dioxide (CO_2). Based on the Environmental Protection Agency (EPA) Emission Factors for Locomotives (2009), the approximated total emissions of SO_2 and CO_2 can be calculated using Equation (3).

$$Total = \frac{Emission\ Factor_{SO2\ or\ CO2}}{400\ ton\text{-}mile/gal} \qquad (3)$$

where,
Emission factors = $SO_2{:}\ 1.88\,\frac{g}{gal} \quad CO_2{:}\ 10{,}217\,\frac{g}{gal}$

The emission factors of other air pollutants, such as NO_x, PM_{10}, and HC, highly depend on engine parameters, which can be found in the Emission Factors for Locomotives from year 2006 to 2040 (EPA, 2008). If the transport mode were changed to heavy-duty trucks, the air pollutants would switch to another six types of air pollutants, including VOC, THC, CO, NO_x, $PM_{2.5}$, and PM_{10}. The total emissions from heavy-duty gasoline/diesel vehicles (HDGV/HDDV) are the sum of the total mileage multiplied by the related emission factors listed in Equation (4).

$$\text{Total Emissions} = EF_{HDGV} * \sum_{i=1}^{n} Mileage_{gasoline} + EF_{HDDV} * \sum_{i=1}^{n} Mileage_{diesel} \quad (4)$$

Moreover, emissions can be measured directly using a Portable Emissions Measurement System (PEMS). For example, Qiao et al. (2005) used PEMS to conduct an on-road vehicle emission test in Houston. In recent years, many studies are inclined to adopt the emission factors that are calculated based on PEMS measurement (Li et al., 2015a; Rahman et al., 2015; Li, et al., 2015b; Munni et al., 2015).

2.4 Impact of Short Line Railroad on Road Infrastructure

Studies have demonstrated that the operation of short lines could reduce the costs of pavement repair and highway user costs by reducing truck traffic (Bitzan et al., 2002; Warner and Terra, 2006). Russell et al. (1996) applied transportation simulation to estimate the wheat movement before and after the proposed railroad abandonment. The additional abandonment-related pavement maintenance costs were estimated to be $1,000,000 annually (Russell et al., 1996). Betak et al. (2009) stated that non-class I railroads (short line and regional railroads) facilitated carloads equivalent to 26 million trucks in the U.S., which prevent pavement damage costs by $1.2 billion every year. A recent TxDOT report of the South Orient Rehabilitation project showed that the estimated saved highway maintenance costs to be $35,532,017 within 5 to 10 years if the project is completed (TxDOT, 2011). Llorens et al. (2014) also showed that the operation of short lines in Louisiana saved $21 million in reduced pavement damage.

Chapter 3. Review of Economic Impact Analysis of Short Line Railroads

3.1 Input-Output Models

The Input-Output model was originally developed by Wassily Leontief, who received a Nobel Prize for this work. This model represents the interdependencies between different divisions of an economy in the regional level. The input-output model is the most commonly used technique by states and the federal government to assess the economic impact of business spending. The advantage of this model is that it quantifies the direct impacts and also quantifies the indirect and induced impacts through the local, regional and state economy. Figure 3 shows the economic activity flow of short line railroad operations.

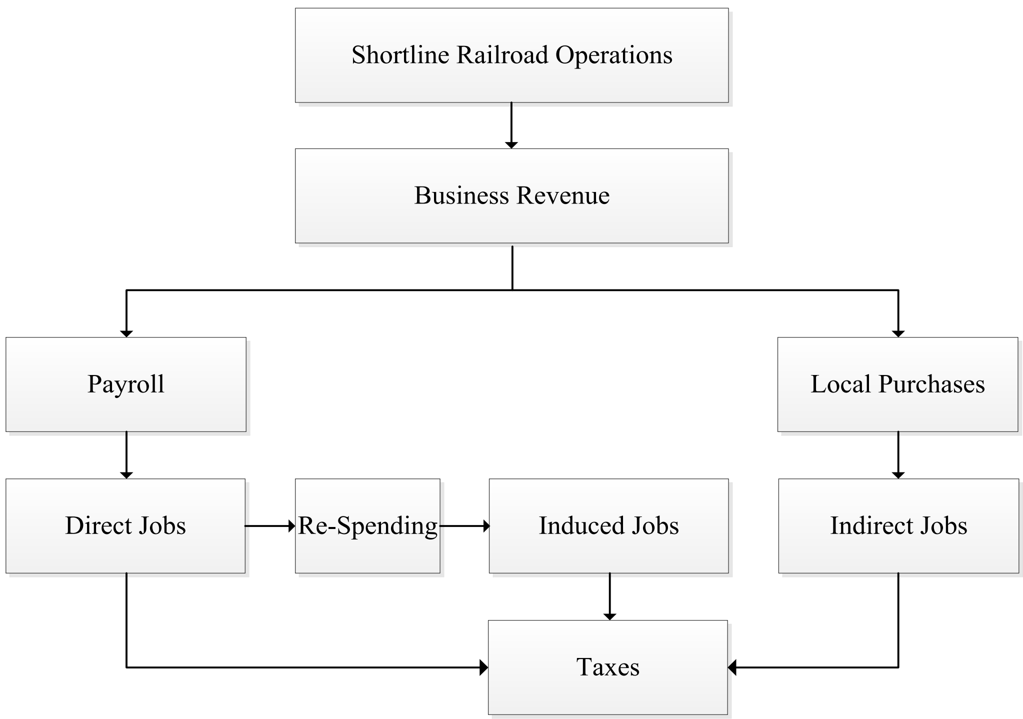

Figure 3 Short Line Railroad Economic Activity Flow

3.2 IMPLAN

IMPLAN is an economic impact estimation software system. The acronym is for Impact Planning and Analyses. IMPLAN was originally developed by the USDA Forest Service in the mid-70s for community impact analysis. The current IMPLAN input-output model and database is maintained and sold by the Minnesota IMPLAN Group (MIG). IMPLAN collects economic data from the system of national accounts for the United States like economic factors, multipliers and demographic statistics with a modeling software. IMPLAN allow users to develop local level input-output models by identifying direct impacts by sector, then developing a set of indirect and induced impacts by sector through the use of the corresponding multipliers, local purchase coefficients, and other factors and associations. Table 4 shows the comparison of IMPLAN with the input-output model RIMS II.

Table 4 Comparison of Input-Output Models IMPLAN and RIMS II

Features	IMPLAN Pro	IMPLAN Online	RIMS II
Study level	County Group of counties State	Zip code County Group of counties State	County Group of counties State
Type	Desktop software and data	Online software	Spreadsheet of multipliers
Demographic data	Basic	Basic	No
Employment and wage data	Yes	Yes	Yes
License	No limit	One year	No limit
Impact calculation	Direct, indirect and induced	Direct, indirect and induced	Direct, indirect
Edit underlying data and assumptions	Yes	Yes	No
Data availability	Most data instantly downloadable	30 minutes	1 to 10 business days
Tax impact	Yes	Yes	No
Cost	**$6,270** Includes information of all industries for state-level and all counties for the state of Texas	**$4,350** Includes information of all industries for state-level and all counties for the state of Texas	**$75** for one industry for state-level **$250** for all industries for each county or group of counties For this project the total cost would exceed $10,000
Results	Automatically calculated by the software	Automatically calculated by the software	Manually calculation required
Information required	Industry, year and one of the following: - Industry Sales - Employment - Employment Compensation - Proprietor Income	Industry, year and one of the following: - Industry Sales - Employment - Employment Compensation - Proprietor Income	- Industry - Year - Industry Sales - Employment - Employment Compensation

3.3 Impact on Local Community

The purpose of calculating the economic impact on local community is to identify and estimate the potential socio-economic effects of a proposed development on the lives and conditions of people within the community. For this project, the research team analyzed the short lines' employment level, expenditures, and wages in the local community's economy. The community economic impact analyses include

- Current social, land use and community status
- Status of other industries
- Social, land use and community changes if the short line railroads are replaced by other modes of transportation.

3.4 Customer Base of Texas Railroad

Rail traffic originated in Texas moves essentially chemicals (plastics and industrial chemicals), stone, sand, gravel, intermodal, and products of petroleum refining and coke (AAR, 2012). The rail traffic terminated in Texas moves coal, stone, sand, gravel, chemicals, farm products, and food products (Figure 4 and Figure 5). The major commodities carried by short lines in Texas include nonmetallic minerals, farm products, crushed stone, and chemicals (Warner and Terra, 2006).

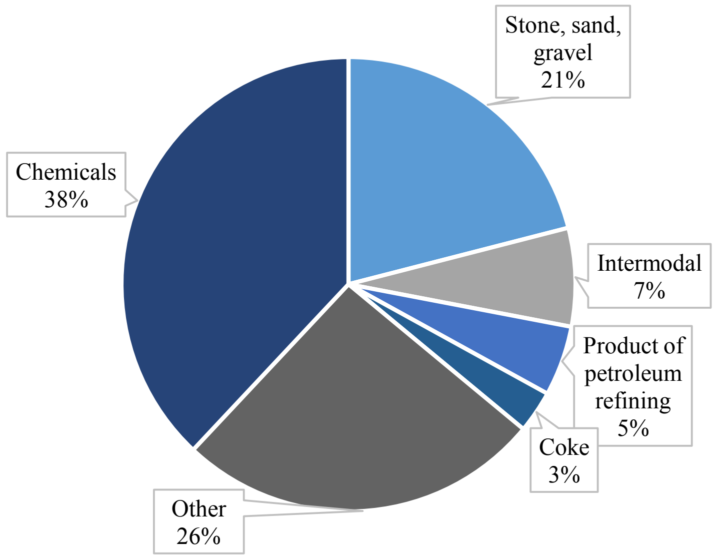

Figure 4 Rail Traffic (Tonnage) Originated in Texas in 2012 (AAR, 2012)

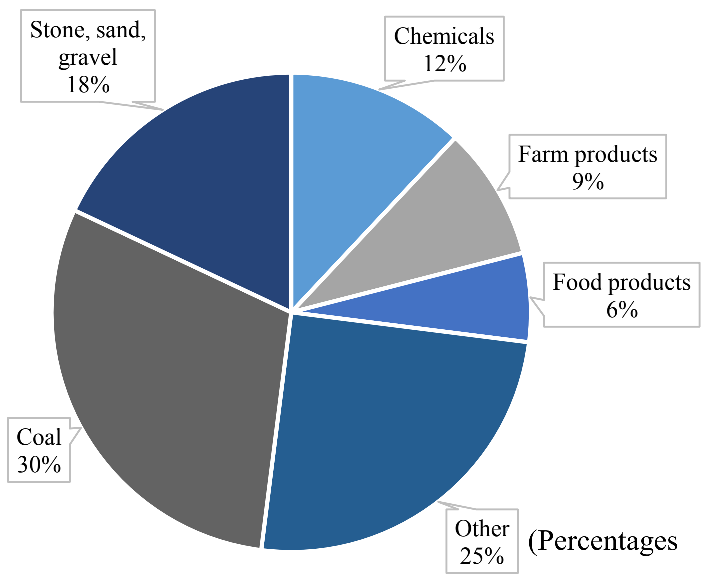

Figure 5 Rail Traffic (Tonnage) Terminated in Texas in 2012 (AAR, 2012)

Moreover, railroads in the state of Texas also moves hazardous materials. Table 5 shows the origin, destination, and the top 5 hazardous materials shipped by rail.

Table 5 Hazardous Material Rail Movement in Texas (TxDOT, 2010)

Category of Rail Movement	Origin	Destination	% of Total Hazardous Waste Rail Shipments by Tonnage in Texas	Top Five Hazardous Materials Commodities Shipped by Rail
Internal	Texas	Texas	14%	Vinyl Chloride Petroleum Gas Liquid Caustic Sodium Petroleum Oil Sulfuric Acid
Through	Non-Texas	Non-Texas	18%	Vinyl Chloride Petroleum Gas Liquid Caustic Sodium Petroleum Oil Sulfuric Acid
Originating	Texas	Non-Texas	43%	Petroleum Fuel Chemicals, NEC Vinyl Chloride Vinyl Acetate Asphalt, Petroleum Liquid
Terminating	Non-Texas	Texas	25%	Petroleum Gas Liquid Sulfur Liquid Propylene Chlorine Gas Sulfuric Acid

3.5 Railroad Economic Impact Analysis from Previous Studies

The team has reviewed reports on economic impact analyses of railroad in other states. Table 6 presents a summary of these studies.

Table 6 Summary of Reviewed Reports

STATE	FOCUS	YEAR	MILEAGE	ECONOMIC MODEL	APPROACH METHOD	DIRECT IMPACT				TOTAL IMPACT			
						JOBS	WAGE	EXPENDITURE	REVENUE	JOBS	WAGE	EXPENDITURE	REVENUE
Wisconsin (Johnson et al., 2006)	Railroad	2006	11	IMPLAN	Surveys	2371	$114,000,000	N/A	$544,000,000	2,883	$137,000,000	N/A	$614,000,000
Texas (Alliance Transportation Group 2007)	Railroad	2007	371	IMPLAN	Estimation	1234	N/A	N/A	$170,945,856	1,955	N/A	N/A	$272,296,738
Minnesota (Tuck et al., 2010)	Railroad	2010	94	IMPLAN	Interviews	15	$1,252,721	$2,521,075	N/A	24	$1,581,197	$3,545,274	N/A
	Shippers	2010	94		Surveys	161	$10,203,691	$212,391,874	N/A	1,031	$45,614,440	$358,944,535	N/A
Pennsylvania (Stone, 2012)	Railroad	2012	141	RIMS II	Interviews	92	$531,383	$1,933,988	N/A	N/A	N/A	$3,090,761	N/A
Wisconsin (Deller, S., 2013)	Railroad	2013	3,387	IMPLAN	Surveys, phone interviews	2927	$315,823	$558,863	$961,694	1,0160	$614,398	$1,028,208	$1,799,794
	Consumer	2013	3,387		Surveys, phone interviews	14961	$929,120	$1,458,900	$3,415,641	34,318	$1,762,817	$2,877,567	$5,917,134
Louisiana (Llorens et al., 2014)	Short line	2014	509	RIMS II	Surveys, interviews	331	$67,000	N/A	N/A	1,490	$4,740,000	N/A	N/A

3.5.1 Wisconsin - Economic Impact Analysis Plymouth-Kohler Rail Corridor (Johnson et al., 2006)

The purpose of this report is to analyze the economic potential of the rail line between the communities of Plymouth and Kohler in Wisconsin and the benefits for the community and businesses if the rail would work again. The railroad was not in service at the moment of this study. Wisconsin & Southern Railroad Company wanted to demonstrate that the reactivation of the railroad would represent a good candidate for a Freight Rail Preservation Program grant to purchase the 11 miles rail line.

Wisconsin Department of Transportation (WisDOT) interviewed businesses and local officials regarding their economic relation with the rail line. They focused only on the foremost important businesses of the area. IMPLAN was used as the economic impact analysis software. The results of the study showed that the four businesses along the Plymouth-Kohler rail line created directly and indirectly approximately 2,883 jobs, $137 million in personal income, and $614 million in sales.

3.5.2 Texas - Potential Economic Impacts of an Improved South Orient Railroad (Alliance Transportation Group, Inc., 2007)

The purpose of this study was to provide evidence of the potential economic benefits of South Orient Railroad (SORR) to the state of Texas if it was rehabilitated. Two impact areas were analyzed - regional level consisting of 34 counties and statewide level. The study also identified the future cargos for the railroad and estimated the number of carloads per year. The direct economic impact of rail related activities was estimated. These activities were measured in terms of new production, consolidation, distribution and storage, rail transportation, truck transportation, and new facilities. Input-output model software IMPLAN was used to calculate the total economic impact if the South Orient Railroad was rehabilitated. The study revealed that if the South Orient Railroad is improved, the investment would pay for itself in a short time and the benefits produced would exceed the costs. Figure 6 shows the map of the South Orient in Texas and Mexico.

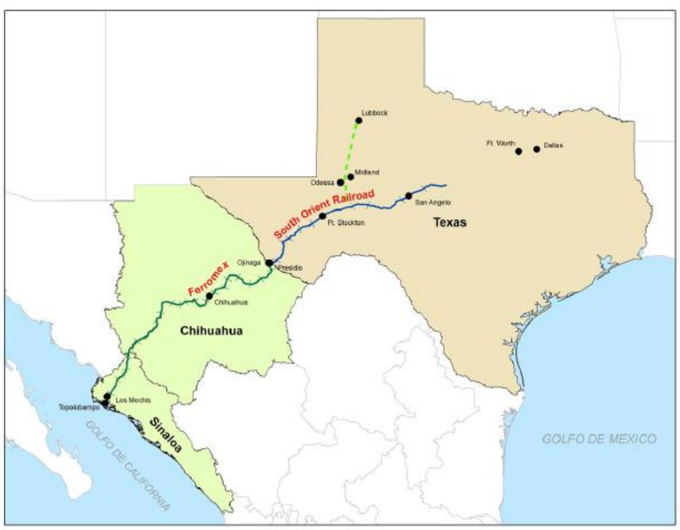

Figure 6 Map of the South Orient Railroad and its Connection to the Pacific Ocean (Alliance Transportation Group, 2007)

3.5.3 Virginia - Statewide Short Line Railroad Improvement Plan (DRPT, 2009)

The purpose of this study was to evaluate the status of the short line railroads in the state of Virginia and determine what kind of funds they would need for their improvement. Short lines were built many years ago with the standards of that time, which were no longer up to date. Moreover, these short lines experienced delayed maintenance for many years. They were able to maintain the traffic volume but failed to invest in track and infrastructure updates due to lack of financial strength. For these reasons, the short lines railroads couldn't afford the investment needed to update the infrastructure to new codes (Virginia DRPT, 2009).

In the study, funding programs in New Jersey, North Carolina, Ohio, Wisconsin and Pennsylvania were used as benchmarks for Virginia's program. These programs essentially consisted of grants and low interest loans to public and private entities, and are usually managed by the departments of transportation of the state and their economic development commissions.

Regarding the policy, the study concluded that a short term and a long term program must be developed. The short term program (six-year improvement program) consists of improving short line railroads to Class 2 standards for freight operations, and Class 3 standards for passenger trains, and continuing to work with the Virginia Economic Partnership and local economic development agencies to attract business with needs of rail services. For the long term program, improvements projects by 2035, the objectives are to complete the improvements of short line railroads to Class 2 standards for freight operations and Class 3 standards for passenger trains, and continue to work with the Virginia Economic Partnership and local economic development agencies to attract business with needs of rail services. Additionally, the study determined the amount of funding needed for each of the ten short line railroads operating in the state of Virginia.

3.5.4 Minnesota - The Economic Contribution of the Minnesota Valley Regional Rail Authority Rail Line (Tuck and Linscheid, 2010)

This project focused in two components: rail operations and shippers. For each component, the impact was calculated at the regional and state-level. The input-output model software IMPLAN was used to calculate the total economic impact. To obtain the budget and employment data from the shippers, the University of Minnesota conducted surveys and the following questions were asked:

- How much of your business is dependent on the MVRRA Rail Line?
- What percent of your business would cease if the MVRRA Rail Line didn't exist?
- If the MVRRA Rail Line didn't exist, what percent of your sales would you transport by truck?
- What changes would you be willing to make if MVRRA improves the rail line?

3.5.5 Pennsylvania - Adirondack Scenic Railroad North Country Regional Economic Impact Analysis (Stone Consulting, Inc., 2012)

The intent of this study was to determine the best use of the rail corridor and its benefits to justify public investments. Data for budgets, revenues and expenditures was provided by the Adirondack Scenic Railroad for FY 2010-11. Using the input-output model software RIMS II, the total economic impact was calculated in terms of number of wages, expenditures, sales and jobs.

3.5.6 Wisconsin - Economic Contributions of the Railroad Industry to Wisconsin (Deller, S., 2013)

The purpose of this study was to determine the impacts of freight rail service to industries in Wisconsin and the economy. Additionally, the study seeks to define the impact of a lack of rail services. Railroad companies and consumers of the rail service were included in the study. Surveys and phone interviews were conducted. For the costumers of the rail service, the survey asked three questions:

- How important is rail service to your business?
- How difficult would it be for your business to shift from rail to truck?
- If rail service was no longer available how likely would you be forced to close/relocate your business?

The responses for the last question were grouped in three scenarios: all rail customers, those that are either somewhat likely or very likely to close/relocate their business and those that are very likely to close or relocate their business. Final results for this study demonstrated that rail service is important for the businesses, but if necessary, they would switch completely to trucks. However, their businesses recognized that the absence of rail would have a negative effect in their profitability.

3.5.7 Louisiana - Economic Impact Analysis of Short Line Railroads Louisiana (Llorens *et al*, 2014)

The purpose of this research project was to evaluate the economic importance and the impact of short line railroads in the state of Louisiana. Data was collected over a 9-month period through electronic surveys, federal, state, and rail association data sources, conversations with persons with knowledge of the short line railroad industry and one visit with a short line rail railroad. Data was used to calculate the total economic impact using the input-output model RIMS II.

This project also identified potential funding opportunities based on the most common practices of other states including:

- State rehabilitation grants
- State loan programs
- State loan/grant hybrid programs

The results of the study showed that short line railroads in Louisiana are a very important support for some of leading industries. The short line railroads operations on the state created 331 direct jobs with average wages and benefits of $67,000.

Chapter 4. Data Collected from Survey, Interview, and Third Party Sources

The purpose of this survey is to collect data for the analysis of the impacts of short line railroads on the Texas economy so as to assist state officials on determining detailed roles, grant opportunities, and plans for short line railroads in Texas. Surveys were conducted through an online survey tool (SurveyMonkey.com). The survey recipients were short line owners/operators, customers, and community leaders (Figure 7). In addition to the online survey, emails, phone calls and on-site interviews were also conducted in this research.

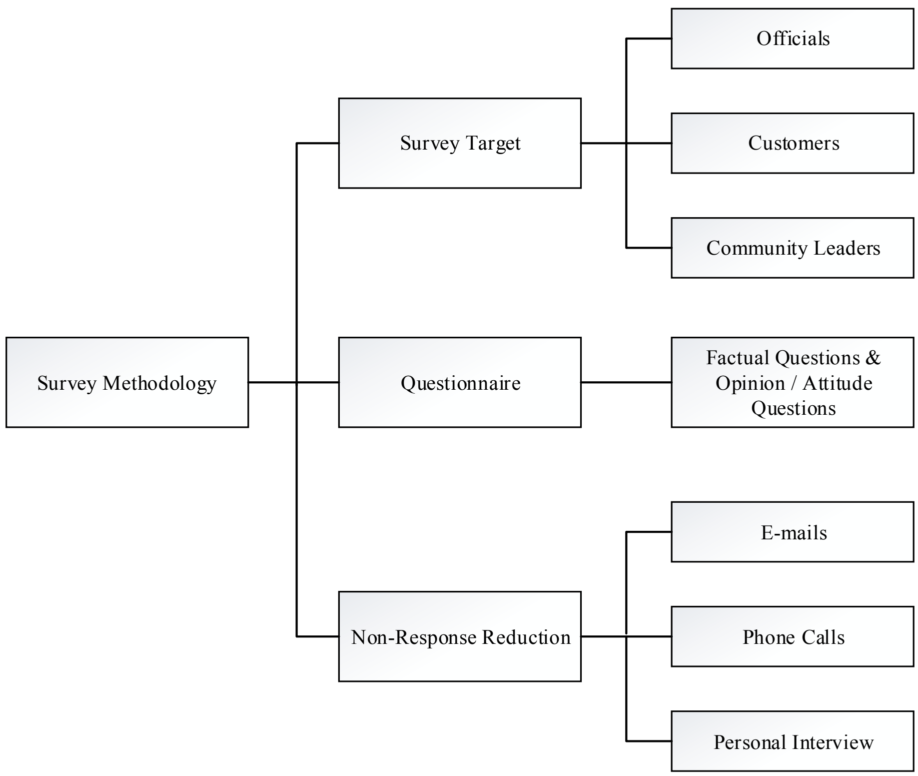

Figure 7 Survey Framework

4.1 Survey and Interview Status

The online survey was sent to a total of 43 short line railroads, of which 20 railroads completed the online survey and 15 railroads completed the follow-up interview. Additionally, the research team visited 5 railroads and conducted interviews with 3 community leaders.

4.2 Third Party Sources

Besides the survey and interviews, the research team has also collected data from third party sources as shown in Table 7. The website www.ReferenceUSA.com was used obtain financial information (e.g., the number of employees, wages and benefits expenses, and annual revenue) of each short line company. For transportation data of short line railroads, the team has carefully studied alternative truck routes. The average annual daily traffic (AADT) in 2013 and corresponding truck percentage were collected through the Texas Statewide Planning Map.

Table 7 Data Sources Used

No.	Data List	Data Source
Economy		
1	Number of employees	ReferenceUSA.com
2	Revenue	ReferenceUSA.com
3	Wages and benefits expenditures	ReferenceUSA.com
Transportation		
1	Alternative Routes	Texas State Planning Map
2	Average Number of Railcars Monthly	Survey & Interview
3	Average Tonnage Transported Monthly	Survey & Interview
4	AADT (Alternative Routes)	Texas State Planning Map
5	Freight Traffic Volume (Truck Percent)	Texas State Planning Map
6	Top five Commodities	Survey & Interview & Other Online Sources
7	Hazardous Materials Transported	Survey & Interview & Other Online Sources
8	Number of Locomotive Units	Other Online Sources
9	Number of Cars	Other Online Sources

4.3 Summary of Survey and Interview Results

This section contains the summary of the survey and the follow-up interview questions and information collected from third party sources[6].

4.3.1 Commodities

The most common commodities moved by short lines in Texas are:

- Frac sand
- Chemicals
- Grain/feed
- Aggregates
- Brick and cement
- Forest products (paper, lumber and pulp)
- Steel and scrap.

Other commodities moved by the short lines include plastic pellets, motor vehicles, alumina trihydrate, veal, pipes, metallic ores, minerals, limestone, lumber, newsprint, metals, grocery products, clay, industrial products, crushed stone, plastics, gas/oil drilling supplies, flammable liquids, beer/spirits, tile, building products, grain and agricultural products, resins, equipment and machinery, fertilizers, sand, ballast, asphalt, food products, petroleum products, military equipment, casing or drilling pipe, barite, bentonite, plywood, carbon black, cottonseed products, cotton linters, canned goods, baling byproducts (wire, bagging), fencing material, electrode binder pitch, autos and trucks, molasses, urea, coal, polyethylene, lime processor, and rubber emulsion (Figure 8).

[6] American Short Line and Regional Railroad Association (ASLRRA, 2016) and each short line's website.

Figure 8 Wordcloud of Commodities Transported by Texas Short Line Railroads

4.3.2 Hazardous Materials

The hazardous materials transported by the short lines are phenol, hydrochloric acid (HCl), caustic soda, sulfuric acid, sodium hydroxide, phosphoric acid, residue combustible liquid, fertilizers, residue petroleum crude oil, ethanol, diesel, and other refinery products. The search results show that 7 of the 21 surveyed railroads do not transport hazardous materials (Figure 9).

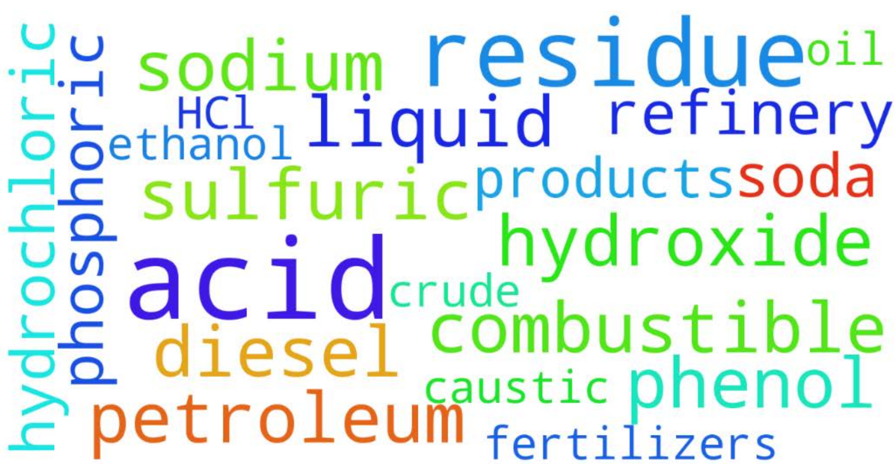

Figure 9 Wordcloud of Hazardous Materials Transported by Texas Short Line Railroads

4.3.3 Type of Service

Short lines in Texas offer line-haul and switching and terminal services. Nineteen railroads offer only switching and terminal service, 19 railroads offer only line-haul service, and 7 short lines offer both services (See Figure 10).

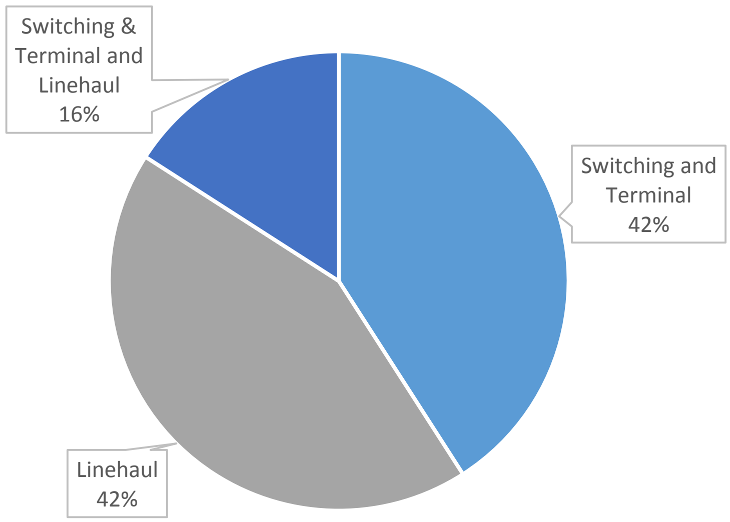

Figure 10 Type of Service Offered by Short Lines in Texas

4.3.4 Customers

The majority of customers are in agriculture, chemical, manufacturer, pipe, metal, oil and gas, minerals, aggregates, and the construction industry. In the agriculture industry, customers include Northeast Texas Farmer's Co-Op, Gavilon, Pilgrim's Pride, Gavilon Grain, Martinek Grains, and Rose Acre Farms. Customers in the chemical field are International Sulphur, Servco Chemical and Fluid Systems. Manufacturer companies are Georgia Pacific, Gulf coast manufacturers, Coca Cola, P & T Burt, AB Mauri, Quanex, ACCO Feeds, Archer Daniels Midland, International Paper, Cell O Core, Atkinson Candies, Jarden Home Brands. There is one customer in the pipe industry, Fort Worth Pipe. In the metal industry, customers include Commercial Metals and New Phoenix Metals. Customers in the oil and gas industry include Pleasant Oil Co, Halliburton, Valero marketing, Phillips 66, Exxon Mobil. In the mineral industry, customers include Prints Minerals, Luminant Mining Co., Fairmount minerals. Customers in the recycling industry include Pine Street Salvage. In the aggregates and construction industry, customers include Lattimore, Owens Corning, United Sands, Hi Crush Partners, Martin Marrietta, Pattison Sand Company, US Silica and Legacy Housing.

4.3.5 Ownership

Among the 15 short line railroads interviewed, 5 short lines' railroad are leased, 9 short lines own their railroads, and 1 partially owns its railroad (Figure 11).

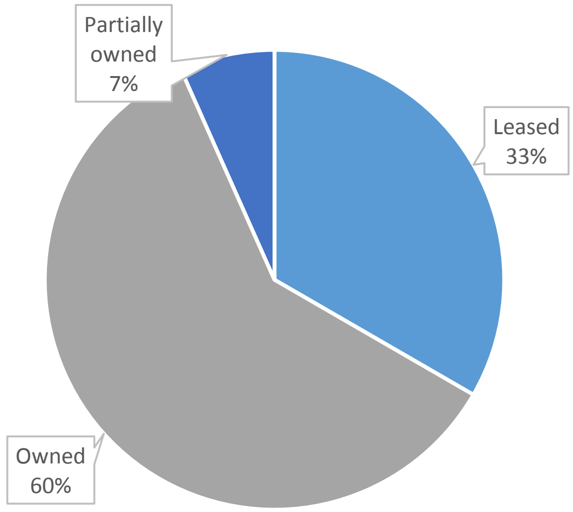

Figure 11 Ownership Status of Short Line Railroads in Texas

4.3.6 Origins and Destinations

Figure 12 shows the origins and destinations at a national level. Major origins of the shipments include Alabama, California, Kansas, Mexico, Minnesota, Montana, Nebraska, Oregon, South Dakota, Texas, Washington, Wisconsin, Wyoming, and upper Midwest. The major destinations of the shipments are California, Kansas, Nebraska, New York, Oregon, South Dakota, Texas, and Washington. Origins in Texas include La Porte, Harlingen, Mission, McAllen and Abilene. Destinations inside the state of Texas include Lufkin, La Porte, Hidalgo, Edinburg and Abilene.

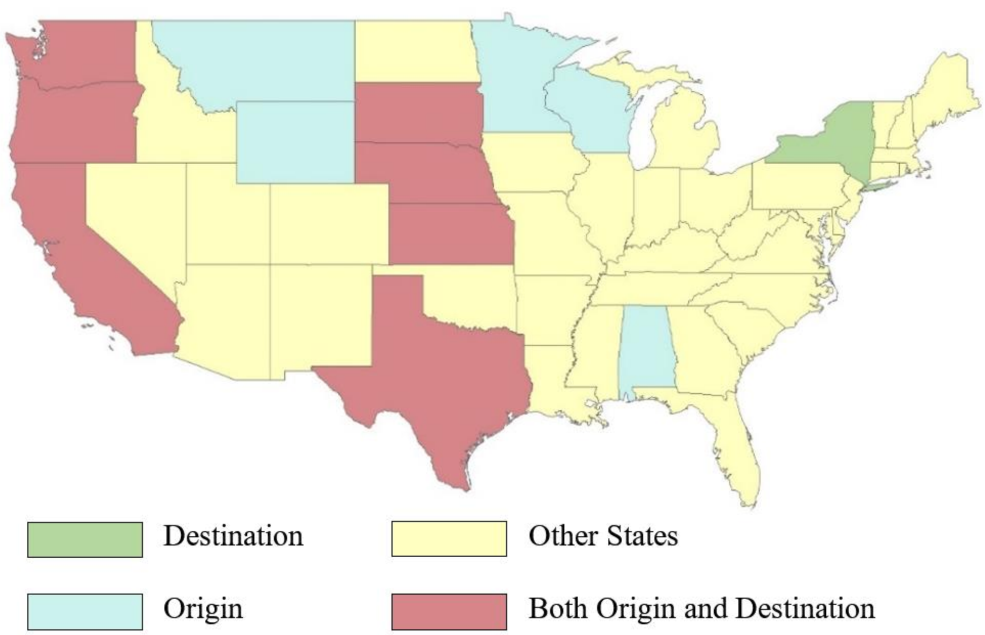

Figure 12 Origins and Destinations

4.3.7 Industries Served

The industries served by short line railroads include drilling, bottling, oil, food processing, security systems, manufacturing, logistics, trans loading and storage, chemical, petrochemical, pulp and paper, agriculture, and recycling. In addition, the short line companies mentioned that potential industries that could use their services are agriculture, building products and materials, chemical, minerals, frac sand, fuel, oil and gas, lumber and rail car cleaning and repair and port businesses. Additionally, all short line railroads interviewed expressed that low oil prices have affected their business either directly or indirectly, as many of the short lines move commodities for the oil and gas exploration operations.

4.3.8 Improvement Needs

During the interviews, short line railroads were asked about the improvements that could potentially benefit their businesses. These improvements include

- better interchange with connecting carrier;
- more customers or businesses;
- extra right of way available for expansion/rehabilitation of a rail line;
- infrastructure improvements;
- more tracks and yard space; and
- more state funding.

Based on the survey and interview results, it was requested by the short line railroads that a short line rail program be established in Texas to provide funding for rail infrastructure improvements and maintenance.

The most important capital improvements desired by the short line railroads are bridge repair and upgrade, land acquisition, track expansion and upgrade, and new interchange point with Class I carriers. For example, several short lines stated that they would need between $200,000 to $1,000,000 per year to enhance their rail and tie infrastructure. However, two surveyed short lines indicated that there are no foreseeable capital improvements.

Furthermore, the short line railroads were asked if they've ever applied for funding from the government and if any of the applications were awarded. One of the surveyed short line railroads had applied for a rail grant (title not recalled) but it was not awarded. Three short lines had applied for Transportation Investment Generating Economic Recovery (TIGER) grant and two were awarded. One of the short lines interviewed stated that TxDOT rail officials had been interested in helping the developments of short line railroads, but there was no adequate resource within TxDOT to do so. This short line recommended that the state government should create a public-private short line infrastructure grant program to assist short line railroads in upgrading lines and expanding capacity.

4.3.9 Connection to Class I Railroads

Thirteen of the surveyed short line railroads have connections with Union Pacific (UP), eight have connections with Burlington Northern Santa Fe (BNSF), and three have connections with Kansas City Southern (KSC). For the short line railroads that didn't respond to the survey and follow up interviews, the information regarding the connection to other railroads was gathered from third party data sources. Twenty of these railroads have connections with Union Pacific (UP), 11 have connections with Burlington Northern Santa Fe (BNSF), and 5 short lines have connections with

Kansas City Southern (KSC). Therefore, in total, 33 short lines have connections with UP, 19 with BNSF, and 8 with KSC (Figure 13).

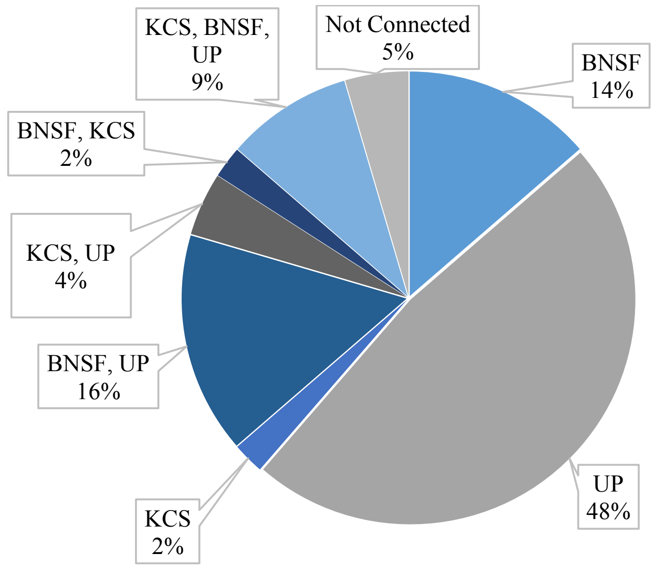

Figure 13 Connections to Class I Railroads

4.3.10 Paper Barriers

The short line railroads were asked if they have paper barriers that would affect their operations. According to the Surface Transportation Board (STB, 2007), paper barriers is defined as

"*a contractual clause limiting the ability or incentive of the purchaser or lessee of a rail line to interchange traffic with railroads other than the line's seller or lessor*."

The survey results show that 3 out of the 15 surveyed short line railroads expressed that their operations were limited to some degrees due to paper barriers. The results also show that 6 of the surveyed short line railroads did not have paper barrier issues and the remaining 6 short line railroads did not answer to this question.

4.3.11 Employment

ReferenceUSA.com, which is an online database of more than 24 million businesses in the United States, was used to obtain the employment information of each short line railroads. The histogram in Figure 14 shows the total direct employment impact of 35 short line railroads. Almost 70% of short lines hire less than 20 employees.

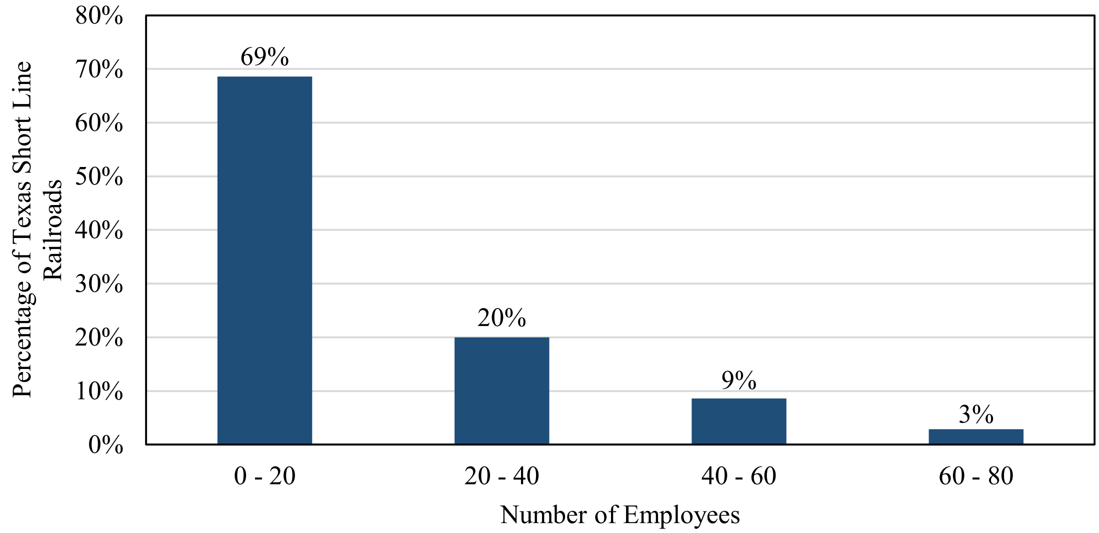

Figure 14 Employment of Short Line Railroads in Texas

4.3.12 Output

Figure 15 shows the histogram of total economic output of Texas short line railroads. As shown in the figure, around 50% of the short lines have annual revenues less than $8 million.

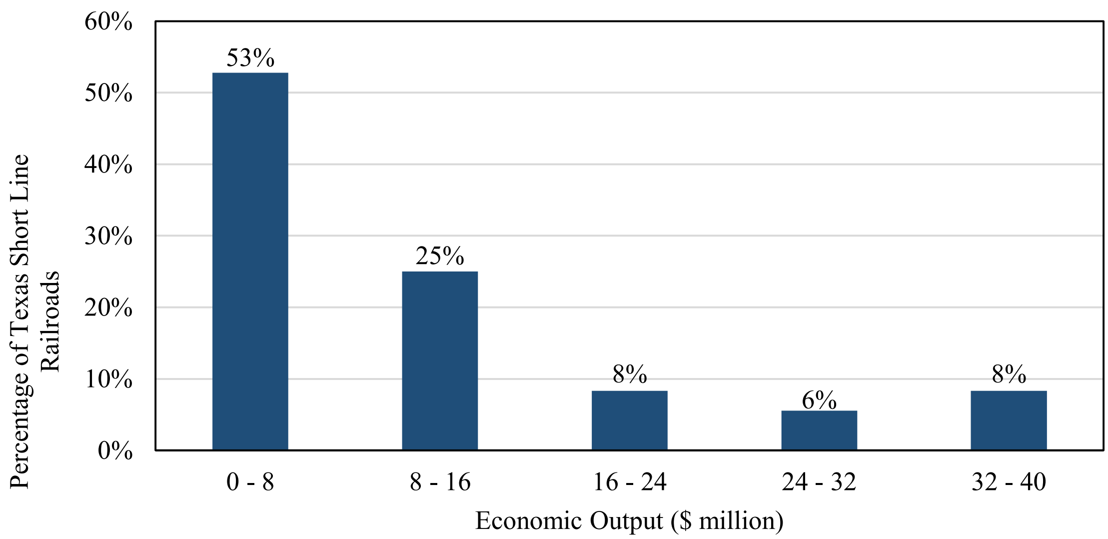

Figure 15 Revenue of Short Line Railroads in Texas

4.3.13 Expenditure on Labor Income

Figure 16 shows the expenditures on labor income by short line railroads in Texas. The majority of short lines (over 50%) spent less than $3 million on labor income in 2015.

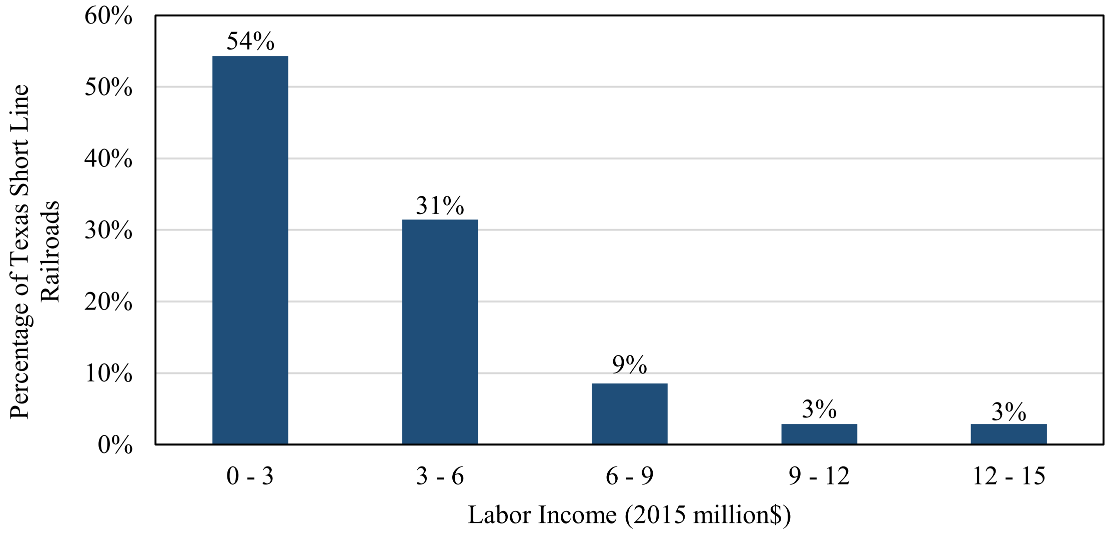

Figure 16 Expenditures on Labor Income of Short Line Railroads in Texas

4.3.14 Operation Speed

Twelve short line railroads provided the information regarding the operation speed of their trains. All stated that the average travel speed is around 10 mph, but two of them mentioned that they also operate above this speed when they enter areas with low population density.

4.3.15 Number of Cars per Train

Information regarding the average number of railcars per train was also collected through follow-up interviews and on-site visits. For the average number of railcars per train, the number varies from 5 to 75.

4.3.16 Number of Carloads

Figure 17 shows the distribution of the carloads transported by short line railroads in Texas. It can be seen from the figure that the majority of the short lines transport less than 1,000 carloads per month.

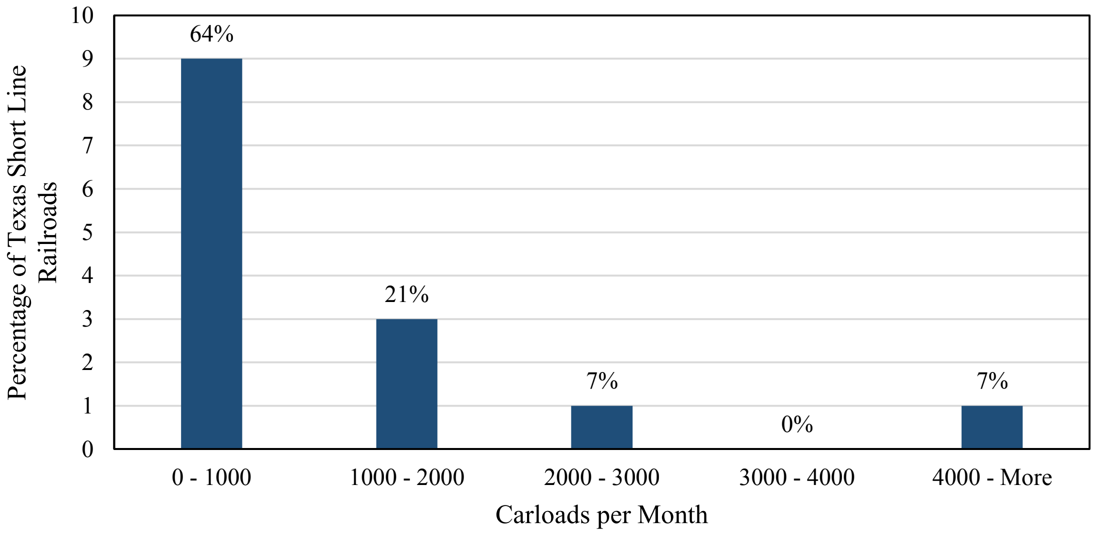

Figure 17 Number of Carloads per Month

4.3.17 Shipping Cost

Likewise, the shipping cost per railcar ranges from \$300 to \$800. According to the information provided by the short line railroads, these rates may vary depending on type of cargo, weight, distance, quantity, and demand.

Chapter 5. Transportation Impact Analysis

5.1 Methodology

Calculations for the transportation impact analysis of short line railroads is discussed in this section. Transportation related costs were estimated for two scenarios: 1) moving freight by railroad; and 2) moving freight by diverted truck. Shipping cost, safety cost, environmental cost, congestion cost, and maintenance cost were considered in this analysis. Cost savings are determined as the difference between the cost by diverted truck and the cost by railroad.

The number of carloads per month and the train route mileage are the main inputs of the transportation impact analysis. The variables and parameters used in the calculation are presented in Table 8.

Table 8 Notations (HDR, 2010; Grimes and Christopher, 2006; FHWA, 2000; Cambridge Systematics, 1997)

Abbreviation	Terms	Value
	Parameters	
ACTM	Accident Cost per Train Mile	$14.67 (per train mile)
ACTrM	Accident Cost per Truck Mile	$0.35 (per truck mile)
ANCT	Average number of carloads per train	27.1
ASRPC	Average shipping rate per carload per mile by rail	1.77 ($/carload/mile)
ASRPT	Average shipping rate per truck per mile by highway	0.84 ($/truck/mile)
CCPTM	Congestion cost per truck mile	0.03 ($/truck/mile)
DR	Discount rate	0.03
PMCT	Rail infrastructure maintenance cost per train ton-mile	$0.0022589 (per ton-mile)
PMCTr	Highway infrastructure maintenance cost per truck ton-mile	$0.00997 (per ton-mile)
SCSRT	Shipping cost savings from rail relative to truck	0.15
TPC	Average number of trucks per rail carload	3 (trucks/carload)
TPT	Average tons of cargo per truck	17.5 (tons per truck)
TRDF	Truck to rail distance factor	0.83
	Variables	
NC0	Number of carloads per month	Varies by railroad
NT	Number of diverted trucks	Varies by railroad
TRM	Train Route Mileage	Varies by railroad
TrRM	Truck Route Mileage	Varies by railroad

5.1.1 Number of Diverted Trucks

Previous study has reported that one railcar can easily accommodate three or four truckloads depending on the product dimensions and rail car size (IowaDOT, 2014). In this study, we assume that each loaded railcar could carry the equivalent of three truckloads. As shown in Equation (5), the number of diverted trucks (NT) equals to the number of carloads per month (NC0) multiplied by the truck-per-carload ratio (TPC).

$$NT = NC0 \times TPC \tag{5}$$

The diverted truck route mileage (TrRM) represents the highway mileage a diverted truck needs to travel for the same original and destination as the railroad. TrRM is calculated by multiplying the train route mileage (TRM) with truck-to-rail distance factor (TRDF).

$$TrRM = TRM \times TRDF \quad (6)$$

5.1.2 Saved Shipping Cost

Equation (7) shows how to estimate the shipping cost by rail (SRC), which equals to the product of the average shipping rate per carload per mile by rail (ASRPC), number of carloads (NC0), and train route mileage (TRM).

$$SRC = ASRPC \times NC0 \times TRM \quad (7)$$

Equation (8) shows the shipping cost by truck (SCT), which equals to the product of the average shipping rate per truck per mile by highway (ASRPT), number of diverted trucks (NT), and truck route mileage (TrRM).

$$SCT = ASRPT \times TrRM \times NT \quad (8)$$

The saved shipping cost is calculated as the difference between SRC and SCT.

$$SShC = SCT - SRC \quad (9)$$

5.1.3 Saved Congestion Costs

Equation (10) shows the estimation of the congestion cost by truck (SCC), which is calculated by multiplying average congestion cost per truck mile (CCPTM) with number of diverted trucks (NT) and truck route mileage (TrRM).

$$SCC = CCPTM \times NT \times TrRM \quad (10)$$

5.1.4 Saved Infrastructure Maintenance Costs

Equation (11) represents the infrastructure maintenance cost caused by truck, which equals to the product of the number of diverted trucks (NT), average tons of cargo per truck (TPT), infrastructure maintenance cost per truck ton-mile (PMCTr), and truck route mileage (TrRM).

$$PMTr = NT \times TPT \times PMCTr \times TrRM \quad (11)$$

Equation (12) shows the track maintenance cost caused by train (PMT), which equals to the product of the number of diverted trucks (NT), average tons of cargo per truck (TPT), infrastructure maintenance cost per train ton-mile (PMCT), and train route mileage (TRM).

$$PMT = NT \times TPT \times PMCT \times TRM \quad (12)$$

The saved maintenance cost is calculated as the difference between PMTr and PMT:

$$SMC = PMTr - PMT \quad (13)$$

5.1.5 Saved Safety Costs

Safety cost represents the cost of fatalities, injuries, and property damage caused by traffic accidents. Equation (14) shows the safety cost caused by trucks, which is calculated by multiplying the number of diverted trucks (NT) with accident cost per truck mile (ACTrM) and truck route mileage (TrRM).

$$SaCTr = NT \times ACTrM \times TrRM \quad (14)$$

Equation (15) shows the safety costs caused by trains, which equals to the number of carloads (NC0) divided by average number of carloads per train (ANCT), then multiply the train route mileage (TRM) and accident cost per train mile (ACTM).

$$SaCT = (NC/ANCT) \times TRM \times ACTM \quad (15)$$

The saved safety cost is calculated as the difference between SaCTr and SaCT:

$$SSaC = SaCTr - SaCT \quad (16)$$

5.1.6 Environmental Costs

Reduced emissions and saved emission costs are associated with a reduction in the number of trucks on alternative routes resulting from the diversion of freight from truck to rail. Four types of emissions including VOC, NO_X, $PM_{2.5}$, and CO_2 are examined in this study. The equations to calculate the emission costs savings are presented below.

Equation (17) represents the emission cost caused by trucks, which is the product of the number of diverted trucks (NT), truck route mileage (TrRM), average tons of cargo per truck (TPT), value of emission, and truck emission factor.

$$ECTr = NT \times TrRM \times TPT \times Value\ of\ emission \times Truck\ emission\ factor \quad (17)$$

Equation (18) represents the emission cost caused by trains, which is the product of the number of diverted trucks (NT), train route mileage (TRM), average tons of cargo per truck (TPT), value of emission, and locomotive emission factor.

$$ECT = NT \times TRM \times TPT \times Value\ of\ emission \times Locomotive\ emission\ factor \quad (18)$$

The saved emission cost is calculated as the difference between ECTr and ECT:

$$SEC = ECTr - ECT \quad (19)$$

Table 9 lists the parameters used in saved emission cost calculations. Locomotives/trucks emissions were estimated on a grams per gallon basis and converted to grams per train/truck ton-mile using average fuel efficiency. However, the locomotives' fuel efficiency varies significantly with locomotive age, locomotive application, and terrain characters. Since EPA does not have detailed information on these variations, the overall emission factors and average values of fuel efficiency were used for calculations.

Table 9 Parameters Used in Emission Calculations

Abbreviation	Description	Value	References
VOCtr	Grams of VOC per truck ton-mile (2015)	0.012	1.Calculated grams/gallon emission factors (EPA, 2008) 2. Average truck fuel efficiency of 130 ton-miles per gallon (The Rocky Mountain Institute, 2009)
PM25tr	Grams of $PM_{2.5}$ per truck ton-mile (2015)	0.006	
CO2tr	Grams of CO_2 per truck ton-mile (2015)	78.440	
NOXtr	Grams of NO_x per truck ton-mile (2015)	0.340	
HCt	Grams of HC per train ton-mile (2015)	0.013	1. Emission factors for locomotives (EPA, 2009) 2. Converting factors for HC and PM_{10} (EPA, 2009) 3. Average train fuel efficiency of 473 miles per gallon (AAR, 2016)
PM10t	Grams of PM_{10} per train ton-mile (2015)	0.007	
CO2t	Grams of CO_2 per train ton-mile (2015)	21.600	
NOXt	Grams of NO_x per train ton-mile (2015)	0.290	
VOCv	VOC cost per short ton (2015$)	1496.740	Emission values (NHTSA, 2009)
NOXv	NOx cost per short ton (2015$)	6076.080	
PMv	$PM_{2.5}$ cost per short ton (2015$)	332708.150	
CO2v	CO_2 cost per short ton (2015$)	24.720	Social cost of carbon (HDR, 2010)

5.2 Transportation Impact Analysis Results

Table 10 and Figure 18 summarize the transportation impact analysis results for the year of 2015. The analysis results indicate that short line railroads have significant advantages over trucks. As shown in Table 10, in year 2015, 14 short line railroads in Texas saved $12,083,227. More specifically, these short line railroads saved $1,997,227 in shipping costs, $963,231 in congestion cost, $4,246,596 in maintenance cost, $4,594,373 in safety cost, and $281,800 in emission costs. Moreover, the calculation results indicated that the operation of these 14 short lines could take 417,177 trucks off the highway every year, which would effectively reduce congestion and enhance safety.

Table 10 Transportation Impact Analysis of 14 Short Lines (Year 2015)[7]

	Short Line Railroad	Truck	Savings
Shipping Cost	$24,629,738	$26,626,965	$1,997,227
Congestion Cost	N.A.	$963,231	$963,231
Maintenance Cost	$1,798,721	$6,045,317	$4,246,596
Safety Cost	$7,532,642	$12,127,015	$4,594,373
Emission Cost	$3,741,298	$4,023,098	$281,800
Total	$37,702,400	$49,785,627	$12,083,227

[7] Transportation costs were calculated based on the data provided by 14 short line railroads in Texas.

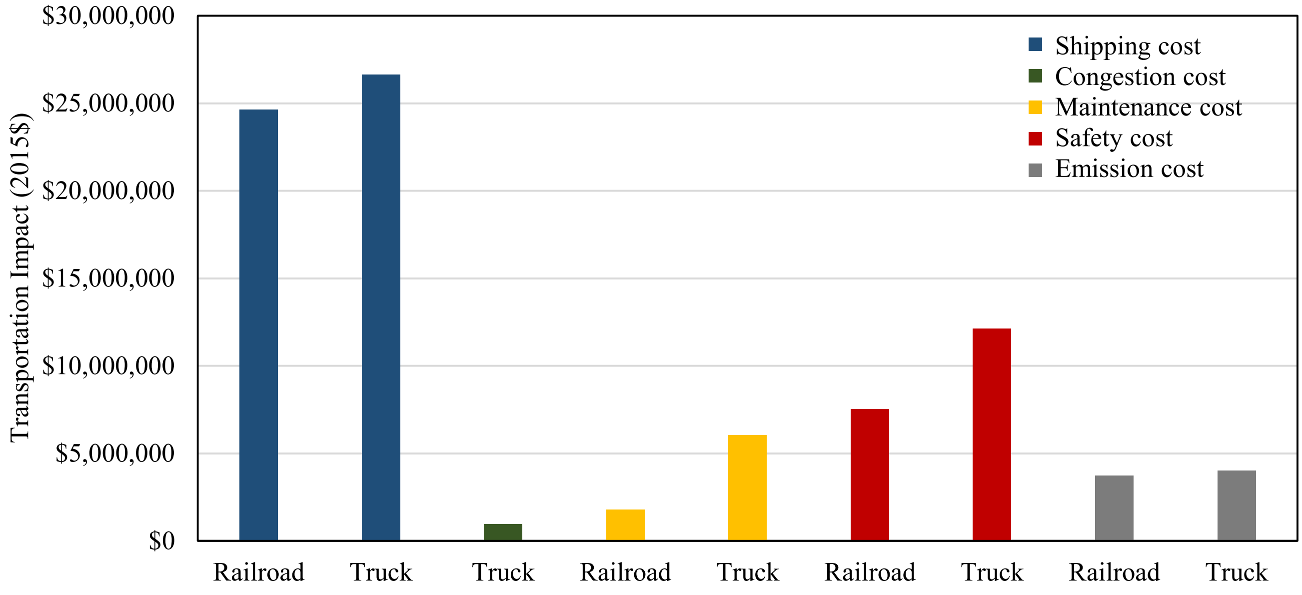

Figure 18 Estimated Transportation Impact of Texas Short Line Railroads

As shown Figure 19, on average, the shipping cost of short line railroad is estimated to be 7.5% less than that of truck. The maintenance cost of short line railroad is estimated to be 70.2% less than that of truck; the safety cost of railroad is estimated to be 37.9% less than that of truck; and the emission cost is estimated to be 7.0% less than that of truck. The average transportation cost of railroad is estimated to be 24.3% less than that of truck.

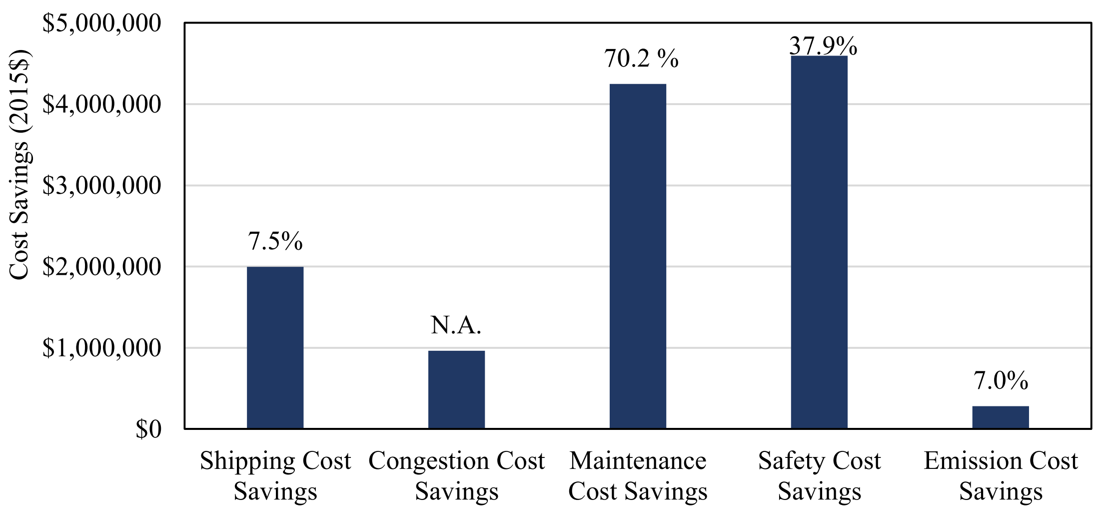

Figure 19 Estimated Transportation Cost Savings of Texas Short Line Railroads in 2015

Table 11 and Figure 20 summarizes the discounted (3%) projection results of Texas short line railroads transportation impact over the next 15 years. It is assumed that carloads grow at 6% annually from 2015-2030. The transportation impact projection was conducted for four categories:

shipping cost, congestion cost, maintenance cost, and safety cost. The saved emission cost was excluded from the projection analysis because the value of emissions and emission factors vary by year. As shown Table 11, saved shipping cost is around $2 million per year in 2015 and it reaches more than $3 million per year by 2030. Similarly, the congestion cost savings are $963,231 in 2015 and they grow to $1,500,683 in 2030. The maintenance cost savings are $4,246,596 in 2015 and will reach $6,616,058 in 2030. The saved safety cost is $4,594,373 in 2015 and will reach $7,157,883 in 2030.

Table 11 Transportation Impact Projection (2015~2030)

Year	Shipping Cost by Rail	Shipping Cost by Truck	Saved Shipping Cost	Saved Congestion Cost	Pavement Maintenance Cost	Track Maintenance Cost	Saved Maintenance Cost	Safety Cost by Train	Safety Cost by Truck	Saved Safety Costs
2015	$24,629,738	$26,626,965	$1,997,227	$963,231	$1,798,721	$6,045,317	$4,246,596	$7,532,642	$12,127,015	$4,594,373
2016	$25,368,630	$27,425,774	$2,057,144	$992,128	$1,852,683	$6,226,677	$4,373,994	$7,758,622	$12,490,826	$4,732,204
2017	$26,129,689	$28,248,547	$2,118,858	$1,021,892	$1,908,263	$6,413,477	$4,505,213	$7,991,380	$12,865,550	$4,874,170
2018	$26,913,580	$29,096,004	$2,182,424	$1,052,549	$1,965,511	$6,605,881	$4,640,370	$8,231,122	$13,251,517	$5,020,395
2019	$27,720,987	$29,968,884	$2,247,897	$1,084,126	$2,024,477	$6,804,058	$4,779,581	$8,478,055	$13,649,062	$5,171,007
2020	$28,552,617	$30,867,950	$2,315,333	$1,116,649	$2,085,211	$7,008,179	$4,922,968	$8,732,397	$14,058,534	$5,326,137
2021	$29,409,195	$31,793,989	$2,384,793	$1,150,149	$2,147,767	$7,218,425	$5,070,657	$8,994,369	$14,480,290	$5,485,921
2022	$30,291,471	$32,747,808	$2,456,337	$1,184,653	$2,212,200	$7,434,977	$5,222,777	$9,264,200	$14,914,699	$5,650,499
2023	$31,200,215	$33,730,243	$2,530,027	$1,220,193	$2,278,566	$7,658,027	$5,379,460	$9,542,126	$15,362,140	$5,820,014
2024	$32,136,222	$34,742,150	$2,605,928	$1,256,799	$2,346,923	$7,887,768	$5,540,844	$9,828,390	$15,823,004	$5,994,614
2025	$33,100,308	$35,784,414	$2,684,106	$1,294,503	$2,417,331	$8,124,401	$5,707,070	$10,123,241	$16,297,694	$6,174,453
2026	$34,093,318	$36,857,947	$2,764,629	$1,333,338	$2,489,851	$8,368,133	$5,878,282	$10,426,939	$16,786,625	$6,359,686
2027	$35,116,117	$37,963,685	$2,847,568	$1,373,338	$2,564,546	$8,619,177	$6,054,630	$10,739,747	$17,290,224	$6,550,477
2028	$36,169,601	$39,102,596	$2,932,995	$1,414,538	$2,641,483	$8,877,752	$6,236,269	$11,061,939	$17,808,930	$6,746,991
2029	$37,254,689	$40,275,674	$3,020,985	$1,456,974	$2,720,727	$9,144,084	$6,423,357	$11,393,797	$18,343,198	$6,949,401
2030	$38,372,329	$41,483,944	$3,111,615	$1,500,683	$2,802,349	$9,418,407	$6,616,058	$11,735,611	$18,893,494	$7,157,883

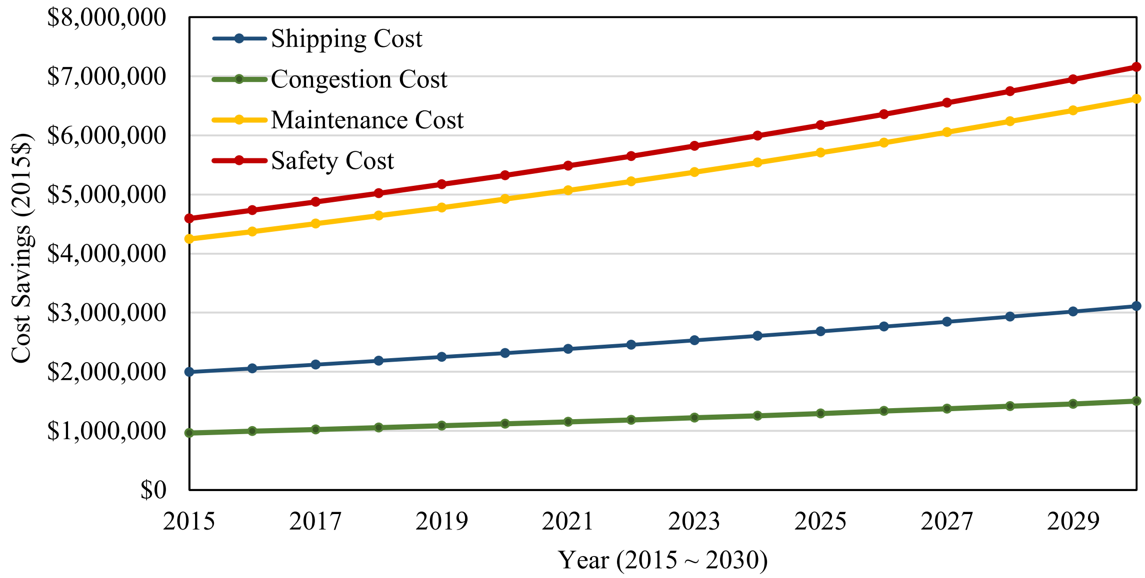

Figure 20 Transportation Impact Projection

Figure 21 shows the distribution of transportation impacts of short line railroads in Texas. On the right side there is only 14% of these 14 short line railroads whose transportation impact is much larger than the others. Seven out of 14 companies have a total transportation impact that is less than $200,000 in year 2015. Three short line railroads fall into the group with a transportation impact range of $200,000 to $400,000. Two short line railroads fall into the group with a transportation impact range of $400,000 to $600,000.

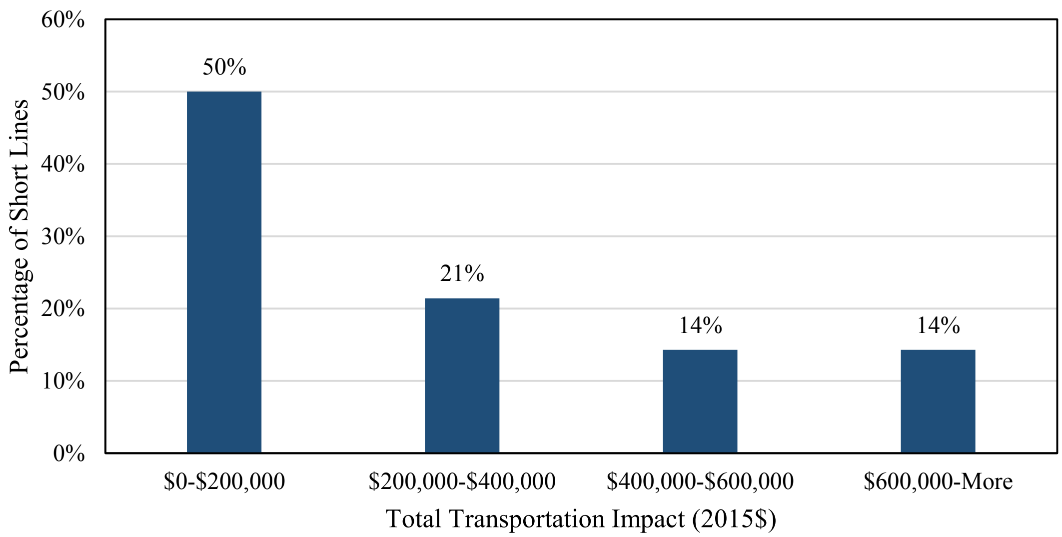

Figure 21 Histogram of Total Transportation Impact

Chapter 6. Economic Impact Analysis

6.1 Introduction

This section documents how the economic activities of Texas short line railroads influence the economy of local communities and the State of Texas. The economic impacts were estimated through IMPLAN. The research team used financial information (e.g., employment, expenditures in labor income, and economic output) to calculate the impacts. Additionally, a total tax impact was estimated.

In the economic impact analysis, employment is defined the annual jobs created by a short line railroad. Expenditures on labor income is the total payroll cost (e.g., wages, benefits, and payroll taxes) paid by the employer. The economic output is the value of services produced by a short line railroad in a year. The estimated taxes are generated from the direct, indirect, and induced expenditures. The total impacts of the taxes include federal taxes and state and local taxes. The tax impacts are estimated at county-level and state-level.

As shown in Figure 22, the economic impacts were estimated at two levels: county-level and state-level. The economic impact did not account for economic activity related to the short line railroads that might occur outside the state of Texas.

In the economic impact analysis, three different impacts are reported: direct, indirect and induced impacts. Direct impact refers to the impact created directly by the short line railroads activities. For example, the sales of the railroad, the numbers of employees directly hired by the short line, and the short line's expenditures on wages and benefits. Indirect impact refers to the second round expenditures on goods and services made by the short line railroads' support industries. For example, when a short line purchases materials or equipment for track maintenance, the supplier must retain employees or hire additional staff to support its operations. Therefore, the hiring of employees by the supplier to support the purchases of the short line is considered indirect employment impact. Induced impact refers to the subsequent round of spending in the local economy made by the households of a short line's employees. Moreover, when the employees of a short line spending their money in groceries and restaurants, it will create more job opportunities and economic activities in these industries. Impacts of this kind are considered as the induced impact.

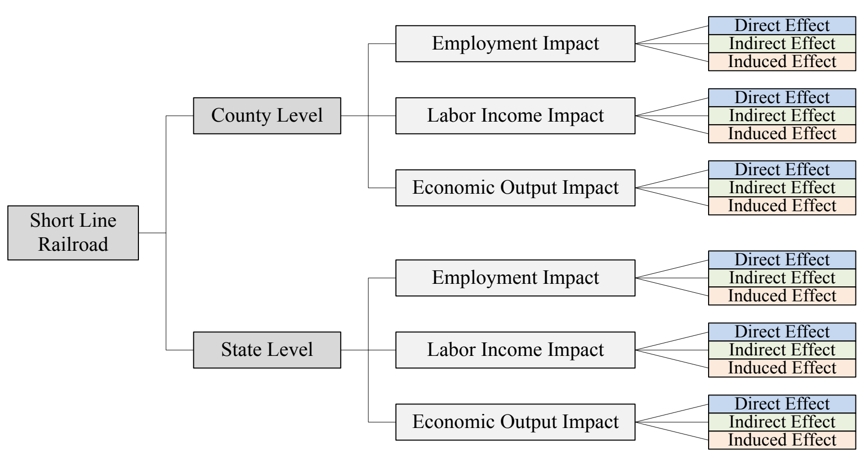

Figure 22 Diagram of Economic Impact Analysis

6.2 Economic Impact Analysis Results

Economic impact analysis was conducted on 35 short line railroads in Texas. Table 12 contains the economic impact results of the short line railroads at both state-level and county-level. At the state-level, in the year of 2015, the short line railroads contributed 1,476 jobs, $113,769,627 in labor compensation, $354,443,588 in economic output, $11,560,394 in local taxes, and $28,714,687 in federal taxes. At the county-level, the short line railroads contribute 1,136 jobs, $87,799,859 in labor compensation, $274,959,869 in economic output, $9,079,987 in local taxes, and $21,433,296 in federal taxes. Figures 23, 24 and 25 show the graphic representation of the economic impact results described above.

Table 12 Economic Impact of Texas Short Line Railroads in 2015

Category	Impact Effect	County-Level	State-Level
Employment Impact (Number of Jobs)	Direct Effect	549	549
	Indirect Effect	284	399
	Induced Effect	303	528
	Total Effect	1,136	1,476
Labor Income Impact	Direct Effect	$60,454,717	$60,454,717
	Indirect Effect	$15,127,971	$28,171,527
	Induced Effect	$12,217,171	$25,143,383
	Total Effect	$87,799,859	$113,769,627
Economic Output Impact	Direct Effect	$184,969,435	$184,969,435
	Indirect Effect	$50,418,969	$91,607,542
	Induced Effect	$39,571,465	$77,866,611
	Total Effect	$274,959,869	$354,443,588
State and Local Tax Impact	**Total Effect**	$9,079,987	$11,560,394
Federal Tax Impact	**Total Effect**	$21,433,296	$28,714,687

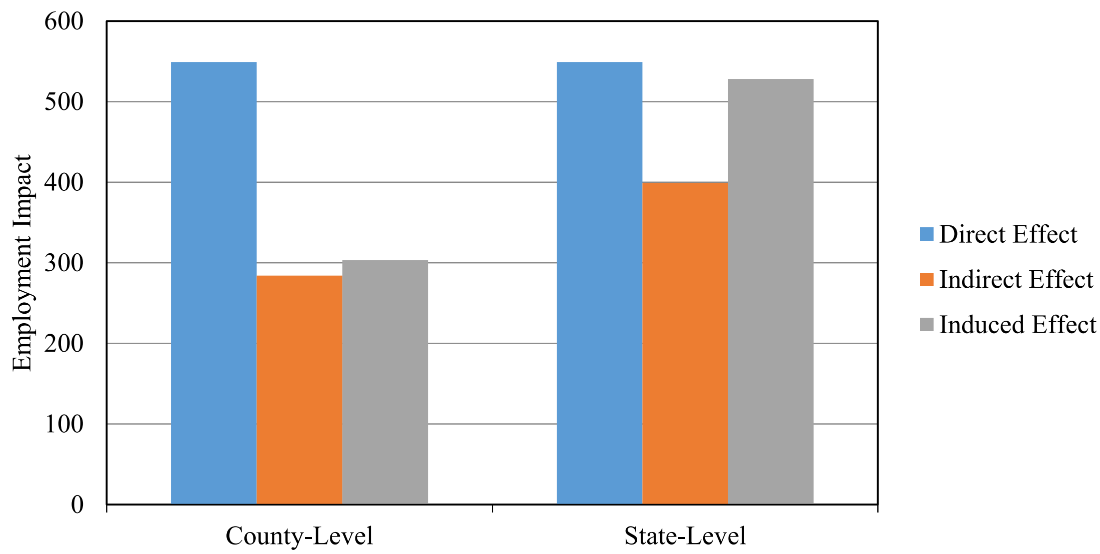

Figure 23 Employment Impact

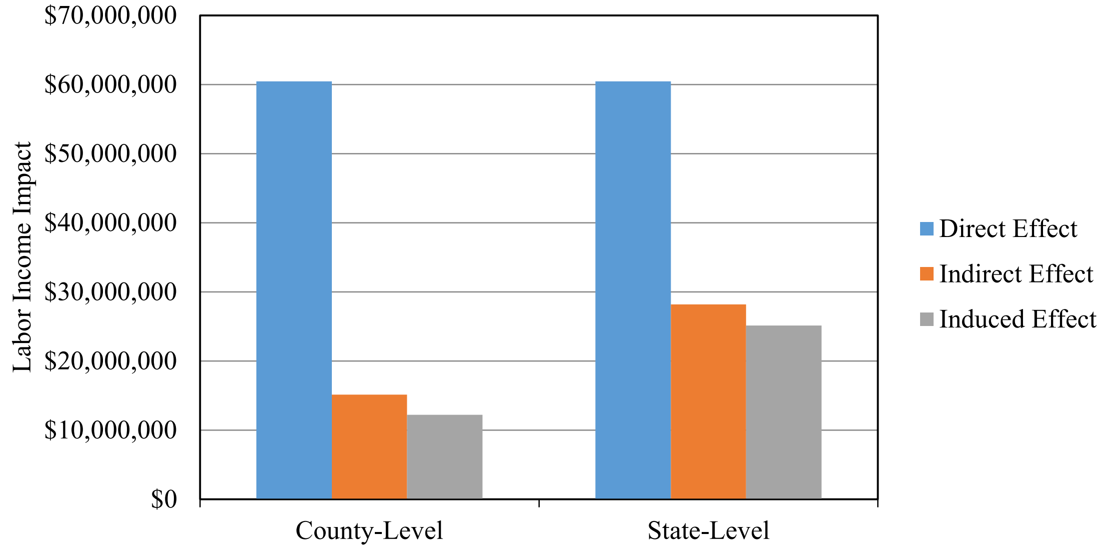

Figure 24 Labor Income Impact

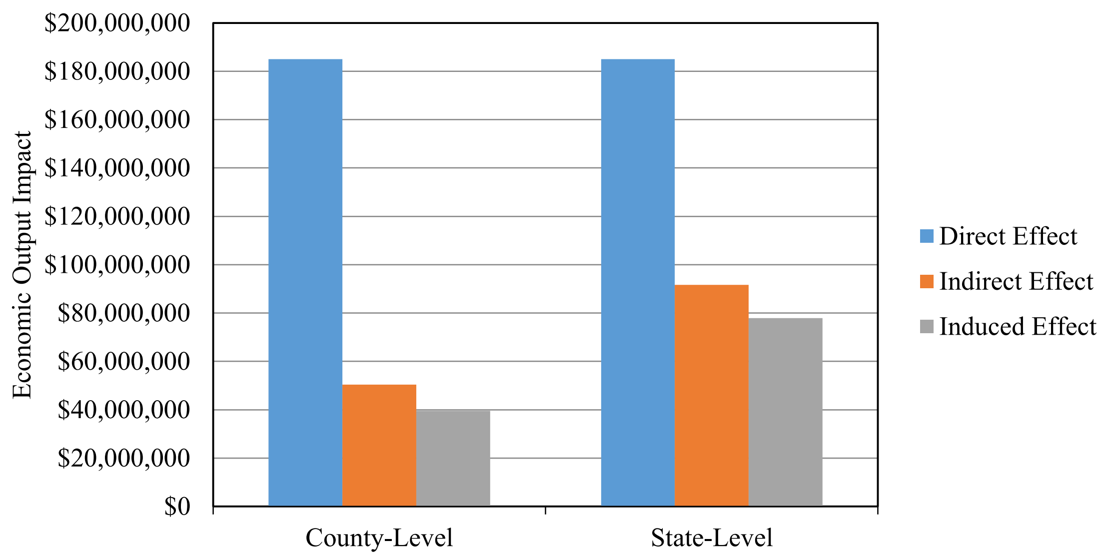

Figure 25 Economic Output Impact

The total tax impact was estimated for 35 short lines in Texas. Figure 26 shows the total state and local tax impact and Figure 27 presents the total federal tax impact, estimated at both county-level and state-level.

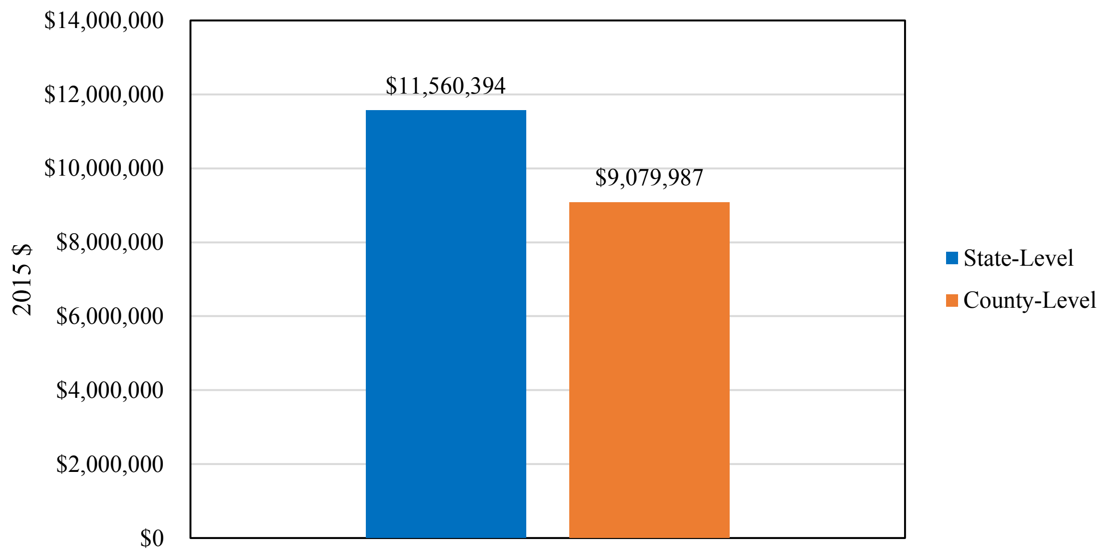

Figure 26 State and Local Tax Impact

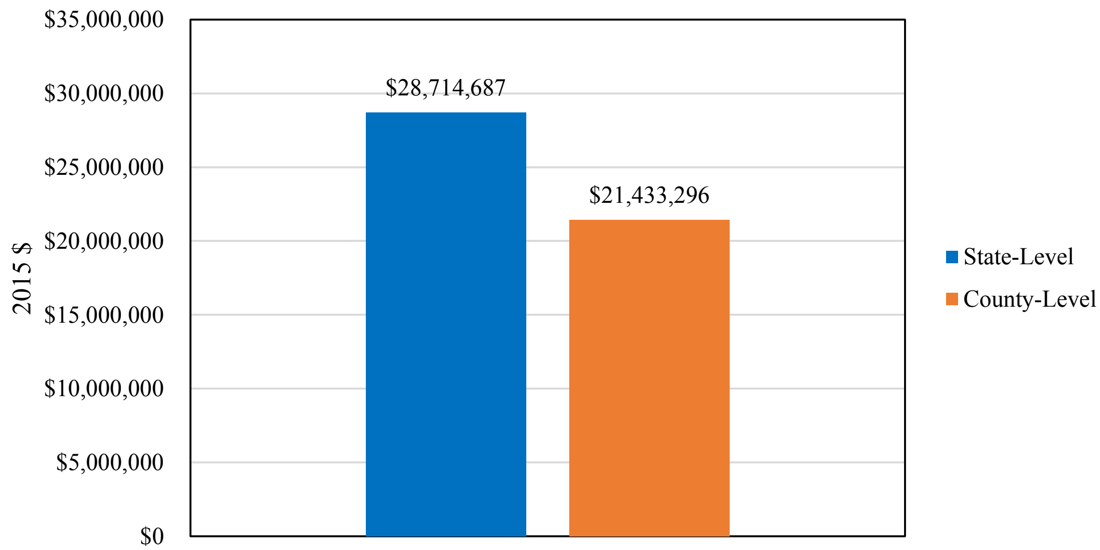

Figure 27 Federal Tax Impact

Figures 28 to 32 show the distribution of total impact of short lines operations at county-level. Figure 28 shows that 82% of short line railroads employment impact ranges from 0 to 50. Figure 29 illustrates that 35% of the short lines spend less than $1,000,000 in labor compensation. Figure 30 shows that 41% of the short lines have an economic output of $4,000,000 or less. Figure 31 shows that 50% of short lines contribute with $200,000 or less in local and state taxes. Lastly, 32% of short lines contribute with $250,000 or less in federal taxes (Figure 32).

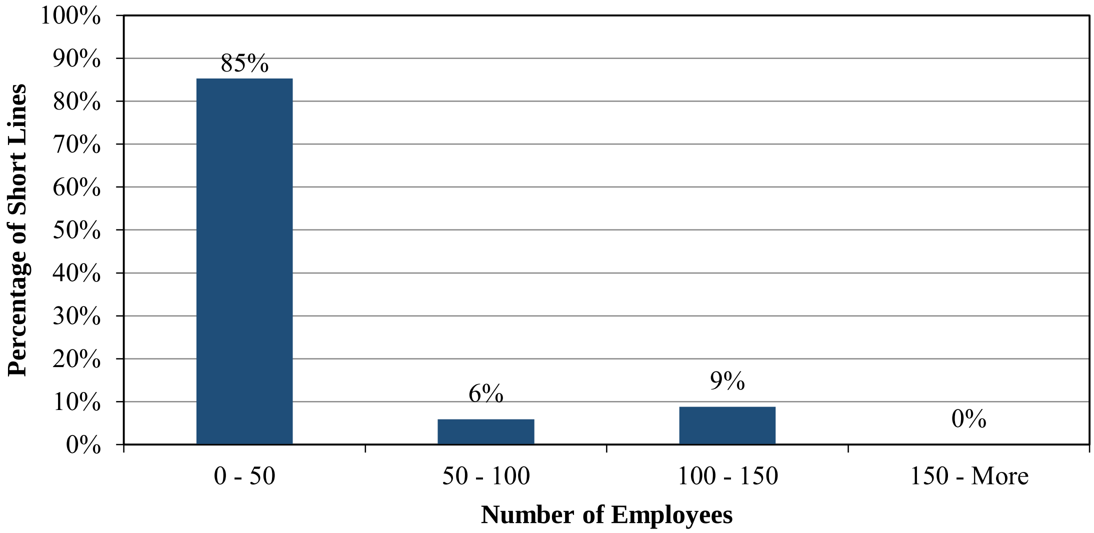

Figure 28 County-level Total Employment Impact

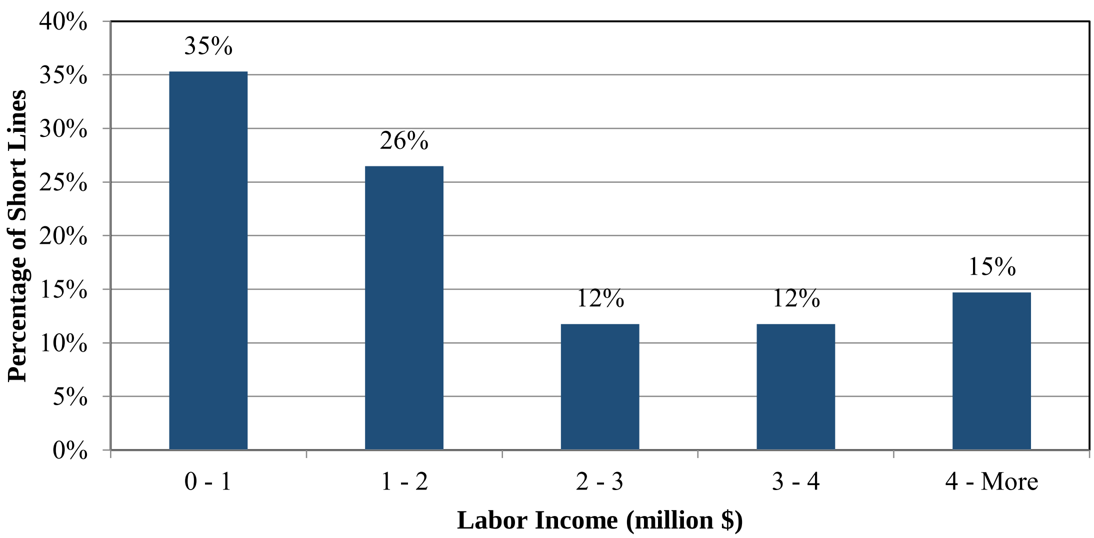

Figure 29 County-level Total Labor Income Impact

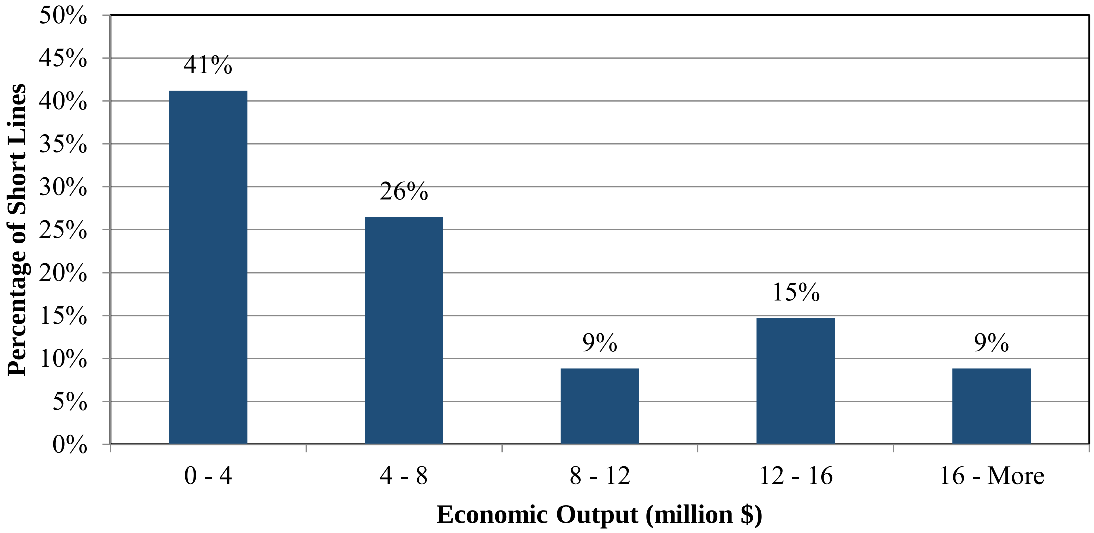

Figure 30 County-level Total Economic Output Impact

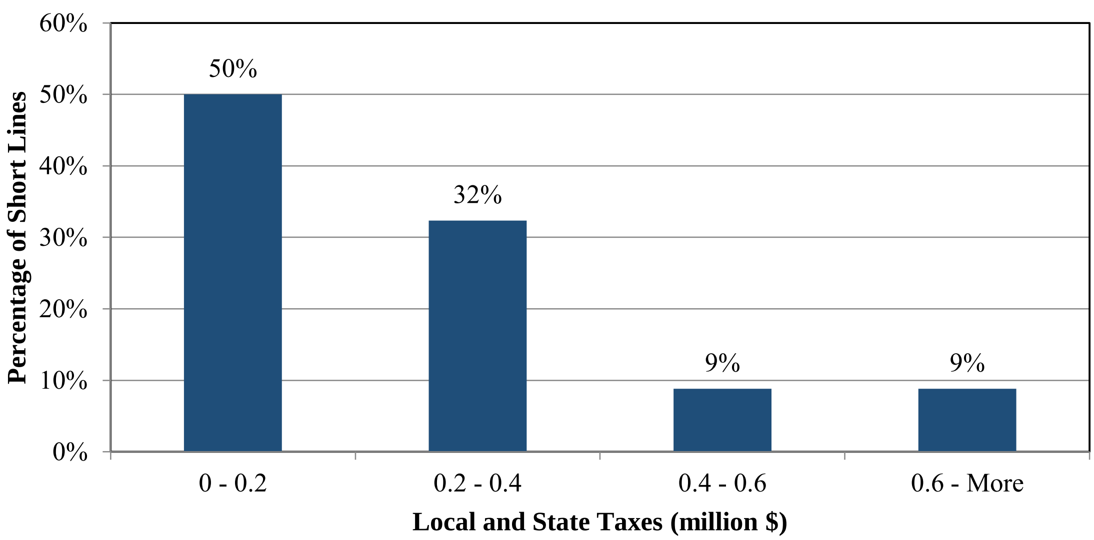

Figure 31 County-level Total Local and State Tax Impact

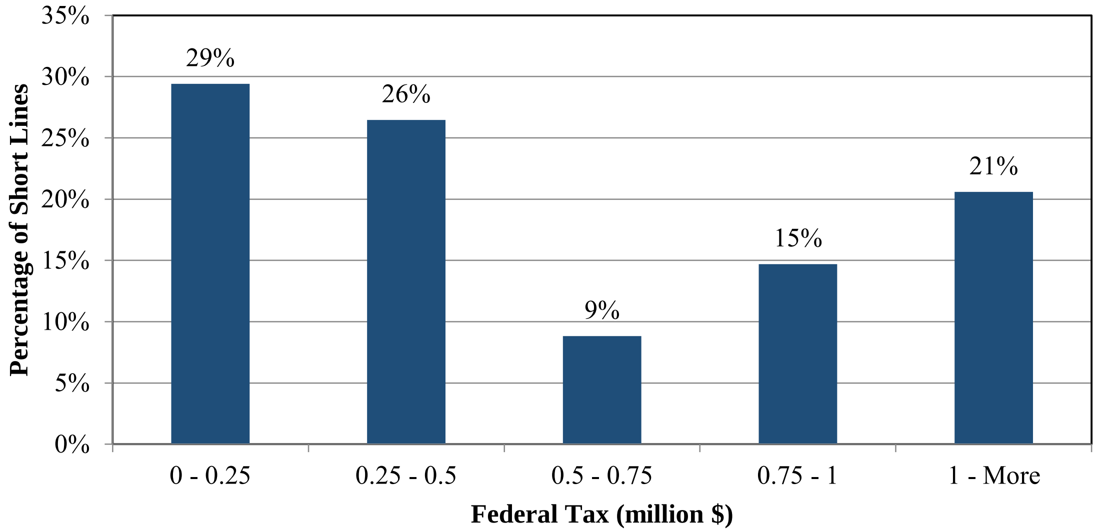

Figure 32 County-level Total Federal Tax Impact

Figures 33 to 37 show the distribution of total impact of short lines operations at state-level. Figure 33 shows that 66% of short line railroads generated less than 50 job opportunities. Figure 34 shows that 31% of the short lines contributed $4,000,000 or more in labor compensation. Figure 35 shows that 29% of the short lines contributed $4,000,000 or less in total economic output. Figure 36 shows that 43% of short lines contributed $200,000 or less in local and state taxes. Figure 37 shows that 34% of short lines contributed $1,000,000 or more in federal taxes at the state-level.

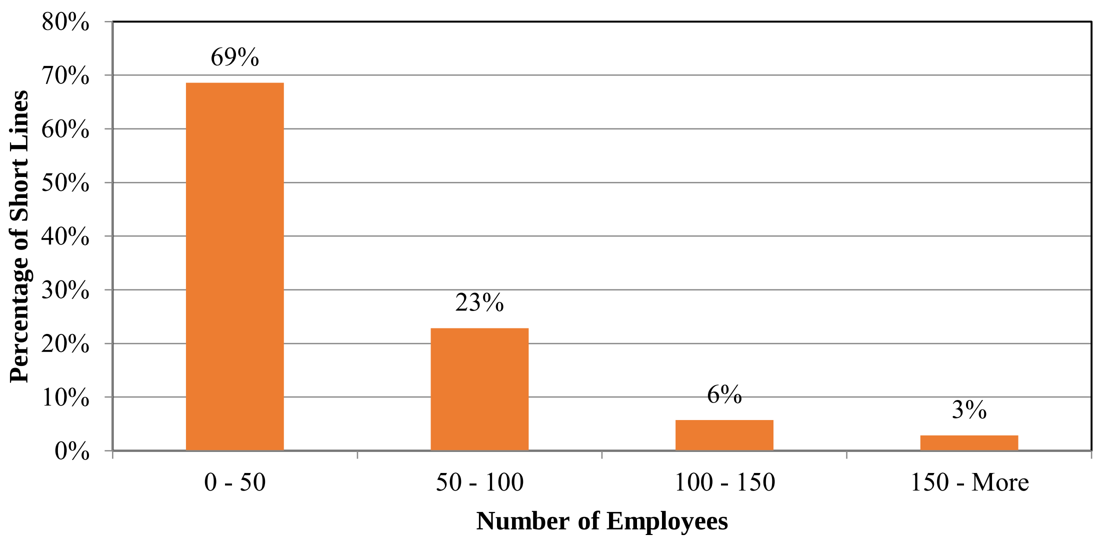

Figure 33 State-level Total Employment Impact

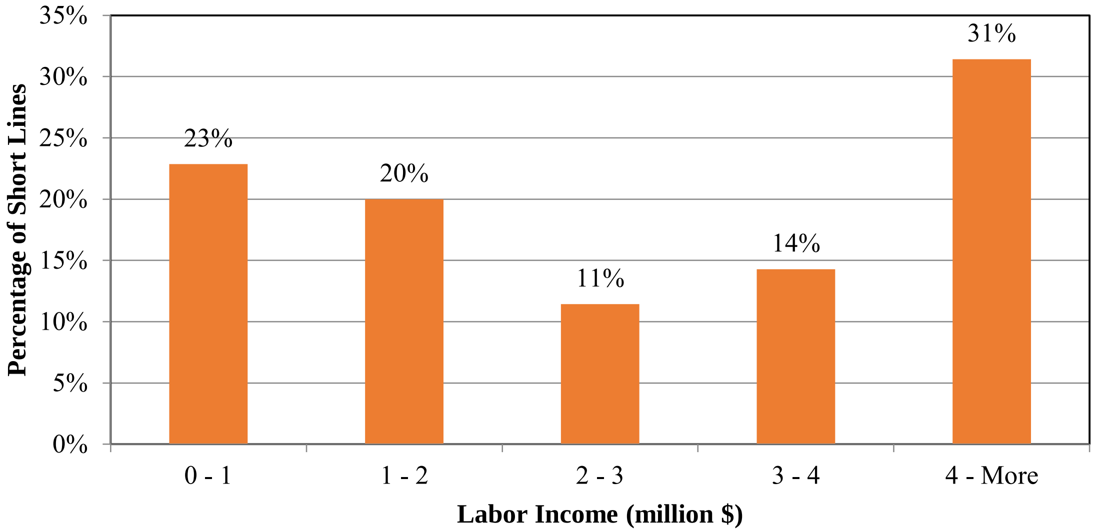

Figure 34 State-level Total Labor Income Impact

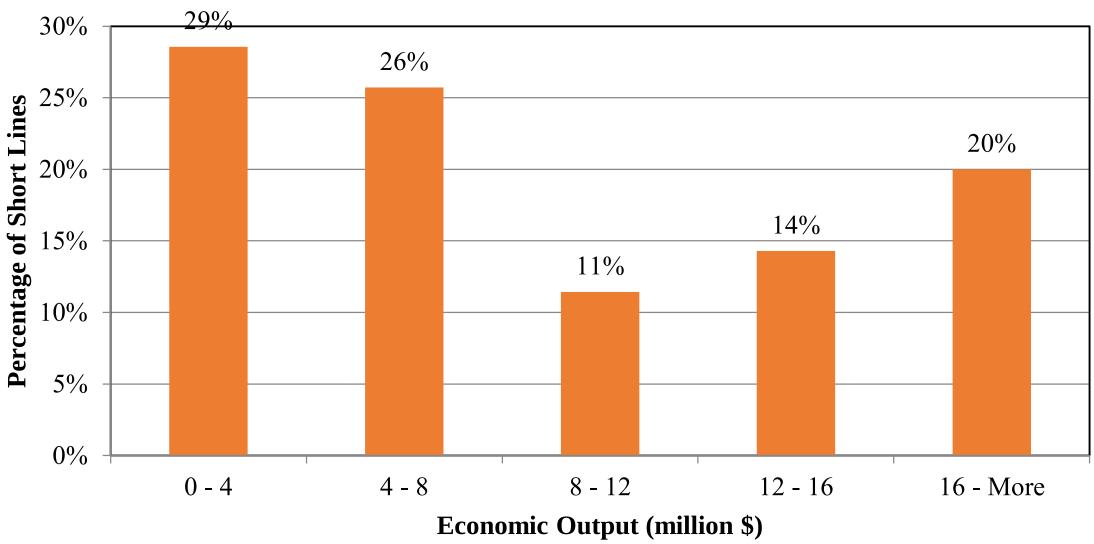

Figure 35 State-level Total Economic Output Impact

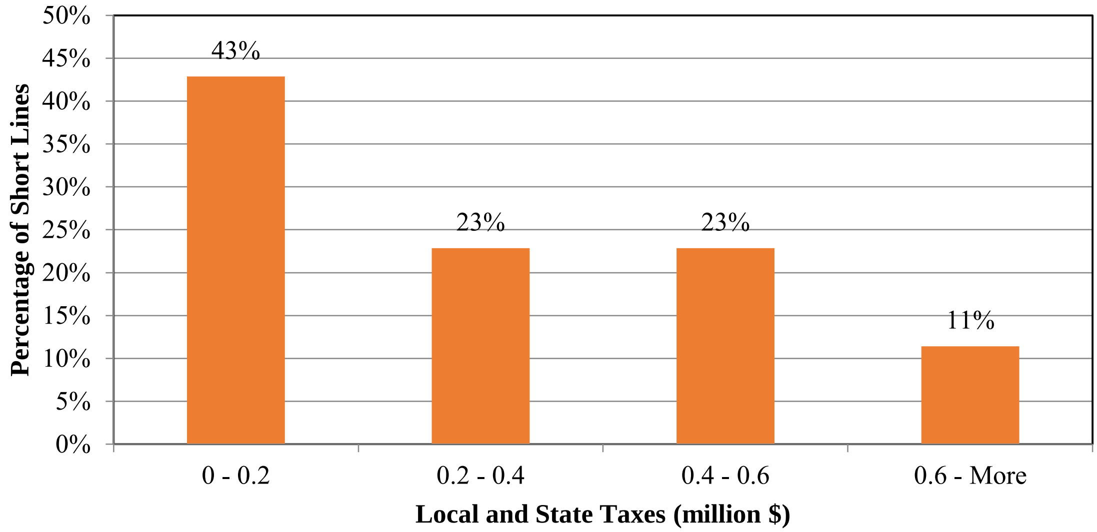

Figure 36 State-level Total Local and State Tax

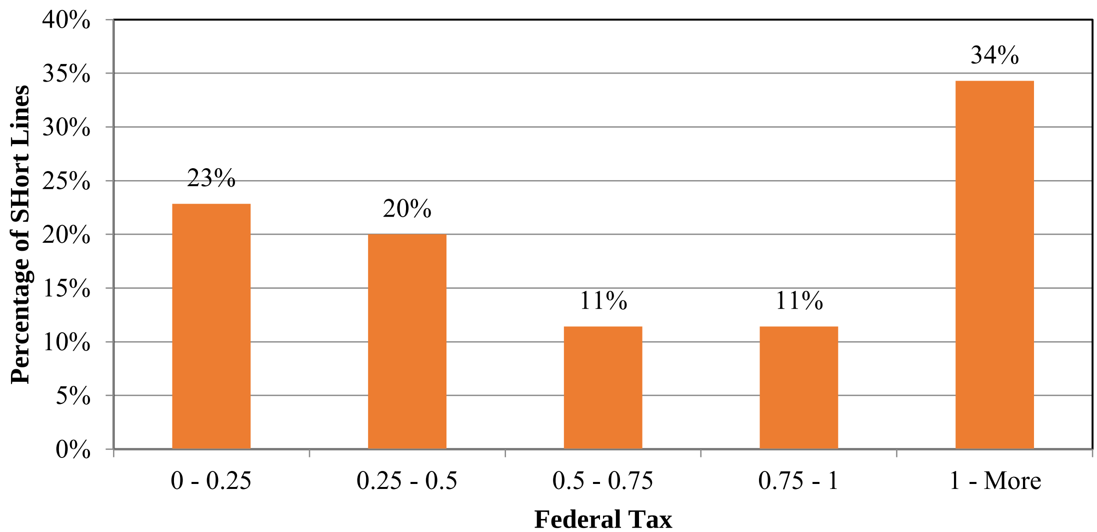

Figure 37 State-level Total Federal Tax Impact

Chapter 7. State Support Programs for Short Line Railroads

7.1 State Support Programs for Short Line Railroads in Other States

The research team reviewed a number of railroad funding programs from other states. Table 13 summarizes these programs by states.

Table 13 Summary of State Support Programs

State	Name of program	State	Name of program
Arizona	Arizona Section 130 Highway-Rail Grade Crossing Program	Montana	Essential Freight Rail Loan Program (MEFRL)
California	Trade Corridors Improvement Fund (TCIF) program	New Hampshire	The Rail Line Revolving Fund, The Special Railroad Fund
Colorado	Colorado State Infrastructure Bank (SIB)	New Jersey	Rail Freight Assistance Program
Florida	Strategic Intermodal System (SIS)	New Mexico	Local Rail Freight Assistance Program, FHWA Highway-Rail Grade Crossing Hazard Elimination Program
Georgia	Governor's Road Improvement Program (GRIP)	North Carolina	Rail Industrial Access Program
Idaho	Idaho Rural Economic Development and Integrated Freight Transportation Program	North Dakota	Freight Rail Improvement Program (FRIP)
Illinois	Rail Freight Loan Program	Ohio	Ohio Rail Development Commission Rail Safety Programs Branch line Rehabilitation Program
Indiana	Industrial Rail Service Fund	Oklahoma	Oklahoma freight car tax
Iowa	Railroad Revolving Loan and Grant Program (RRLGP)	Oregon	Short Line Infrastructure Program, *Connect* Oregon
Kansas	State Rail Service Improvement Program	Pennsylvania	The Rail Freight Assistance Program
Kentucky	Kentucky Short Line Railroad Assistance Fund, Kentucky Railroad Crossing Improvement Program	South Dakota	South Dakota Railroad Trust Fund (for state-owned rail)
Louisiana	Port Construction and Development Priority Fund	Tennessee	The Short Line Railroad Rehabilitation Program
Maine	The Industrial Rail Access Program (IRAP)	Texas	Texas Rail Relocation and Improvement Fund
Massachusetts	Industrial Rail Access Program (IRAP)	Virginia	Rail Enhancement Fund, The Rail Preservation and Development Program, Rail Industrial Access Grants

State	Name of program	State	Name of program
Michigan	Michigan Rail Loan Assistance Program (MiRLAP)	Washington	Freight Rail Assistance Program (FRAP), Grain Train Revolving Fund, Produce Rail Car Program
Minnesota	Minnesota Rail Service Improvement (MRSI)	West Virginia	Rail revenues, The Public Port Authority's Special Railroad, Intermodal Enhancement Fund
Mississippi	Railroad Revitalization Fund	Wisconsin	The Freight Rail Infrastructure Improvement Program, Freight Rail Preservation Program
Missouri	State Transportation Assistance Revolving Fund (STAR), The Missouri Transportation Finance Corporation (MTFC)		

State support programs for short line railroads in other states typically take on four major forms (Table 14):

1. state grant programs;
2. state loan programs;
3. loan/grant hybrid programs; and
4. tax based incentives and benefits.

Table 14 Summary of Funding Types

Funding Types	Strategy	Samples of States
State grant programs	Competitive-based	CA, FL, ID, IN, KY, LA, ME, MA, TN, VA, WA, WV, WI
State loan programs	Competitive-based	CO, IL, KS, MI, MN, MS, MT, SD, WI
Loan/grant hybrid programs	Competitive-based	IA, OR
Tax based incentives and benefits	Tax exemption, Credits	KY, OK, GA, NJ, CT, NC, MA

Many states offer one or more of these programs. The detail of these programs are discussed in the following sections.

7.1.1 State Grant Programs

State grant programs provide capital improvements for short lines on a competitive basis. State grant programs are intended to award state funds to railroads for capital improvements that directly benefit economic development interests (Llorens e*t al*, 2014). Examples of state grant programs are discussed below.

7.1.1.1 California – Trade Corridors Improvement Fund (TCIF) program

Eligible projects include track improvements, rail port, and yard improvements. Applications will be evaluated based on both eligible screens and evaluation criteria. Screens focus on deliverability, secured matching funds and emission reductions while the criteria focuses on freight system factors, transportation system factors, and community impact factors. In 2008, the TCIF program funded 79 projects with a total amount of $3.088 billion, in which rail projects received $643 million (TCIF, 2016).

7.1.1.2 Florida – Strategic Intermodal System (SIS)

The purpose of SIS is to provide the highest degree of mobility for people and goods traveling throughout Florida and eventually enhance Florida's economic prosperity and competitiveness. Funds are available for capacity and operational improvements to SIS/emerging SIS corridors and connectors. This grant requires a 75/25 match, which means that state pays 75% of project costs for qualifying short line railroads on a reimbursable basis. Short lines are expected to contribute 25% of the project cost (SIS, 2016).

7.1.1.3 Indiana – Industrial Rail Service Fund

The Industrial Rail Service Fund is intended to help maintain and increase business shipping levels on the rail line, and also to provide assistance in upgrading (e.g., track infrastructure improvements) of Class II and Class III railroads. Funds are available for applicants including Class II and Class III freight railroads, and port authorities. The grant awarded to a railroad project will pay up to 75% of the total project cost. In year 2015, the maximum grant award for a railroad is $300,000 (Indiana Department of Transportation, 2011).

7.1.1.4 Kentucky – Kentucky Short Line Railroad Assistance Fund

The Kentucky Short Line Railroad Assistance Fund, which is maintained by the Kentucky Transportation Cabinet, is intended to provide funds for the rehabilitation and improvement of Class II and Class III railroads within the Commonwealth. Funds are available for construction/reconstruction, improvement, and rehabilitation of rail infrastructures including track, ties, and related structures. Applicants need to complete a TC Form 59-13 and provide a series of supporting documents. For fiscal year 2011-2012, grant totaling $3,138,726 were awarded under this program (Kentucky Department of Transportation, 2015).

7.1.1.5 Louisiana – DOTD Port Construction and Development Priority Program

The general purpose of this program is to provide financial assistance to projects on infrastructure improvements of Louisiana's harbor and ports. The components of this priority program include legislative authorization, rules of the program's implementation, application process, application evaluation, funding, and finally implementation. The eligible applicants should have feasibility study and an immediate market need. Besides, projects need to have a benefit-cost ratio of at least one and a rate of return on state's investment of 2.375. The average funding level is about $20 million (Louisiana Department of Transportation, 2015).

7.1.1.6 Maine – The Industrial Rail Access Program (IRAP)

This program is intended to facilitate the economic development and job growth through expanding rail services, to preserve essential rail services, and to enhance intermodal transportation. Funds are available for projects under four categories: rehabilitation, new rail infrastructure, intermodal improvements, and equipment acquisitions. Applicants will need to demonstrate the public benefits of project from the following perspectives: transportation cost savings, economic impact (e.g., employment), benefit-cost ratio, improvement of rail service levels, and environmental impact. IRAP offers 50/50 matching funds to private businesses, which means that the financial assistance is up to 50% of total eligible project cost (Maine Department of Transportation, 2014).

7.1.1.7 Massachusetts – Industrial Rail Access Program (IRAP)

IRAP is a public/private partnership program that provides financial support to qualified projects on industry-based rail infrastructure access improvement. Evaluation criteria includes the public benefits, contribution to rail transportation system, consistency with local and regional development plan, financial feasibility, useful life of projects, etc. In 2015, five grants totaling over $2 million were awarded by MassDOT to eligible projects (Massachusetts Department of Transportation, 2010).

7.1.1.8 Tennessee – Short Line Track Rehabilitation Program, Short Line Bridge Rehabilitation Program

The program consists of two parts: track rehabilitation and bridge rehabilitation. Funds must be used for repair, replacement or upgrade of existing railroads. Rail authorities must manage the grants which are funds at 90% state and 10% local or non-state share. Allocations are annual and each contract has a 3-year duration (Tennessee Department of Transportation, 2002).

7.1.1.9 Virginia – Rail Industrial Access Grants

The purpose of this program is to encourage industrial or commercial development in the Commonwealth of Virginia. Funds are available for site preparation (e.g., grading and drainage), track construction/reconstruction, track improvement, and environmental mitigation. This grant requires a 30 percent match. Projects are selected based on a point system considering the total number of carloads, added employment, commonwealth's portion, unemployment rate, etc. Applicants that receive less than 50 points (of 100) will not be recommended to the Commonwealth Transportation Board (CTB). The maximum grant amount allocated to a project is 15% of the total capital investment up to $450,000 (Virginia Department of Transportation, 2013).

7.1.1.10 Washington – Grain Train Revolving Fund, Freight Rail Investment Bank (FRIB), Freight Rail Assistance Program (FRAP)

Grain Train Revolving Fund is a self-sustaining program that supports short line railroads, farmers, and rural economic development through the implementation of a fee to use a grain car owned by the state. Another program is the Freight Rail Investment Bank (FRIB) which can be used to fund small capital rail projects like rehabilitation, infrastructure preservation or economic development, with a funding match of at least 20%. It provides grants to publicly and privately owned railroads, shippers and port districts. Moreover, there is the Freight Rail Assistance Program (FRAP), a loan program for publicly owned railroads, ports, counties and cities (Washington Department of Transportation, 2014).

7.1.1.11 West Virginia

In the state of West Virginia state-sponsored rail investment is provided through WVDOT and its State Rail and Port Authorities. The funding is provided through the state budget process to operate and maintain railroads owned by the state. Public Port Authority manages the Special Railroad and Intermodal Enhancement Fund which are used only for maintenance, construction, reconstruction, and repair of railways; construction of railway-related structures; and payment of state bonds issued for rail purposes. Moreover, The West Virginia Economic Development Authority offers financial assistance for infrastructure improvements to support economic development projects (West Virginia Department of Transportation, 2013).

7.1.1.12 Wisconsin – Freight Rail Preservation Program

The Freight Rail Preservation Program (FRPP) provides grants to railroads, industries and local units of government with the purpose of preserving and rehabilitating essential rail lines. The program provides grants of up to 100 percent of the cost of rail lines acquisitions and 80 percent of the cost to perform rail line improvements to help maintain the current freight service or future services, and to rehabilitate facilities on publicly owned rail lines (Wisconsin Department of Transportation, 2010).

7.1.2 State Loan Programs

Similar to state grant programs, state loan programs are competitively based. The purpose of state loan programs is to provide financing alternatives for short line railroads' capital improvements (Llorens *et al.*, 2014). Examples of state loan programs are discussed below.

7.1.2.1 Colorado – Colorado State Infrastructure Bank (COSIB)

The COSIB is a revolving fund created by the Colorado legislature. The goal of COSIB is to seek loan applicants and projects that can both benefit from the loan and have revenue sources to repay the loan in the short-term. Funds are available for qualified projects on construction, resurfacing, safety, acquisition of transportation vehicles and facilities, etc. The interest rate will correspond to a rate equal to or less than the market rate (COSIB, 2016).

7.1.2.2 Illinois – State Rail Freight Loan Program

The purpose of this low-interest loan is to provide capital assistance to communities, railroads and shippers to improve rail freight service in Illinois and to facilitate investments in rail service. Under special circumstances grants may be considered. Metrics considering the contribution to economic development (e.g., job creation, transportation savings) will be used to evaluate the eligibility of applicants (Illinois Department of Transportation, 2012).

7.1.2.3 Kansas – State Rail Service Improvement Program

This program provides lower-than-market interest rate loans to assist Kansas short lines in the rehabilitation of tracks and its components, bridges, sidings and yards. Eligible applicants are railroad, local government, port authority, and shippers. For fiscal year 2000-2008, available funding is about $3 million per year (Kansas Department of Transportation, 2011).

7.1.2.4 Michigan – Michigan Rail Loan Assistance Program (MiRLAP)

The purpose of these no-interest, competitive-based loans is to support rail infrastructure preservation and improvements, and to enhance the efficiency and safety of existing freight rail service. Applicants are evaluated based on program goals and public benefits. Funds are available for applicants including railroads, local governments, economic development corporations, and current/future rail users. Loans are up to $1 million per project and per applicant for each year (Michigan Department of Transportation, 2011).

7.1.2.5 Minnesota – Minnesota Rail Service Improvement (MRSI)

This program is intended to assist rail users to improve the efficiency of rail transportation by providing interest-free loans. Funds are available for projects on expending industrial spurs, adding storage and transfer capacity, loading efficiency improvements, etc. The applicants are required to submit a loan application and provide a detailed description of the project. The maximum loan amount is $200,000 (Minnesota Department of Transportation, 2010).

7.1.2.6 Mississippi – Railroad Revitalization Fund

The Railroad Revitalization Fund administrated by the Mississippi Department of Transportation provide a ten-year loan at 0% interest to qualified recipients to improve rail infrastructure. The financial assistance is limited to 75% of the railroad rehabilitation project cost. Applicants need to provide information on traffic counts, project description, and project cost estimation. Currently, no specific criteria exist for this fund. Available funding is about $4.5 million (Mississippi Department of Transportation, 2011).

7.1.2.7 Montana – Essential Freight Rail Loan Program (MEFRL)

The purpose of MEFRL is to provide a low-interest revolving loan fund to encourage projects for construction, reconstruction, or rehabilitation of railroads and related facilities in the state. This loan requires a 30 to 50 percent match for applicants. Applicants need to provide details about the organization, project plan (description, costs and benefits), security, and repayment. Besides, support documents to determine the compliance with environmental laws and rules are required. As of 2015, available funding is about $257,000 (Montana Department of Transportation, 2010).

7.1.2.8 South Dakota – Railroad Crossing Improvement Program and Railroad Trust Fund

The Railroad Crossing Improvement Program (RCIP) is funded through the FHWA Federal Section 130 Program. Funds may be used on projects at all public rail crossings, including roadways, bike trails and pedestrian paths. 50 percent of a state's apportionment is used for the installation of protective devices at crossings. The other 50 percent of the funds apportionment can be used for any hazard elimination plan, including protective devices. The funds can also be used as incentive payments for local agencies to close public crossings provided there are matching funds from the railroad. Normally, Section 130 projects are funded at a 90 percent Federal share, but some projects may allow 100 percent Federal share. The purpose of the Railroad Trust Fund includes planning, enlarging, maintaining, equipping, and protecting railroads and its facilities. The South Dakota State Railroad Board can make loans from the fund to regional railroad authorities, based on terms and conditions set by the State Railroad Board. These funds may be used to match Federal railroad rehabilitation funds, and can also be spent directly on rail lines owned by the state (South Dakota Department of Transportation, 2014).

7.1.2.9 Wisconsin – The Freight Rail Infrastructure Improvement Program

The Freight Rail Infrastructure Improvement Program (FRIIP) provides loans for a wide variety of rail projects like connecting industries to the national rail system, enhancing safety and intermodal freight movements, and offering opportunities for economic development. The program supports up to 100 percent of the cost of the project (Wisconsin Department of Transportation, 2010).

7.1.3 Loan/grant Hybrid Programs

The loan/grant hybrid programs combine elements of state grant programs and state loan programs. Typically, the loan/grant hybrid programs are intended to provide financial support to railroads through no-interest loans, low-interest loans, and grants. Examples of loan/grant programs are discussed below.

7.1.3.1 Iowa – Railroad Revolving Loan and Grant Program (RRLGP)

The RRLGP is intended to provide financial assistance to preserve and improve rail facilities that will contribute to economic development and job growth in Iowa. This program has three award types: targeted job creation, rail network improvement, and rail port planning and development. Applicants need to submit application forms and provide a local match as detailed for each type of award. Staff will review applications and prepare a recommendation for funding to present to the Iowa Transportation Commission (Iowa Department of Transportation, 2009).

7.1.3.2 Idaho – Idaho Rural Economic Development and Integrated Freight Transportation Program (REDIFiT)

The goal of this program is to support planning and development of Intermodal Commerce Authorities, and to develop and expand options for shipping freight and products to market. REDIFiT is a revolving loan program with a low interest rate (<4%). Applicants are required to match loans with 10% of the project costs, although greater matches can be negotiated. Grants are also provided at a $100,000 maximum. Applicants are evaluated based on selection criteria. Some primary factors considered in the selection criteria include economic benefits and long-term impact, quality of project, soundness of project, measurable results, etc (Idaho Department of Transportation, 2013).

7.1.3.3 Oregon – Short Line Infrastructure Program

The short line infrastructure program was created by the Oregon legislature with an allocation of $2 million in 2001. This program offers loans and grants. The legislature approved an affirmed an extra $2 million for the first program and started an $8 million rail spur program for every kind of railroads (Oregon Department of Transportation, 2014).

7.1.4 Tax-based Incentives and Benefits

In addition to state grant programs, state loan programs, and state loan/grant hybrid programs, some states provide tax based incentives and benefits in the form of exemptions (e.g., property taxes) and credits. In contrast to the other three types of programs, tax-based incentives support the development of railroads indirectly by reducing the tax burden. Examples of tax based incentives and benefits are discussed below.

7.1.4.1 Georgia

The constitution of Georgia limits the use of the State Highway Accounts for purposes other than highway and roadway use. However, the state of Georgia has sponsored railroads through public financing such as legislative appropriations, bonding, a State Infrastructure Bank, Governor's Road Improvement Program (GRIP) and public-private partnerships. Moreover, the state has used funding through local Special Local Option Sales Tax revenues and rail assistance given by economic development agencies and the Georgia Ports Authority (GPA) (Georgia Department of Transportation, 2015).

7.1.4.2 Oklahoma – Oklahoma Freight Car Tax

The Oklahoma freight car tax is based on an annual 4 percent tax on freight rail car revenues. This fund yields a consistent annual income because its rate has not been changed since 1978 when it was introduced (Oklahoma Department of Transportation, 2015).

7.1.5 Summary

State grant and/or loan programs are typically managed by the State Department of Transportation or Economic Development Commission. These programs benefit the short lines directly by providing financial support for maintenance, construction/reconstruction, and rehabilitation. These programs are all competitive-based and proposals are evaluated based on different criteria defined by each program. Typically, the criteria cover public benefits, transportation cost, consistency with environmental laws and rules, cost-benefit ratio, feasibility of project, etc. Additionally, applicants need to provide information such as detailed project description, feasibility study, and project cost estimation. For some state loan programs, applicants need to submit supporting documents to demonstrate reliable revenue sources to repay the loan.

According to a report from Louisiana, tax credits will not be as effective as a direct expenditure program to support short lines for the reason that it will be more efficient and timely to focus on a legitimate public responsibility (Llorens *et al*, 2014). However, in the 2014 South Dakota State Rail Plan, it was pointed out that a Short Line Tax Credit is an ideal program to support short lines because it is difficult for small short line railroads to demonstrate adequate business in order to obtain loans (SDDOT, 2014).

7.2 State Support Programs for Short Line Railroads in Texas

Like many other states, the Texas constitution limits what can be funded with motor vehicle taxes and fees, including carbon or mileage taxes (Commonwealth of Virginia, 2015). The state-level legislation has limited ability to fulfill the infrastructure improvement needs of railroads under the constitutional restrictions on investment in rail projects (TxDOT, 2016; TTI, 2005). It should be noted that the Texas rail line network is largely private and investments are primarily market-driven. The state of Texas currently does not have constant and reliable public funding sources available for rail improvement. According to the 2016 Texas Rail Plan Updates, potential funding sources include 1) local option transportation funding, 2) value capture for rail investments through various taxes and fees; tax incentives, and 3) revolving loans and railcar taxes (TxDOT, 2016). Table 15 summarizes the state sponsored rail funding sources.

Table 15 Summary of State Sponsored Rail Funding (TxDOT, 2016; TxDOT, 2011; FRA, 2005)

Program/Funding	Description
TxDOT Highway-Railroad Grade Crossing Safety Program	The Federal Section 130 Program, which began in 1973, provides funding for the installation of active grade crossing devices such as flashers and gates. The state of Texas developed a prioritization formula (priority index ranking) to determine the risk at each at-grade crossing and to select eligible crossing locations. The objective of this program is to reduce the number and severity of auto-train collisions by decreasing the potential for crashes at public highway-rail grade crossings. It should be noted that Federal Section 130 funding cannot be used to upgrade private at-grade crossings.
Texas State Infrastructure Bank (SIB)	SIB were authorized by the National Highway Designation Act of 1995 (NHS Act), section 350, with the intention to accelerating needed mobility improvements through a variety of financial assistance options made to local entities through state transportation departments. The overall goal of the SIB program is to finance local transportation projects at lower-than-market interest rates. Projects must be consistent with transportation plans developed by local metropolitan planning organizations. TxDOT manages the SIB program as a revolving loan fund.
Texas Emissions Reduction Program (TERP)	This TERP program, which is comprised of nine different grant programs, is established in 2001 through the creation of Chapters 386 and 387, Health and Safety Code, by Senate Bill 5, 77th Legislature. The primary goal of this fund is to fund projects that reduce air pollution and engine idling through relieving congestion at rail intersections and locomotive control. The program has been utilized to retrofit locomotives in the Corpus Christi and Houston areas.
Texas Economic Development Bank	The purposes of the Texas Economic Development Bank are to provide incentives to expand or relocate businesses in Texas, and to ensure communities and businesses' access to capital for economic development purposes. Funds can be utilized for rural rail development projects.
Texas Railroad Relocation and Improvement Fund	The 79th Texas Legislature passed HB 1546 in 2005, which enabled the establishment of the Texas Railroad Relocation and Improvement Fund (TRRIF) through a constitutional amendment. The amendment was approved during the general election in the fall of 2005. However, subsequent Texas Legislative Sessions have not taken any action to provide a revenue stream or appropriate funding for the TRRIF and it remains unfunded and unused.
Transportation Reinvestment Zones (TRZ)	TRZ is an innovative tool that was created in the 2007 legislative session (Senate Bill 1266) as a value capture method for transportation projects. This funding mechanism is designed as below: the local governing body designates a zone in which it will promote a transportation project. Once the zone is created, the incrementally increasing property tax revenue collected inside the zone will be used to finance a project in the zone. This mechanism has allowed metropolitan areas operating rail facilities to diversify funding options.

Chapter 8. Recommendations for Improving Short Line Railroads in Texas

The research has shown that short line railroads provide significant benefits to the state. However, many short line railroads operate on railroad infrastructure that is in a deteriorated condition as a result of deferred maintenance by the prior owners. Most short line railroads do not have sufficient revenues or access to the large amounts of capital that are necessary to rehabilitate their infrastructure. Track and bridge conditions often cause short lines to operate at minimal train speed which reduces their operating efficiencies and limits their ability to attract new business to the line. There are other issues that limit short line railroad efficiencies, such as funding for locomotive acquisition or overhaul, equipment maintenance facilities, train dispatching services, construction of new track, and expansion into new markets. This section of the report provides possible methods of funding some short line railroad needs.

8.1 Short Line Needs

During this research, the surveyed short line railroads expressed their concerns about the rail infrastructure status and lack of public sector support in the state of Texas. The major issues and needs that were highlighted are:

- Bridge repair/replacement
- Limited track space
- Limited storage space
- Capacity upgrade to 286,000 lbs
- New interchange with other rail carriers
- Crossings upgrade
- Rail and tie enhancement
- Rail reutilization
- Limited grant opportunity
- Develop and properly fund a public-private short line infrastructure grant program
- Increase funding of the Railway-Highways Crossing (Section 130) Program

Moving goods by rail has positive impacts on pollution reduction, congestion, safety, highway pavement maintenance costs, fuel consumption, and the state economy. For these reasons, short line railroads are an excellent candidate for public-private partnerships that could leverage the improvements to meet transportation and economic objectives.

8.2 TIGER Grant Assistance Program

8.2.1 Introduction of TIGER Grant

The Transportation Investment Generating Economic Recovery Discretionary Grant program (TIGER) is a United States Department of Transportation (DOT) program that invests in critical road, transit, rail, and port projects across the country. It is administered by the DOT's Office of the Secretary. The Federal Railroad Administration (FRA) manages several of these grants that are specifically for rail. The TIGER program was launched in 2009 and since then the Congress has dedicated approximately $4.6 billion to fund projects that have a significant impact on the nation, a region or a metropolitan area (USDOT, 2016). Figure 38 shows all awarded projects by type. The rail industry has been awarded 21.4% of the grants since 2009, which represents a total of $985.380.349 and 60 funded projects. However, TIGER grant programs are difficult for railroads in rural areas to obtain. This is because the awards were usually given to municipal areas and larger cities (SDDOT, 2014). The TIGER program allows the Department of Transportation to use a strict merit-based process to select projects with excellent benefits and make needed investments in infrastructure that make communities more livable, prosperous and sustainable. A portion of the TIGER program funds are usually directed to rural projects, though the amount is limited and awarded on a competitive basis.

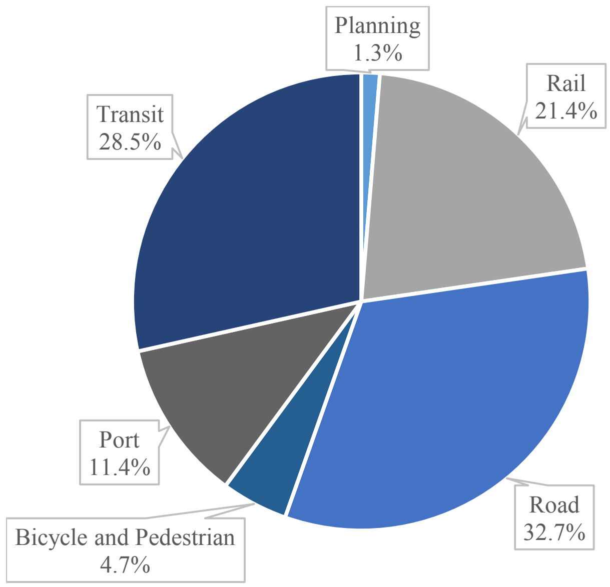

Figure 38 TIGER Grant Awarded Since 2009 (USDOT, 2016)

8.2.2 Texas Short Line and TIGER Grant

In this research, three of the surveyed short line railroads have applied for TIGER Grant before. One short line's application was awarded, but the grant was never initiated because the city government did not have enough resources to administer the funds. During the survey of this research, it was mentioned by several short line railroads that they need assistance for grant writing. Most of the short line railroads only employ less than 20 employees. There is a lack of expertise in writing proposals for external funding. Therefore, there is a need to develop a program to assist Texas short line railroads in seeking and applying for TIGER grant. Short line railroads could partner with city, county, or state governmental entities to submit TIGER grant applications when the benefit-cost ratio of the project is sufficient to make the project competitive with other applications. These partnerships must include a mechanism to administer grant funds to avoid instances where a project is selected for TIGER funding, but never implemented, as mentioned previously.

8.2.3 Assistance Program

The Texas Local Technical Assistance Program (TxLTAP), which is jointly funded by TxDOT and FHWA, is established to provide quality training and technical assistance to local city/county road agencies in Texas. The following services could be considered as additions to the existing TxLTAP program:

- Access to helpful resources
    - Grant proposal guidelines
    - Tools (e.g., spreadsheet template) to conduct Benefit-Cost Analysis (BCA) for a specific short line project
    - Template based on previous successful proposals
- Advice from grant writing experts
- Group training and workshop presentations
- Assistance with proposal crafting and editing

8.3 Short Line Grant Programs

8.3.1 Short Line Policies

According to the reviewed funding programs of other states, state-level support plans for short line railroad infrastructure improvement, rehabilitation, and investment usually take on one of these forms:

- Grant programs
- Loan programs
- Grant/Loan hybrid programs
- Tax based incentives and benefits.

The results of the surveys and interviews conducted during this research show that there are significant needs for the short lines in Texas in terms of improving their infrastructure. However, these infrastructure improvement needs are usually beyond an affordable capacity for the short lines. There is no specific public funding program in Texas to help short lines maintain and improve the existing infrastructure and crossings. Short line railroads can partner with public entities to pursue federal grants such as the TIGER program mentioned earlier, the FASTLANE grant program in the latest federal transportation act, U.S. Department of Agriculture grants, and other grant programs as they are identified or developed. It is critical that these partnerships include adequate resources to manage federal grants once they are approved.

8.3.2 Selection Criteria for Grant Applications

Typically, transportation needs exceed the amount of funding available in the nation and in the states. Therefore, transportation agencies must make tough decisions when selecting projects to fund. For this reason, it is important to have an evaluation methodology to select potential projects for grant applications. Most federal grant programs, such as TIGER and FASTLANE, include the selection criteria in the Notice of Funding Opportunity (NOFO). Public-private partnerships should consider all established criteria during the project development stage and determine how the proposed project meets or exceeds the selection criteria. Other grant programs may not have stringent funding criteria. In those cases, public-private partnerships can be based on the performance of the applicant and the efficiencies to be realized from the project. The purpose is to guarantee the highest return on each dollar spent, and make sure that grant funding awards are fulfilling the intended purposes. This performance-based approach can provide a more quantitative and clear means of project review, and will instill more liability into the process of project selection. Community and environmental impacts should be used as an evaluation criterion in selecting a project for grant submittals. Priority should be given to projects with the lowest emission and less environmental impact on the region. Also, projects willing to maintain and reuse existing infrastructure should have priority. This prioritization will build upon critical investments already made by local agencies and their private sector partners. The methodology to create a fund evaluating system should follow the next steps:

- Step 1: Develop evaluation criteria
- Step 2: Assign scores or weights to the criteria
- Step 3: Consider a benefit-cost ratio as a separate metric
- Step 4: Evaluation result: combination of points described above.

The grant application narrative should be presented in a clear way in order to enable the evaluators to integrate the findings into their decision making process.

8.3.3 Other Recommendations

Considering the needs of Texas short lines, the following are some recommendations from the research based on the most relevant points found in the programs and policy recommendations of other states:

- Provide summary information to the state's legislature and congressional delegation on the public benefits realized from Texas short line railroads and the challenges they face in continuing operations. Results of this research can help demonstrate funding needs.
- Public-private partnerships for short line improvements should seek innovative funding and financing sources to leverage public funds and provide more value with limited resources.
- Public entities can facilitate discussions regarding funding strategies to address local community impacts resulting from increased rail traffic at at-grade crossings.
- Explore new public sector funding sources for rail-related programs, infrastructure, and services.
- Public entities can facilitate meetings among Class I and short line railroads and regional economic development agencies to explore opportunities to grow the local and regional economies.
- Consideration can be given to incentivize private investment like increasing the use of public-private partnerships or offering special-purpose tax credit bonds.

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