**GEORGIA DOT RESEARCH PROJECT 16-08**

**FINAL REPORT**

# ECONOMIC IMPACT ANALYSIS OF GDOT'S SHORT LINE RAILROADS


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| 1.Report No.: FHWA-GA-18-1608 | 2. Government Accession No.: | 3. Recipient's Catalog No.: |
|---|---|---|
| 4. Title and Subtitle: Economic Impact of GDOT's Short Line Railroads | 5. Report Date: April 2018<br>6. Performing Organization Code: | |
| 7. Author(s): Patrick McCarthy, Zhe Zhai | 8. Performing Organ. Report No.: | |
| 9. Performing Organization Name and Address: Georgia Institute of Technology Atlanta, GA 30332 | 10. Work Unit No.:<br>11. Contract or Grant No.: PI No. 0014918 | |
| 12. Sponsoring Agency Name and Address: Georgia Department of Transportation Office of Performance-Based Management and Research 15 Kennedy Drive Forest Park, GA 30297-2534 | 13. Type of Report and Period Covered: Final; April 2016 – April 2018<br>14. Sponsoring Agency Code: | |

15. Supplementary Notes:

Prepared in cooperation with the U.S. Department of Transportation, Federal Highway Administration.

16. Abstract:

Short line railroads are critical to Georgia's transportation infrastructure and support the efficient movement of goods into and out of the State. Twenty-nine short line railroads operate in Georgia, six of which operate either partially or totally on 596 miles of rail track that the Georgia Department of Transportation (GDOT) owns. Based on the Bureau of Economic Analysis RIMS II backward-linkage model, this study estimates under different sets of assumptions the economic impacts associated with short line railroad revenues and with GDOT infrastructure spending on these six short line systems. Among the economic impacts, and depending on the assumptions, the study finds that the cumulative impact of the six systems increases annual output in the range of $2.8-$14.5 million, increases annual earnings in the range of $0.7-$4.1 million, and generates annual value-added in the range of $1.4-$7.5 million. Cumulatively, these systems annually add 10 - 93 jobs on average.

| 17. Key Words: Short Line, Railroad, Economic Impact, Infrastructure, RIMS II | | 18. Distribution Statement: | |
|---|---|---|---|
| 19. Security Classification (of this report): Unclassified | 20. Security Classification (of this page): Unclassified | 21. Number of Pages: 102 | 22. Price: |

GDOT Research Project No. 16-08

# ECONOMIC IMPACT ANALYSIS OF GDOT'S SHORT LINE RAILROADS

Final Report


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Contract with

Georgia Department of Transportation

In cooperation with

U.S. Department of Transportation
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April 2018

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## EXECUTIVE SUMMARY

This study analyzes the economic impact of six short line railroads (SLRs) operating on track owned and maintained by the Georgia Department of Transportation (GDOT). Three of these short line railroads provide freight services only, two provide freight service with some sightseeing and tourist services, and one short line railroad provides only sightseeing services. Among the findings of this study:

- Short line railroads are critical to an efficient transportation network in Georgia. In all, twenty-nine short line railroads operate but only six of these operate either wholly or partially on GDOT-owned track. These short line railroads complement Georgia's Class I railroads in the state and help meet state, national and international transportation needs.
- Among the core industries that Georgia's short line railroads support are agricultural, forestry, and manufacturing.
- Short line railroads operate on 1,362 miles of track in Georgia, 29% of total operating route track. GDOT owns 596 miles or 44% of the route mile track that short line railroads use. GDOT short line railroads operate in thirty-four counties.
- In 2016, GDOT short line railroads carried 15,763 carloads, 7.5% of all short line railroad carloads in Georgia. In 2015, GDOT SLRs employed 46 workers and generated $5.1 million in revenues.
- The study uses the Bureau of Economic Analysis RIMS II model to estimate the impacts that GDOT SLRs have on output, earnings, value-added and employment. The study reports economic impacts using revenues and GDOT project spending and calculates impacts based on alternative assumptions on the area of impact and where funds are spent.

- The analysis finds that GDOT's SLR systems, on average, annually increase output from \$2.8 to \$14.5 million, increase earnings from \$0.7 to \$4.1 million, and increase value-added from \$1.4 – \$7.5 million. And, on average, these systems annually increase employment from 10 to 93 workers.
- Short line railroads have community impacts in addition to their economic impacts. Railroads on average are more energy and environmentally efficient than trucking, consuming less fuel per ton-mile and generating fewer greenhouse gas emissions. And the number of incidents for railroads is 5% of that for trucking.
- Short line rails also have fiscal impacts generating, on average, \$3.45 per carload in state and local taxes. And access to short line rail networks can serve to incentivize existing business to expand and to attract new businesses to the local area.

An important feature of this study is recognizing that any estimate of an economic impact critically depends on the underlying assumptions and model limitations, quality of data, the extent to which the model captures the specific economic environment for which economic impact are calculated, and the inability to quantify some impacts. These uncertainties argue for a range of economic impacts and this study estimates economic impacts under various assumptions on the geographic extent of the impact and whether part of the exogenous spending occurs outside the local area. Incorporating the inherent uncertainties in a range of expected impacts will help GDOT identify the economic impacts of specific rail infrastructure investments.

## ACKNOWLEDGEMENT

The authors are very grateful to Dr. Laurie Garrow, the project's Principal Investigator, for her help and support throughout this project and to several individuals with Georgia DOT, Intermodal Division, who facilitated this project in several ways. Of primary importance in the early stages of the project were Ariel Heckler, Rail Planner/Transportation Specialist I, who provided important context and data for the analysis and Nancy Cobb, Intermodal Division Administrator, whose knowledge of Georgia's transportation networks and study suggestions were extremely helpful. Also of continuing assistance throughout the project was Sarah Lamothe, Project Manager, and most recently Supriya Kamatkar in GDOT Office of Research. The authors are also grateful to Kaycee Mertz, Rail Planning Manager, and Ashley Finch, Rail Planner, for their insights on Georgia's shortline rail systems and assistance in the latter stages of the project.

## I INTRODUCTION

Freight railroads are a vital component of the U.S. transportation network. In 2012, there were 575 freight railroads with 138,524 freight mileage. Freight railroads directly employed in 2012 181,264 persons, with an average compensation (wages and benefits) worth $109,570 (American Association of Railroads (AAR), www.aar.org/). From the AAR, freight railroad traffic at the origin accounted for 1.76 billion tons and 28.7 million carloads.[1] Top commodities shipped in 2012 were coal (750.2 million tons), chemicals (152.8 million tons), and farm products (134.5 million tons). The Bureau of Economic Analysis estimates for-hire rail transportation services accounted for 43.9 billion of GDP in 2013 (current dollars).

National and state freight rail networks include Class I, II, and III railroads, most commonly classified on the basis of revenue. The most recent definition of Class I, II, and III carriers from the Surface Transportation Board (STB) defined Class I carriers as having annual revenues equal to $467.1 million or more, Class II ('regional') carriers having revenues between $37.4 and $467.1 million, and Class III carriers with revenues less than $37.4 million. Regardless of revenues, the STB defines all switching and terminal carriers as Class III ('short line') carriers.[2]

Class I railroads form the backbone of the U.S. freight rail network. In 2012, there were 96,391 miles of track servicing Class I railroads, accounting for 70% of total rail freight mileage (DOT, 2016). To supply rail services to shippers, Class I rails in 2014 employed 25,916 locomotives and 371,642 freight cars, with a 990-mile average length of haul. The Bureau of Economic Analysis

[1] The number of tons shipped, and number of carloads were similar at the destination (AAR, www.aar.org/).

[2] Department of Transportation, Surface Transportation Board, 49 CFR 1201.1-1. U.S. Government Publishing Office (https://www.gpo.gov/fdsys/search/pagedetails.action?granuleId=CFR-2011-title49-vol8-subtitleB-chapX&packageId=CFR-2011-title49-vol8)

(BEA) estimates that railroads shipped 1.73 trillion ton-miles in 2011, 44.9% of total ton-miles shipped (DOT, 2016).[3] Average revenue per ton-mile was 3.75 cents (current dollars) in 2011.

As noted, railroads below the Class II threshold, as well as switching and terminal carriers, are "short line" railroads (SLRs) that often operate in rural communities and serve as feeder carriers that link to the Class I carrier network.[4] SLRs are individually small in extent. Based on 2014 AAR data, Table 1 indicates that Class II and Class III railroads accounted for 98.7% of the total number of railroads, operating in every state except Hawaii, but accounted for a much smaller 31.2% of miles operated. Further, Class II and III railroads accounted for only 9.8% of freight railroad employees and generated 4.0 billion or 5.6% of total revenues.

**Table 1**

**U.S. Railroad System Characteristics**

| Types of Railroad | # Railroad | Miles Operated | Employees | Revenues (billions) |
|---|---|---|---|---|
| Class I | 7 | 95,264 | 163,464 | 67.6 |
| Class II | 21 | 10,355 | 5,507 | 1.4 |
| Class III | 546 | 32,858 | 12,293 | 2.6 |
| Total | 574 | 138,477 | 181,264 | 71.6 |

Source: Department of Transportation, Federal Railroad Administration, *Summary of Class II, and Class III Railroad Capital Needs and Funding Sources*, October 2014, Table 1, p. 4.

For Class II and Class III railroads nationally, Table 2 indicates that Class III railroads represent 84% of total miles. Class III railroads average 108 miles operated per railroad much smaller than the 701 average operated per Class II regional railroad.

[3] AAR, based on ton-mile values from the Surface Transportation Board's Waybill sample, which includes all Class I railroads and some major short line railroads.
[4] Not uncommonly, one may see Class II and Class III railroads identified as short-line railroads.

**Table 2**

**U.S. Class II and III Railroads**

| | Regional (Class II) | Local/Switching & Terminal (Class III) | Total |
|---|---|---|---|
| Total Miles | 6,316 | 32,348 | 38,664 |
| % of Miles | 16% | 84% | 100% |
| Average Miles | 701 | 108 | 38 |
| Median Miles | 377 | 47 | 26 |

Source: 2016 ASLRRA Data Survey, ASLRRA (2017) Page 9.

Short line railroads complement Class I railroads, consolidating shipments and providing the first mile and the last mile of service for one in five rail cars (ASLRRA, 2017). As many SLR systems serve rural communities, they can provide more efficient transportation alternatives to shippers as well as a broader economic impact on the communities which these systems serve. Short line railroads also benefit local communities by increasing local business volume, reducing highway maintenance and user costs, and increasing economic development opportunities.

Allen, Sussman and Miller (2002) documents the evolution and growth of the short line industry in the U.S and discusses the ownership problems that the industry faces. A 1993 FRA study found that Class II and Class III operators had difficulty accessing capital markets, generally not able to meet funding requirements to obtain needed loans for maintenance or system upgrades (FRA, 1993, pp. 27-29). During this same period, the market structure of Class II and Class III systems changed with the rise of railroad holding companies. A consequence of market consolidation was greater access to private capital markets as the consolidated companies were better able to meet the funding requirements of private sector financial institutions. This further spurred the growth of holding companies, the largest of which is Genesee & Wyoming Inc. which controls more than 100 railroads. Between 1996 and 2012, railroad holding companies increased from 14 to 27 and the number of small railroads controlled by holding companies increased from just over 100 to nearly 270. This number has dropped to just under 250 small railroads recently (DOT, 2014, pp. 27-28).

Short line railroads are critical to Georgia's transportation infrastructure and support the efficient movement of goods into and out of the State. The State of Georgia rail network currently includes 4,643 route miles. Two of the 31 freight railroads in Georgia, CSXT and Norfolk Southern, are Class I railroads and together own 3,631 route miles, 78% of the total rail mileage in the State. Since Georgia has no Class II railroad, the remaining route miles are short line railroads (SLRs). Of the 29 SLRs with 1362 mileage, GDOT owns 44% of the mileage (596 miles) over which six short line railroads operate. During the period from 2010 to 2015, these six short line rail railroads handled 60,032 carloads, generated $28.7 million revenues, and diverted 596,960 truckloads from the highways (GDOT, 2016).

However, despite their importance to Georgia's economy, no studies have formally quantified the economic impact associated with Georgia's short line railroads.  Without a formal assessment, securing adequate funding to maintain or upgrade the infrastructure is difficult. And without sufficient funding to maintain the trackage, safe and reliable shipment of goods would be unattainable due to lower speed limits and/or lower weight limits. In addition, bottlenecks can occur (often near switching lines). By increasing shipping times and costs, these outcomes lead to less efficient transportation of goods, can significantly disrupt the movements of goods to and from Georgia, and puts SLRs at a competitive disadvantage as some shippers shift their shipments from rail to truck. This can place stress on the highway network and can shorten highway pavement life, thereby increasing road maintenance funding.

If Georgia multi-model network is to improve, , understanding the direct and indirect economic impact that SLRs have on Georgia's economy in general and specifically on those communities where these systems operate is crucial. Quantifying SLRs' economic impact will enable GDOT to more rationally allocate its limited resources for rehabilitating short line rail system infrastructure and to better understand the spillover effects on Georgia's roads in the absence of sufficient funding to maintain Georgia's short line rail infrastructure.

Section II of this report reviews the literature on short line rails and their economic impact. Section II introduces and describes Georgia's short line rail systems. Section IV analyzes the direct and indirect economic impact of Georgia's SLR system and Section V analyzes the economic implications of Georgia's SLR system for the community. Section VI identifies policy implications of the study and Section VII provides summary comments.

## II LITERATURE REVIEW

In contrast to the literature that exists on Class I railroads, there are relatively few studies that focus on short line railroads, whether SLRs are defined narrowly defined as Class III systems or more broadly defined as Class II and Class III systems. There are several reasons for this. The federal government does not routinely collect data on short line rails. Short line rails are small systems with short lengths of haul that link into Class I rail networks. Short line rails typically serve rural areas and do not generate the same economic or competitive concerns to policy makers as the much larger Class I systems. With smaller average lengths of haul, SLRs can exploit economies of scale, but to a much smaller extent vis-à-vis Class I systems. In addition, trucking is a more economically viable alternative to short line rails relative to Class I systems. The implication of higher unit costs and greater competition from trucks is that SLRs have little market power and thus little ability to sustain monopoly-type profits.

### A. Deregulation and the Rail Industry

Appendix A reports a number of studies that identify how the 1980 Staggers Act affected freight rail markets. Wilson (1994, 1997) and Davis and Wilson (1999, 2003) analyze the price, productivity, employment, and wage effects. Their studies focus on Class I carriers and find that economic deregulation generally led to more productive operations and lower costs (up to 40%). Shipper rates initially increased but then stabilized or fell as carriers experienced productivity gains. Employment in the industry decreased by about 60% while real wages increased by over 40% from 1978 to 1994. Using firm level data, Davis and Wilson (2003) separates the effects of deregulation from the effects of mergers and firm characteristics caused by the Staggers Act. The study finds that deregulation contributes 20-23% of the employment decrease and that additional employment decrease occurred through mergers and changes in traffic mix.

In a number of post-Staggers studies, Bitzan and Keeler (2003), Bitzan (2003), and Bitzan and Keeler (2014) find that innovating train set operations (e.g. by eliminating the caboose) had a significant impact on productivity and reduced labor costs by 5-8% and that vertically integrating shipping and maintenance activities generated economies for the carriers. At the same time, the study argues for market-based pricing, finding that in the post-Staggers environment, revenue-cost margins for the most captive products (e.g. coal) changed little while there were significant increases in revenue cost margins for non-captive products (e.g. lumber and intermodal shipments).

The Staggers Act of 1980 and the Interstate Commerce Commission (which administratively liberalized railroad rates and contracting in the late 1970s) combined to significantly deregulate, although not completely, the rail industry (Winston, 1993). Gomez-Ibanez (2003, p. 195) reports that between 1960 and 1980 freight revenue per ton mile decreased 18% and, in the pre-post, deregulatory period, average length of haul increased 27% and 39% and ton-miles per employee hour increased 164% and 307%. In two meta-analyses, Winston (1998) summarizes the economic effects of deregulation in the rail industry. In terms of industry wide economic welfare effects, Winston (1993) finds rate changes had an indefinite effect on economic welfare but a clear positive effect on service quality. Wages fell 20% with little effect on employment and, overall, net positive economic welfare gains for the industry. Winston (1998) finds that deregulation benefited railroads and shippers. Average shipper rates fell more than 50% and quality of service (average transit times and variations in transit time) fell at least 20%. Enabling rails to shed uneconomic operations and develop more rational pricing policies, rails reduced its track miles 33% and implemented longer term contract rates. The net result enhanced rationalization of the industry's pricing and operational policies increased profits and produced a 60% decrease in real operating costs per ton-mile. A further innovation in the rail industry was the significant rise of third-party logistics providers.

B. Short Line Railroads

*Entry and Ownership*

Importantly, the Staggers Act of 1980 pre-empted state regulation which enabled rails to merge operations and abandon thousands of track mileage. Whereas in 1975 there were 73 Class I carriers, this dramatically fell to 10 in 1994 (Teske, Best, and Mintrom, 1995, Dooley, 1991). Although the abandoned parts were not economically viable for Class I operators, they were economically viable for lower cost operators. This gave rise to a significant increase in Class III carriers, the short line railroads. Allen, Sussman, and Miller (2002) found that SLRs grew 260% since the Staggers Act. In a related study, Babcock and Sanderson (2004) notes that 227 and 229 short line railroads were created nationwide in the 1980s and 1990s, respectively. These changes, reflecting the deregulatory-induced effects in rail and related markets, have since established SLRs as a key component of the US transportation industry. Consistent with this, Babcock, Russel, Prater, and Morrill (1993) finds that SLRs in Kansas and Iowa are a viable transportation alternative but an alternative whose financial viability is uncertain.

The short line rail sector is moderately concentrated, with top three companies accounting for about 65% of the total market (IBISWorld, 2015). Allen, Sussman and Miller (2002) finds that holding companies control or own 64% of the non-Class I rails, the largest of which is Genessee & Wyoming Inc. The study also argues that large rail holding companies could contribute to better financial stability. However, from the limited literature on SLR ownership, we find no evidence of the impact of ownership type on SLR financial or operating performance.

Based on an AASLRR survey of SLRs in 2011, Table 3 reports SLR ownership in the US. As seen in the table, nearly all SLR systems are in the private sector in the form of holding companies and independent RRs, Class I rails, or shippers. State/local governments own only 4.80% of the systems.

**Table 3**

**U.S. SLR Ownership**

| SLR Ownership | Number Owned | % of Railroads | Route-Miles | % of Route Miles |
|---|---|---|---|---|
| Holding Company, Independent RR, or Other | 439 | 81.20% | 43,062 | 87.60% |
| Class I Railroad | 11 | 2.00% | 1,601 | 3.30% |
| State/Local Government | 26 | 4.80% | 1,433 | 2.90% |
| Shipper | 55 | 10.20% | 2,282 | 4.60% |
| Not Specified | 9 | 1.70% | 783 | 1.60% |

Source: 2011 ASLRRA Biennial Survey, Reproduced in 2014 ASLRRA Short Line and Regional Railroads: Facts and Figures.

Understanding the potential impact of SLR ownership would not only provide more insight on whether holding companies or shippers, for example, are more efficient than single SLR companies but also the extent to which state government ownership affects financial and operating efficiencies.

*Operating Characteristics and Performance*

Although short line railroads don't have the capacity to originate and terminate most shipments, SLRs provide short-haul gathering service to the main lines. Compared to Class I railroads, Fischer, Bitzan and Tolliver (2001) finds that short line railroads serve the community with more flexibility and lower rates that are attractive to local manufacturers and producers. In addition, SLRs experience economies of size and density, implying reductions in unit cost from using the track more intensively and increasing the amount shipped. Consistent with this, Babcock, Prater, and Russell (1997) finds that increased traffic density (i.e. carloads per track mile) is critical to SLR profitability. Bitzan, VanWechel, Benson, and Vachal (2003) finds that SLRs were involved in 30% of all rail movements and identify a number of factors (e.g. traffic levels, commodities shipped, employee productivity) relevant to SLR performance and viability.

Focusing on SLR managerial characteristics and based on a survey of SLR managers, Grimm and Sapienza (1993) analyzes traffic and managerial determinants of short line railroad a multi-dimensional measure of performance. Consistent with Fischer, Bitzan and Tolliver (2000), the study finds that traffic density and system size positively affect performance. The extent to which the SLR can originate its own traffic (relative to distributing traffic that originates elsewhere) also has a positive effect. Shipping a smaller set of commodities and higher financial leverage (i.e. debt) has a negative effect on the performance of the short line.

Because SLRs are small local systems that link into Class I networks, trucking is a viable shipper alternative that often provides intense competition. Fischer, Bitzan and Tolliver (2000) finds from a survey of shippers that trucking has an advantage in "dependable transit, door to door service, and lower rates for short movements". SLR, on the other hand, is competitive for its ability to move larger quantities at one time, slightly longer movements, and fewer environmental impacts (e.g. pollution and congestion per ton-mile moved).

Truck and rail can also work together to better serve the local community, especially in the rural areas, where trucking and rail are the primary means of transportation. Berwick (2000) identifies the shipping cost and quality advantages of rail-truck intermodal transportation that characterizes seamless and continuous door-to-door freight transportation. This provides market-based growth opportunities but requires intermodal facilities. The study notes, for example, that North Dakota's agricultural sector is at a competitive disadvantage because there are no intermodal facilities in the state. In a related study, Vachal, Bitzan, VanWechel and Vinje (2006) finds that in grain shipping, the lower transit rates and high productivity benefits from deregulation favored areas with more intermodal competition.

### *Economic Viability*

There are a large number of studies that examine the long-term health prospects of SLRs and almost uniformly these studies focus on capital investment. Baldwin (2001) and Casavant and Tolliver (2001) find that SLRs require substantial investments to rehabilitate and upgrade trackage. Resor, Zarembski and Patel (2001) puts the cost of track replacement to handle heavier cars at $6.86 billion (1999 dollars). Warner and Terra (2006) estimates that Texas SLRs require a $250 million investment to upgrade the infrastructure to support 286,000-pound railcars. For SLRs in Kansas, Babcock, and Sanderson (2004) concludes that abandoning those lines on which systems cannot earn an adequate return on investment (ROI) is a viable option. If the local railroads were abandoned, a large amount of traffic would divert to truck, significantly impacting rural highways and local shippers (Bitzan, Tolliver and Benson, 2002). Highways, especially those were not designed for heavy use would deteriorate faster, which leads to higher pavement damage costs. And there would be safety and fuel efficiency implications if SLRs were no longer a viable option.

Related to capital needs is the ability to finance these investments. The Federal Railroad Administration (FRA, 1993) finds that small independent railroads (that is, not part of a holding company) may have more difficulty obtaining financing for several reasons, including a limited number of banks that specialize in small railroad loans and little public information for assessment of the risks. Bitzan, Tolliver and Benson (2002) also identify access to financing as hindering SLR capital investment.

### *Economic Impact of Short Line Rail System*

The existing literature on the economic impact of short line rail systems is sparse. Most studies are either conducted or funded by a state DOT. There also exist a number of state 'needs' assessments which, similar to some research papers in Appendix A, identify rehabilitation, upgrading, and other capital investments as critical for SLRs. The Georgia Department of

Transportation (GDOT, 2016) has recently released a report of GA's state rail plan which includes a discussion of short line rails and rail's economic impact but not the specific impact of short line rails. A few studies estimate the economic impact that SLR systems have on the economy. Often these studies focus on the economic impact of the state's total rail system, including Class I, II, and III rails.

In conducting their economic impact assessments, states and researchers have used several methods. Primarily due to limited data availability in this sector of the industry, surveys are a common method for developing firm level data on SLRs. Examples include Grimm and Sapienza (1993), Babcock and Sanderson (2004), Deller (2013), Llorens, Richardson and Buras (2014), and Sage, Casavant and Eustice (2015). Regression-based methodologies, input-output analysis, and cost-benefit analysis are the predominant statistical techniques for estimating economic effects, depending on data availability and the objective of the analysis. Often, in generating direct and indirect economic effects, researchers use input-output multipliers publicly available from the government (e.g. Regional Input-Output Multipliers System (RIMS II, BEA)) or from private companies (e.g. Impact Analysis for Planning, IMPLAN, Regional Economic Models from Regional Economic Models, Inc., (REMI), and Transportation Economic Development Impact System from TREDIS).[5]

Appendix B includes short line rail state DOT reports for Kansas, Louisiana, Georgia, Maryland, Washington, and Wisconsin. Short line rail systems have various impacts on a state's economy – employment and spending, operational mode diversion, environment and communities. The most important effects of SLR systems are the direct and indirect employment impact with their

[5] The three widely-utilized models for economic impact analysis are RIMS II, IMPLAN, and REMI (AKRF, 2013). Each model is based on the US Department of Commerce Input-Output tables first developed in the 1970s. RIMS II is relatively inexpensive and simple, while REMI is the most sophisticated and integrated model.

attendant effects on spending and state revenues. Increasingly, however, attention focuses on the environmental and community effects.

### C. Employment and Spending Impacts

Short line rails directly contribute to the local economy by providing jobs and increasing business volume and opportunities. Bitzan, Tolliver and Benson (2002) argues that if short line railroads were abandoned, the reduction in personal income and gross business volume in the local community could lead to a reduction in employment. In a Kansas DOT study, Brinkerhoff (2005) finds that SLR's net (of truck drivers) direct effect on employment is 1,333 jobs with an additional indirect employment effect of 1,831 jobs, annually generating $90.5 million in business saving.

Deller (2013) explores the overall scale of the railroad industry in Wisconsin and how the state's railway contributes to its economy. The study finds significant economic effects: more than 10,000 jobs created, over $1 billion in total income, just under $2 billion in industrial sales, and over $90 million in state/local tax revenues. Similar to Deller's study of Wisconsin's system, GDOT (2016) finds that the state's rail system provides significant economic benefits. In particular, Georgia's railroads in total generate nearly 672,630 jobs in the state (with annual earnings of $32.2 billion) and a combined value-added of $54.1 billion per year. Neither of these studies, however, provided separate impact analyses for Class I and Class II/III rail systems.

Llorens, Richardson and Buras (2014) estimated the economic impact of Louisiana's SLR system and is most relevant for this analysis. Using survey and secondary data to estimate the direct and indirect economic impact of short line railroads, Llorens, Richardson and Buras (2014) concludes that the SLR system in Louisiana accounts for approximately 1,821 jobs, directly and indirectly, and more than $44 million in annual state revenues. The study also estimates that SLRs spend approximately $3,800 per mile annually in contractor services and earn approximately $89,000 annually per mile of functioning track.

D. Operational and Shipping Impact

Babcock and Sanderson (2004) finds that SLRs in Kansas decrease the cost of shipping (specifically handling) wheat (and presumably other agricultural products). More generally, Brinkerhoff (2005) estimates that SLRs generate $65.3 million savings in transportation costs to shippers. SLR services are important for industries with high amounts of input materials and final product shipments. In particular, the short line rails bring input materials to the manufacturer and transfers its products to mainline for domestic and international markets. Serving as the connector between shippers and mainlines, short line rails are important to the related industries. In their study of Louisiana, Llorens, Richardson and Buras (2014) estimates those industries using SLRs in Louisiana support over 260,000 jobs in Louisiana, about 15% of the jobs in the state.

E. Mode Diversion Impact

Mode diversion effects are additional costs incurred if states abandoned their SLR systems. SLRs reduce the number of truckloads and local truck traffic, which reduces pavement damage and congestion (Betak, Theofanis, and Boile (2009)). Babcock and Sanderson (2004), for example, estimates that SLRs in Kansas annually save the state government $58 million in reduced maintenance on roads. And in 2010, the ASLRRA (2012) estimated that short line railroads in Louisiana facilitated the transportation of approximately 472,000 truckloads of freight which prevented approximately $21 million in pavement damage. In a related study, Sage, Casavant, and Eustice (2015) examines the implications of not upgrading existing infrastructure in Washington State and estimates that the SLR systems require a $600 million investment to upgrade the system's track to Class II standards in order to accommodate 286,000-pound rail cars. Absent this investment, the study identifies the impact this would have upon highway congestion, maintenance, and safety as shippers divert their demands from SLR to truck.

In addition to these effects, as part of the transportation network, short line rail is more fuel-efficient than trucks. According to FRA (2010), on a ton-mile per gallon basis, rail transportation is more than twice as efficient as truck transportation; and rail transportation is more than nine times as safe in terms of traffic fatalities per billion-ton miles. Thus, short line rail systems can provide communities with environmental and safety benefits. Evaluating the full cost of shifting traffic from SLRs to truck includes not only a state's 'out-of-pocket' cost related to highway maintenance but also the net effects on travel delays, the environment, and safety.

### F. Community Effects

Bitzan, VanWechel and Benson (2003) and Bitzan, Tolliver and Benson (2002) discuss the implications for communities from abandoning short line rail systems. Their arguments focus on the above economic impact – employment and spending, shipping rates, state revenues, and diversion effects – the net impact of which would be to lower the economic viability of a community. For large metropolitan areas, the loss of SLRs would likely be small, depending on congestion, environmental and safety effects.

But for smaller rural communities, SLR systems have a large impact on the local economy. Bitzan, Tolliver and Benson (2002) makes the point that rail abandonment would lead to increased transportation costs, highway and road deterioration, environmental and safety impacts, reductions in rural personal income and gross business volume, unemployment, reduction in local property values, and reduced economic development opportunities. Taking increased transportation costs as an example, local shippers would have to pay higher user fees. Vehicle operating costs would also increase because of road deterioration. And opportunity costs increase with increased shipping times. An increase in the distribution costs of landlocked shippers could also be possible because of the higher transportation rates due to longer distances and truck rate increases due to absence of rail competition.

An important aspect of SLR systems in small communities is to identify those ways in which a SLR system can profitably service the community. Cirillo, Schonfeld, and Zhang (2016) conducts a market opportunity analysis for SLR demands and explores the impact that alternative improvements in SLR performance would have upon shipper demands. Such analyses would be important in identifying circumstances under which SLR systems profitably serve and help meet a community's shipping needs. And in a related study, Miller and Stich (2014) examines the economic development benefits of short line railroads in Mississippi, and critiques the cost-benefit analysis methodology widely used in similar studies in light of the fact the SLR systems often struggle to be on a sound financial footing.

## III GEORGIA'S SHORT LINE RAIL SYSTEM

A. Industry Overview

GDOT SLRs operate on tracks owned by either the state, private companies, or both within Georgia. For example, the Heart of Georgia Railroad (HOG) operates on 140 miles of track, all of which GDOT owns. The Georgia Northeastern Railroad (GNRR), on the other hand, operates on 98 miles of track, of which GDOT owns 23 miles (23.5%). Although the percentage of GDOT-owned tracks may vary, we define SLRs operating on any portion of GDOT-owned tracks as GDOT short line rails. Since these systems operate on tracks that the state owns and maintains, GDOT's SLRs must annually report their operating and financial data to GDOT.

*GDOT's SLR Network*

In Georgia, short line railroads operate on 1,362 miles of track, which accounts for 29% of the 4,643-total operating route trackage in the state (GDOT, 2016). Of these 1,362 miles, GDOT owns 596 miles of track, 43.8%. And of the 29 short line railroads that operate in Georgia, 26 are local operating railroads and 3 are switching or terminal railroads. (GDOT, 2016 Page-42) Table 4 lists the short line railroads operating in Georgia and provides information on miles of track and the percentage of SLR track, counties served, and the miles and percentage of track that GDOT owns.

From Table 4, Georgia's short line railroads vary considerably by track mileage and number of counties served. For example, Heart of Georgia Railroad is a relatively large railroad, operating 140 miles across 11 counties in southern Georgia, while Chattahoochee Bay Railroad is much smaller, operating only 2 miles in one single county in the southwest corner of Georgia. There are also railroads that perform only switching and terminal activities. Fulton County Railway, for example, has no route miles but 22 miles of terminal trackage.

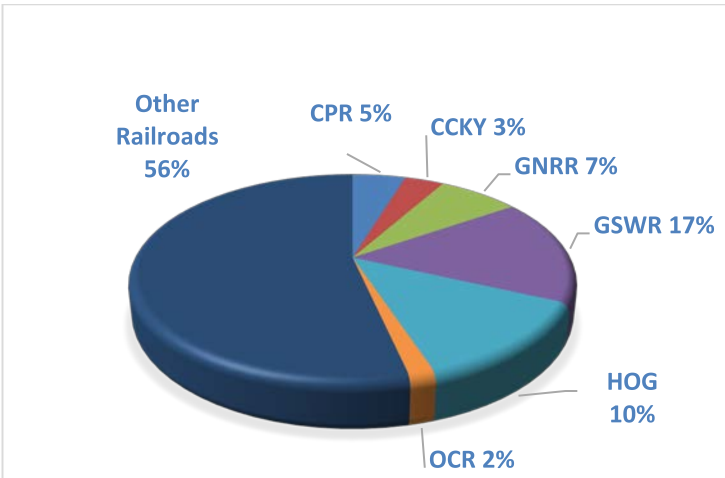
## Table 4

## Georgia Short Line Rails – Size and Scope, 2015

| Railroad | Route Miles Operated | % non-GDOT Tracks | % GDOT Tracks | Counties Served |
|---|---|---|---|---|
| The Athens Line | 22 | 1.60% | 0% | Jackson, Clarke, Oconee, Morgan |
| Cater Parrott Railnet | 64 | 4.70% | 67.19% | Atkinson, Berrien, Lanier, Lowndes, Jasper, Morgan, Newton |
| Chattahoochee Bay Railroad | 2 | 0.10% | 0% | Early |
| Chattahoochee Industrial Railroad | 15 | 1.10% | 0% | Early |
| Chattooga and Chickamauga Railway | 47 | 3.50% | 100.00% | Catoosa, Walker, Dade |
| Columbus & Chattahoochee | 0 | 0.00% | 0% | Girard, Al, Mahrt, AL |
| First Coast Railroad | 8 | 0.60% | 0% | Camden |
| Fulton County Railway | 0 | 0.00% | 0% | Fulton |
| Georgia and Florida Railway | 222 | 16.30% | 0% | Dougherty, Mitchell, Colquitt, Thomas, Worth, Lowndes, Cook, Brooks, Berrien, Madison, Taylor |
| Georgia Central Railway | 171 | 12.60% | 0% | Bibb, Twiggs, Laurens, Treutlen, Montgomery, Toombs, Tattnall, Evans, Brayan, Chatham |
| Georgia Northeastern Railroad | 98 | 7.20% | 20.41% | Fannin, Gilmer, Pickens, Cherokee, Cobb |
| Georgia Southern Railway | 74 | 5.40% | 0% | Bulloch, Candler, Crawford, Peach, Houston, Emanuel |
| Georgia Southwestern Railroad | 225 | 16.50% | 45.36% | Quitman, Randolph, Calhoun, Early, Miller, Decatur |
| Georgia Woodlands Railroad | 17 | 1.20% | 0% | Wilkes, Warren, Taliaferro |
| Golden Isles Terminal Railroad | 12 | 0.90% | 0% | Glynn |
| Golden Isles Terminal Wharf | 0 | 0.00% | 0% | Chatham |
| Great Walton Railroad | 10 | 0.70% | 0% | Walton |
| Hartwell Railroad | 58 | 4.30% | 0% | Stephens, Franklin, Hart, Elbert |
| Heart of Georgia Railroad | 140 | 10.30% | 100.00% | Stewart, Webster, Sumter, Crisp, Wilcox, Dodge, Telfair, Wheeler, Montgomery, Toombs, Emanuel |
| Hilton and Albany | 56 | 4.10% | 0% | Dougherty, Calhoun, Early |
| Louisville and Wadley | 10 | 0.70% | 0% | Jefferson |
| Ogeechee Railway | 22 | 1.60% | 100.00% | Effingham, Screven |
| Riceboro Southern Railway | 33 | 2.40% | 0% | Bryan, Liberty |
| Sandersville Railroad | 9 | 0.70% | 0% | Washington |
| Savannah Port Terminal Railroad | 0 | 0.00% | 0% | Chatham |
| Southern Electric Railroad | 0 | 0.00% | 0% | Effingham |
| St. Marys Railroad | 14 | 1.00% | 0% | Camden |
| St. Marys West Railway | 23 | 1.70% | 0% | Atkinson, Ware |
| Valdosta Railway | 10 | 0.70% | 0% | Lowndes |

Source: GDOT (2016) Page A-42.
Notes: (1) While Columbus & Chattahoochee railroad operates all its line hauls in Alabama, the railroad does interchange traffic in Georgia at Columbus with another G&W carrier. (GDOT, 2016).
(2) Switching &Terminal Companies have no route miles operated. The three switching & terminal companies and their terminal miles are: FCR, 22; GITW, 7; SATP, 19. In addition to its route miles, GITM has 24 Terminal miles. (GDOT, 2016 Page-42). See Appendix C, for definition of acronyms.

Figure 1 shows the distribution of the tracks of the six GDOT short line railroads in Georgia's short line railroad system, operating over596 (43.8%) miles of track. Figure 2 shows the distribution of the GDOT owned tracks among the six short line railroads. As seen in the figure, HOG and GSWR operate on 64% of all the tracks owned by GDOT. The other four systems (CPR, CCKY, GNRR, and OCR) operate on 36% of GDOT's tracks.

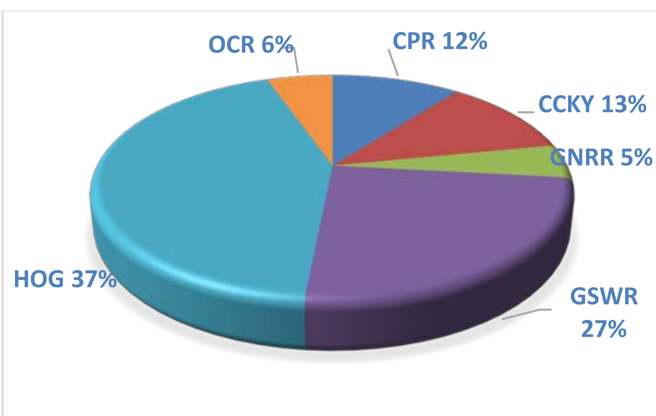



OCR – Ogeechee Railroad
HOG – Heart of Georgia Railroad
CPR – Cater Parrott Railnet
CCKY– Chattooga and Chickamauga Railway Company
GNRR – Georgia Northeastern Railroad
GSWR – Georgia Southwestern Railroad

Source: GDOT (2016) Page A-42.

**Figure 1**

**Short Line Railroads Operating on Tracks in Georgia**




OCR – Ogeechee Railroad
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CCKY– Chattooga and Chickamauga Railway Company
GNRR – Georgia Northeastern Railroad
GSWR – Georgia Southwestern Railroad

Source: GDOT (2016) Page A-42.

**Figure 2**

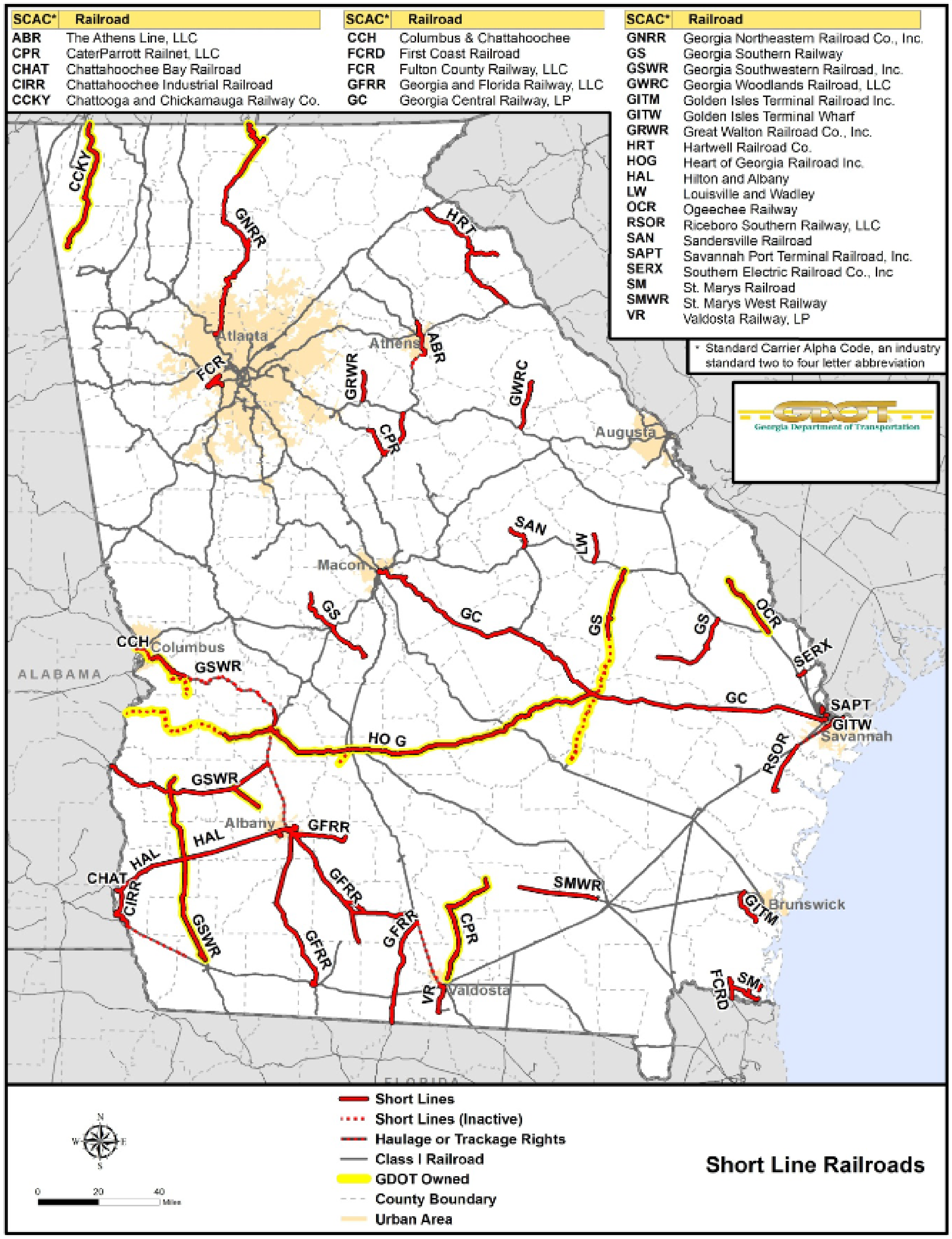
**Short Line Railroads Operating on GDOT Track**

Figure 3 illustrates the geographic scope of Class I and short line railroads in Georgia. Many of Georgia's short line railroads operate over short distances and operate in the north-south direction.

However, in the southern part of Georgia, the Heart of Georgia and Georgia Central Railway, two of the larger systems, move in a west-east direction, connecting counties from the west border to the Port of Savannah on the eastern coast of Georgia.

B. GDOT and Non-GDOT SLRs

Table 5 compares the size and ownership and operational scope between GDOT short line railroads and other short line railroads operating in Georgia. The track length reported is the length of tracks, including both operated tracks and tracks out of service. In terms of ownership, the tracks could be owned, leased or under trackage rights. Whereas GDOT SLRs operate 44% (596 miles) of the 1,362 miles of SLR track, only 38.3% of the 1,362 miles are GDOT tracks as mentioned earlier. On average, track length for GDOT short lines is 99 miles, three times longer than track length (33 miles) for other short lines operating in GA. The difference is larger when comparing median lengths (81 versus 12 miles). On the other hand, GDOT SLRs serve a smaller percentage of GA counties (34) relative to other SLRs (57), which reflects the much larger number of non-GDOT short lines operating in GA.




Source: GDOT (2016).

**Figure 3**

**Short Line Railroads in Georgia**

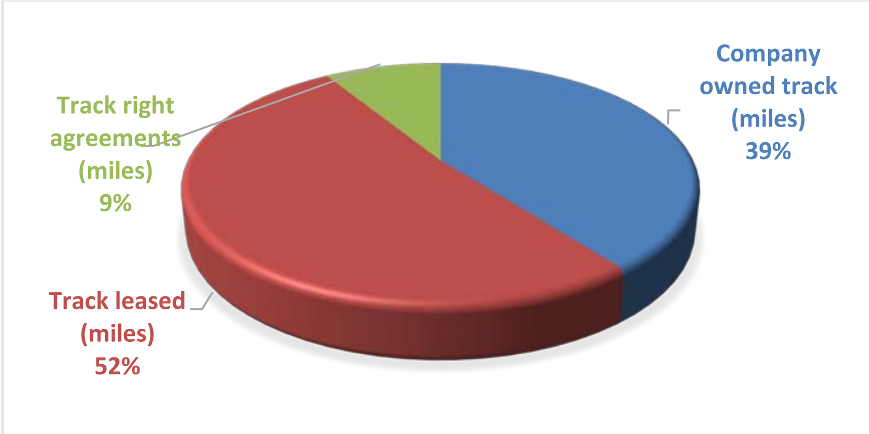
**Table 5**

**Size and Scope Comparison**

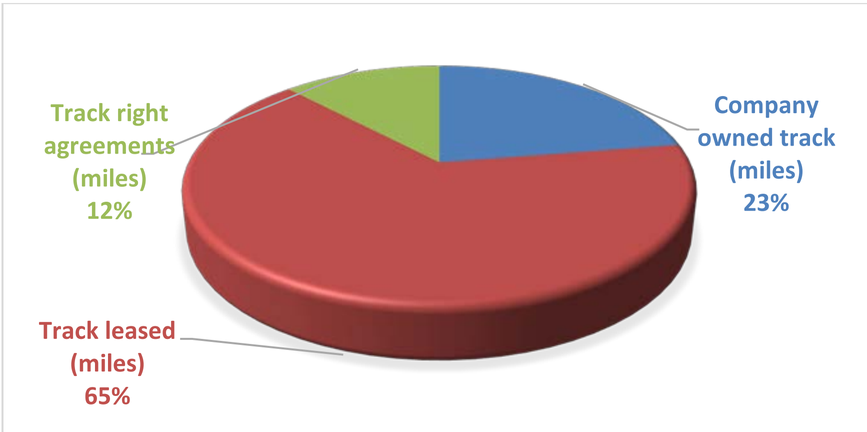
| | All SLRs | GDOT SLRs | Other SLRs |
|---|---|---|---|
| **Network** | | | |
| Track length (miles) | 1543.6 | 710.7 | 832.9 |
| Operational track (miles)* | 1362.1 | 596.3 | 765.8 |
| % Operational track in the state | 100.0% | 43.8% | 56.2% |
| Average operational track length per system (miles) | 47 | 99.4 | 33.3 |
| Median operational track length per system (miles) | 17 | 81 | 12 |
| Number of short line railroads using track | 29 | 6 | 23 |
| **Service Area** | | | |
| Total number of counties served | 91 | 34 | 57 |
| Average of number of counties served per system | 3.1 | 5.7 | 2.5 |
| Median of number of counties served per system | 2 | 5.5 | 1 |
| **Track Ownership** | | | |
| Company owned track (miles) | 518.5 | 134 | 384.5 |
| Company owned track as % of total operational track | 38.1% | 22.5% | 50.2% |
| Track leased (miles) | 679.8 | 390.3 | 289.5 |
| Leased track as % of total operational track | 49.9% | 65.5% | 37.8% |
| Track right agreements (miles) | 115.8 | 72 | 43.8 |
| Track agreements as a % of total operational track | 8.5% | 12.1% | 5.7% |

Source: GDOT (2016).
*The operational tracks do not include switching and terminals. GDOT (2016) does not make it clear how many miles of the tracks out of service are owned, leased, or under trackage right. Since trackage right agreements are often short-term agreements and the tenant and owner often have to share the track, we assume the tracks out of service are all tracks owned or leased. Therefore, in the table, despite the first row which includes tracks out of service, all other rows only include operated tracks. Operated mileage includes owned tracks operated, leased tracks operated, and tracks operated under trackage right.

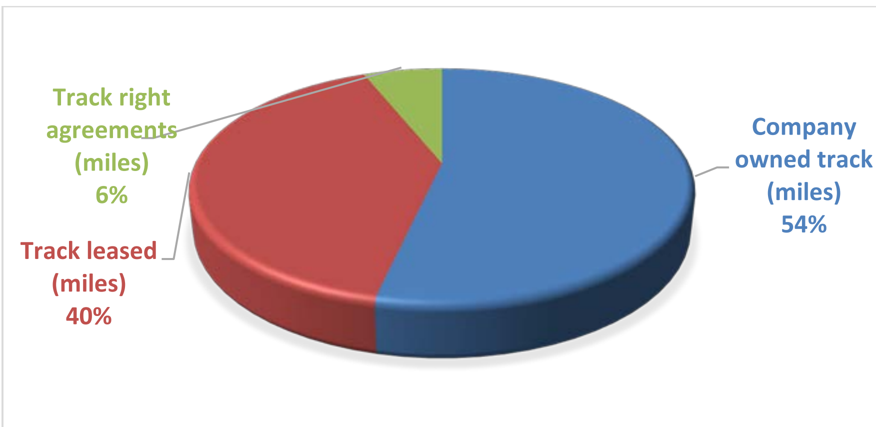
Table 5 and Figure 4 provide information on differences in the ownership structure of tracks over which SLRs in Georgia operate. Private companies own 519 miles (38%) of all SLR tracks in GA. Of these 519 miles, non-GDOT SLRs operate on 385 miles, while GDOT SLRs operate on




GDOT SLRs




Non-GDOT SLRs




Source: GDOT (2016).

**Figure 4**

**Ownership Comparison – Total, GDOT, Non-GDOT SLRs**

134 miles of tracks. A higher proportion (65.5%) of GDOT SLRs operate on leased track. In addition to owning and leasing tracks, SLRs can sign track-right agreements that provide track access. As seen in the last row of Table 5, track right agreements are much less prevalent in Georgia than track ownership or track lease arrangements.

Georgia's short line rail network reflects the national trend towards consolidation. Three major rail holding companies, Genesee and Wyoming (G&W), OmniTRAX, and Pioneer Railcorp, control 17 of the 29 short line systems in Georgia.[6] B. R. Anderson, a smaller multi-property short line railroad operator, controls three short line railroads in Georgia. Eight short line rails are controlled by independent companies. Table 6 and Figure 5 report the number of short line railroads and mileage under the control of these companies. G&W and OmniTRAX operate 60%

**Table 6**

**Short Line Railroads Holding Companies**

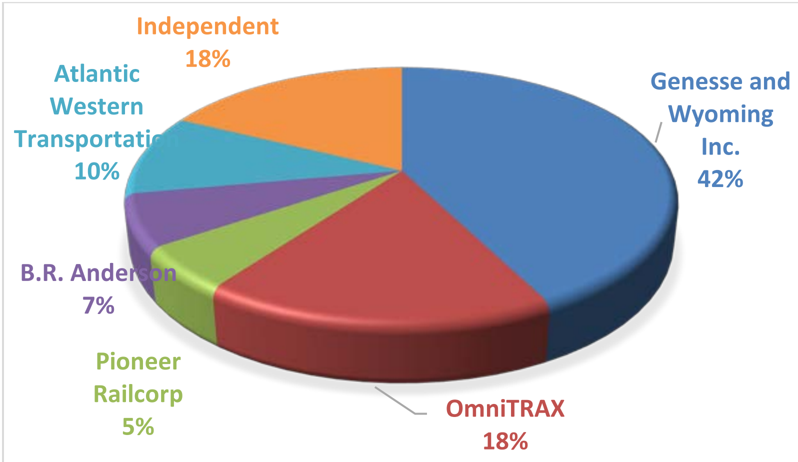
| Parent Company | SLR Operators (number) | Route Miles Operated | Route Miles Owned |
|---|---|---|---|
| Genesee & Wyoming Inc. | CHAT, CIRR, CCKY, CCH, FCRD, GC, GSWR, GITM, GITW, HAL, RSOR, SAPT, VR (13) | 579 | 257 |
| OmniTRAX | FCR, GFRR, GWRC (3) | 239 | 111 |
| Pioneer Railcorp | GS (1) | 74 | 0 |
| B.R. Anderson | ABR, GRWR, HRT (3) | 90 | 20 |
| Atlantic Western Transportation | HOG (1) | 140 | 0 |
| Independent | CPR, GNRR, LW, OCR, SAN, SM, SMWR, SERX (8) | 240 | 131 |

Source: Calculated using information from GDOT (2016).

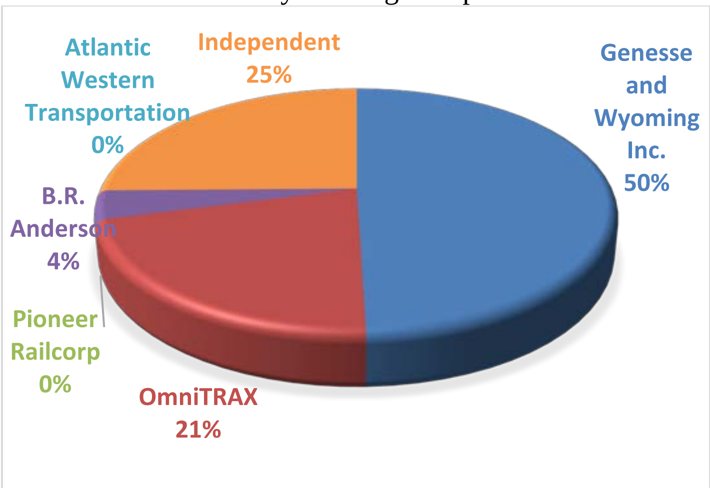
[6] Genesee and Wyoming Inc. has agreed to acquire the shares of Atlantic Western Transportation in 2017. Therefore, after the acquisition, HOG will be under Genesee and Wyoming Inc. and Atlantic Western Transportation will no longer be a parent company of any short line rails in Georgia.

of the tracks by mileage, while the eight independent companies operate 18% of the tracks. In terms of ownership, G&W and OmniTRAX own 71% of the tracks, while the eight independent companies own 25%.

Operated by Holding Companies




Owned by Holding Companies




Source: GDOT (2016)

**Figure 5**

**Route Miles Owned and Operated by Holding Companies**

C. GDOT SLR Operating Statistics

*Short Line Freight Traffic*

The short line railroad industry in Georgia handled 208,000 carloads of freight in 2016 (ASLRRA, 2017). GDOT short line railroads handled a 7.6% of these (15,763 carloads). Figures 6 and 7 identify recent carload and customer trend, respectively, for GDOT SLRs from 2010 – 2015/2016.

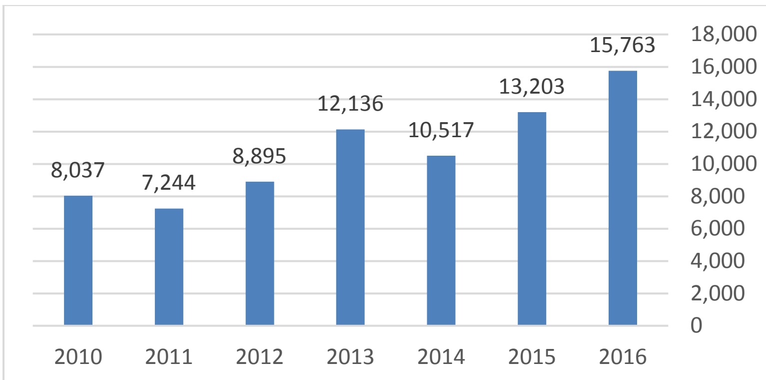
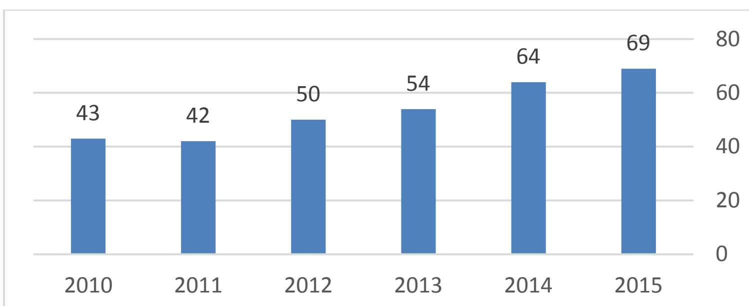



**Figure 6**

**GDOT SLR Carloads**




Source: For both figures: GDOT Short Line Economic Impact Data, GDOT Division of Intermodal.
Notes: The figures do not include Georgia Northeastern Railroad (GNRR), a tourist line. Data for CaterParrott Railnet (CPR) in 2010 and 2011 are unavailable.

**Figure 7**

**GDOT SLR Number of Customers**

Carloads have nearly doubled (96%), from 8,037 in 2010 to 15,763 in 2016, representing an average annual increase of 13.7%, while customer numbers increased by 60.5% from 2010 to 2015, with an average annual increase of 10.1%.

*Short Line Tourism Traffic*

Short line rails in Georgia mainly provide freight service, but there are four short line railroads for passenger service, mainly used for sightseeing in Georgia, reported in Table 7: Blue Ridge Scenic Railway on Georgia Northeastern Railroad (GNRR), SAM short line on Heart of Georgia Railroad (HOG), Saint Mary's Express on St. Mary's Railroads (SM), and Tennessee Valley Railroad Museum on Chattooga & Chickamauga Railway (CCKY). These tourist short line railways help to preserve railroad history and introduce the public to the important role of

**Table 7**

**Short Line Railroads for Tourism**

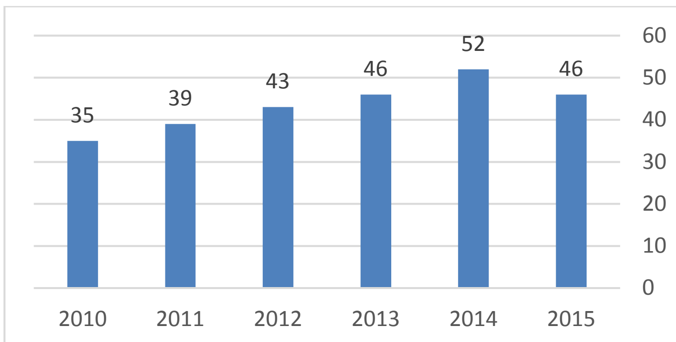
| Tourist line | Operated by | Short line (track miles) | Track Owned by | Short line Parent Company |
|---|---|---|---|---|
| Blue Ridge Scenic Railway | The Blue Ridge Scenic Railway (BRSR) | GNRR (98) | GDOT (23), Georgia Northeastern Railroad Co. (75) | Georgia Northeastern Railroad Co. |
| SAM Short line | The Georgia Department of Natural Resources under guidance from the Southwest Georgia Railroad Excursion Authority | HOG (140) | GDOT (140) | Atlantic Western Transportation |
| Saint Mary's Express | SM | SM (14) | Boatright Companies (14) | Boatright Companies |
| Tennessee Valley Railroad Museum | Tennessee Valley Railroad Museum (TVRM) | CCKY (47) | GDOT (47) | Genesee and Wyoming Inc. |

Source: GDOT (2016).
Notes: Number in parentheses is the number of miles operated. For example, Blue Ridge Scenic Railway is part of GNRR which has 98 miles of track, 23 miles of which GDOT owns. Saint Mary's Express is not a GDOT short line rail whereas other tourist lines operating in GA are GDOT short line rails.

contemporary rail industry in the state's economy. They have significant economic impact on areas along the line and, by attracting visitors, generate income for restaurants, hotels, and other tourist-related business.

*Resources*

Short line railroads in Georgia employ 212 workers, according to ASLRRA (2017). In 2015, GDOT's six short line railroads employed 46 workers. Figure 8 identifies the number of employees working for GDOT short line railroads during the period 2010 – 2015, which showed a steady increase until 2014 when the number of employees fell from 52 to 46.




Source: Short Line Economic Impact Data, GDOT, Division of Intermodal.
Notes: The employees are all at freight service positions, The data exclude GNRR, a tourist line in GA. Data for CPR (2010 and 2011) are missing.

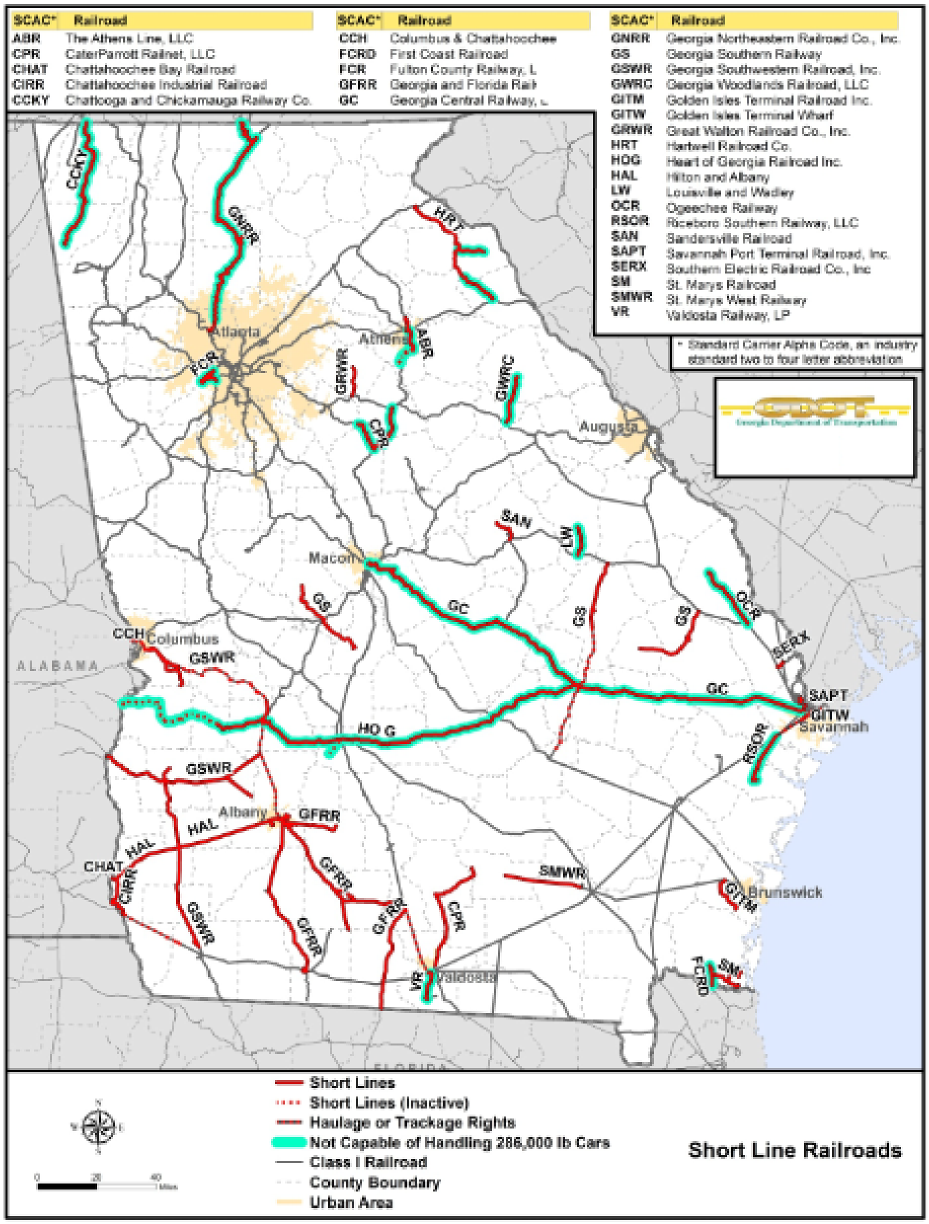
**Figure 8**

**GDOT SLR Number of Employees**

The current track standard for a maximum loaded car is 286,000 pounds. For those railroads in Georgia operating on substandard track, i.e. track with maximum loads that are lower than 286,000 pounds, the majority are short line railroads. Of the 29 short line railroads operating in Georgia, 15 SLRs have reported operating on tracks with weight limits under 286,000 pounds.[7] Of the six GDOT short line railroads, four railroads belong to these railroads which needs track

[7] Weight limit information for Southern Electric Railroad Company Inc. is not available (GDOT, 2016)

improvement. Figure 9 shows the short line railroads (highlighted in blue) that are not able to handle maximum car weights of 286,000 pounds.




Source: GDOT (2016).

**Figure 9**

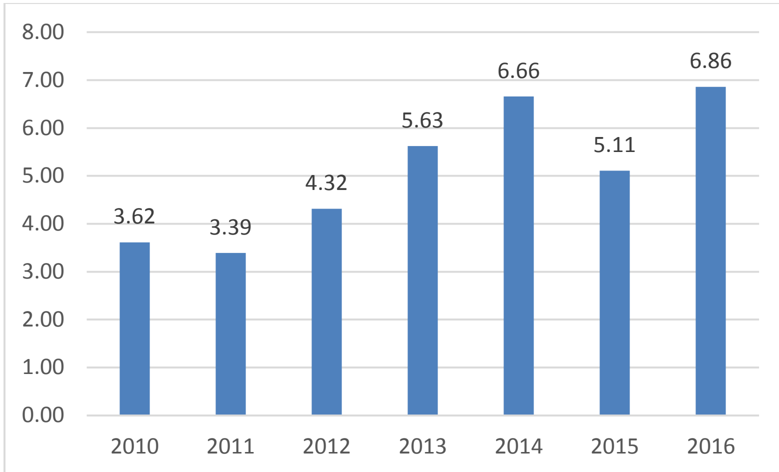
**Short Line Segments Incapable of Handling 286,000 lb. Railcar Weights**

By upgrading the track to accommodate 286,000-pound weight limit, short line railroads could increase operating efficiency and lower shipping costs. Therefore, the ability to handle the maximum carloads of 286,000 pounds is important for the survival of both the short line railroads and their customers.

However, the short line railroads are currently faced with difficulties in obtaining funds for such infrastructure improvements. GDOT Intermodal Division works with these systems on infrastructure improvement projects. GDOT developed short- and long-range proposed rail investment programs to improve freight and passenger rail. Projects for short line railroads include a short-range (2015-2018) and long-range program (2019-2040). The short-range program focuses on GDOT SLRs (i.e. operating on state-owned track), while the long-range program includes both state and privately-owned railroads. The SLR projects in the short-range program include track and structure improvements, a short line economic impact analysis and GDOT short line infrastructure inventory and needs analysis. Short line railroads projects in the long-range program include specifically identified short line infrastructure projects and ongoing maintenance of GDOT short line railroads. Funding for projects in the short-range program come from federal, state, and local sources. (GDOT, 2016)

D. Financial Data

Figure 10 reports GDOT short line railroad revenues for the period 2010 through 2016. As seen in the figure, revenues steadily increased between 2011 and 2013, with little change in 2014 and a drop in 2015. Revenues in 2016, however, significantly increased from $5.1 million in 2015 to $6.9 million in 2016, a 35% increase in one year. For the six systems, average revenue per year ranged from a low $0.6 million in 2010 to 1.1 million in 2016. These system revenues are small relative to the average SLR nationally. From Table 1, 546 short line railroads earned $2.6 billion revenues or $4.76 million per railroad.




Source: Short Line Economic Impact Data, GDOT Division of Intermodal.

Note: Only freight revenues are shown here. Since GNRR only has tourist lines in GA, the revenue data for GNRR is not included.

**Figure 10**

**GDOT Short Line Rail System Total Revenues (Millions)**

## IV RIMS II – ECONOMIC IMPACT METHODOLOGY

### A. Introduction

Short line rail systems are an important part of the state's transportation and logistics system that directly and indirectly impact regional and state output, employment, and earnings. In order to estimate the economic impact of Georgia's SLR systems, this study uses Bureau of Economic Analysis (BEA) multipliers generated from the BEA's Regional Input-Output Modelling System (RIMS II) that models goods produced by each industry and goods consumed by industry sectors and final users. RIMS II is a national model but provides economic impact multipliers that take into account regional supply conditions. While the RIMS II framework provides important information on the economy-wide (e.g. local, regional) effects of a change in final demand, the input-output model in RIMS II (as well as in other economic impact models) rests on a number of assumptions. Knowledge of the assumptions and understanding their implications are critical to deriving multipliers that accurately reflect the economic impacts of changes in the demand for Georgia's short line rail services.[8]

### B. RIMS II Methodology

The RIMS II methodology assumes that there are n industries, where each industry i uses its own inputs and the inputs from other industries to produce its gross output (expressed in dollars). Industry i then sells its output to other industries and/or to final consumers. The expression below summarizes this relationship:

(1) $$X_i = z_{i1} + z_{i2} + \ldots + z_{in} + Y_i$$

where $X_i$ is the gross value of output that industry i produces, $z_{ij}$ (j = 1, …, n) is the amount of industry i's output sold as an intermediate input to industry j (j = 1, …, n), and $Y_i$ is the amount of

[8] Sources on RIMS II methodology include Bureau of Economic Analysis (1992, 1997, 2013), Lynch (2000), Barret (2011), Beemiller and Friedenberg (1997) and Bess and Ambargis (2011).

industry i's output sold to the final consumer. Part of the input-output framework is a set of 'technical coefficients' $a_{ij}$ that give the amount of industry i's output needed to produce one dollar of industry j's output. $a_{ij}$ is simply the ratio $a_{ij} = (z_{ij} / X_i)$.

Embedded in the RIMS II methodology are some key assumptions:

- Backward linkage – an increase in demand measures the impact on the demand for intermediate inputs (including labor). For example, expenditures on upgrading SLR track will have an impact on the demand for inputs to upgrade the track (backward linkage) but will not reflect the increase in output associated with companies that use the track (forward linkage)
- Fixed purchase patterns – an industry uses inputs in a fixed proportion and this proportion will not change. Producing an extra mile of short line rail services, for example, will not alter the proportion of inputs (e.g. labor, fuel, cars) to produce that extra mile
- Industry homogeneity – each firm in the industry uses the same production process. For example, in the short line industry, the production process in producing tourism trips is different from the production process in moving freight. Although both activities use short line rails, grouping these systems together to estimate the economic impact would lead to an aggregation bias
- No supply constraints – input resources are sufficiently available that an increase in the demand for inputs will put no upward pressure on the prices of the inputs. For example, an increase in the demand for short line rail services would increase the demand for all inputs needed to meet the increased demand, including labor. If SLRs could hire additional labor at the same wage that they are paying existing labor, then the industry is not facing any supply constraints for labor
- Local supply conditions – RIMS II is a national model but adjusts the multipliers to account for local supply conditions. Suppose there is investment to upgrade the quality of

track. If rail track required for the upgrade is only available from outside the region, the model accounts for this leakage. However, if the region manufactures rail track but the track used is actually purchased from outside the region ('cross hauling' is a term used to describe this), the model assumes regional rail track in its calculations, which biases upwards the economic impact

- No regional feedback – the RIMS II model is a single region model that ignores any potential feedback from other regions. Suppose, for example, that SLR purchases rail track from outside the region in order to improve SLR tourism. If this results in an increased number of tourists from outside the region, this feedback effect is absent, and this would bias downward the economic impact of the new track
- No time dimension – the model is static in the sense that the model is a snapshot of 'before' and 'after' situations. The 'before' is prior to any change in demand; the 'after' is the full – complete – response to the change in economic activity. The model does not account for how long the full economic impact of the change could take.

## C. Multiplier Effect

The notion of a multiplier effect reflects the multiple rounds of spending that occur when final spending increases by $1. Each round of spending generates additional rounds of smaller spending and this will continue until the last round is negligibly small. Adding up all the rounds of spending gives a multiplied effect of the original dollar of spending and this multiplied effect reflects the total amount of additional income the $1 supports. For example, if the marginal propensity to consume from a $1 increase in income is .75, then the individual who receives a $10,000 raise spends $7,500, which generates $5,625 (.75 x 7500) in spending, which generates

$4,218 in subsequent spending, and so forth. After all rounds of spending are complete, the $10,000 supports $40,000 of new spending.[9]

Output multipliers in the RIMS II methodology underlie three other multipliers reported in RIMS II, earnings, employment, and value-added multipliers. If, for example, Δ SLR Output ($) is the dollar change in output of short line services that final users purchase (where Δ denotes 'change in') then the multiplied dollar change in total output, (Δ Final SLR Output ($)), is

(1) $$\Delta \text{ Final SLR Output (\$)} = (\text{RIMS II Output Multiplier}) \times \Delta \text{ SLR Output (\$)}$$

Suppose that the rail transport multiplier is 1.89 and the initial increase in local output final demand is $1 million, then the 1$ million increases generate a total increase in SLR final demand equal to $1.89 million.[10]

*Type I and Type II Multipliers*

RIMS II produces Type I and Type II multipliers and the context of changes in economic activity determines which type of multiplier the analyst should use. Both Type I and Type II multipliers report direct and indirect economic impacts. The direct impact corresponds to the initial change in spending and the first round of inputs that the final-demand industry purchases. The indirect effect reflects inputs that supporting industries purchase in subsequent rounds of spending. Adding the direct and indirect effects give the <u>interindustry</u> effect.

The distinction between Type I and Type II multipliers is the induced effect. The induced economic effect includes spending by workers whose incomes have changed as a result of the

[9] In this example, if the marginal propensity to consume is mpc, then the multiplier can be shown to equal (1/ (1 – mpc)). Thus, if mpc equals .75 then the multiplier is (1/.25) = 4 and a $10,000 increase in income supports $40,000 of total spending.
[10] 1.89 is BEA's rail transportation output multiplier for the state of Georgia.

change in final demand.[11] However, if the worker resides and works in the region, then the direct and indirect impact include household spending and a Type I multiplier is appropriate. Since the spending of workers who live in the region is already counted in the Type II multipliers, in studies using Type II multipliers, all changes in household purchases must exclude the spending of workers who live and work in the region, while in studies using Type I multipliers, changes in household purchases are final demand changes.

Table 8 below defines the RIMS II final demand multipliers.

**Table 8**

**RIMS II Multipliers**

Final Demand Multipliers

| Multiplier | Definition | Application |
|---|---|---|
| Output | Total industry output per $1 change in final demand | Change in final demand multiplier × multiplier = total output impact |
| Value Added | Total value added per $1 change in final demand | Change in final demand multiplier × multiplier = total valued added impact |
| Earnings | Total household earnings per $1 change in final demand | Change in final demand multiplier × multiplier = total earnings impact |
| Employment | Total number of jobs per $1 million change in final demand | Change in final demand multiplier × multiplier = total employment impact |

Direct Effect Multipliers

| Multiplier | Definition | Application |
|---|---|---|
| Earnings | Total earnings per $1 change in earnings in the final demand industry | Change in earnings in the final demand industry × multiplier = total earnings impact |
| Employment | Total jobs per one job change in the final demand industry | Change in jobs in the final demand × multiplier = total jobs impact |

Source: Reproduced from Table 3.1 (page 3-3) and Table 3.2 (page 3-5), BEA, *RIMS II: An Essential Tool for Regional Planners and Developers*).

[11] RIMS II and other I-O models have similar definitions for induced impact, but different definitions for other impacts. The direct impact in alternative models is the final-demand change in RIMS II, while the indirect impact in alternative models include both direct impact and indirect impact in the RIMS II.

D. RIMS II Application – Additional Considerations

To conduct an economic impact study using RIMS II, three basic decisions must be made: 1) what is the final-demand area or region? 2) what are the final-demand industries; and 3) what is the final demand change?[12] Knowing the final demand area and the industries affected are necessary to identify the appropriate impact multipliers. And the product of the impact multipliers and final demand change give the economic impact (as illustrated above in Equation (1) for SLR output).

*Changes in Economic Activity*

RIMS II multipliers generally focus on new spending. Given an exogenous increase in final demand and the underlying assumptions of the input-output relationships, the RIMS II multipliers estimate the economic impact on output, employment, earnings, and value added. In these applications, final demand changes can be consumer purchases from outside the region, investment expenditures, government purchases, and household purchases.

*Leakages*

An important consideration when analyzing the regional economic effect of exogenous changes in final demand is 'leakage', that is, spending outside the region or local economy. For example, suppose that GDOT invests $1 million to upgrade track on the Chattooga and Chickamauga Railway (CCKY) system, which operates in three counties (Catoosa, Walker, and Dade). And suppose that $200,000 of the investment is spent on GDOT personnel in Atlanta to oversee the project. Then the amount of GDOT direct spending that will have an economic impact on the three-county region is $800,000. The $200,000 spent outside the region is an 'upfront leakage'. In addition, for the $800,000 spent in CCKY's three-county region, there will be some leakage (i.e.

[12] If final demand changes are unavailable but estimates of changes in earnings or employment are available, then the analyst uses the direct multipliers to estimate changes in total output.

spending on inputs outside region) in subsequent and diminishing rounds of spending. These leakages must also be captured since the more leakages in subsequent spending rounds, the lower will be the multiplied effect and the lower will be the economic impact on the region's economy.

For upfront leakages, RIMS II assumes that the change in final demand excludes upfront leakages. And for leakages that occur in subsequent rounds – industry and household spending on goods and services produced outside the study area – RIMS II adjusts the multipliers according to each industry's concentration in the study area relative to its concentration nationally.[13]

*Price Level Changes*

In order to ensure that spending in different years is comparable, we account for changes in the overall price level by converting all spending from current (nominal) dollars to constant (real) 2015 dollars. Since the economic impact of the SLR system focuses on the producer side of the market, the producer price index (PPI) is the appropriate index for converting current (expenditures) to constant 2015 dollars (Bureau of Labor Statistics, https://www.bls.ogv/).[14]

*Gross and Net Economic Impacts*

RIMS II multipliers are useful in estimating the gross effect to a regional economy from an exogenous increase in final demand. The RIMS II methodology, in focusing on how changes in an industry's final demand affect the demand for intermediate goods (i.e. backward linkage), does not consider the impact on users of the industry's good or the impact on other industries (forward-

[13] The intuition in adjusting the multipliers in the RIMS II methodology is whether the local region can supply all of the intermediate input needed to produce the change in final demand. To operationalize these indirect leakages, RIMS II uses regional location quotients, defined as the ratio of industry's share of regional earnings to industry's share of national earnings) to adjust national input-output coefficients for the region (Bess and Ambargis, 2011, p. 9). An important qualification is that this adjustment methodology does not account for 'cross-hauling', which occurs when both the region and producers outside the region supply the intermediate input.

[14] The Bureau of Labor Statistics provides data on the PPI. Using 2015 as a base (i.e. $PPI_{2015} = 100$), we convert all PPI indices to a 2015 base year and then convert nominal expenditures to constant dollar expenditures. Let $E_{N,t}$ be nominal expenditures in year t. Then $E_{2015,t} = E_{N,t} / (PPI_N/PPI_{2015})$, where $E_{2015,t}$ are annual expenditures in year t in constant 2015 dollars, convert these expenditures to constant 2015 dollars.

linkage). For example, upgrading SLR track infrastructure may cause shippers to shift their business from truck to SLR, increasing the demand for SLR, reducing the demand for trucking and potentially reducing spending on highway maintenance. The gross economic impact ignores these forward-linkage effects. If, however, the economic impact of these effects were separately determined, then the net effect from upgrading SLR track infrastructure would account for these additional effects.

*Changes in Gross Output and Changes in Value Added*

One other important distinction in using RIMS II multipliers is that RIMS II output multipliers are not measures of gross regional production. The RIMS II output multiplier gives the value of total output from a change in final demand, which includes spending on intermediate goods.

Gross regional product, however, measures the value of spending on final goods, which excludes spending on intermediate goods. By excluding spending on intermediate goods, gross regional product only includes the 'value added' at each stage of production.[15] Thus, in RIMS II methodology, to estimate the impact that a change in final demand has on gross regional product, the appropriate multiplier is the RIMS II 'value added' multiplier.

E. Methods of Estimation of Impacts

In this study, we analyze the economic impact of SLR systems at the *extensive* and *intensive* margins. The extensive margin reflects an 'all or nothing' approach in the sense that we focus on the total impact that the six GDOT SLR systems have on the economy. We consider the total impact from two perspectives: 1) the total revenue contribution that GDOT SLRs have on the

[15] RIMS II output multiplier (gross regional product) is a 'duplicated' (non-duplicated) multiplier because the measure includes (excludes) spending on intermediate goods (Bess and Ambargis (2011).

economy; and 2) the total impact on the economy if GDOT SLRs were no longer available as a shipping alternative.[16] For the extensive margin, we use multipliers for the short line rail industry.

The intensive margin reflects changes in spending on the system. For this analysis, the intensive margin corresponds to GDOT's project spending on infrastructure that the six GDOT SLRs use. And we use two alternative methods for calculating the economic impact of GDOT's infrastructure spending: 1) final demand approach which uses total project spending and rail industry multipliers; and 2) bill-of-goods approach which uses the spending categories (e.g. cross ties, labor) and multipliers corresponding to each industry category. Tables in the Appendices D and E list the multipliers for each project spending category.

Below, we illustrate each of these approaches.

*Contribution Method – Economic Impact at the Extensive Margin*

According to BEA (2012), the contribution of an industry comes from the idea that a local industry (SLR system) supports other industries through its purchases of intermediate inputs and through workers' purchase of goods and services. The data for approach is the total value of the industry's output, often sales or revenues.[17] To illustrate, suppose that a system's annual revenue is $1,000,000.

- **Final-demand region.** The final-demand region corresponds to the counties in which the system operates. Since we are interested in calculating the system's total contribution to its local region, Type II multipliers which include induced employment effects are appropriate.

[16] GDOT SLR system revenues are proprietary. For this approach, we focus on the annual impact using the summed revenues for all GDOT SLR systems.

[17] Figure 10 shows the total revenues for GDOT short line rails from 2010 to 2016.For GNRR, the revenue is from passenger service. For other, short line rails, even though some of (CCKY, and HOG) have tourist lines, we only include their fright revenue.

- **Final-demand industry.** The industry most closely matched with the short line rail industry in Georgia is "482000 Rail transportation" under "48TW Transportation and warehousing", which corresponds to the "482" subsector in the North America Industry Classification System (NAICS). The NAICS definition for the industry is "Industries in the Rail Transportation subsector that provide rail transportation of passengers and/or cargo using railroad rolling stock. The railroads in this subsector primarily operate on networks, with physical facilities, labor force, and equipment spread over an extensive geographic area, or over a short distance on a local rail line."[18]

- **Final-demand change.** There is no final-demand change. Based on the hypothetical $1,000,000 revenues and GA multipliers for the railroad industry (Columns (1) to (4)), Columns (5) – (8) in Table 9 report the economic impact for this system. The system annually contributes $1,229,600 ($1,000,000*1.2296) in output and $652,000 in value-added in 2015 to its region.

**Table 9**

**Economic Impact – Contribution Method Example**

| | Final-demand multipliers | | | | Impact | | | |
|---|---|---|---|---|---|---|---|---|
| Industry Sector | Output | Earnings | Employ-ment | Value-added | Output ($) | Earnings ($) | Employ-ment (jobs) | Value added ($) |
| 482000 Rail transportation | 1.2296 | 0.1981 | 3.1078 | 0.652 | $1,229,600 | $198,100 | 3 | $652,000 |

Source: BEA RIMS II multipliers (https://bea.gov/regional/rims/rimsii/). The employment multiplier is the number of jobs per $1 million expenditure.

*Departure Method – Economic Impact at the Extensive Margin*

The departure method estimates the impact of the SLR industry were it to depart from the local economy. Similar to the contribution method, this approach uses revenue or sales as the basis for

[18] There are two industry classification systems given in the RIMS II data: detailed industry, and aggregate industry. For this example, we use the detailed industry classification system, although the multipliers for the two systems are very close for the rail transportation industry.

its calculations. However, the final demand multipliers in this approach must be normalized by the output multipliers in order to ensure that the impact of the industry's departure is not greater than its loss in output (BEA, 1997).[19] Therefore, the normalized output impact is one and the other multipliers are correspondingly adjusted downwards. Table 10 reports the normalized multipliers and the economic impacts.

**Table 10**

**Economic Impact – Departure Method Example**

| | | Output-driven multipliers | | | | Impact | | |
|---|---|---|---|---|---|---|---|---|
| | | **Output** | **Earnings** | **Employment** | **Value-added** | **Earnings** | **Employment** | **Value-added** |
| **482000** | **Rail transportation** | 1 | 0.16 | 2.53 | 0.53 | $160,000 | 3 | $530,000 |

Source: BEA RIMS II multipliers (https://bea.gov/regional/rims/rimsii/). The employment multiplier is the number of jobs per $1 million expenditure.

*Final Demand Change Method – Economic Impact at the Intensive Margin*

The final demand change method is closely related to the contribution method. Assume that: GDOT invests $100,000 in infrastructure spending; this spending is an exogenous increase in Georgia's final demand SLR infrastructure; and there are no leakages. Then, using the multipliers in Columns (1) – (4) in Table 11, the economic impact that this change in final demand has on the region's economy is $122,960 in output, $19,810 in earnings, 0 jobs, and $65,200 in value-.added. Note that the value-added impact in Column (4) is smaller than the output impact in Column (1). As discussed in the last section, the output measure includes purchases on intermediate goods whereas the value-added measure only includes the additional value produced

[19] As discussed earlier, the RIMS II methodology reflects backward linkage of a change in demand. The departure of a short line rail from this region should also affect its input industries. Here, we simplify the method by only calculating the impact of its own industry, therefore, the results only give us a lower bound of the real departure impact. This method does not consider the potentially off-setting impact of the re-employment of the labor and capital that were left idle as the result of the departure.

**Table 11**

**Economic Impact – Final Demand Change Method Example**

| | Final-demand multipliers | | | | Impact | | | |
|---|---|---|---|---|---|---|---|---|
| Industry Sector | Output | Earnings | Employ-ment | Value-added | Output ($) | Earnings ($) | Employ-ment (jobs) | Value added ($) |
| 482000 Rail transportation | 1.2296 | 0.1981 | 3.1078 | 0.652 | $122,960 | $19,810 | 0 | $65,200 |

Source: BEA RIMS II multipliers (https://bea.gov/regional/rims/rimsii/). The employment multiplier is the number of jobs per $1 million expenditure.

at each stage of production. Thus, the impact on gross output is greater than the impact on value-added and the $65,200 in value-added estimates the change in the region's gross product.

*Bill-of-Goods Method – Economic Impact at the Intensive Margin*

The Bill-of-Goods approach calculates the economic impact of first-round spending by the final demand industry on intermediate inputs. Summing the separate impacts on inputs gives the total impact. This method requires more detailed information, but it has two main advantages. First, it can significantly improve the accuracy of the results. Second, the method makes it easier to examine the sensitivity of the results by modifying the assumptions.

The method requires spending information on intermediate inputs. For purchases of goods, changes in final demand are in purchaser prices. However, because RIMS II methodology assumes a backward linkage that focuses on intermediate products and services, changes in the final demand for these goods are in producers' prices rather than purchasers' prices. The relationship between the purchaser's price and producer's price is (Bess and Ambargis, 2011):

*Purchasers' Price = Transportation Costs + Wholesale Margin + Retail Margin + Producers' Price*

RIMS II has separate multipliers for transportation, wholesale margin, and retail margin sectors. Thus, the economic impact for an increase in the demand for intermediate goods is the sum of the economic impacts of intermediate goods purchases in producer prices, transportation services, wholesale, and retail margins.[20]

We illustrate the method in the following example. In 2015, GDOT spent $ 595,000 on new wooden cross and switch ties installation for CCKY and we calculate the impact of this spending on the local economy's output, earnings, and jobs.

Assume that 25% of the installation cost is for labor and that 75% of the materials cost occur outside the region.[21] The nearest RIMS II industry sector for cross and switch ties is industry 321000, 'Sawmills and Wood Preservation'. In this study, we use the BEA's national distribution shares, reported in Table 12, for producer value, transportation costs, wholesale and retail margins for this industry sector.

**Table 12**

**National Input-Output Commodity Composition (%)**

| Industry Sector | Producers' Value | Transportation Costs | Wholesale Margin | Retail Margin | Total (%) |
|---|---|---|---|---|---|
| 321100 Sawmills and wood preservation | 79.8 | 6 | 14.1 | 0 | 100 |

Source: Commodity Composition of Private Fixed Investment in Equipment (PEQ) from the BEA National Income and Product Accounts (NIPAs). (https://www.bea.gov/industry/xls/io-annual/Margins_After_Redefinitions_2007_Detail.xlsx).

Using the bill-of-goods approach, GDOT's spending on cross and switch tie installation for CCKY produces an increase in local final demand for materials equal to $111,562 and an increase

[20] Since regional distribution costs are generally unavailable, we follow Bess and Ambargis (2011) by estimating regional distribution costs with national distribution costs which are available from the BEA. In particular, the BEA provides data on the national purchase value shares of producer value, transportation costs, and trade margins. Multiplying the ratios by the corresponding spending provides estimates of the final-demand change for each of these categories. Also, Since RIMS II multipliers use 2007 U.S. Benchmark I-O data, we use the Use Tables (after redefinition) from BEA Annual Industry Account for 2007.

[21] In communications with GDOT, the agency estimates that 70-80% of materials spending occurs outside the region (an upfront leakage as discussed in Section 3.1) and 20-30% of the installation cost is labor. For this analysis, we assume that 75% of the cost of cross and switch is leakage and 25% of the cost is labor.

in local final demand for labor equal to $148,750.[22] Based on the percentages in Table 12, the final demand increase for cross and switch ties includes $89,026 in producer value, $6,693 for transportation, and $15,730 for wholesalers. Table 13 provides BEA multipliers for these separate components.

**Table 13**

**RIMS II Type II Final-Demand Multipliers**

| Project Item | RIMS II code | Description | Output ($) | Earnings ($) | Employment (jobs) |
|---|---|---|---|---|---|
| Cross and Switch Ties | 321100 | Sawmills and wood preservatior | 1.3968 | 0.1665 | 3.5763 |
| Transportation | 484000 | Truck transportation | 1.3285 | 0.2831 | 6.5163 |
| Wholesaale trade | 420000 | Wholesale trade | 1.2853 | 0.3582 | 6.1076 |
| Labor | H00000 | Households | 0.5159 | 0.1452 | 4.6368 |

Source: BEA RIMS II Type II multipliers (https://bea.gov/regional/rims/rimsii/). The table does not include retail margin because cross and switch ties are intermediate goods with no retail margin.

To calculate the economic impact of GDOT's $595,000 cross and switch expenditures on local economy output for the local region where CCKY operates, we use multipliers for the separate project items to get the separate economic impact and then sum the separate impacts to get the total impact. The multiplier appropriate for GDOT's expenditure on labor is the final demand multiplier for households.

Table 14 uses the multipliers in Table 13 to estimate the economic impact of each category. As seen in the table, the total impact of GDOT spending on cross and switch ties for the CCKY system in 2015 is $230,202 in output, $42,951 in earnings, and 1 job. The table does not include retail margin because cross and switch ties are intermediate goods with no retail margin. Also, because there is no information on direct employment, i.e. the number of workers employed on the installation project, we can only calculate the indirect employment impact of the project.

[22] 75% of the total cost is for materials ($446,250) and 25% of this change is the change in local final demand. 25% of the total cost is expended on labor.

## F. Final Comments

This section has outlined BEA's RIMS II methodology for calculating gross and net economic impact that flow from final demand spending. As noted throughout this section, the size of the economic impact depends on various assumptions and factors, including the impact area, magnitude of leakages and adjustments, industries sector affected, and the extent to which local suppliers can meet intermediate input demands. In the next section, we apply this methodology

**Table 14**

**Economic Impact – Bill of Goods Method Example**

| Project Item | Final-demand Output ($) | Final-demand Earnings ($) | Final-demand Employment (jobs) |
|---|---|---|---|
| Cross and Switch Ties | $124,352 | $14,823 | 0.32 |
| Transportation | $8,892 | $1,895 | 0.04 |
| Wholesale trade | $20,218 | $5,634 | 0.1 |
| Labor | $76,740 | $21,599 | 0.69 |
| Total impacts | $230,202 | $43,951 | 1.15 |

Source: Authors' calculations.

under these alternative sets of assumptions in order to assess the economic impact of GDOT short line rail systems as a whole (i.e. at the extensive margin) and from increased expenditures on infrastructure projects (i.e. at the intensive margin).

## V GDOT SHORT LINE RAIL ECONOMIC IMPACT

### A. Introduction

In this section, we use RIMS II multipliers to estimate the economic impact of GDOT short line rail systems operating in Georgia. GDOT short line rail systems, as discussed in Section III (Table 4), are those railroads operating partially or entirely on GDOT-owned track. CaterParrott Railnet (CPR), Greater Northern Railroad (GNRR), and Greater Southwestern Railroad (GSWR) lease 67.2%, 20.4% and 45.4%, respectively, operating track from GDOT. Chattooga and Chickamauga Railway (CCKY), Heart of Georgia Railroad (HOG), and Ogeechee Railway (OCR) lease all of their operating track from GDOT.

Annually, GDOT invests resources for routine maintenance and rehabilitating rail track that GDOT owns and that SLR systems use. A primary question for this study is the economic impact of GDOT's investment in these six short line rail systems.[23] As discussed in the last section, there are two basic approaches that we use to evaluate the economic impact of GDOT's short line rail system. One approach assesses the total economic impact of GDOT's six SLRs. This approach focuses on the *extensive margin* and reflects 1) the total contribution of the six systems as one alternative or 2) the counterfactual that GDOT-related SLR services currently offered in each of these regions are no longer available.

A second approach focuses on the *intensive margin* whereby GDOT invests more (or fewer) resources on the existing infrastructure. This approach emphasizes GDOT's annual expenditures on maintaining, rehabilitating, and upgrading its railroad track and related infrastructures, which could be interpreted as a 'business-as-usual' strategy in which GDOT maintains ownership of the track and continues to support those SLR systems that use GDOT-owned tracks. These two

[23] As noted throughout this report, GDOT's short line rail system refers to the rail infrastructure that GDOT owns and maintains.

perspectives provide useful information on the importance that GDOT's SLR systems have for the specific regions in which each operates and collectively to the state of GA.

B. <u>GDOT SLR Track Infrastructure – Descriptive Statistics</u>

Tables 15 and 16 summarize GDOT project maintenance and rehabilitation expenditures in current (nominal) and constant 2015 dollars on GDOT-owned track during the period 2010 – 2015. From Table 15, GDOT annually spends an average of $6.3 million (in inflation-adjusted) dollars to support its short line rail infrastructure. Annual expenditures are generally variable from one year to the next, as indicated by the $3.9 million standard deviation. In 2013 and 2014, for example, GDOT spent a relatively small amount on its track, $2.5 and $2.4 million respectively (constant $). In 2012 and 2015, on the other hand, spending was approximately 5 and 4 times higher than in 2013 and 2014.

**Table 15**

**Total GDOT Infrastructure Expenditures, By Year**

**(Current and 2015 Constant $)**

| Year | Current Dollars | 2015 Constant Dollars |
|---:|---:|---:|
| 2010 | $4,810,664 | $5,528,260 |
| 2011 | $5,415,000 | $5,934,362 |
| 2012 | $11,950,000 | $11,323,663 |
| 2013 | $2,543,973 | $2,348,422 |
| 2014 | $2,376,083 | $2,237,324 |
| 2015 | $10,595,000 | $10,595,000 |
| Total | $37,690,720 | $37,967,031 |
| Average | $6,281,787 | $6,327,839 |
| Std. Deviation | $4,071,210 | $3,912,266 |

Source: GDOT (2016). Authors' calculations.

For the same 6-year period, Table 16 identifies the target of GDOT's infrastructure spending on its SLR rail tracks. By category, in 2015, the majority of GDOT's expenditures, $19.9 million (50.5%) in constant dollars is on cross and switch tie installation, a maintenance expenditure that primarily reflects the impact of line rail operations. Related, ballast installation accounts for 10.1% of GDOT expenditures during this time period. Bridge and rail crossing rehabilitation comprises 20.4% of expenditures with the bulk of these on bridge rehabilitation. Rail installation accounts for a small 7.0% of total expenditures from 2010 – 2015. In nominal dollars, category expenditures and percentages are similar to those for constant (inflation-adjusted) dollars.

**Table 16**

**Total GDOT Infrastructure Expenditures, By Category**

**2010 – 2015 (Current and 2015 Constant $)**

| Spending Category | Current Dollars | % Total | 2015 Constant $ | % Total |
|---|---|---|---|---|
| Ballast Installation | $3,720,770 | 10.16% | $4,004,470 | 10.13% |
| Bridge Rehabilitation | $7,761,985 | 21.19% | $8,061,201 | 20.39% |
| Crossings Rehabilitation | $2,109,718 | 5.76% | $2,314,491 | 5.85% |
| Crossties & Switch ties Installation | $18,267,170 | 49.87% | $19,946,812 | 50.45% |
| Rail Installation | $2,503,490 | 6.83% | $2,781,092 | 7.03% |
| Miscellaneous Engineering Services | $2,267,486 | 6.19% | $2,431,797 | 6.15% |
| Total | $36,630,620 | | $39,539,863 | |
| Average | $6,105,103 | | $6,589,977 | |
| Std. Deviation | $6,324,685 | | $6,889,590 | |

Source: GDOT, Authors' calculations.

Also, evident in Table 16 is a much higher standard deviation in category expenditures than was true for annual expenditures. This is not surprising given the expenditure heterogeneity across infrastructure categories. From Table 16, large expenditures on routine maintenance associated with cross and switch ties replacement underlies $6.9 million (constant $) standard deviation. GDOT owns 710.7 miles of track, 596 of which is operational (Table 5, Section III). On a per-mile of operational track basis, Table 17 identifies GDOT expenditures by year and by category for the 2010 – 2015 period. Over the six-year period, Table 17(a) indicates that GDOT spent an average of $10,617 inflation-adjusted dollars per mile of operational track with the largest expenditures occurring in 2012 ($18,999) and 2015 ($17,777). Table 17(b) reports the same information but by expenditure category. For cross and switch tie installation, GDOT spent $33,468 per mile of operational track.

**Table 17**

**Total GDOT Infrastructure Expenditures per Mile of Operational Track**

| Year | (a) 2015 Constant $ | Spending Category | (b) 2015 Constant $ |
|---|---|---|---|
| 2010 | $9,276 | Ballast Installation | $6,719 |
| 2011 | $9,957 | Bridge Rehabilitation | $13,526 |
| 2012 | $18,999 | Crossings Rehabilitation | $3,883 |
| 2013 | $3,940 | Crossties & Switch ties Installation | $33,468 |
| 2014 | $3,754 | Rail Installation | $4,666 |
| 2015 | $17,777 | Miscellaneous Engineering Services | $4,080 |
| **Average** | $10,617 | | $11,057 |

Source: GDOT, Authors' calculations.
Notes: The average in (a) and the average in (b) should be equal. However, the average in (a) is calculated by adjusting inflation at the annual spending, while the average in (b) is calculated by adjusting inflation at components of spending category and then summing up. The difference of about $439 is the cumulative effect of rounding.

To put these numbers in context, the latest edition of American Short Line and Regional Railroad Association *Facts and Figures* (2017) reports that the short line railroads in the US generated $2.75 billion in 2015 revenues and, on average, spent 24% of their revenues on maintenance and capital investment. Given a short line rail network of 33,900 miles of track, this implies that an average SLR system expended $19,469 per mile of track operated. Relative to these US based numbers, GDOT's per mile project spending is about half of the national average that SLRs spend per mile of operated track.

C. Statewide and Local Area Economic Impact Multipliers

As discussed in the last section, we will use RIMS II multipliers to provide alternative estimates of the economic impacts that each GDOT short line rail systems make to the local region and collectively to the state. We will also provide economic impact estimates based on differing sets of assumptions that underlie systems' impacts at the extensive and intensive margins.

Table 18 identifies the local regions in which each of GDOT SLR systems operate. As reported in Table 6, 100% of CCKY, HOG, and OCR operations are on GDOT tracks whereas about 20% to 67% of CPR, GNRR, and GSWR operations are on GDOT tracks.

**Table 18**

**GDOT SLR Local Impact Regions**

| SLR System | Local Regions (Counties) |
|---|---|
| Cater Parrott Railnet | Atkinson, Berrien, Lanier, Lowndes, Jasper, Morgan, Newton |
| Chattooga and Chickamauga Railway | Catoosa, Walker, Dade |
| Georgia Northeastern Railroad | Fannin, Gilmer, Pickens, Cherokee, Cobb |
| Georgia Southwestern Railroad | Quitman, Randolph, Calhoun, Early, Miller, Decatur |
| Heart of Georgia Railroad | Stewart, Webster, Sumter, Crisp, Wilcox, Dodge, Telfair, Wheeler, Montgomery, Toombs, Emanuel |
| Ogeechee Railway | Effingham, Screven |

Source: GDOT (2016) Page A-42. GSWR have operations on GDOT and non-GDOT track.
For each of the regions and for the state of Georgia (GA), Table 19 gives the RIMSII Type II

Table 19 lists the economic impact multipliers for each of these local regions.[24] In the table, we see that the Final Demand Output multipliers are larger than the Final Demand Value Added multipliers because the output multipliers include spending on intermediate goods. As such, the Final Demand Value Added multipliers come closest to a measure of gross regional product. Two aspects of the multipliers in Table 19 are worth noting. First, the earnings, employment, and value-added multipliers for OCR are 0. This does not imply that OCR has no impact on the local region, but it does indicate that the *economic impact* in terms of increased earnings, employment,

[24] For a discussion of these multipliers, see Section III of this report.

and value added in the RIMS II model is negligible. This reflects, at least in part, OCR's operations in only two counties. Second, the multipliers for Georgia are uniformly larger than for the local area multipliers. This reflects a broader statewide impact of final demand spending and assumes that spending will have impact across the state.

For a given short line rail system, we assume that the effect will be local, that is, the extent to which increases in final demand spending affect the state will only be reflected by the impact on the local economy. Collectively, however, the economic impact may be broader than the local regions. Using the Georgia multipliers would put an upward limit on the total economic impact of the GDOT SLR systems.

**Table 19**

**RIMS II Type II Local Area and State Multipliers**

| Short line rail | Final-demand Output | Final-demand Earnings | Final-demand Employment | Final-demand Value-added |
|---|---|---|---|---|
| CCKY | 1.230 | 0.198 | 3.108 | 0.652 |
| CPR | 1.373 | 0.268 | 4.563 | 0.736 |
| GNRR | 1.536 | 0.276 | 4.728 | 0.843 |
| GSWR | 1.310 | 0.277 | 4.232 | 0.703 |
| HOG | 1.392 | 0.263 | 4.056 | 0.717 |
| OCR | 1.000 | 0.000 | 0.000 | 0.000 |
| GA | 1.891 | 0.492 | 9.062 | 1.035 |

Source: BEA RIMS II Type II multipliers (https://bea.gov/regional/rims/rimsii/).
Notes: Local impact regions given in Table 18. GDOT (2016) Page A-42.

## D. Economic Impact – Industry Contribution and Departure Approach

### *Industry Contribution*

Using revenue data, we calculate the contribution of the short line rails to the state economy and to the regions they serve. Table 20 gives the contribution of the six GDOT short line rails using the state multipliers. Except for 2011, every year sees an increase in operating revenues and, therefore, increases in the output, earnings, employment, and value-added impacts. Since the state multipliers assume the impact of the short line rails can reach beyond its local region throughout the state, these estimated contributions are best interpreted as upper bounds of the real impact of the six GDOT short lines.

**Table 20**

**GDOT SLRs' Statewide Contribution by Year (Constant $)**

| Year | Operating Revenues | Output Effect | Earnings Effect | Employment Effect | Value Added Effect |
|---|---|---|---|---|---|
| 2010 | $6,101,138 | $11,538,473 | $3,002,370 | 55 | $6,311,628 |
| 2011 | $5,482,963 | $10,369,379 | $2,698,166 | 49 | $5,672,125 |
| 2012 | $6,415,355 | $12,132,720 | $3,156,996 | 58 | $6,636,685 |
| 2013 | $7,519,190 | $14,220,293 | $3,700,194 | 68 | $7,778,602 |
| 2014 | $7,587,629 | $14,349,725 | $3,733,872 | 68 | $7,849,403 |
| 2015 | $7,931,848 | $15,000,711 | $3,903,262 | 71 | $8,205,497 |
| Total | $41,038,123 | $77,611,301 | $20,194,860 | 369 | $42,453,940 |
| Mean | $6,839,687 | $12,935,217 | $3,365,810 | 61.5 | $7,075,657 |

Source: Authors' calculations.

The economic impact reported in Table 21 use the regional multipliers, which assume that short line rails only have impact within the counties that the systems serve. These estimates are best

**Table 21**

**GDOT SLRs' Local Area Contribution by Year (Constant $)**

| Year | Operating Revenues | Output Effect | Earnings Effect | Employment Effect | Value Added Effect |
|---|---|---|---|---|---|
| 2010 | $6,101,138 | $9,102,197 | $1,871,994 | 33 | $4,776,192 |
| 2011 | $5,482,963 | $8,285,660 | $1,722,451 | 30 | $4,385,422 |
| 2012 | $6,415,355 | $9,629,234 | $1,976,176 | 34 | $5,061,617 |
| 2013 | $7,519,190 | $11,108,275 | $2,261,443 | 39 | $5,826,344 |
| 2014 | $7,587,629 | $11,237,702 | $2,271,370 | 39 | $5,838,041 |
| 2015 | $7,931,848 | $12,092,071 | $2,504,036 | 47 | $6,375,422 |
| Total | $41,038,123 | $61,455,139 | $12,607,470 | 222 | $32,263,038 |
| Mean | $6,839,687 | $10,242,523 | $2,101,245 | 37 | $5,377,173 |

Source: Authors' calculations.

seen as a lower bound of the economic impact of the six short line rails. From Tables 20 and 21, we can identify likely ranges of the economic impact of GDOT SLR systems. In particular, over the six-year period, the annual output, earnings, and value-added effects (in million $) lie, respectively, in the range of ($8.3, $15.0), ($1.7, $3.9), and ($4.4, $8.2), respectively.

The annual total job creation effect employment effect of the six systems lies in the range (30, 71). However, differences in the average annual effects were relatively small: $2.7 million for output, $1.3 million for earnings, and $1.7 million for value-added. The state and local difference in average jobs created was 25.

*Industry Departure*

Tables 22 and 23 report estimates of the economic impact were GDOT's six SLR systems to no longer provide service to shippers. Operating revenues are the calculation base for this analysis.

Recall that the difference between SLR contribution and departure is that for industry departures the multipliers are normalized to ensure that the total economic effect is no greater than the output effect. Since the output multiplier is greater than one, the normalization has two implications. First, the estimated economic impact effects will be uniformly smaller for industry departure than for total industry contribution. Second, normalizing by the output multiplier implies that the state output effect and local area output effect from industry departure will be  the total revenue loss.

For this counterfactual scenario, and consistent with Tables 20 and 21, the statewide economic impacts in Table 22 are larger than the estimated impact for the local areas in Table 23. In particular, the (low, high) range of economic impact (million $) from Tables 22 and 23 is ($1.1, $2.1) in lost earnings, ($2.9, $4.3) in lost value-added. Jobs destroyed ranges from a low of 19 to a high of 38. Differences in the average annual effects were again small: $0.4 million for earnings and $0.2 million for value-added. The state and local difference in average jobs created was 10.[25]

**Table 22**

**Statewide Impact from GDOT SLR Departure (Constant $)**

| Year | Operating Revenues | Final Demand Output | Final Demand Earnings | Final Demand Employment | Final Demand Value Added |
|---|---|---|---|---|---|
| 2010 | $6,101,138 | $6,101,138 | $1,587,548 | 29 | $3,337,367 |
| 2011 | $5,482,963 | $5,482,963 | $1,426,695 | 26 | $2,999,220 |
| 2012 | $6,415,355 | $6,415,355 | $1,669,309 | 30 | $3,509,245 |
| 2013 | $7,519,190 | $7,519,190 | $1,956,532 | 36 | $4,113,051 |
| 2014 | $7,587,629 | $7,587,629 | $1,974,340 | 36 | $4,150,488 |
| 2015 | $7,931,848 | $7,931,848 | $2,063,908 | 38 | $4,338,778 |
| Total | $41,038,123 | $41,038,123 | $10,678,332 | 195 | $22,448,149 |
| Mean | $6,839,687 | $6,839,687 | $1,779,722 | 32.5 | $3,741,358 |

Source: Authors' calculations.

**Table 23**

**Local Area Impact from GDOT SLR Departure (Constant $)**

| Year | Operating Revenues | Final Demand Output | Final Demand Earnings | Final Demand Employment | Final Demand Value Added |
|---|---|---|---|---|---|
| 2010 | $6,101,138 | $6,101,138 | $1,229,248 | 21 | $3,175,256 |
| 2011 | $5,482,963 | $5,482,963 | $1,120,571 | 19 | $2,889,885 |
| 2012 | $6,415,355 | $6,415,355 | $1,291,783 | 21 | $3,350,330 |
| 2013 | $7,519,190 | $7,519,190 | $1,504,818 | 24 | $3,919,675 |
| 2014 | $7,587,629 | $7,587,629 | $1,499,433 | 24 | $3,898,265 |
| 2015 | $7,931,848 | $7,931,848 | $1,613,442 | 27 | $4,159,784 |
| Total | $41,038,123 | $41,038,123 | $8,259,295 | 136 | $21,393,195 |
| Mean | $6,839,687 | $6,839,687 | $1,376,549 | 22.7 | $3,565,533 |

Source: Authors' calculations.

[25] There are no differences in the output effects. For the departure scenario, all multipliers are normalized by the output multiplier (see discussion on page 41). Note that these are gross effects that do not account for the positive economic impact from shipper modal changes, i.e. when shippers who had used a short line rail for all or part of its shipments now use other modes to ship its products.

E. <u>Economic Impact – Project Spending Approach</u>

*Project Spending in Total*

For the impact calculation using project spending, we focus on the intensive margin, that is, the economic impact of GDOT's annual spending for the six GDOT SLR systems. For this approach, since all project funds come from GDOT, we assume that these are outside funds from the perspective of the local area (i.e. the countries that the short line rail serves).

Based on the state and local multipliers, respectively, Tables 24 and 25 give the state (higher bound) and local (lower bound) economic impact on output, earnings, employment and value-added. Because of the wide variability in project spending, focusing on average annual effects is preferred. For the six-year period, GDOT's infrastructure project spending had annual economic impact ranges for output, earnings, and value-added equal to ($2.8, $21.4), ($0.5, $5.6), and ($1.3, $11.7).

**Table 24**

**Statewide Impact of Project Spending by Year (Constant $)**

| Year | Project Spending | Output Effect | Earnings Effect | Employment Effect | Value Added Effect |
|---|---|---|---|---|---|
| 2010 | $5,528,260 | $10,455,046 | $2,720,457 | 50 | $5,718,985 |
| 2011 | $5,934,362 | $11,223,065 | $2,920,300 | 53 | $6,139,097 |
| 2012 | $11,323,663 | $21,415,312 | $5,572,375 | 102 | $11,714,330 |
| 2013 | $2,348,422 | $4,441,336 | $1,155,658 | 21 | $2,429,443 |
| 2014 | $2,237,324 | $4,231,226 | $1,100,987 | 20 | $2,314,511 |
| 2015 | $10,595,000 | $20,037,264 | $5,213,800 | 96 | $10,960,528 |
| Total | $37,967,031 | $71,803,249 | $18,683,577 | 342 | $39,276,894 |
| Mean | $6,327,839 | $11,967,208 | $3,113,930 | 57.0 | $6,546,149 |

Source: Authors' calculations.

**Table 25**

**Local Area Impact of Project Spending by Year (Constant $)**

| Year | Project Spending | Output Effect | Earnings Effect | Employment Effect | Value Added Effect |
|---|---|---|---|---|---|
| 2010 | $5,528,260 | $7,126,537 | $1,227,270 | 18 | $3,735,738 |
| 2011 | $5,934,362 | $8,241,514 | $1,567,588 | 23 | $4,274,545 |
| 2012 | $11,323,663 | $15,239,745 | $2,887,677 | 45 | $8,039,165 |
| 2013 | $2,348,422 | $3,203,733 | $619,719 | 8 | $1,687,213 |
| 2014 | $2,237,324 | $2,804,264 | $478,472 | 5 | $1,313,138 |
| 2015 | $10,595,000 | $14,056,019 | $2,494,203 | 37 | $6,794,406 |
| Total | $37,967,031 | $50,671,812 | $9,274,929 | 136 | $25,844,205 |
| Mean | $6,327,839 | $8,445,302 | $1,545,822 | 22.7 | $4,307,368 |

Source: Authors' calculations.

Corresponding differences between the state and local area average annual impacts are most at $3.5, $1.6 and $2.2 million, respectively. Annual job creation effects difference averaged 34.3. The percentage difference in job creation effects are similar to the percentage differences in the other economic effects identified.

*Project Spending by System*

GDOT projects between 2010 and 2015 were not spent uniformly across the six systems. To get a sense of this, Table 26 reports the estimated economic impact of GDOT's expenditures in 2015. Note that the last row of Table 26 gives totals for 2015 and these totals are equal to local impact numbers for 2015 in Table 25.

In Table 26, two systems received no project investment funds, CPR and GNRR. HOG on the other hand, received the largest percentage (64.1%) of GDOT 2015 spending. OCR received a modest amount of spending but there is no impact because OCR's service area is so small that the effects are negligible.

**Table 26**

**Local Area Impact of 2015 Project Spending by SLR (Constant $)**

| Short Line Rail System | Project Spending | Output Effect | Earnings Effect | Employment Effect | Value Added Effect |
|---|---|---|---|---|---|
| CCKY | $900,000 | $1,106,640 | $178,290 | 2 | $586,800 |
| CPR | $0 | $0 | $0 | 0 | $0 |
| GNRR | $0 | $0 | $0 | 0 | $0 |
| GSWR | $1,900,000 | $2,489,380 | $526,110 | 8 | $1,336,270 |
| HOG | $6,795,000 | $9,459,999 | $1,789,803 | 27 | $4,871,336 |
| OCR | $1,000,000 | $1,000,000 | $0 | 0 | $0 |
| All GDOT Systems | $10,595,000 | $14,056,019 | $2,494,203 | 37 | $6,794,406 |

Source: Authors' calculations.

From Table 26, we see that the primary effects of GDOT's 2015 spending occurred in the southern part of Georgia where HOG operates. Of the total economic impact generated in 2015 from GDOT spending, between 64% and 73% of these benefits accrued to HOG's service area. Because infrastructure spending depends on system needs and GDOT economic development plans, future GDOT spending will likely concentrate on those systems and areas where GDOT generates the largest expected economic impacts.

F. <u>Economic Impact – Bill of Goods (BOG) Approach</u>

Using more detailed information of the input industries, Tables 27 – 31 report the impacts of project spending using the bill-of-goods approach. The BOG methodology allows us to calculate more detailed estimates based on the source location of materials. In particular, we assume that 25% of the project material spending occurs within the region (state or local area) and 75% outside the region (state or local area).[26] Appendices D and E report the statewide and local area multipliers used to calculate the BOG economic impacts.

[26] Source: Rail engineers at GDOT.

*With No Leakage*

Assuming no leakage, Tables 27 reports the annual economic impact for 2010 – 2015, which is the sum of the detailed effects by type of spending. From Table 27, we see that GDOT spending generated an output effect that ranged from a low of $5.0 million in 2014 to a high of $28.0 million in 2012. Correspondingly, GDOT's spending generated annual employment effects ranging between 29 and 179.

**Table 27**

**Statewide Impact of Project Spending, Without Leakage (Constant $)**

| Year | Spending | Output Effect | Earnings Effect | Value Added Effect | Employment Effect |
|---|---|---|---|---|---|
| 2010 | $5,376,089 | $11,678,505 | $3,394,056 | $6,315,037 | 75 |
| 2011 | $6,354,100 | $14,080,757 | $3,974,519 | $7,313,118 | 89 |
| 2012 | $12,433,725 | $28,029,289 | $7,673,762 | $14,056,292 | 179 |
| 2013 | $2,480,087 | $5,464,289 | $1,621,593 | $2,968,831 | 32 |
| 2014 | $2,302,912 | $5,003,707 | $1,432,993 | $2,669,858 | 29 |
| 2015 | $10,292,948 | $23,005,596 | $6,531,491 | $11,961,835 | 152 |
| Total | $39,239,861 | $87,262,143 | $24,628,414 | $45,284,971 | 556 |
| Mean | $6,539,977 | $14,543,691 | $4,104,736 | 7,547,495.2 | 92.7 |

Source: Authors' calculations.

From Table 27, we see that in 2015, GDOT project spending produced $23.0 million in output, $6.5 million in earnings, $12 million in value added and 152 jobs. For 2015, Table 28 provides more detail on these numbers. Note that the last row of Table 28 for All GDOT Systems equals the numbers for 2015 in Table 27.

From Table 28 we see that the largest economic impact effects associated were associated with cross and switch ties ($11.6 million output effect and 72 jobs) and bridge rehabilitation ($7.9 million output effect and 59 jobs).

**Table 28**

**Statewide Impact of 2015 Project Spending by Type, Without Leakage (Constant $)**

| Project | Spending Type | Spending | Output Effect | Earnings Effect | Value-Added Effect | Employ -ment Effect |
|---|---|---|---|---|---|---|
| Ballast Install | Intermediate goods | $374,416 | $644,182 | $140,668 | $391,152 | 3 |
| | Labor | $162,625 | $230,098 | $68,205 | $135,467 | 1 |
| | Transport | $79,422 | $176,308 | $53,419 | $91,160 | 1 |
| | Wholesale Trade | $34,038 | $70,465 | $21,900 | $44,603 | 0 |
| Bridge Rehab | Intermediate goods | $3,596,000 | $7,910,840 | $2,408,241 | $4,409,775 | 59 |
| Cross Switch Ties Install | Intermediate goods | $2,991,115 | $8,186,381 | $2,036,351 | $3,542,975 | 48 |
| | Labor | $1,249,375 | $1,767,741 | $523,988 | $1,040,729 | 15 |
| | Transport | $225,667 | $500,958 | $151,784 | $259,021 | 3 |
| | Wholesale Trade | $529,291 | $1,095,739 | $340,546 | $693,584 | 6 |
| Crossings Rehab | Intermediate goods | $55,000 | $120,995 | $36,834 | $67,447 | 0 |
| Misc. | Intermediate goods | $436,000 | $1,069,944 | $374,524 | $599,195 | 7 |
| Rail Install | Intermediate goods | $560,000 | $1,231,944 | $375,032 | $686,728 | 9 |
| All GDOT Systems | | $10,292,948 | $23,005,596 | $6,531,491 | $11,961,835 | 152 |

Source: Authors' calculations.

Assuming that there is little economic impact outside the local area, Tables 29 and 30 provide the local area economic impact of GDOT infrastructure spending. As we have previously seen, these effects are smaller than the statewide effect, which reflects the smaller multiplier effects. To the extent that the primary economic impact of GDOT spending is on the local area, then we see from Table 29 that this generated annual output, earnings, value added and employment effects that are on the order of $3.1 - $18.2 million, $0.7 - $3.9 million, $1.5 - $8.0 million, and 10 – 74 jobs, respectively.

For 2015, Table 30 provides detailed industry impact associated with GDOT project spending where we again see that bridge rehabilitation and cross and switch tie installation provide the largest economic impacts.

**Table 29**

**Local Area Impact of Project Spending, Without Leakage (Constant $)**

| Year | Spending | Output Effect | Earnings Effect | Value Added Effect | Employment Effect |
|---|---|---|---|---|---|
| 2010 | $5,376,089 | $7,032,745 | $1,639,818 | $3,393,187 | 31 |
| 2011 | $6,354,100 | $9,292,994 | $2,099,434 | $4,200,957 | 41 |
| 2012 | $12,433,725 | $18,221,830 | $3,891,758 | $8,001,812 | 74 |
| 2013 | $2,480,087 | $3,617,717 | $893,202 | $1,840,298 | 15 |
| 2014 | $2,302,912 | $3,094,563 | $724,026 | $1,512,288 | 10 |
| 2015 | $10,292,948 | $14,963,014 | $3,526,852 | $7,265,855 | 65 |
| Total | $39,239,861 | $56,222,863 | $12,775,090 | $26,214,397 | 236 |
| Mean | $6,539,977 | $9,370,477 | $2,129,182 | 4,369,066.2 | 39.3 |

Source: Authors' calculations.

**Table 30**

**Local Impact of 2015 Project Spending by Type, Without Leakage (Constant $)**

| Project | Spending Type | Spending | Output Effect | Earnings Effect | Value-Added Effect | Employ-ment Effect |
|---|---|---|---|---|---|---|
| Ballast Install | Intermediate goods | $374,416 | $429,815 | $52,666 | $213,915 | 0 |
| | Labor | $162,625 | $76,674 | $22,814 | $46,159 | 0 |
| | Transport | $79,422 | $106,409 | $27,546 | $51,031 | 0 |
| | Wholesale trade | $34,038 | $43,042 | $12,146 | $28,561 | 0 |
| Bridge Rehab | Intermediate goods | $3,596,000 | $5,423,884 | $1,491,506 | $2,989,255 | 33 |
| Cross Switch Ties Install | Intermediate goods | $2,991,115 | $5,716,570 | $1,026,876 | $2,119,114 | 21 |
| | Labor | $1,249,375 | $641,339 | $177,875 | $383,574 | 3 |
| | Transport | $225,667 | $319,653 | $76,137 | $151,314 | 0 |
| | Wholesale trade | $529,291 | $681,333 | $189,230 | $450,458 | 1 |
| Crossings Rehab | Intermediate goods | $155,000 | $220,749 | $61,589 | $123,585 | 0 |
| Misc. | Intermediate goods | $486,000 | $658,251 | $217,660 | $354,849 | 2 |
| Rail Install | Intermediate goods | $710,000 | $1,054,392 | $291,357 | $583,564 | 6 |
| All SLR Systems | | $10,592,949 | $15,372,11<br>1 | $3,647,402 | $7,495,379 | 66 |

Source: Authors' calculations.

*With Leakage*

Assuming that part of GDOT spending occurs outside the area, Tables 31 and 32 report the statewide and local area economic impact with leakage. The statewide and the local area impacts are necessarily lower than those in Tables 27 and 29, respectively, because part of GDOT's spending is for inputs outside the area. The total statewide and local area output effect, for example, over the six-year period is $87.3 million (in Table 27) and $56.2 million (in Table 29), respectively; however, when

**Table 31**

**Statewide Impact of Project Spending by Year, With Leakage (Constant $)**

| Year | Spending | Output Effect | Earnings Effect | Value Added Effect | Employment Effect |
|---|---|---|---|---|---|
| 2010 | $1,738,653 | $3,477,989 | $1,014,022 | $1,907,487 | 21 |
| 2011 | $2,368,854 | $4,624,277 | $1,320,900 | $2,478,293 | 28 |
| 2012 | $5,003,959 | $9,689,304 | $2,713,425 | $5,093,048 | 64 |
| 2013 | $753,918 | $1,555,522 | $461,554 | $853,743 | 7 |
| 2014 | $804,746 | $1,574,964 | $454,299 | $858,237 | 7 |
| 2015 | $3,632,237 | $7,249,778 | $2,077,017 | $3,872,606 | 46 |
| Total | $14,302,367 | $28,171,834 | $8,041,217 | $15,063,414 | 173 |
| Mean | $2,383,728 | $4,695,306 | $1,340,203 | 2,510,569.0 | 28.8 |

Source: Authors' calculations.

**Table 32**

**Local Area Impact of Project Spending by Year with Leakage (Constant $)**

| Year | Spending | Output Effect | Earnings Effect | Value Added-Effect | Employment Effect |
|---|---|---|---|---|---|
| 2010 | $1,738,653 | $1,961,776 | $467,255 | $972,921 | 7 |
| 2011 | $2,368,854 | $2,764,088 | $642,542 | $1,310,156 | 10 |
| 2012 | $5,003,959 | $5,707,890 | $1,292,628 | $2,692,456 | 21 |
| 2013 | $753,918 | $979,076 | $243,197 | $504,032 | 2 |
| 2014 | $804,746 | $891,795 | $215,259 | $449,538 | 1 |
| 2015 | $3,707,237 | $4,381,536 | $1,062,365 | $2,196,143 | 16 |
| Total | $14,377,367 | $16,686,161 | $3,923,246 | $8,125,246 | 57 |
| Mean | $2,396,228 | $2,781,027 | $653,874 | 1,354,207.7 | 9.5 |

Source: Authors' calculations.

part of GDOT's spending is for inputs outside the area, the output effect is significantly lower at $28.2 million (Table 31) and $16.7 million (Table 32). Appendix F provides the economic impact on the specific categories when there is leakage.

## G. Economic Impact of GDOT's SLR System – A Consolidation

Understanding the economic impacts of GDOT's SLR system necessarily requires assumptions about the extent of the effect (statewide or local area) and about the extent of spending on inputs outside the area (leakage). The approach taken in this section is to obtain economic impacts under alternative sets of assumptions. Sections F – G reported economic impact estimates based on the sector's presence or absence, on project spending, and on a bill-of-goods approach to project spending.

Table 33 consolidates the results from Sections F – G, identifying the assumptions on the extent of impact and leakage and providing average annual impacts over the six-year period, 2010 – 2015. Table 33 gives the range of economic impacts from the alternative approaches.

In general, the range of average impacts is relatively large. Depending on the extent of impact and leakage, GDOT project spending will generate an average of 10 to 93 jobs, a 9-fold difference. In contrast, the range of differences for the output, earnings, and value-added effects is not as large (a five- to six-fold difference). Of importance, these ranges highlight the importance that the underlying assumptions have on the estimates.

There are two key implications to draw from Table 33. First, the extent of leakages and the input source have a significant impact on the magnitude of economic impact generated. The bill-of-goods approach in Section F illustrates this. Second, although there are many uncertainties surrounding the 'true' economic impact of GDOT's SLR system, calculating these impacts under various assumptions provides greater confidence in the range of an effect. For example, we may have concerns whether annual spending average will generate $5 million or $8 million in output but, from Table 33, we can be considerably more confident that the effect will be no lower than $2.8 million nor higher than $14.5 million.

**Table 33**

**Average Annual Economic Impact**

| | Average Output Effect | Average Earnings Effect | Average Value-Added Effect | Average Employment Effect |
|---|---|---|---|---|
| | *Statewide Economic Impacts - State Multipliers* | | | |
| Industry Presence Approach | | | | |
| Revenue Contribution | $12,935,217 | $3,365,810 | $7,075,657 | 62 |
| Departure from Area | $6,839,687 | $1,779,722 | $3,741,358 | 33 |
| Project Spending Approach | | | | |
| No Leakage | $11,967,208 | $3,113,930 | $6,546,149 | 57 |
| Leakage | - | - | - | - |
| Bill of Goods Approach | | | | |
| No Leakage | $14,543,691 | $4,104,736 | $7,547,495 | 93 |
| Leakage | $4,695,306 | $1,340,203 | $2,510,569 | 29 |
| **Statewide Range of Impacts** | $4.7-$14.5 | $1.3 - $4.1 | $2.5 - $7.5 | 29 - 93 |
| | *Local Area Economic Impacts - SLR Area Multipliers* | | | |
| Industry Presence Approach | | | | |
| Revenue Contribution | $10,242,523 | $2,101,245 | $5,377,173 | 37 |
| Departure from Area | $6,839,687 | $1,376,549 | $3,565,533 | 23 |
| Project Spending Approach | | | | |
| No Leakage | $8,445,302 | $1,545,822 | $4,307,368 | 23 |
| Leakage | - | - | - | - |
| Bill of Goods Approach | | | | |
| No Leakage | $9,370,477 | $2,129,182 | $4,369,066 | 39 |
| Leakage | $2,781,027 | $653,874 | $1,354,208 | 10 |
| **Local Area Range of Impacts** | $2.8-$10.2 | $0.7 - $2.1 | $1.4 - $5.4 | 10 - 39 |
| | Output (million) | Earnings (million) | Value-Added (million) | Employment |
| **Overall Range of Average Impacts** | $2.8-$14.5 | $0.7 - $4.1 | $1.4 - $7.5 | 10 - 93 |

Source: Authors' calculations.
Notes: Average output, earnings and value-added effects are in constant 2015 dollars. The '-' denotes that these estimates were not report in Section E. Industry presence approach based on average annual revenues of $6.839 million. Project Spending and Bill of Goods approaches based on average annual project spending of $$6,327,839. The roughly 200,000 is due to round-ups of the BOG method during the margin calculation step.

H. GDOT Short Line Railroads and Tourism

Table 7 in Section II identifies three GDOT short line railroads that offer tourism rail services, GNRR, HOG, and CCKY. HOG and CCKY primarily offer freight service whereas GNRR is the only GDOT short line railroad that provides only tourism services.

In general, the economic impact of a short line railroad that offers tourism services is greater than that for a freight short line rail system. Table 34 identifies the multipliers for rail transportation (RIMS II code 482000) and for transportation sightseeing and tourism. Uniformly, the multipliers

**Table 34**

**General Railroad and Transportation Sightseeing Multipliers**

| | Code | Output Effect | Earnings Effct | Employment Effect | Value Added Effect |
|---|---|---|---|---|---|
| GA | 482000 | 1.8912 | 0.4921 | 9.0624 | 1.0345 |
| | 48A000 | 2.3711 | 0.7603 | 17.9313 | 1.2941 |
| GNRR | 482000 | 1.5358 | 0.276 | 4.7284 | 0.8434 |
| | 48A000 | 1.8474 | 0.4261 | 9.9867 | 0.9992 |
| HOG | 482000 | 1.3922 | 0.2634 | 4.0562 | 0.7169 |
| | 48A000 | 1.5022 | 0.4095 | 9.0589 | 0.7868 |
| CCKY | 482000 | 1.2296 | 0.1981 | 3.1078 | 0.652 |
| | 48A000 | 1.3707 | 0.32 | 7.2373 | 0.7237 |

Source: Source: BEA RIMS II Type II multipliers (https://bea.gov/regional/rims/rimsii/).
Notes: Local impact regions given in Table 18. GDOT (2016) Page A-42.
482000 – Rail transportation. 48A000 – Scenic and sightseeing transportation and support activities for transportation.

for sightseeing activities are higher than for rail transportation in general. In particular, the employment effects for sightseeing are significantly higher than for freight. For example, the output multipliers for sightseeing transportation are 25% higher or less relative to freight services.

But the employment multipliers for sightseeing transportation are nearly twice as high as for freight for Georgia as a whole and more than twice as high for each of the areas in which a system operates.

The economic impacts identified in this section partially but not completely account for tourist and sightseeing activities. First, for project spending and the bill-of-goods approaches, there is no need to account for tourism because these are exogenous expenditures to the area and the economic impacts are related to the inputs expenditures associated with infrastructure expenditures (reflecting RIMS II backward-linkage model). Second, the basis for the economic impacts associated with the SLR sector's contribution (or departure) were system revenues. The economic impacts for GNRR, the GDOT system that offers only tourism services, are those for transportation sightseeing and support services. For CCKY and HOG, however, data on the distribution of revenues between freight and tourist activities were unavailable. For these systems, the economic impacts are those associated with rail transportation.

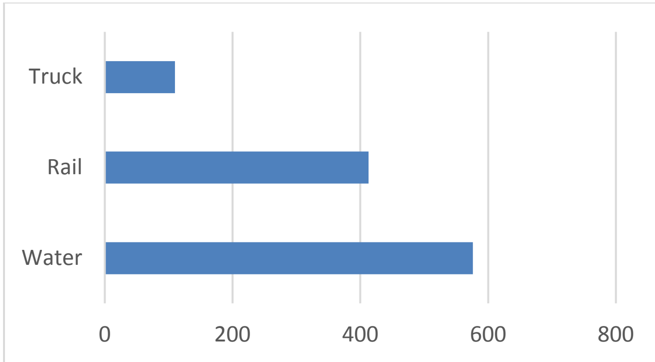
## VI COMMUNITY IMPACT

In addition to their economic impact on output, earnings, value added, and jobs, short line railroads also have environmental, safety, fiscal, and business development implications. All transport modes have impacts on the environment, consume energy, have inherent risks that can cause delays, property damage and, much more seriously, life-altering injuries and fatalities. For short line railroad systems, trucking is the primary alternative. And relative to trucking, short line railroads have less impact on the environment, consume less energy per ton-mile, and lead to fewer serious injuries and fatalities. In addition, short line rail shipments have fiscal impacts for the state and the local community. In reducing the number of truck movements, short line rail reduces highway maintenance expenditures, increases time between major resurfacing, and provides tax revenues to the local areas. Further benefits of short line railroads are their potential for business development, attracting businesses seeking locations with short line rail access for origination and destination shipments, and the transportation facilitation support that short line railroads provide to a broad range of industries in the state.

Lacking specific data on these community effects for the local areas in which GDOT's six SLR systems operate, we will use data from a variety of sources to provide a general sense of the magnitudes associated with these effects.

### A. Environmental Impact

Rail transportation is considerably more energy efficient than trucking transportation. Figure 11 compares the fuel efficiency of trucking, rail, and water transportation per gallon of fuel used. Water transportation is most efficient, expending one gallon to move 576 ton-miles. Although not as efficient as water transport, rail transport moves 413 ton-miles per gallon of gasoline. For the same amount of fuel expended, trucking moves 110 ton-miles, only 19% and 27% as efficient as water and rail, respectively. And according to the later release of AAR data, the fuel efficiency of




Source: U.S. DOT (2010).

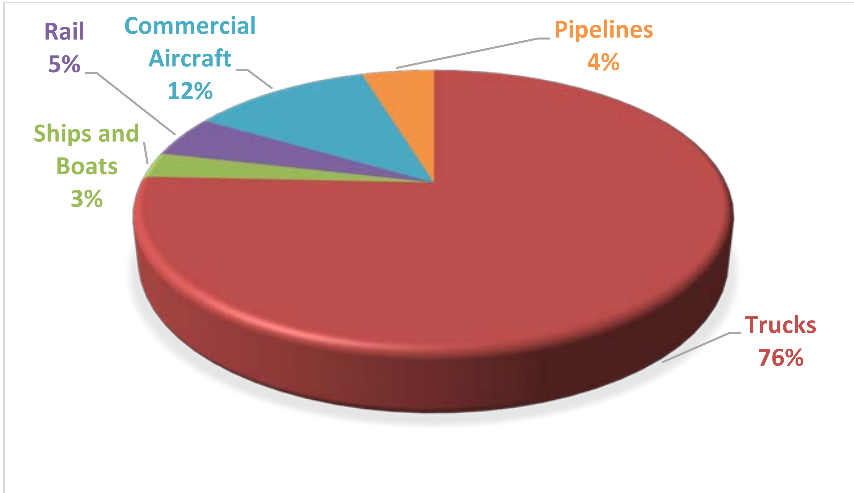
**Figure 11**

**Transportation Mode – Ton-Miles per Gallon**

rail transportation has increased from 413-ton miles per gallon in 2010 to 476-ton miles per gallon in 2012. [27]

Compared to truck transportation, rail transportation is also more environmental friendly. AAR (2014) estimates that rail transportation generates 75% fewer greenhouse gas emissions than truck transportation. Figure 12 depicts freight-related greenhouse gas emission inventory for freight from the U.S. Environmental Protection Agency (EPA, 2016). Truck accounts for 745.5 million metric tons of CO2 equivalent, 76% of the total. Rail transportation, in contrast, generates 47.6 million metric tons of CO2 equivalent, 5% of the total and substantially less than trucking and not much higher than shipping over water.

[27] See https://www.aar.org/newsandevents/Press-Releases/Pages/The-Nations-Freight-Railroads-Average-476-Ton-Miles-Per-Gallon.aspx.




Source: U.S. Environmental Protection Agency, Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2014. EPA 430-R-16-002. April 2016.

**Figure 12**

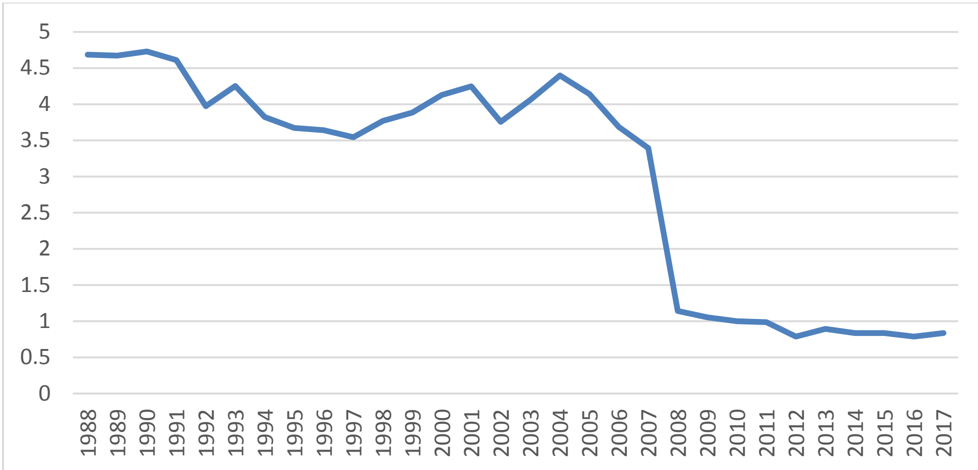
**Green Gas Emission from Freight**

(Million Metric Tons CO2 Equivalent)

B. Safety Impact

Rail transportation also has good performance records on safety. According to AAR (2013), the train crash rate fell 80% from 1980 to 2012, reaching the lowest rate recorded in the U.S.

In Figure 13, we see that the number of crashes per million train miles fell from a high of 4.67 in 1988 to 0.79 in 2016.

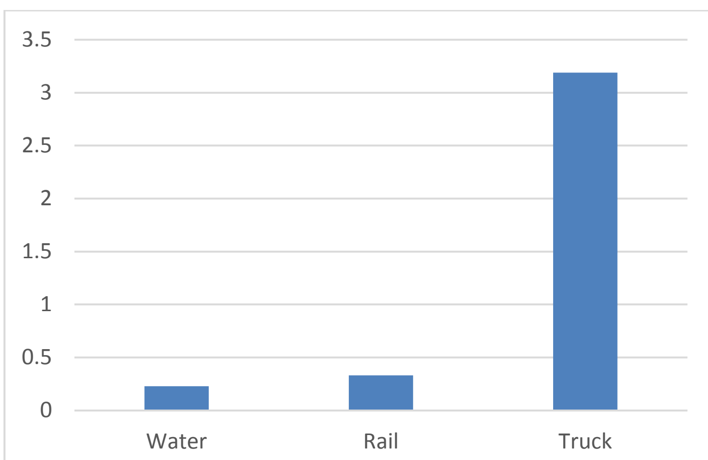



Source: "1.12 – Ten Year Accident / Incident Overview", FRA Office of Safety Analysis, 2017

**Figure 13**

**Train Accident Rate per Million Train Miles**

Further, Figure 14 compares the fatality rates for of rail, water, and trucking. Rail and water have similar rates per billion ton-miles, 0.23 and 0.33, respectively and much lower than the corresponding 3.19 fatalities per billion ton-miles for trucking.




Source: U.S. DOT (2010).

**Figure 14**

**Fatalities per Billion Ton-Miles**

These differences in rates are also present in shipping hazardous materials. Railroads and trucks transport similar ton-mileage of hazardous materials (American Association of Railroads, 2013) yet the number of incidents for rail transportation is 5% of the number of same incidents for truck transportation.

C. Fiscal Impact

Using rail transportation to move goods has an immediate impact on the state's existing road infrastructure, reducing highway congestion and saving pavement maintenance and repair costs. To illustrate the impact, for example, in 2016 Georgia short line railroads moved 208,000 carloads of freight. According to ASLRRA (2016), 1 carload is equivalent to 2.87 trucks and the average pavement cost of 1 truck is $43.17. If short line railroads were no longer available and the short line rail freight were now shipped by truck, there would be more than half a million additional truck movements at an annual pavement cost of $25.8 million.[28]

A further community impact is the state and local taxes that short line railroads pay. In 2016, ASLRRA reports that short line railroads in Georgia paid $717,000 in state and local taxes or $3.45 per carload. This implies that providing high quality infrastructure that facilitates intermodal shipments will increase the demand for short line rail carloads and generate additional tax revenues for the local and state communities.

D. Business Development

An important role for transportation networks at any level – national, state, city – is community development. Having an efficient intermodal transportation system often provides strong incentives for new entrepreneurs starting a business and for existing businesses wanting to expand or relocate. Short line railroads can be an important component of a business's supply chain and overall business strategy.

[28] One trucks imposes $43.17 in pavement costs which implies that one rail carload diverted to trucking generates $123.9 in pavement costs. Multiplying by 208,000 gives $25.8 million.

Section V identified the economic impact of GDOT's short line railroads under alternative assumptions. However, as noted in Section IV, economic impact modeling systems such as RIMS II are backward-linkage models, that is, these models focus on the direct and indirect multiplier effects associated with an increased demand for inputs when there is an exogenous increase in spending. All of the economic impacts identified in Section V assume backward linkages.

Forward-linkage models, on the other hand, account for the impact on users of the industry's good or the impact on other industries. We alluded to this when discussing environmental, energy, safety and fiscal benefits of short line railroads relative to trucking. Forward-linkage models would explicitly account for the economic impact of an increased demand for trucking where significant amounts of traffic diverted to trucking.

Another aspect of a forward-linkage perspective is the extent to which increased output in the short line rail sector from increased GDOT track maintenance, rehabilitation, and upgrades or from extending the existing short line rail network attract new businesses to the community. Although forward-linkage models are beyond the scope of this study, we can provide anecdotal evidence on the important role that short line rails have in business and community development.

*Business Development Case Study – CCKY and Audia International*

There exist numerous examples of the pivotal role that short line railroads have in attracting business. Genessee & Wyoming's (G&W) webpage (https://www.gwrr.com/customers/case-studies/) identifies nine case studies that highlight the business and community development importance of the company's short line railroads. One of these case studies, reproduced on the following page from G&W's webpage is Audia International's (a plastics manufacturer) to expand its operations to the South and locate in LaFayette, GA (site of Walker County's industrial park). Audia required a location with access to a short line railroad and, having had a successful relationship with G&W, Audia worked with G&W's CCKY SLR, the state of Georgia and Walker County to meet Audia's needs. The first railcar moved in January 2016 with an expected 50% increase in CCKY's traffic volume.

Appendix G provides URLs for short line railroad webpages that provide case studies, examples, and testimonials of the business development roles of short line railroads.

**Chattooga & Chickamauga Railway-Audia International**

**Audia International**, a Pennsylvania-based plastics manufacturer that serves the automotive, appliance, construction and packaging markets, decided to expand its existing business to the South and allocated $50 million for investment in a new manufacturing plant. After solidifying a relationship with Genesee & Wyoming's Pittsburgh& Ohio Central Railroad years before and recognizing its stellar customer service, Audia wanted another Genesee & Wyoming railroad to service the new plant.

With the help of **Walker County**, the **State of Georgia**, and Genesee & Wyoming's **Chattooga & Chickamauga Railway (CCKY)**, Audia chose to be the first customer in the Walker County Industrial Park, located in LaFayette, Georgia.

CCKY built two storage tracks and offered Audia a reduced switching contract. The railroad will store plastic pellets that are brought into the plant and altered per customer specifications.

Walker County cleared 500,000 cubic yards of dirt and built the roads for the industrial park.

The State of Georgia built the lead into the industrial park and committed to adding a siding for CCKY in the near future.

Site selection commenced in 2014, construction began in March 2015 and the first car moved in January 2016. The anticipated traffic represents a 50% increase in CCKY's total volumes. Early direct benefits from this project include:

Twenty-eight secured acres in the 460-acre Walker County Industrial Park

Local job creation

The project is the result of effective collaboration between CCKY, Walker County, the State of Georgia and Audia. As a result, Walker County Industrial Park is now a player in commercial development for Walker County and Georgia as a whole.

Source: https://www.gwrr.com/customers/case-studies/

*Tourism*

As discussed in the last section, tourism and sightseeing activities have higher economic impact multipliers than freight services and much higher job creation potential. Infrastructure and related support investments to improve the overall quality and experience of the sightseeing trip can not only create increased demands from outside the local area but can attract new businesses to the local area to meet the associated demand for support food, lodging, parking, and other activities. The example below comes from GNRR's Blue Ridge Scenic Railway webpage.

## Blue Ridge Scenic Railway

### Trip Description

Welcome! A great family adventure on the Blue Ridge Scenic Railway starts at the historic depot, built in 1905, in downtown Blue Ridge, Georgia. This charming mountain village is nestled in the lush Chattahoochee National Forest and is known for its pleasant and unique shopping with friendly folks and an old-time atmosphere.

Our regularly schedule trips are 26 miles roundtrip (4 hours ) winding along the beautiful Toccoa River in your choice of vintage, climate controlled rail cars or open-air rail cars arriving in the quaint sister towns of McCaysville, Georgia and Copperhill, Tennessee.

Passengers have a 2 hour layover in McCaysville/Copperhill; plenty of time to eat lunch, shop for unique crafts and antiques, snack on ice cream, or walk across the old bridge in town to view the river.

Source: (http://www.brscenic.com/)

E. <u>State Industry Support</u>

Short line railroads work together with Class I railroads to make rail service available in more areas. Counties involving in agriculture, food, wood, mining and other related industries depend heavily on rail transportation. For example, farms in the southern counties depend on short line railroad to ship their agriculture products to markets near and larger markets through Class I railroads. As mentioned previously, the mix of commodities shipped via short line railroads is quite diverse, shown in Table 35.

**Table 35**

**Commodities Shipped via Short Line Rail in Georgia**

| | | | |
|---|---|---|---|
| Aggregates | Corn syrup | Machinery | Pulp |
| Aluminum | DDG (Distillers' Dried Grain) | Marble | Sand |
| Asphalt | Ethanol | MDF (Medium Density Fiberboard) | Seed |
| Automobiles | Farm products | Metallic ore | Soda ash |
| Beer | Fertilizer | Metals | Soy |
| Bricks | Feed products | Minerals | Starch |
| Bulk freight | Food products | Oil | Stone |
| Car storage | Forest products | Paper products | Talc |
| Cement | Grain | Paraffin wax | Wallboard |
| Chemicals | Granite | Peanuts | Waste paper |
| Clay products | Kaolin | Petroleum products | Wood products |
| Coal | Limestone | Plastics | |
| Corn | Lumber | Plywood | |

Source: GDOT (2016).

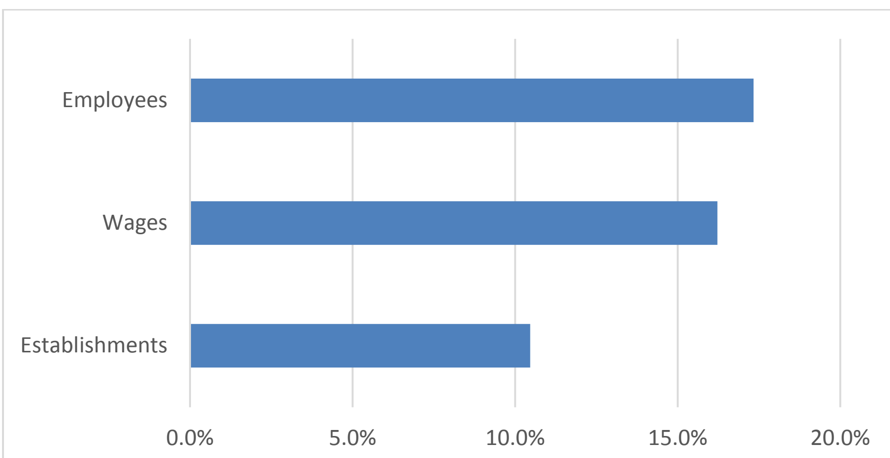
Table 36 highlights the economic impact of the industries represented by the commodities listed in Table 35. Although not every business in each core industry is served by short line railroads, the economic impact of those core industries shows us how wide the short line rail has attached to the state economy. Combined, these industries support nearly 738,972 jobs in Georgia. Figure 15 shows the percentage of those industries in the state economy of Georgia in terms of employment, total wage, and number of establishments. Those industries accounts for over 15% of the state employment, and over 10% of the total number of establishment in Georgia.

**Table 36**

**Core Industries and Impact on the Georgia Economy**

| Industry | Employment | Total Wage (in thousands) | Number of Establishments |
|---|---|---|---|
| Agriculture, Forestry, Fishing and Hunting | 25,168 | 853,138 | 2,541 |
| Mining, Quarrying, and Oil and Gas Extraction | 5,036 | 344,711 | 237 |
| Manufacturing | 385,905 | 21,854,475 | 10,097 |
| Administrative and Support and Waste Management and Remediation Services | 322,863 | 11,976,580 | 18,364 |
| Total | 738,972 | 35,028,904 | 31,239 |

Source: Quarterly Census of Employment and Wages -- Industry, U.S. Bureau of Labor Statistics, 2017




Source: Quarterly Census of Employment and Wages -- Industry, U.S. Bureau of Labor Statistics, 2017. Authors’ calculation.

**Figure 15**

**Percent of Supported Industries in Georgia, 2016**

## VII CONCLUSION

This study finds that the Georgia Department of Transportation (GDOT) short line rail system is an integral part of Georgia's transportation system and that these systems generate economic benefits broadly to the state but more importantly to the local communities that these systems serve.

Using output, earnings, value-added and employment multipliers from a RIMS II backward-linkage model, this study estimates the economic impacts of GDOT's six short line railroads. The study estimated these impacts under various assumptions on the geographic extent of the impact and whether part of the exogenous spending was not local but rather spent outside the area. Recognizing upfront that that any estimate of an economic impact critically depends on the underlying assumptions and model limitations, quality of data, the underlying model, the extent to which the model captures the specific economic environment for which economic impact are calculated, and the inability to quantify some impacts.

These uncertainties argue for generating an expected range of economic impacts, which can assist policy makers in several ways. First, policy makers will likely have more confidence in a range of estimates based on alternative sets of assumptions. Second, given a range, policy makers have the flexibility to narrow the range depending on the specific circumstances. For example, if, in a backward-linkage model, there is expected to be a significant amount of leakage, then a policy maker can use the lower end of the range to assess the jobs or earnings effect of exogenous spending. As another example, if a policy maker believes that exogenous spending in one area will have more general statewide impacts then using the upper end of the range will be appropriate for estimating the output or value-added effects of the spending.

Overall, an expected set of economic impacts for GDOT's six short line rail systems would be those reported in Table 33 associated with the bill-of-goods approach, with and without leakage. The bill-of-goods approach uses more detailed information and the economic impact estimates, with and without leakage, encompass the project spending estimates and the counterfactual departure estimates. Only by a small amount do the bill-of-goods estimates differ from the revenue contribution estimates.

Thus, the average annual expected economic impact from GDOT infrastructure spending can be expected to increase: 1) output from $2.8 – $14.54 million; 2) earnings from $0.7 –$4.1 million; 3) value-added from $1.4 – $7.5 million; and generate 10 – 93 jobs.

Importantly, as noted in Section VI, GDOT's short line rail system also produces a number of beneficial community effects relative to SLR's main competitor, trucking, and not explicitly captured in the RIMS II methodology. In particular, in shipping a given quantity of freight, short line railroads relative to trucking are more environmentally friendly, energy-saving, and safe. They generate tax revenues for the community and play an important business development role as access to high quality short line railroads increases the likelihood for keeping existing businesses and attracting new manufacturing and other business with short line rail needs.

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# APPENDICES

## APPENDIX A – Academic Literature Related to Short Line Railroad Systems

| Year | Author(s) | Methodology | Focus | Data | Findings |
| --- | --- | --- | --- | --- | --- |
| | | | | *Deregulation* | |
| 1993 | Winston, C. (1993), JA | Meta-analysis | US | Past studies on deregulation | Ambiguous effect on shipper welfare from change in rates; significant positive effect on welfare from serice quality changes; positive effect on industry profits; 20% decrease in wages, no effect on employment; large welfare and efficiency gains. |
| 1994 | Wilson, W. (1994) JA | OLS | US | 1972-1988, Carload Waybill Statistics | Majority of prices initially rose after deregulation but then decreased or maintained prices due to enhanced productivty. |
| 1997 | Wilson, W. (1997) JA | TL cost function | US | Class I carriers, 1978-1989. | Significant (up to 40%) cost savings due to deregulations. Productivity initially increased and then returned to pre-deregulation levels. |
| 1998 | Winston, C. (1998) JA | Meta-analysis | US | Past studies on deregulation | Increased entry of smaller (non-union) railroads, greater competition among existing railroads. Increase in negotiated contract ratesand 60% reduction in real operating costs per ton-mile, 33% reduction in track miles, higher rail profits. Decrease in average rail rates (> 50%), average (> 20%) and standard deviation of transit time (> 20%). Rise of 3rd party logistics. |
| 1999 | Davis, D. and Wilson, W. (1999) JA | OLS, 2SLS | US | Annual R-1 Report, ICC-STB, Class I rails, 1978-94; wage form A-300. | Partial dergulation led to large direct employment effects. Indirect effects occurred thrugh mergers and changes in traffic mix. |

**Appendix A (continued)**

| Year | Author(s) | Methodology | Focus | Data | Findings |
|---|---|---|---|---|---|
| | | | *Deregulation (cont'd)* | | |
| 2003 | Bitzan, J. (2003) JA | TL quasi-cost function | US | ICC, STB R-1 Reports, Class I rails, 1983 - 97 | Vertically integrating railroads maintenance and transport activiteis yield economies. |
| 2003 | Bitzan, J. and Keeler, T. (2003) JA | TL cost function | US | ICC, STB R-1 Reports, Class I rails, 1983 - 97 | Post Staggers Act innovations (e.g. eliminating cabooses) reduced costs 5-8%. Net of innovation, productivity slightly increased. |
| 2003 | Davis, D. and Wilson, W. (2003) JA | OLS, 2SLS, IV | US | Annual R-1 Report, ICC-STB, Class I rails, 1978-94; wage form A-300. | Employment (wages) increased (decreased) 60% (40%). Mergers (5-15%), partial deregulation (20%), and operations (4-5%) accounted for wage increases. *CHECK* directions of change are reveerse I think |
| 2003 | Gomez-Ibanez, J. (2003) B | Qualitatative analysis | | AAR, Railroad Facts and Figures, various editions | Comparing 1960-80 with 1981-2001, larger % decrease in revenue per ton-mile and miles of right-of-way; larger increases in average length of haul and ton-miles per employee hour. |
| 2006 | Vachal, K., Bitzan, J, VanWechel, T. and Vinje, D. (2006) JA | OLS | US | US rail grain rates, 1981-2000, STB. | The lower rates and higher productivity benefits from deregulation are not uniformly distributed across grain shippers and favor those in areas with more intermodal competition. |
| 2014 | Bitzan, J. and Keeler, T. (2014) JA | TL cost function | US | R-1 Reports, STB, Class I railroads, 5 commodity types, 1986-2008 | Revenue-cost margins for the 'most captive' products changed little whereas changes for 'non-captive' products were large. Results argue for market-based pricing. |

**Appendix A (continued)**

| Year | Author(s) | Methodology | Focus | Data | Findings |
|---|---|---|---|---|---|
| | | | | *Short Line Rails* | |
| 1991 | Dooley, F. (1991) WP | Simulation | US | AAR Profiles of American Railroads | SLRs experience greater economies from traffic density rather than size of the network. |
| 1993 | Babcock, M., Russel, E., Prater, M., and Morrill, J. (1993) RP | Qualitative analysis | Kansas; Iowa | Kansas and Iowa short line railraod survey | Short line railroads are a viable transportation alternative, but the long term financial survivability of short line railroads as an industry is not assured. |
| 1993 | Grimm, C. & Sapienza, H. (1993) JA | OLS | US | AAR, survey; | Selected predictors of short line performance: traffic density (+), commodity concentration (-), traffic originated (+), financial leverage (-), size (+) |
| 1997 | Babcock, M., Prater, M., and Russell, E. (1997) RP | OLS panel, sensitivity analysis | Kansas | Short line rail survey, AAR, Profiles of American Rail roads | Lagged carloads per mile is found to be a key factor influencing profitability of SLR in all the three criteria: the sensitivity analysis, the elasticities and the t-statistics of the explanatory variables. |
| 2000 | Berwick, M. (2000) WP | economic engineering cost/sensitivity analysis; | North Dakota | Annual Data Profile of the short line industry | In reducing costs and providing higher quality servcie, intermodal transportation can generate market growth opportunities. |
| 2001 | Baldwin, F. (2001) JA | (Not applicable) | Ohio | (Not applicable) | Railroads require substantial capital investment. A region may benefit from track upgrades, the rehabilitation of an old rail line, or the rail equivalent of an access road for an industrial park. |

## Appendix A (continued)

| Year | Author(s) | Methodology | Focus | Data | Findings |
|---|---|---|---|---|---|
| | | | *Short Line Rails (cont'd)* | | |
| 2001 | Casavant, K. and Toliver, D. (2001) RP | Technical evaluation; | Washington | Survey, interview | Investment in upgrading trackage appears to be the only long-term solution. Light-rail sections will not perform adequately under heavy axle loads unless trains are restrict to very slow speeds. |
| 2001 | Fischer, P., Bitzan, J. and Tolliver, D. (2001) WP | TL cost function | US | American SLR database, UGPTI | Short lines could achieve greater cost savings if they were to increase their density (revenue ton miles per mile) and their size (mile of road). |
| 2001 | Resor, R., Zarembski, A. and Patel, P. (2001) JA | Qualitative analysis | US | Survey, short line and regional railroads RailAmerica | Using standard railroad industry unit costs, ZETA-TECH estimated the cost of replacements needed to handle heavier cars at $6.86 billion in 1999 dollars. |
| 2002 | Allen, W., Sussman, M., and Miller, D. (2002) JA | (Not applicable) | US | AAR, Strategic Rail Finance database | Since the Stagger Act of 1980, the number of nonclass I freight railroads has grown by about 260%. Today 341 (59%) of the nonclass I freight railroads and 64.5% of the nonclass I mileage are owned /controlled by 81 holding companies. |
| 2002 | Bitzan, J., Tolliver, D. and Benson, D. (2002) WP | OLS | US | ASLRRA Annual Data Profile | The study finds substantial capital investment needs for the industry, some difficulty in obtaining financing to meet these needs, large public interest benefits of short-line railroad operations, and a positive contribution of short-line operations to safety and fuel efficiency. |

**Appendix A (continued)**

| Year | Author(s) | Methodology | Focus | Data | Findings |
|---|---|---|---|---|---|
| | | | *Short Line Rails (cont'd)* | | |
| 2003 | Bitzan, J., VanWechel, T., Benson, D. and Vachal, K. (2003) WP | OLS polynomial regression | US | AAR Profiles of American railroads, ASLRRA | In 2000, short line participated in nearly 30% (9.9 million carloads) of all rail movements. Factors affecting short line viability: operating expense, traffic levels, industries served, number of customers, number of productive employee. |
| 2006 | Warner, J. and Terra, M. (2006) WP | Qualitative analysis | Texas | ASLRRA, survey, interview | An investment of approximately $250 million is needed to upgrade the infrastructure in order to support 286,000 pound railcars. |
| 2009 | Betak, J. Theofanis, S., and Boile, M. (2009) RP | Qualitative analysis | US | Interview | Short line and regional railroads could reduce the level of truck congestion on freeways and expressways leading into and out of major metropolitan areas. |
| 2014 | Miller, C. and Stich, B. (2014) JA | Qualitative analysis | Mississippi | Annual freight railroad traffic, AAR, MDOT | Short line railroads tend not to be highly profitable, but have significant economic development implications. |

Explanations of abbreviations in the table. SLR – short line railroad, OLS – ordinary least squares, TL – translog, 2SLS – two stage least squares, IV – instrumental variable, AAR – American Association of Railroads, ASLRRA – American Short Line and Regional Railroad Association, STB – surface transportation board, ICC – Interstate Commerce Commission, MDOT – Mississippi Department of Transportation.

## APPENDIX B – Short Line Rail State Department of Transportation (DOT) Reports

| Year | Author(s) | Source | Methodology | Data | Findings |
|---|---|---|---|---|---|
| 2004 | Babcock, M. and Sanderson, J. (2004) | Kansas | IRR analysis; cost estimation | Kansas road damage costs, Economic Impacts of Railroad Abandonment on Rural Kansas Communities (2003); Profiles of U.S. Railroads, AAR; survey | Shortlines annually save the state: 1) at least $58 million per year in avoided road damage costs; and 2) $20.7 million in wheat transportation handling costs. |
| 2005 | Brinkerhoff, P. (2005) | Kansas | Cost benefit analysis | Kansas SLR data, various years; completed improvement projects between 2000-2005; interviews with SLRs, Class I rails, and customers; and public hearings. | Operational savings and abandonment avoidance benefits of rehabilitation projects include: 1) $65.3 million in shipper cost savings and 1,333 direct employment (net of truck drivers) effect; and $90.5 million in indirect business earnings and 1,831 indirect employment effect |
| 2006 | Georgia Department of Transportation (2006) | Georgia | Qualitative analysis, with some statistics | GDOT databases (Tpro, Intermodal Data Sources, Road Characteristic (RC) File | There is a major structural funding gap between needs and approved programs on the one hand, and available funding on the other. |
| 2010 | Georgia Department of Transportation (2010) | Georgia | Qualitative analysis, with some statistics | TRANSEARCH data, FHA's Freight Analysis Framework (FAF) data, and GDOT Classification Count Data | The Georgia Freight & Logistics Action Plan determined that by investing $18-$20 billion over the next 40 years in freight improvement projects, the State could generate over $65 billion in additional economic output and thousands of new jobs. |
| 2013 | Deller, S. (2013) | Wisconsin | WI Railroad economic impact analysis | Wisconsin data, various years; BEA-REIS; BLS | Total impact of freight railroads include: 1) 10,160 jobs with $614 million in wages; 2) $1.03 billion in total income; 3) $1.8 billion in industrial sales; and 4) $91.9 million in state and local tax revenues. |

**Appendix B (continued)**

| Year | Author(s) | State | Methodology | Data | Findings |
|---|---|---|---|---|---|
| 2014 | Llorens, J., Richardson, J. and Buras, M. (2014) | Louisiana | Descriptive analysis; RIMS | AAR; ASLRRA, state employment and wage data, BLS; RIMS, Commerce Department, Census Bureau | SLRs employ over 1,800 individuals per year; 2) annually generate revenues of $89,000 per functional track mile, and $21 millon less in highway pavement damage. |
| 2015 | Sage, J., Casavant, K. and Eustice, J. (2015) | Washington | Qualitative analysis, descriptive statistics; case study | Survey of owners and operators | Current SLR inventory falls short of the state's future needs; part of SLR system will become obsolete without upgrading to 286,000 pound rail cars. |
| 2016 | Georgia Department of Transportation (2016) | Georgia | Qualitative analysis, with some statistics | Railroad Waybill Sample database, STB; Survey | Impact of GA railroads: include: 672,630 rail-related employment, $32.2 billion in earnings, and $54.1 billion in value-added. SLR track requires upgrades to handle the rail standard of 286,000 pounds. |

Explanations of abbreviations in the table. SLR – short line railroad; ASLRRA – American Short Line and Regional Railroad Association; AAR – American Association of Railroads; IRR – internal rate of return; GDOT– Georgia DOT; FHA – Federal Highway Administration; WI – Wisconsin; BEA – Bureau of Economic Analysis; REIS – Regional Economic Information System; RIMS – Regional Impact Modeling System; BLS – Bureau of Labor Statistics; STB – Surface Transportation Board.

## APPENDIX C – Short Line Railroad Systems

| | |
|---|---|
| ABR | The Athens Line |
| CPR | CaterParrott Railnet |
| CHAT | Chattahoochee Bay Railroad |
| CIRR | Chattahoochee Industrial Railroad |
| CCKY | Chattooga and Chickamauga Railway |
| CCH | Columbus & Chattahoochee |
| FCRD | First Coast Railroad |
| FCR | Fulton County Railway |
| GFRR | Georgia and Florida Railway |
| GC | Georgia Central Railway |
| GNRR | Georgia Northeastern Railroad |
| GS | Georgia Southern Railway |
| GSWR | Georgia Southwestern Railroad |
| GWRC | Georgia Woodlands Railroad |
| GITM | Golden Isles Terminal Railroad |
| GITW | Golden Isles Terminal Wharf |
| GRWR | Great Walton Railroad |
| HRT | Hartwell Railroad |
| HOG | Heart of Georgia Railroad |
| HAL | Hilton and Albany |
| LW | Louisville and Wadley |
| OCR | Ogeechee Railway |
| RSOR | Riceboro Southern Railway |
| SAN | Sandersville Railroad |
| SAPT | Savannah Port Terminal Railroad |

| | |
|---|---|
| SERX | Southern Electric Railroad |
| SM | St. Marys Railroad |
| SMWR | St. Marys West Railway |
| VR | Valdosta Railway |

## APPENDIX D – Statewide Economic Impact Multipliers

| RIMS II code | Spending Type | Final-demand Output ($) | Final-demand Earnings ($) | Final-demand Employ-ment (jobs) | Final-demand Value-added ($) | Direct-effect Earnings ($) | Direct-effect Employ-ment (jobs) |
|---|---|---|---|---|---|---|---|
| 48A000 | Scenic and sightseeing transportation and support activities for transportation | 2.3711 | 0.7603 | 17.9313 | 1.2941 | 2.3004 | 2.6356 |
| 23030A | Bridge Rehabilitation/Rail Installation/Crossings Rehabilitation | 2.1999 | 0.6697 | 16.5612 | 1.2263 | 2.0245 | 2.185 |
| 321100 | Crossties & Switch ties Installation | 2.7369 | 0.6808 | 16.265 | 1.1845 | 4.3774 | 4.4444 |
| 212310 | Ballast Installation | 1 | 0 | 0 | 0 | 0 | 0 |
| 482000 | Rail Transportation | 1.8912 | 0.4921 | 9.0624 | 1.0345 | 2.1981 | 3.6955 |
| 541300 | Miscellaneous Engineering Services | 2.454 | 0.859 | 18.1778 | 1.3743 | 2.1557 | 2.9924 |

Source: BEA RIMS II multipliers (https://bea.gov/regional/rims/rimsii/). The employment multiplier is the number of jobs per $1 million expenditure.

## APPENDIX E – Local Area Economic Impact Multipliers

| Short line rail | RIMS II code | Spending Type | Final-demand Output ($) | Final-demand Earnings ($) | Final-demand Employment ( jobs) | Final-demand Value-added ($) | Direct-effect Earnings ($) | Direct-effect Employ-ment (jobs) |
|---|---|---|---|---|---|---|---|---|
| CCKY | 23030A | Bridge Rehabilitation/Rail Installation/Crossings Rehabilitation | 1.3834 | 0.377 | 8.8887 | 0.7799 | 1.3342 | 1.4641 |
| CCKY | 321100 | Crossties & Switch ties Installation | 1.3968 | 0.1665 | 3.5763 | 0.4199 | 1.8906 | 2.0237 |
| CCKY | 212310 | Ballast Installation | 1 | 0 | 0 | 0 | 0 | 0 |
| CCKY | 482000 | Rail Transportation | 1.2296 | 0.1981 | 3.1078 | 0.652 | 1.4181 | 1.8644 |
| CCKY | 541300 | Miscellaneous Engineering Services | 1.3304 | 0.4215 | 7.7565 | 0.7181 | 1.273 | 1.5208 |
| CPR | 23030A | Bridge Rehabilitation/Rail Installation/Crossings Rehabilitation | 1.549 | 0.3856 | 9.3673 | 0.8644 | 1.5514 | 1.754 |
| CPR | 321100 | Crossties & Switch ties Installation | 2.0849 | 0.3909 | 8.8537 | 0.8018 | 3.1882 | 3.5984 |
| CPR | 212310 | Ballast Installation | 1 | 0 | 0 | 0 | 0 | 0 |
| CPR | 482000 | Rail Transportation | 1.3727 | 0.2677 | 4.5634 | 0.7363 | 1.5745 | 2.2496 |
| CPR | 541300 | Miscellaneous Engineering Services | 1.6033 | 0.5578 | 11.1279 | 0.8798 | 1.4482 | 1.8756 |
| GNRR | 23030A | Bridge Rehabilitation/Rail Installation/Crossings Rehabilitation | 1.6714 | 0.3525 | 8.4163 | 0.9446 | 1.6379 | 1.8198 |
| GNRR | 321100 | Crossties & Switch ties Installation | 1.6179 | 0.2512 | 5.4221 | 0.5962 | 2.2582 | 2.4285 |
| GNRR | 212310 | Ballast Installation | 1.5136 | 0.2633 | 4.8835 | 0.9328 | 1.711 | 2.1531 |
| GNRR | 482000 | Rail Transportation | 1.5358 | 0.276 | 4.7284 | 0.8434 | 1.7216 | 2.4723 |
| GNRR | 541300 | Miscellaneous Engineering Services | 1.9251 | 0.5042 | 10.3186 | 1.0795 | 1.7674 | 2.3482 |
| GSWR | 23030A | Bridge Rehabilitation/Rail Installation/Crossings Rehabilitation | 1.3744 | 0.3867 | 9.0003 | 0.7772 | 1.3657 | 1.4794 |
| GSWR | 321100 | Crossties & Switch ties Installation | 1.9536 | 0.3779 | 8.123 | 0.7452 | 3.0923 | 3.3114 |
| GSWR | 212310 | Ballast Installation | 1.1925 | 0.183 | 3.1517 | 0.7433 | 1.4188 | 1.6575 |
| GSWR | 482000 | Rail Transportation | 1.3102 | 0.2769 | 4.2316 | 0.7033 | 1.4466 | 1.8533 |
| GSWR | 541300 | Miscellaneous Engineering Services | 1.3099 | 0.4774 | 8.5369 | 0.7044 | 1.2455 | 1.446 |

| Short line rail | RIMS II code | Spending Type | Final-demand Output ($) | Final-demand Earnings ($) | Final-demand Employment ( jobs) | Final-demand Value-added ($) | Direct-effect Earnings ($) | Direct-effect Employ-ment (jobs) |
|---|---|---|---|---|---|---|---|---|
| HOG | 23030A | Bridge Rehabilitation/Rail Installation/Crossings Rehabilitation | 1.5147 | 0.4167 | 9.6045 | 0.8339 | 1.4083 | 1.5108 |
| HOG | 321100 | Crossties & Switch ties Installation | 2.0497 | 0.3997 | 8.6156 | 0.7807 | 3.3273 | 3.5733 |
| HOG | 212310 | Ballast Installation | 1 | 0 | 0 | 0 | 0 | 0 |
| HOG | 482000 | Rail Transportation | 1.3922 | 0.2634 | 4.0562 | 0.7169 | 1.4956 | 1.9301 |
| HOG | 541300 | Miscellaneous Engineering Services | 1.3768 | 0.4709 | 8.5891 | 0.7421 | 1.2829 | 1.5192 |
| OCR | 23030A | Bridge Rehabilitation/Rail Installation/Crossings Rehabilitation | 1.3399 | 0.3629 | 8.5507 | 0.758 | 1.2957 | 1.421 |
| OCR | 321100 | Crossties & Switch ties Installation | 1.8305 | 0.2679 | 5.8935 | 0.662 | 2.7741 | 3.0404 |
| OCR | 212310 | Ballast Installation | 1 | 0 | 0 | 0 | 0 | 0 |
| OCR | 482000 | Rail Transportation | 1 | 0 | 0 | 0 | 0 | 0 |
| OCR | 541300 | Miscellaneous Engineering Services | 1.2724 | 0.2742 | 5.3124 | 0.6873 | 1.3476 | 1.6951 |

Source: BEA RIMS II multipliers (https://bea.gov/regional/rims/rimsii/). The employment multiplier is the number of jobs per $1 million expenditure.

## APPENDIX F – Statewide Detailed Impact, 2015 Project Spending with Leakage

(Constant $)

| Project | Spending Type | Spending | Output Effect | Earnings Effect | Value Added Effect | Employ-ment Effect |
|---|---|---|---|---|---|---|
| Ballast Install | Intermediate goods | $93,604 | $161,046 | $35,167 | $97,788 | 0 |
| | Labor | $162,625 | $230,098 | $68,205 | $135,467 | 1 |
| | Transport | $19,855 | $44,077 | $13,355 | $22,790 | 0 |
| | Wholesale Trade | $8,509 | $17,616 | $5,475 | $11,151 | 0 |
| Bridge Rehab | Intermediate goods | $899,000 | $1,977,710 | $602,060 | $1,102,444 | 14 |
| Cross Switch Ties Install | Intermediate goods | $747,779 | $2,046,595 | $509,088 | $885,744 | 12 |
| | Labor | $1,249,375 | $1,767,741 | $523,988 | $1,040,729 | 15 |
| | Transport | $56,417 | $125,240 | $37,946 | $64,755 | 0 |
| | Wholesale Trade | $132,323 | $273,935 | $85,137 | $173,396 | 1 |
| Crossings Rehab | Intermediate goods | $38,750 | $85,246 | $25,951 | $47,519 | 0 |
| Misc. | Intermediate goods | $121,500 | $298,161 | $104,369 | $166,977 | 2 |
| Rail Install | Intermediate goods | $177,500 | $390,482 | $118,872 | $217,668 | 2 |
| Total | | $3,707,237 | $7,417,947 | $2,129,611 | $3,966,428 | 47 |

Source: Authors' calculations.

## APPENDIX G – Statewide Detailed Impact, 2015 Project Spending with Leakage

(Constant $)

| Project | Spending Type | Spending | Output Effect | Earnings Effect | Value Added Effect | Employ-ment Effect |
|---|---|---|---|---|---|---|
| Ballast Install | Intermediate goods | $93,604 | $107,454 | $13,166 | $53,479 | 0 |
| | Labor | $162,625 | $76,674 | $22,814 | $46,159 | 0 |
| | Transport | $19,855 | $26,602 | $6,886 | $12,757 | 0 |
| | Wholesale trade | $8,510 | $10,760 | $3,036 | $7,140 | 0 |
| Bridge Rehab | Intermediate goods | $899,000 | $1,355,971 | $372,877 | $747,314 | 8 |
| Cross Switch Ties Install | Intermediate goods | $747,779 | $1,429,142 | $256,720 | $529,779 | 4 |
| | Labor | $1,249,375 | $641,339 | $177,875 | $383,574 | 3 |
| | Transport | $56,417 | $79,912 | $19,035 | $37,828 | 0 |
| | Wholesale trade | $132,323 | $170,334 | $47,306 | $112,614 | 0 |
| Crossings Rehab | Intermediate goods | $38,750 | $55,187 | $15,398 | $30,896 | 0 |
| Misc. | Intermediate goods | $121,500 | $164,563 | $54,416 | $88,713 | 0 |
| Rail Install | Intermediate goods | $177,500 | $263,598 | $72,839 | $145,891 | 1 |
| Total | | $3,707,238 | $4,381,536 | $1,062,368 | $2,196,144 | 16 |

Source: Authors' calculations.

## APPENDIX H – Short Line Railroads and Business Development

| Short Line Railroad | URL |
| --- | --- |
| Aberdeen & Rockfish Railroad | http://www.newsobserver.com/news/business/article157602944.html |
| Aberdeen and Rockfish Railroad | http://www.thepilot.com/business/local-rail-line-marks-years/article_5a32629c-2511-11e7-b189-9fc6586a2efb.html |
| Aberdeen Carolina & Western Railway | http://www.acwr.com/ |
| Alabama & Gulf Coast Railway | https://www.gwrr.com/customers/case-studies/alabama--gulf-coast-railway-partners-with-genesis- |
| Apache Railway | https://www.clearinghousecdfi.com/impact_story/apache-railway/ |
| Arizona Eastern Railway | https://www.gwrr.com/customers/case-studies/arizona-eastern-railway-helps-freeport-mcmoran-exp |
| Arkansas Louisiana & Mississippi Railroad | https://www.gwrr.com/customers/case-studies/arkansas-louisiana--mississippi-railroad-drax-biom |
| Blacklands Railroad | http://blacklandsrailroad.com/about-us/ |
| Chattooga & Chickamauga Railway | https://www.gwrr.com/customers/case-studies/chattooga--chickamauga-railway-audia-international |
| Golden Isles Terminal Railroad | https://www.gwrr.com/customers/case-studies/golden-isles-terminal-railroad-georgia-biomass |
| Grainbelt Corporation and Farmrail Corporation | http://www.bnsf.org/news-media/news-releases/BNSF-names-farmrail-shortline-of-the-year.html |
| Greenville & Western Railway | http://www.wcrscorp.com/railroads.html |
| Missouri & Northern Arkansas Railroad | https://www.gwrr.com/customers/case-studies/missouri--northern-arkansas-acj-international |
| Morristown & Erie Railway | http://www.merail.com/about/ |
| Norfolk Southern Railway | http://www.progressiverailroading.com/rail_industry_trends/article/Transloading-provides-railroads-with-another-way-to-attract-business--52369 |

| Short Line Railroad | URL |
|---|---|
| Ohio Central Railroad System | https://www.arc.gov/magazine/articles.asp?ARTICLE_ID=56 |
| OmniTRAX | http://greatwesternindustrialpark.com/ |
| Oregon Short Line Railroad | http://tremontoncity.org/community/business/industrial-business-parks/ |
| Palmetto Railways | http://palmettorailways.com/2015-1022-railroad-being-resurrected.html |
| Rockdale, Sandow & Southern Railroad | https://www.gwrr.com/customers/case-studies/frac-sand-and-the-rockdale-sandow--southern-railro |
| San Diego & Imperial Valley Railroad Terminal | https://www.gwrr.com/customers/case-studies/san-diego--imperial-valley-railroad-choice-termina |
| Western New York Short Line Freight Rails | https://www.dot.ny.gov/recovery/sponsors/tiger/repository/Buffalo%20Short%20line%20Rail%20Initiative%20Application.pdf |