



AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

The World's Largest Open Access Agricultural & Applied Economics Digital Library

This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search

<http://ageconsearch.umn.edu>

aesearch@umn.edu

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

378.784
U664
D-145



**SMALL RAILROADS — INVESTMENT NEEDS,
FINANCIAL OPTIONS, AND PUBLIC BENEFITS**

**John Bitzan
Denver Tolliver
Douglas Benson**

UGPTI Departmental Publication No. 145

September 2002

UPPER GREAT PLAINS TRANSPORTATION INSTITUTE
.....
NORTH DAKOTA STATE UNIVERSITY

Waite Library
Dept. of Applied Economics
University of Minnesota
1994 Buford Ave - 232 ClaOff
St. Paul, MN 55108-6040 USA

NDSU

378.784

2664

D-145

***SMALL RAILROADS - INVESTMENT NEEDS,
FINANCIAL OPTIONS, AND PUBLIC BENEFITS***

John Bitzan
Denver Tolliver
Doug Benson

Upper Great Plains Transportation Institute
North Dakota State University

September 2002

Acknowledgment

This report has been prepared with funds provided by the Federal Railroad Administration, U.S. Department of Transportation under Grant # DTFR53-00-C-00026. The authors would like to thank Rob Hart, Ed Robinson, and Dan Zink for suggestions in developing the survey. We also would like to thank Jo Anne McGowan for useful comments and suggestions on earlier drafts of the current research. However, any errors that remain are, of course, the responsibility of the authors.

TABLE OF CONTENTS

INTRODUCTION	1
CAPITAL INVESTMENT NEEDS FACING THE SHORT-LINE INDUSTRY	4
FINANCING TERMS, AVAILABILITY, AND BARRIERS FOR SMALL RAILROADS	11
PUBLIC INTEREST BENEFITS OF SHORT-LINE RAILROADS	21
Continued Service	22
Estimating Rail Car Loadings by Commodity	42
Methodology for Estimating Carloads	48
Estimates of Short Line Participation, Origination, and Termination	51
Revenue Ton-Miles	56
Customers	59
RELATIONSHIP OF LIGHT-DENSITY RAILROAD SERVICES TO STATUTORY RESPONSIBILITIES OF THE SECRETARY OF TRANSPORTATION	61
Statistical Model	66
CONCLUSION	72
REFERENCES	75
APPENDIX A Survey to Banks Specializing in Small Railroad Financing	79
APPENDIX B Hypothetical Example of the Internal Rate of Return to Line Upgrading for Short Lines with Various Lengths of Financing Availability	89

LIST OF TABLES

Table 1.	Large Banks that Have a Specialization in Financing Small Railroads	12
Table 2.	Summary of Terms Provided by Banks that Offer Financing to Small Railroads	13
Table 3.	Banks' Ranking of Informational Barriers Listed in the Survey	16
Table 4.	Banks' Ranking of Non-Informational Barriers to Financing Small Railroads . .	17
Table 5.	The Importance of Various Non-Financial Items in Determining the Credit Worthiness of Small Railroads Applying For Loans — From Surveyed Banks' Perspectives	18
Table 6.	The Importance of Various Financial Ratios in Determining the Credit Worthiness of Small Railroads Applying For Loans — From Surveyed Banks' Perspectives	19
Table 7.	Estimation of the Natural Logarithm of Short-Line Revenue Ton-Miles per Gallon	67
Table 8.	Estimated Revenue Ton-Miles per Gallon for Short Lines with Varying Traffic Levels	69
Table 9.	Estimated Revenue Ton-Miles per Gallon for Short Lines with Varying Lengths of Haul	70
Table 10.	Estimated Revenue Ton-Miles per Gallon for Short Lines with Varying Lengths of Haul, Traffic Levels, and Customers	71

LIST OF FIGURES

Figure 1.	Railroad Industry Consist - 1999	40
Figure 2.	Miles Operated, Employee, and Revenues of U.S. Railroads - 1999	41
Figure 3.	Percent of Rail Miles Operated by Short Lines, 1999	41
Figure 4.	Estimated Percent of Industry Carloads Captured by the ADP	45
Figure 5.	Carloads Originated by Local, Regional, and S&T Railroads, 1995	47
Figure 6.	Short-Line Participation in U.S. Carloadings - 1993-1999	51
Figure 7.	Short-Line Participation in U.S. Carloadings - 1999 (by Commodity)	52
Figure 8.	Short-Line Origination of U.S. Carloadings - 1993-1999	53
Figure 9.	Short-Line Origination of U.S. Carloadings - 1999 (by Commodity)	54
Figure 10.	Short-Line Termination of U.S. Carloadings - 1993-1999	55
Figure 11.	Short-Line Termination of U.S. Carloadings - 1999 (by Commodity)	56
Figure 12.	Short- Line Percentage of U.S. Revenue Ton-Miles	57
Figure 13.	Short-Line Percentage of U.S. Ton-Miles - 1999 (by Commodity)	58
Figure 14.	Estimated Number of Short-Line Customers - 1999	60
Figure 15.	Estimated Fatalities per Billion Ton-Miles of Freight Handled	63

INTRODUCTION

Railroads play an important role in the U.S. transportation system. Annually, railroads haul more than 1.5 billion tons of freight for an average distance of more than 750 miles, with a value of more than \$319 billion.¹ These numbers account for more than 14 percent of the tonnage, 38 percent of the ton-miles, and 4.5 percent of the value of products hauled by all modes in the U.S.

For some products, the role of railroads in the U.S. is even more pronounced. Railroads serve as an important transporter of many of the low-valued, bulky natural resource commodities produced in the U.S., such as coal, grain, fertilizer, and basic chemicals. In 1997, rail handled 57 percent of U.S. coal tonnage transported and more than 81 percent of the coal ton-miles.² For cereal grains, fertilizers, and basic chemicals, rail handled 29, 36, and 28 percent of the tonnage and 58, 55, and 51 percent of the ton-miles respectively.³ Rail provides an important low-cost form of transportation for shippers of such products, enhancing the global competitiveness of U.S. producers of such products and of the domestic users of such products for inputs into some other process. Furthermore, rail's relative safety, energy efficiency, and environmental friendliness make it an important mode of transportation for reaching the nation's stated goals of a safe, energy efficient, environmentally friendly, and competitive transportation system.

¹U.S. Department of Transportation, Bureau of Transportation Statistics and U.S. Department of Commerce, Economics and Statistics Administration, Census Bureau, *1997 Economic Census of Transportation - 1997 Commodity Flow Survey*.

²Ibid.

³Ibid.

Currently, there are more than 550 railroads in operation in the U.S. These railroads are generally classified by their size in terms of revenues and road miles, and in terms of their operating characteristics. The largest rail carriers in the U.S. are referred to as Class I railroads. Class I railroads are those that meet a revenue threshold defined by the Surface Transportation Board.⁴ In 1999, railroads that had operating revenue of \$258.5 million or more were identified as Class I. Railroads that do not meet this revenue threshold are further categorized by the Association of American Railroads as regional or local. Regional railroads are those that have operating revenues between \$40 million and \$258.5 million and/or operate at least 350 miles of road. Local railroads are those that earn less than \$40 million in revenue annually. Local railroads are further categorized as local line-haul railroads and switching and terminal railroads. Local line-haul railroads are those that are involved in line-haul activities, while switching and terminal railroads are those that primarily provide switching and terminal services for other railroads. Collectively, all non-Class I railroads are referred to as short lines in this study.

Of the 550 railroads in the U.S., eight of these railroads are Class I railroads, while the remainder are local and regional railroads. These short lines account for 29 percent of all U.S. rail miles operated, 12 percent of all U.S. railroad employees, and 9 percent of all U.S. railroad freight revenues.⁵

Although short-line railroads comprise a small portion of U.S. freight revenues, they serve as an important feeder into the nation's large Class I railroads. While most of the nation's rail traffic travels on high-density mainline routes at some point on its journey, a large portion of this traffic originates on light-density branchlines, much of which is operated by short-line

⁴This threshold is adjusted annually to reflect inflation.

⁵Association of American Railroads, *Railroad Ten-Year Trends 1990-1999*.

railroads. It is estimated that nearly 14,000 shippers rely on short-lines for access to the nation's rail system (Bitzan and Benson, 1999).

However, a recent change in the industry standard for the size of rail cars interchanged between railroads could threaten viability of the nation's short-line network. The old industry standard of 263,000-pound cars is being replaced with an industry standard of 286,000-pound cars. Many short-line railroads can not handle these larger cars, as they have light rail in place, shallow or poor ballast, and/or deferred tie maintenance. Although it is possible to load the larger rail cars at lighter weights or operate at lower speeds on such lines, railroads operating over such lines eventually will face a decision between upgrading and abandoning lines that cannot handle the 286,000 pound cars at full weight.

Where such lines are abandoned, several potential negative impacts affect the local community. These may include: an increase in the costs of shipping commodities and a resulting loss in net income of shippers, decreases in local gross business volume, decreases in local employment, decreases in local property values, increases in highway maintenance costs, increases in highway user costs, and decreased economic development opportunities.

In many cases, the traffic levels available to short-line railroads may not justify a major upgrade to handle these larger rail cars. However, in many other cases, although the traffic may be sufficient to justify the upgrading expenditure from the short line's point of view, financing at terms agreeable to the short-line operator may not be available.⁶ Moreover, the potential impacts resulting from abandonment may justify an upgrading investment from the local community or state. [This study examines: (1) capital investment needs facing the short-line industry, (2) terms

⁶See Federal Railroad Administration, U.S. Department of Transportation. *Small Railroad Investment Goals and Financial Options*, January 1993.

available for meeting these needs, (3) public interest benefits of short-line railroads, and (4) the relationship of short-line railroad services to the statutory responsibilities of the Secretary of Transportation. } The capital investment needs facing the short-line industry and the terms available for financing these needs are assessed first.

CAPITAL INVESTMENT NEEDS FACING THE SHORT-LINE INDUSTRY

Several recent studies have estimated capital investment needs facing the U.S. short-line industry. Two of these studies attempt to estimate capital investment needs facing the entire U.S. short-line industry, while several others estimate capital investment needs for short lines in specific states. While short lines have capital needs that are not directly the result of a switch to 286,000 pound cars, the primary reason capital needs of the short-line industry are so great is due to this switch. Thus, most of the studies focus on investment needs resulting from the switch to larger cars. These studies are reviewed in the following paragraphs.

Two studies attempting to estimate capital investment needs for the entire U.S. short-line industry were performed by AASHTO (1999) and ZETA-TECH Associates (2000).⁷ AASHTO (1999) surveyed 185 local and regional railroads regarding their ability to handle 286,000 pound cars, their projected 10-year investment needs, and the portion of investment needs the railroads believed would be available through private funding. The study found 41 percent of the respondents could handle 286,000 pound cars on existing facilities, while 87 percent believed

⁷American Association of State Highway and Transportation Officials, *The Ten Year Needs of Short Line and Regional Railroads*, December 1999, and ZETA-TECH Associates, Inc., *An Estimation of the Investment in Track and Structures Needed to Handle 286,000 Pound Rail Cars*, prepared for the American Short Line and Regional Railroad Association, May 2000.

they would have to handle these larger cars in the future. Thus, the study also found that the 185 railroads surveyed were in need of a great deal of track rehabilitation and construction due to deferred maintenance, increased safety requirements, and the switch to larger (286,000 pound) rail cars. For the 185 railroads surveyed, the average cost per mile of track rehabilitation and construction needed was estimated at approximately \$92,000 per mile, or approximately \$1.7 Billion. The study also found a need for bridge rehabilitation and construction, amounting to approximately \$517 million on the 185 railroads surveyed. Other capital investment needs as perceived by the 185 short lines surveyed included signal rehabilitation and construction, equipment rehabilitation and purchase, and other capital costs amounting to more than \$600 million. In total, the estimated capital investment needs amounted to nearly \$3 billion for the 185 railroads surveyed. Expanding these capital investment needs to the entire short-line industry under the assumption that the needs of railroads not surveyed were similar to those surveyed, the study estimated that total capital investment needs for the industry were between \$7.9 Billion and \$11.8 Billion. Finally, based on survey responses that only 23 percent of the investment needs could be privately funded, the study estimated that between \$6.1 Billion and \$9.5 Billion of short-line capital investment needs over the next 10 years would not be privately funded.

In a study specifically addressing the switch to 286,000 pound cars, ZETA-TECH Associates (2000) used an economic engineering approach to estimate the short-line capital investment needs resulting from a need to handle larger cars. The study correctly defined the problem by noting that free interchange of freight cars among railroads requires that short lines have the capability to handle the larger cars. It also noted that because of the lower maintenance standards traditionally associated with short-line operation and because of an inability to realize

much of the operating savings resulting from a switch to larger cars by short lines, the maintenance and rehabilitation burden placed upon short lines by the switch to larger cars is much greater than that placed upon Class I railroads. Moreover, the authors also noted that the resources available to pay for such investments are much less for short lines than for Class I's because of lower traffic levels.

In defining the minimum rail structure necessary to handle 286,000 pound cars, ZETA-TECH and Associates used a proprietary engineering model that defines minimum rail weights, tie conditions, and ballast conditions depending on the conditions of each of the other components. Their model showed that rail less than 90 pounds per yard could only handle 286,000 pound cars at speeds of less than 10 MPH, with low traffic density, and with ties and ballast in good condition. The model also showed that approximately half of railroad ties on a rail section must be in good condition to haul 286,000 pound cars at speeds of less than 10 MPH, if rail and ballast are in good condition. Finally, the model showed that a minimum of two inches of ballast is needed to handle the 286,000 pound cars at speeds of less than 10 MPH, if rail and ties are in good condition.

Using an in-depth survey of 46 short-line railroads with a total of 4,742 track miles in combination with their engineering model and estimates of component costs, the ZETA-TECH Associates authors estimated capital investment needs for handling the larger cars. For the 46 railroads surveyed, the authors estimated that 22 percent of track miles needed rail replacement, 43 percent of track miles needed some tie replacement, 23 percent of track miles needed ballast surfacing, and 49 percent of bridges needed replacement or upgrading. They estimated the total upgrading cost for the short lines surveyed to be in excess of \$650 Million. Expanding these estimates to the industry, based on the assumption that short-line industry track characteristics as

a whole were similar to those of the 46 railroads surveyed, the authors estimated the total short-line industry upgrading costs to be in excess of \$6.8 Billion.

In addition to studies examining capital investment needs of short lines for the U.S. as a whole, a number of studies have examined capital investment needs of short lines in specific states as a result of the industry switch to 286,000 pound cars. These studies include those by Bitzan and Tolliver (2001) for North Dakota, a study by the Iowa Department of Transportation, a study by the Kansas Department of Transportation, and a study by Tolliver (2000) for the state of Washington.

The Iowa Department of Transportation (1998)⁸ examined the cost of upgrading all branchlines with traffic levels greater than .5 million gross ton-miles (GTM) and less than 5 million GTM in the State of Iowa as a result of the industry switch to 286,000 pound rail cars. To estimate these costs, the Iowa Department of Transportation (IDOT) made several assumptions regarding the track structure necessary for long-term ability to handle larger cars. These assumptions were that all rail lines had to have at least 112 pound per yard rail, all lines had to have 75 percent of ties not defective, and all lines had to have a minimum of 6 inches of clean ballast. Using the minimum standards, IDOT concluded that approximately 1,400 miles of rail line needed rehabilitation in Iowa, at a total cost of \$250 million. This amounted to an average rehabilitation cost of approximately \$177,000 per mile.⁹

⁸Iowa Department of Transportation, Office of Program Management, *"Iowa in Motion" Report for Upgrading Rail Lines for Heavy Cars*, July 1998.

⁹This estimate did not include bridge rehabilitation costs.

Bitzan and Tolliver (2001)¹⁰ performed engineering simulations on various rail lines to assess their ability to handle 286,000 pound cars, developed estimates of traffic densities where short lines are more likely to upgrade rail lines to handle larger cars, estimated the costs of upgrading North Dakota rail lines where such upgrading is likely, and discussed some impacts that the upgrading decision could have for North Dakota communities. Simulations performed by the authors suggested that with good tie maintenance, good ballast, and slow speed operations, rail that weighs 90 pounds per yard may perform satisfactorily under 286,000 pound car loads. Lighter rail (e.g. 60 pounds per yard and 70 pounds per yard) was not likely to perform satisfactorily with heavier cars, even at very slow speeds. Based on component cost estimates, the authors found that if all rail lines in the state less than 90 pounds per yard were upgraded (1,200 miles), the costs of upgrading could range from \$258 Million to \$324 Million excluding bridge rehabilitation costs. However, as the authors noted, it would be unlikely that all of these lines would be upgraded. In developing estimates of the internal rate of return to upgrading for a hypothetical short-line railroad, the authors found that under current revenue splits, short lines would have to generate traffic of more than 200 cars per mile to justify an upgrade.¹¹ In modeling the internal rate of return to upgrading for a hypothetical Class I branchline facing the threat of lost traffic to a competitor, the authors found that such a railroad could justify an upgrade with as little as 35 cars originated per mile. Thus, they argued that in cases where a short line has lower traffic levels but helps the Class I retain traffic that would otherwise go to a competitor, the revenue split available to the short line may be increased, reducing the amount of

¹⁰Bitzan, John and Denver Tolliver, *North Dakota Strategic Freight Analysis - Heavier Loading Rail Cars*, 2001.

¹¹Based on the assumptions used in modeling the short-line internal rate of return.

traffic necessary to justify upgrading for the short line. Based on their analysis of internal rates of return, the authors concluded that anywhere from 900 to 1,200 miles of rail line could be abandoned in North Dakota as a result of the switch to larger cars. Finally, the authors made a generalized estimate of the incremental highway maintenance impacts resulting from eliminating lines with various traffic thresholds. They found that if all lines with less than 35 cars per mile originated and light rail were abandoned, the annual highway impacts would exceed \$1 million, but the costs of upgrading the lines would exceed \$191 million.¹² Similarly, they found that the annual highway impacts from abandoning all lines with less than 150 cars per mile originated and light rail were abandoned, the annual highway impacts would exceed \$1.8 million, but the cost of upgrading these lines would exceed \$257 million. Thus, the authors concluded that a state-funded subsidy to upgrade all such potentially abandoned lines did not appear warranted by highway impacts.

A study by Tolliver (2001) for the Washington Department of Transportation¹³ examined the ability of existing rail branchlines in the State of Washington to handle 286,000 pound cars, the rail weights and maintenance levels needed to ensure long-run performance under heavier axle loads, and the cost of upgrading rail lines to maintain short-line and branchline viability. The study found that rail lines with less than 90 pounds per yard could not handle 286,000 pound cars over the long run, that all track that has less than 90-pound rail should be upgraded, that 480 of the 1500 branchline and short-line miles in the State of Washington would need to be

¹²These estimated highway impacts assumed an incremental average truck haul of 44 miles, based on the average length of haul of local and regional railroads obtained from the American Shortline and Regional Railroad Associations Annual Data Profile. Highway impacts could be much greater than these in cases where long truck hauls are needed to gain access to rail facilities, or they could be lower than these in cases where nearby rail lines exist.

¹³Tolliver, Denver, *Washington State Heavy Axle Load Study: Technical Report*, Washington State Department of Transportation, 2001.

upgraded, and that the cost of upgrading these lines would range between \$117 million and \$141 million, excluding bridge upgrading costs.

Finally, a study by the Kansas Department of Transportation (1999)¹⁴ surveyed short lines to make an assessment of their ability to handle 286,000 pound cars and the costs of upgrading their rail lines to accommodate these larger cars. The study found that only 37 percent of short-line rail miles could handle 286,000 pound cars and 50 percent of bridges on these lines could handle 286,000 pound cars. The study also found that the cost of rehabilitating track, sidings, and bridges on short lines in Kansas would exceed \$170 million. Finally, the study estimated that railroads would only be able to privately fund 30 percent of the total upgrading cost.

While the above studies suggest varying amounts of capital investment needs for the short-line railroad industry, all of them suggest that the capital investment needs as a result of a shift to larger rail cars will be substantial. Moreover, some of the studies suggest that short lines may have difficulty in obtaining private financing to meet these capital investment needs. The following section of this report examines terms available to short-line and regional railroads in obtaining bank financing, the factors considered by banks in extending financing to small railroads, and informational and other barriers to financing small railroads from the perspectives of banks that provide financing to such railroads.

¹⁴Kansas Department of Transportation, Bureau of Transportation Planning, *286,000-Pound Rail Cars and Their Effects on Shortlines*, 1999.

FINANCING TERMS, AVAILABILITY, AND BARRIERS FOR SMALL RAILROADS

A 1993 study performed by the Federal Railroad Administration (FRA) found that small railroads considered to be creditworthy still may have difficulty in obtaining financing.¹⁵ Reasons for this difficulty included: (1) there were few banks that specialized in small railroad loans, and few of these knew the territories where short lines were seeking financing, (2) little public information was available regarding small railroads, making it difficult for banks to make an assessment of the risks associated with lending to small railroads and factors mitigating risk, (3) large minimum loan amounts (\$5 million) for lending from banks specializing in small railroad loans, (4) a lack of interest by banks currently involved in small railroad loans in more small railroad loans, (5) short railroad loan terms (7 to 8 years) in comparison to long physical lives of railroad assets (15 to 30 years), and (6) some unwillingness by banks to make loans for track and structures because of an inability to liquidate such assets.

This section of the report examines whether these same problems still exist, by presenting results of a survey that was administered to banks specializing in small railroad financing.¹⁶ To obtain a list of banks to survey, we used the “2001 Railroad Financial Desk Book” from *Railway Age*, a list of banks previously surveyed by the Federal Railroad Administration, and we asked banks that we contacted about other lenders specializing in small railroad financing. After contacting banks from these sources, we found that there are few banks that have a specialization

¹⁵Federal Railroad Administration, U.S. Department of Transportation. *Small Railroad Investment Goals and Financial Options - A Report to Congress*, January 1993.

¹⁶The telephone survey administered to banks specializing in small railroad financing is in Appendix A.

in small railroad financing at the national level. Table 1 shows the list of major banks that we identified as having a specialization in small railroad financing. As the table shows, only six large banks specialize in this area, although many local banks provide financing to short lines that serve communities served by the bank. While the number of large banks providing loans to small railroads are few, all banks surveyed indicated an interest in taking on more loans.

Table 1. Large Banks that Have a Specialization in Financing Small Railroads		
Name of Bank	Contact Person	Telephone Number
Allfirst Bank	Chris Pistell	(410) 244-3829
Bank of America	Howard Capito	(865) 673-2002
BNP Paribas	Brian Hewett	(312) 977-1380
Deutsche Financial Services - Railroad Finance Group	Patrick Mazzanti	(815) 675-3812
Fleet Boston Financial	Michael Blake	(617) 434-0670
LaSalle National Bank	Rob Hart	(312) 904-7136

As highlighted in the previous section of the report, small railroads currently have a large need for loans to finance track and bridge improvements. However, small railroads also may need financing for cars and locomotives, for acquiring railroad property, or for refinancing. Moreover, the banks willing to provide financing, and the terms they are willing to provide often vary based on the purpose of the loan. Table 2 shows the number of banks willing to provide financing and a summary of the terms available for each type of small railroad need. As the table shows, with the exception of the length of loan term offered, the loan terms offered for different types of loans are similar. Although there are banks that do not have a stated minimum loan amount, most of the banks surveyed (4 out of 6) require a loan of at least \$300,000. However,

only two of the banks require minimums in excess of \$5 million. Thus, the financing barrier of high minimum loan amounts identified by the 1993 study may not be as much of a problem today. As far as the actual loan terms, most loans use a floating interest rate that is based on the London Interbank Offered Rate (LIBOR), which is the rate that banks in London charge to other banks for borrowing. LIBOR is a short-term interest rate that tends to be low relative to many other rates. Moreover, most loans are made at a rate that is from one-half to 6 percentage points above the LIBOR (Currently the 3-Month LIBOR is at 1.77%). Finally, most loans require some collateral, and have up front fees ranging from .25 percent to 3 percent.

Table 2. Summary of Terms Provided by Banks that Offer Financing to Small Railroads	
Loans for Track and Bridge Improvements	
Provide Loans?	3 out of the 6 Banks Surveyed
Maximum Term	5 to 8 years
Interest Rate (fixed or floating)	Floating
Baseline Interest Rate	LIBOR or Prime
Interest Rate in Relation to Baseline Rate	50 to 550 basis points above LIBOR
Collateral Requirements	100 to 120 percent of Loan Value
Min. Loan Amount	0 to \$5 Million
Up Front Fees	25 to 100+ Basis Points
Rolling Stock (Cars and Locomotives)	
Provide Loans?	5 out of the 6 Banks Surveyed
Maximum Term	7 to 15 years
Interest Rate (fixed or floating)	Both (3 out of 5 use Floating Only)
Baseline Interest Rate	Mostly LIBOR
Interest Rate in Relation to Baseline Rate	112.5 to 600 basis points above LIBOR
Collateral Requirements	100 to 120 percent of Loan Value

Min. Loan Amount	0 to \$5 Million
Up Front Fees	25 to 200 basis points
Acquisition of Railroad Property	
Provide Loans?	4 out of the 6 Banks Surveyed
Maximum Term	6 to 8 years
Interest Rate (fixed or floating)	Floating
Baseline Interest Rate	LIBOR or Prime
Interest Rate in Relation to Baseline Rate	50 to 500 basis points above LIBOR
Collateral Requirements	0 to 120 percent
Min. Loan Amount	0 to \$10 Million
Up Front Fees	25 to 300 basis points
Refinancing	
Provide Loans?	5 out of the 6 Banks Surveyed
Maximum Term	6 to 15 years
Interest Rate (fixed or floating)	Both
Baseline Interest Rate	Mostly LIBOR
Interest Rate in Relation to Baseline Rate	50 to 600 basis points above LIBOR
Collateral Requirements	0 to 120 percent
Min. Loan Amount	0 to \$10 Million
Up Front Fees	25 to 300 basis points

While many loan terms are the same, the length of the loans offered and the number of banks offering each type of loan are not the same. As Table 2 shows, the most difficult area to obtain financing appears to be that associated with loans for track and bridge improvements. Only three major banks offer financing to small railroads for track and bridge improvements, in comparison to at least four banks for other types of small railroad loans. Railroads that do not

provide track and bridge financing suggested that the inability to liquidate railroad property was the major hurdle preventing them from providing these types of loans.

Moreover, banks that do provide financing for track and bridge improvements typically do not extend the terms of financing beyond eight years. Banks recognize that although the physical lives of railroad assets are long, the economic lives of such assets often depend on an uncertain future flow of traffic. If such traffic is lost in the future, the inability to liquidate railroad property limits the bank's ability to recover its loan. Short financing terms offered by banks may limit the ability of obtaining such financing to railroads with high traffic levels. Appendix B provides an example of the role that the length of a loan can have on the internal rate of return available to short lines from making a major railroad improvement. As the appendix shows, the internal rate of return to upgrading rail lines to accommodate heavy rail cars is not likely to justify an upgrade on lower traffic lines with terms of eight years.

In contrast to track and bridge loans, banks provide loans for cars and locomotives over longer periods of time. If the railroad obtaining the loan goes out of business, cars and locomotives can be sold to other operators at a value similar to the loan amount. Thus, the risk to the bank from lending for cars and locomotives over longer periods of time is small in comparison to the risk from lending for track and bridge improvements.

As stated previously, one of the barriers to financing identified in the 1993 study was a lack of public information regarding small railroads, making it difficult for banks to assess risks associated with lending to small railroads and of the factors mitigating risk. To identify whether there still are such informational barriers to financing small railroads, we asked banks two questions: (1) Are there informational barriers to determining the credit quality of a small railroad? and (2) what types of information would improve the likelihood that more favorable

terms could be provided to credit worthy railroads? Then we asked them to rank various informational barriers to determining the credit quality of small railroads. In answering the first question, three of the six banks said that there are informational barriers to determining credit quality of small railroads. Specifically, they suggested that a lack of willingness by small railroads to deal with audited financial statements and a lack of industry benchmarks were problems in determining credit quality of small railroads. Regarding types of information that would improve the likelihood of more favorable terms provided to creditworthy railroads, banks cited a need for more standardized and audited industry financial and operating data, and suggested that research showing the relationship between operational characteristics and financial ratios for small railroads would be useful.

Table 3 shows the banks' combined ranking of informational barriers to determining the credit quality of small railroads. As the table shows, a lack of audited financial statements and a lack of benchmarks are the most important informational barriers to financing small railroads.

Table 3. Banks' Ranking of Informational Barriers Listed in the Survey
1. A lack of audited financial statements
2. A lack of benchmarks for the small railroad industry
3. A lack of public ratings by S&P or some other organization

In addition to informational barriers, there are other potential barriers to financing small railroads, such as an inability to liquidate railroad property as identified in the 1993 FRA study, the railroad having a long-term lease of the line rather than ownership of the line, the railroad having funding from a state grant where the state has a priority claim on railroad property, and a

lack of expertise by banks in understanding the rail industry. We asked banks to state whether they thought each of these was: (1) a major barrier, (2) a minor barrier, or (3) not a barrier to financing. Table 4 shows the combined ranking of each of these potential barriers by the banks surveyed.

Table 4. Banks' Ranking of Non-Informational Barriers to Financing Small Railroads	
Combined Ranking of Barrier Importance	Number Listing Item as a Major or Minor Barrier (out of a possible 6)
1. Inability to Liquidate Railroad Property	5
2. Having a Long-Term Lease rather than Line Ownership	4
3. Funding from a State Grant (State has Priority Claim on Railroad Property)	3
4. A Lack Expertise by Banks in Understanding the Rail Industry	2

As the table shows, the inability to liquidate railroad property is perceived as the most important of these potential barriers to financing small railroads. This suggests that just as in 1993, the inability to liquidate railroad property could serve as an important obstacle to financing future track and bridge improvement needs. The table also suggests that railroads with long-term line leases and with state funding may have a more difficult time obtaining financing than other small railroads.

Finally, in addition to the availability of financing, the terms available, and the types of barriers to financing that exist today, it is useful to examine criteria used by banks in evaluating the credit worthiness of small railroads. Table 5 shows the importance of various non-financial characteristics in identifying the credit worthiness of small railroads from the perspectives of banks surveyed.

Table 5. The Importance of Various Non-Financial Items in Determining the Credit Worthiness of Small Railroads Applying For Loans - From Surveyed Banks' Perspectives
Combined Ranking of Non-Financial Items Listed in the Survey
1. Traffic Projections
2. Arrangements with Class I Railroads
3. Commodity Concentration / Shipper Concentration
4. Future Capital Spending Requirements
5. Environmental Concerns
6. Labor Issues
7. Net Liquidation Value
8. Real Estate in Operating vs. Non-Operating Property
Other Factors Considered
Quality of Management
Quality of Financial Information

As the table shows, a variety of non-financial factors are considered by banks in determining the credit quality of small railroads. All these factors provide insight into the future profit potential of the line, the types of problems that could interrupt this profit stream, and the ability of the railroad to insulate itself from risks not associated with its direct operation (e.g. the risk of a downturn in a particular industry).

In addition to examining these non-financial factors, banks also examine a variety of financial ratios. Table 6 shows a ranking of the importance of various financial ratios in evaluating credit quality from the perspectives of the banks surveyed, and shows acceptable ranges for each of these financial ratios. As the table shows, banks also consider a variety of financial ratios in determining the credit quality of small railroads. Two financial ratios that were listed as either the most important or the second most important financial ratio to consider

Table 6. The Importance of Various Financial Ratios in Determining the Credit Worthiness of Small Railroads Applying For Loans — From Surveyed Banks' Perspectives	
Ranking of the Importance of Various Financial Ratios	Acceptable Ranges
1. Total Debt to EBITDA (earnings before interest, taxes, deprec., and ammortization)	Less than 4
2. Fixed Charge Coverage Ratio (earnings before interest, taxes, deprec., and ammort. divided by fixed charges such as interest and long-term leases)	Greater than 1.25
3. Debt / Equity Ratio	Less than 1.5 to 1 – Less than 4 to 1
4. EBITDA to Total Revenue	15 to 20 percent
5. Current Ratio	Greater than 1
Other Ratios Considered	
Operating Ratio	Less than 90 percent
Senior Debt to EBITDA	Less than 3
(EBITDA - Capital Expenditures)/ Interest	Greater than 1.1
Cash Flow Margin	

by five out of the six banks were: (1) Total Debt to EBITDA (earnings before interest, taxes, depreciation, and ammortization), and (2) Fixed Charge Coverage Ratio. These measure the ability of small railroad firms to service debt. A lower ratio for the first measure and a higher ratio for the second measure suggest that the small railroad has less difficulty in meeting its debt obligations and could take on additional debt more easily. Although other financial ratios are also important, discussions with banks suggest that good coverage type ratios are crucial to obtaining additional funding for small railroads.

This section of the report has shown that many of the factors that made it more difficult for small railroads to obtain financing in 1993 still exist today. Specifically, we found that: (1) there are few major banks with a specialization in small railroad financing, (2) there is a

need for better public information regarding small railroads (specifically, audited financial statement data), (3) there are short loan terms offered to small railroads for financing track and bridge improvements (5 to 8 years), and (4) there still is some unwillingness by banks to make loans for track and bridge rehabilitation because of an inability to liquidate these assets.

However, in contrast to the 1993 study, we found that all banks surveyed were interested in taking on more small railroad loans, whether the loans were to new railroads or to railroads with existing loans. Moreover, banks stated an extremely low default rate associated with small railroad loans, and an overall satisfaction with their experience in lending to small railroads. Finally, we found that although some banks require large minimum loan amounts, most of the banks surveyed did not require large minimums for loans. The next section of the report examines some of the public interest benefits provided by short-line railroads.

PUBLIC INTEREST BENEFITS OF SHORT-LINE RAILROADS

Short-line railroads offer several benefits to U.S. shippers, local communities, and states. For the most part, these benefits occur as a result of the short line's ability to maintain service on light-density rail branch lines that would otherwise be abandoned.

When a rail branch line is abandoned, there are potentially several negative impacts to shippers, the local community, and the state. These impacts result from the elimination of a vital portion of the transportation system, causing a significant shift to truck. Potential impacts include an increase in the costs of shipping commodities and a resulting loss in net income of shippers; decreases in local gross business volume, local employment, local property values, and economic development opportunities; and increases in highway maintenance costs and highway user costs.

Certainly, these types of impacts are not realized for all branch-line abandonments. In some cases, rail traffic levels are so low that a significant shift of traffic to truck does not occur. However, in cases where there is enough rail traffic to make continued line operation by short-line railroads profitable, the potential impacts from abandonment can be large.

By operating with more flexibility in terms of labor and equipment, short-line railroads often are able to operate previously unprofitable branch lines at a profit. This enables short-line railroads to ensure continued service, where it would otherwise be abandoned. In addition to benefits provided by short lines resulting from the avoidance of abandonment, these small railroads can, in many cases, provide improved service and lower rates. Additional public benefits result, as the improved service and rates shift traffic that would otherwise travel by truck to rail. The following paragraphs will review studies that highlight benefits conferred by short-line railroads. The studies include those that have quantified impacts of rail abandonment, as

well as those that have quantified the service, cost, and rate improvements resulting from short-line ownership of light-density rail lines.

Continued Service

Schwieterman and Crowley (1996) estimate that more than 9,000 communities have lost rail service since 1977, and more than 300 cities with populations of over 3,000 people have lost rail service since 1980. In many cases, rail abandonment can be the result of, rather than the cause of, economic decline in rural communities. In these cases, maintaining service on light-density rail lines is not desirable.

However, in many other cases, substantial traffic volumes still are available on light-density rail lines that Class I railroads wish to abandon. Faced with an array of investment opportunities, Class I railroads often see a greater return available in investing in high-density mainline routes.

Low-cost, flexible labor, and lower cost equipment often allow short lines to operate such lines profitably. Continued service provides many benefits to shippers and communities located on light-density rail lines, and allows Class I railroads to maintain the traffic for the high-density portions of the movements.

Several impacts of abandonment on shippers, communities, and government have been identified by previous research. The avoidance of such identified impacts can be considered a benefit of continued service. Identified impacts have included:

- increased transportation costs to shippers
- highway and road deterioration
- environmental and safety impacts

- reductions in rural personal income and gross business volume
- unemployment
- reductions in local property values
- reduced economic development opportunities

A brief explanation of each of these impacts is presented here, followed by a review of studies that have measured such impacts. All identified impacts result from a reduction in the number of transportation alternatives available to shippers following abandonment. Most shippers of low-valued, bulky products where rail has an inherent cost advantage are forced to use truck for a portion of their shipment after rail abandonment. For shippers of natural resource products like coal and grain, that typically are located at long distances from terminal markets and often are not in close proximity to water transportation, the loss of rail service can be particularly damaging. The following paragraphs discuss each of these impacts.

Shippers served by abandoned rail lines often realize increases in transportation costs after abandonment takes place. For landlocked shippers having few transport alternatives this increase may be large. Rail line abandonment increases distribution costs for landlocked shippers for two reasons. First, truck costs are not competitive with rail costs in long-distance markets. This is particularly important for natural resource based shipments, such as grain and coal, which typically travel long distances. While grain shippers often have the opportunity to truck their commodity a short distance to a rail loading facility, the extra loading and unloading costs associated with this type of movement represent a significant addition to costs above a straight rail movement. Such an alternative often is not available for coal and other shippers. The second reason is that once a rail line in a landlocked area is abandoned, trucks don't incur as much intermodal competition. Thus, transportation rates also may be increased by a reduction in

competitive factors.¹⁷ In transport competitive regions, the increased transportation cost is likely to be much smaller as the alternative form of transportation may be a nearby rail line or barge access.

Because rail abandonment often diverts a great amount of traffic from rail to truck, impacts on rural roads and highways can be significant. This impact is intensified by the fact that much of this traffic is likely to occur on highways that weren't designed for heavy use. A recent Federal Highway Administration (FHWA) study estimates that the marginal pavement cost per mile of travel for a combination truck is 21 times greater on a minor collector highway than it is on a rural interstate highway, and 13.5 times greater on a major collector than on a rural interstate.¹⁸ Moreover, another FHWA study suggests that single-unit and combination trucks pay user fees that are about 90 percent of the pavement damage costs that they impose on all highways.¹⁹ Thus, in the case where collector roads realize increased heavy traffic as a result of abandonment, incremental user fees may not cover the increased damage costs.

Furthermore, this increased highway and road damage resulting from incremental truck traffic may have a significant impact on highway and road user costs. Vehicle operating costs increase with road deterioration due to increased vehicle wear and tear, increased fuel consumption, and increased frequency of routine maintenance. In addition, opportunity costs increase with deterioration due to increased time spent traveling. Increased vehicle operating and opportunity costs also may result from rural highway capacity problems. In the event of an

¹⁷However, intramodal competition between trucks will substitute for the lack of intermodal competition to a certain extent.

¹⁸See Federal Highway Administration, *Comprehensive Truck Size and Weight Study*, Draft Report, June, 1997.

¹⁹See Federal Highway Administration, *Highway Cost Allocation Study*, 1997.

abandonment, a great deal of truck traffic often is added to rural highways having limited traffic capacity.²⁰

These impacts of increased pavement damage and increased congestion also may have safety and environmental impacts. Automobile travelers will face increased exposure to truck traffic, encounter a less stable ride, and spend more time with vehicles running in an idle state. Furthermore, a simple comparison of truck to rail safety, and truck to rail emissions for comparable volumes shipped shows an increased likelihood of accidents and a degradation of air quality associated with shifting rail traffic to truck.

The initial transportation cost increases incurred by the shipper can impact the entire community. Increases in transportation costs to the shipper result in reductions in local property values, personal income, and gross business volume. Because of the loss of rail service, affected shippers' profits are reduced, decreasing the value of the property they use to operate their businesses. Reductions in gross business volume and personal income can be explained through an example. If the affected shipper in a community is a grain elevator, the increase in transportation costs is likely to result in a decrease in prices that farmers receive for their commodities.²¹ This decrease will result in a multiplicative effect throughout the local economy as farmers decrease their purchases of other goods.

In addition, reductions in employment are the direct result of reductions in personal income and gross business volume. As firms start to feel the effects of reduced purchases throughout the local economy, they will cut jobs and salaries (in some cases).

²⁰Although congestion is not likely to be a problem on many rural roads, it may be in port areas, at inland terminals or subterminals, and on access roads to processing plants.

²¹Farmers are assumed to bear the burden of the transportation costs, since their price elasticity of supply for commodities is small, relative to grain elevators' price elasticity of demand for commodities. However, secondary impacts are likely to occur no matter who bears the burden of the increase.

Finally, economic development opportunities may be reduced for communities experiencing rail abandonment. Several industries rely heavily on rail transportation for inputs or outputs, due to the comparative advantage rail has in shipping these commodities. Such industries are unlikely to locate in a community not served by rail. Moreover, as the general level of economic activity declines in rural areas where rail lines are abandoned, attractiveness of the community to firms that use rail, as well as those that do not, significantly decreases.

Several studies have examined impacts of rail abandonment to communities previously having rail service. The review of literature presented here is not exhaustive, but gives a flavor of the different types of studies performed and the types of impacts discovered.

Allen (1975) examined impacts of rail abandonment to 10 communities throughout the U.S. In identifying the theoretical impacts of rail abandonment, the author cited three possible effects: (1) an immediate effect of increased transportation costs in the region and with other regions for outbound and inbound shipments, (2) a short-run effect of increased transportation costs causing a slowdown in economic activity in affected communities, and (3) a negative effect on long-run development resulting in a loss in local businesses and in the ability to attract new businesses that depend on rail service.

To estimate impacts of abandonment, the author attempted to compare the community before and after abandonment by interviewing chamber of commerce officials, business owners, and others. For the 10 cities, which tended to have a disproportionately higher number of inbound than outbound rail shipments, Allen found minimal short-run and long-run effects from abandonment. However, he did find several documented cases where businesses previously planning to locate in the communities decided against it because of the abandonment. The study provides useful insights into potential abandonment impacts, but is not able to quantify impacts

of abandonment because of the reliance on opinions of those in the community and an inability to separate abandonment impacts from any other factors that may have affected the well being of the community that were unrelated to abandonment.

Weinblatt, Matzzie, and Harman (1978) examined the impacts of rail abandonment for approximately 8,000 miles of lines in the Northeast that were not included in the Final System Plan for Conrail, and more than 36,000 miles of rail line throughout the country where abandonment applications were pending in 1976 or where the traffic data appeared to indicate that continued Class I operation was not economically feasible. The case study is interesting, since many of the lines that were analyzed by the authors currently are being operated by short-line railroads.

The authors obtained traffic data from the U.S. Rail Waybill Sample, and surveyed shippers regarding the use of alternative modes in the case of abandonment and regarding the anticipated increased costs of shipping in the event of rail abandonment. In attempting to quantify the impacts of abandonment, Weinblatt et. al found a large shift in traffic from rail to truck, an increase in transportation costs of between 9 and 18 percent, increased capital investment by shippers forced to move all or part of their facilities, and additional highway investment costs. In examining the effects of abandonment on fuel consumption, the authors found an increase in fuel consumption after abandonment on rail lines with moderate traffic, but a decrease in fuel consumption after abandonment on the most lightly used lines. While the study provides useful illustrations of abandonment impacts, it provides little detail on the commodities carried on the rail lines studied or the methodology used to obtain abandonment impacts.

Similarly, other 1970s studies, such as those by the University of South Dakota (1975) and Janski (1975), identify several important impacts that could result from abandonment, but may not provide reliable impact estimates due to a heavy reliance on opinions in measuring abandonment impacts. Impacts identified by these studies include increased transportation costs, reduced local business volume and personal income, reduced land values, and increased highway impacts.

In addition to these 1970s studies examining the impacts of railroad abandonment, there have been several studies since 1980. There are at least three reasons to focus more heavily on the post-1980 studies: (1) Prior to railroad deregulation in 1980, the abandonment process was costly to the applying railroad – thus, lines that were abandoned prior to 1980 were more likely to be low traffic lines, where the impacts of abandonment were minimal, (2) studies performed after 1980 tended to use more modern techniques for assessing the impacts of abandonment, making the results more believable, and (3) more recent estimates of abandonment impacts are more likely to be similar to impacts avoided from continued short-line operation of light-density lines.

Three reports illustrative of the types of impacts found in the post-1980 studies are those that examined a large number of rail lines in Kansas that were slated for potential abandonment in the late 1980s. The three studies that examined various potential impacts of abandoning these lines are highlighted in the following paragraphs.

One study by Klindworth and Batson (1991), estimated the impacts of potential railroad abandonment of 480 miles of rail line in Kansas for lines anticipated to be abandoned within three years of the study. In examining the abandonment areas, the authors found that most of the businesses losing rail service were grain elevators.

The authors found that the primary expected impacts of abandonment were: (1) an increase in transportation costs to farmers, and the resulting reduction in net farm income, (2) incremental highway maintenance costs as a result of increased truck traffic, (3) a reduction in property tax collections on property previously owned by the railroad, (4) decreased long-run viability of grain elevators on abandoned lines, and (5) reduced potential for future industrial development. By using a survey to determine the historical grain volumes of various elevators and the percentages of outbound grain traveling by rail, Klindworth and Batson estimated the amount of grain diverted to other elevators as a result of rail abandonment to be nearly 15 million bushels. They used this estimate along with an estimate of average farm distances from grain elevators prior to and after abandonment to estimate the additional farmer transportation costs of \$1.1 million. In addition, they estimated that the abandonments would increase highway maintenance costs by nearly \$1 million, and reduce property tax collections by \$182 thousand.

A second study by Eusebio and Rindom examined the highway impacts of abandonment of three of these same rail lines in south central Kansas. Although the study by Klindworth and Batson also addressed highway impacts, the study by Eusebio and Rindom provides a more detailed assessment of highway impacts. Eusebio and Rindom (1991) argued that there are two types of impacts that rail abandonment can have on the county, city, and state road systems in grain areas. With a rail abandonment: (1) farmers are willing to travel longer distances by farm truck to get a higher price for grain at elevators still served by rail, and (2) local elevators that previously shipped by rail to terminal elevators, ship by truck for at least part of the movement.

Using a network model to simulate traffic flows when transportation costs are minimized with the three lines in place and without the three lines in place, the authors found: (1) road damage costs from farm to elevator shipments increase by 43 percent as a result of a 49 percent

increase in the distance that farmers ship by truck on average (increase of five to seven miles) and (2) road damage costs from the local grain elevator to terminal grain elevators increase by 24 percent as a result of a 42 percent increase in grain moved by trucks to terminal elevators. The study shows that pavement damage costs from abandonment can be substantial, and that pavement damage costs are much higher when the abandonment results in truck traffic increases on local roads not designed to withstand heavy truck traffic.

Babcock, Russell, and Burns (1992) also examined potential impacts of abandonment on these three same rail lines. However, the study goes into greater detail regarding the economic development impacts resulting from abandonment of these lines. The authors listed potential impacts of abandonment of these rail lines, including increased transportation costs to some shippers, reduced economic development opportunities, increased road maintenance expenditures, displacement of rural residents, and reduced access to goods and services.

In examining trends in rail and motor carrier freight originating at locations served by the three branchlines, Babcock, et. al found a trend of declining rail traffic in the area, which explained the proposed sale of these lines to short-line operators. The authors used surveys of shippers to determine major destinations of shipments, and in comparing rail and truck rates for wheat and flour, found that an increase in the transportation rate for export wheat or flour would not occur with an abandonment unless the distance from branchline elevators to terminals or flour mills were greater than 100 miles, in general. Many shipments on these lines were found to travel less than 100 miles.²² However, the authors found that although many shippers would not

²²It should be noted that Kansas is an area with intense intermodal and intramodal competition, and may not be representative of other areas potentially served by short lines.

experience increased transportation costs, they would lose out on other advantages associated with shipping by rail, such as faster payment for grain and lower record keeping costs.

One of the unique elements of the study by Babcock, et. al is its detailed analysis of potential foreclosed economic development opportunities. The authors surveyed 450 Kansas manufacturing firms and examined nationwide freight transportation market shares to identify the types of firms that would not likely locate in areas without rail access. These firms are in the following industries: (1) food and kindred products, (2) lumber and wood products, (3) pulp and paper products, (4) chemicals, (5) stone, clay, glass and concrete products, (6) primary metal products, and (7) motor vehicle equipment.

Finally, the study identified an increase in road damage costs of an estimated \$1 million in the study area and potential out-migration. The study suggests that communities far from Kansas population centers are those most likely to be adversely impacted by rail abandonment.

Another study that examined a broad array of abandonment impacts was a 1995 USDA study. Bitzan, Honeyman, Tolliver, Casavant, and Prater (1995) developed a consistent, objective methodology to analyze impacts of abandonments on communities, and applied this methodology to three case studies of abandonment in areas with varying levels of transportation competition and varying rail traffic levels. The authors identified several important impacts of rail abandonment, including increased shipping costs for those served by the rail line, decreases in gross business volume and personal income, decreased property values, increased highway maintenance costs, increased highway user costs, and decreased economic development opportunities.

In applying their methodology to the three case studies, the authors found that the impacts of abandonment vary widely with different levels of transportation competition. Impacts are

much lower in areas with many transportation alternatives, as the incremental distances shipped by truck in such areas are small in comparison to the incremental truck distances shipped in areas with few transportation alternatives. The study also showed that short-line ownership of light-density rail lines can have an additional benefit beyond the avoidance of an abandonment. Short-line railroads often provide better service, providing additional secondary benefits as a result.

In addition to studies that estimate impacts of abandonment using theoretical and mathematical models, some studies attempt to measure impacts of abandonment by examining areas where abandonment has occurred before and after the abandonment. Such studies provide useful insights into the impacts of abandonment, but their reliance on before and after observation may not allow the impacts of abandonment to be separated from other factors influencing economic activity. Thus, one should be cautious of claims that the only impacts of abandonment were those actually observed. Two studies that use a before and after approach are highlighted next.

Feser and Cassidy (1996) reviewed the methods used by state transportation planners to quantify benefits of preserving rail service, and performed an ex post case study of the benefits of rail preservation for a line where upgrading began in 1986. In their review of the methods used by state rail planners to quantify the benefits of rail preservation, the authors argued that these rail planners focus too heavily on job creation resulting from rail preservation and not enough on other important benefits. The authors suggested that ex post investigations of job creation resulting from line preservation have shown that such impacts typically are overstated.²³

²³While the authors make an important point by showing that predicted job benefits generally have been larger than actual job benefits, this type of ex post comparison is not necessarily a good way to judge the accuracy of the ex ante prediction. Changes in the level of national economic activity (e.g. recession), changes in consumer preferences affecting particular industries, changes in local ordinances or property taxes, and many other factors can affect the number of jobs available in a community. These changes are not accounted for in the ex post comparisons used by Feser and Cassidy.

Moreover, they pointed to the obvious shortcomings associated with the most frequently used methodology to estimate job impacts of rail preservation - surveying potentially affected shippers regarding the impact that a line abandonment would have on their business creates incentives for such shippers to overstate job impacts. Feser and Cassidy also suggested that most state rail planners do not consider other important impacts of rail abandonment, such as an increase in highway damage and a reduction in safety resulting from rail traffic shifting to truck.

In performing an ex poste case study of the benefits of rail line preservation in North Carolina, Feser and Cassidy found that the employment benefits of line preservation were minimal, but that there were significant highway maintenance cost savings and safety benefits. Although they were not able to quantify the benefit associated with preserving the right-of-way for future transportation needs, they suggested that such preservation provides substantial benefits to the state.

Kuehn (1989) examined the extent to which grain shippers in northwest Iowa became captive as a result of rail abandonment, identified mechanisms used by such shippers in adjusting to abandonment, and highlighted benefits that the sale of rail lines to a regional railroad had for northwest Iowa shippers. The author found that shippers in this part of Iowa did not become captive as a result of rail abandonment, as such shippers had a number of transportation alternatives and often had informal relationships for selling grain to elevators that had trainload service available. In adjusting to abandonment, shippers took advantage of the heavy truck competition available, and low backhaul rates. They also developed greater cooperation with existing railroads, and developed relationships with affiliated and non-affiliated unit-train elevators to ship large volumes of grain for a premium above the price the large elevators offer to

farmers. In some cases, these elevators made such adjustments before abandonment, as a result of a necessity resulting from declining railroad service.

To examine the benefits of a sale of rail lines to a regional operator, Kuehn surveyed six elevators served by the Chicago, Central, and Pacific (CCP) Railroad in northwest Iowa - a line that previously was owned by the Illinois Central. He found that all elevators reported that service was at least as good as that prior to the sale to the CCP, and that rates were lower overall. Further, four of the six elevators reported that service was "much better" after the sale. Finally, the author found that railroad profitability also had improved as a result of the sale, as labor costs decreased substantially.

These benefits of short-line railroad operation beyond the benefits of preserving rail service also have been highlighted by other authors. The following paragraphs highlight three studies that have examined such benefits.

Tolliver (1989) examined the net benefits of potential short-line sales in North Dakota. The author estimated that short-line railroad operation of North Dakota branch lines would result in an average cost savings of 23 percent in comparison to Class I operation of the same lines. As a result, these railroads would be able to operate profitably on lines where Class I railroads were losing money. In addition to estimating the avoided impacts of abandonment in a similar fashion to the abandonment impact studies highlighted earlier, Tolliver shows benefits of short-line operation in comparison to continued Class I operation. As a result of service improvements and/or rate reductions, shippers often increase the proportion of their traffic shipped by rail, resulting in a gains in consumer and producer surplus on this new rail traffic, increased regional personal and business income, and reduced pavement costs resulting from diverted traffic. The study shows that the positive impacts of short-line railroad operation, in addition to those

resulting from service preservation, can be significant. It also provides a rigorous methodology for estimating the positive impacts of short-line sales.

Several studies suggest that short-line railroads may provide improved service in comparison to Class I railroads. It is argued that because short lines maintain a smaller system, they have an increased incentive and ability to gain knowledge of individual shipper needs. They also are able to tailor work rules to specific shippers more easily than Class I railroads, due to the flexibility of the work rules governing employees.

Two studies that explicitly examine the effect of short-line ownership on the quality of service provided are those by Dooley and Rodriguez (1988) and Babcock, Prater, Morrill, and Russell (1995). Both studies survey shippers regarding their perceptions of the service quality available with short-line railroads and how it has changed as a result of a shift in ownership from the Class I railroad to the short line.

Dooley and Rodriguez (1988) surveyed 68 grain elevators (51 single-car and 17 multiple-car elevators) located on short lines in Minnesota, North Dakota, and South Dakota to obtain their rankings of the importance of different service characteristics in modal choice, their perceptions regarding the change in service quality resulting from a transfer of operation of the rail line to a short line, and their modal preferences given these changes. The authors found that the grain elevators surveyed ranked rates as the most important factor in selecting a mode, followed by reliability, overall customer service (shipment tracing, billing, sales calls), transit time, and loss and damage.

In examining the shippers' perceptions regarding the change in service quality resulting from ownership change, the authors asked shippers to compare service factors between the new short line and the previous Class I ownership using a five-point Likert Scale, ranging between

much better and much worse. The authors found that, on average, the change in individual service items was not rated as large by shippers responding to the survey. On average, shippers found no major differences in delivery times and billing, while they rated the amount of free time before demurrage charges take place as worse under short-line ownership and the quality and frequency of sales calls as better under short-line ownership. However, in asking shippers to rate their preferences regarding overall service, the authors found that 52 percent of shippers preferred short-line service and 25 percent preferred Class I service, with the remaining shippers indifferent between the two or having no opinion. The authors found that the percentage of multiple-car shippers preferring short lines was even higher, at 65 percent. In examining the amount of grain shipped, 40 percent of all elevators reported an increase in the amount shipped after the transfer of ownership to short lines, and 59 percent of multiple-car shippers reported such an increase. However, not all of the increase was attributable to the change in ownership.

In making a comparison of the service provided by short line railroads to the service provided by trucks, shippers rated service as better by trucks overall. However, shippers responding to the survey stated a preference of rail over truck of 71 to 19 percent, with the remaining shippers indifferent between the two. For multiple-car shippers these figures were 94 percent preferring rail and 0 percent preferring truck, with remaining shippers indifferent between them.

The study suggests that there are some perceived improvements in service from short-line ownership in comparison to Class I ownership. Shippers reporting improved service from short-line ownership cited factors such as increased individual attention and better working relationships. While the study's findings may not be considered conclusive, they nonetheless provide support to the notion that short-line railroads may offer improved service to shippers.

Babcock, Prater, Morrill, and Russell (1995) surveyed 309 shippers located on 13 short-line railroads in Iowa and Kansas in an attempt to examine shipper perceptions regarding the quality of short-line service, the rates that shippers pay using short lines, the change in service quality and rates resulting from the rail line shifting ownership from a Class I railroad to a short line, and how service quality and price compare to motor carrier service quality and price. The authors used a five-category Likert scale to evaluate shipper perceptions of a variety of rate and service characteristics, with 1 representing very good and 5 representing very poor. Rate and service characteristics examined include:

- rates on inbound and outbound freight
- market access
- inbound freight service
- transit times for inbound and outbound freight
- dependability of transit times
- frequency of inbound and outbound service
- loss and damage
- shipment tracing capability
- billing procedures
- on-time car delivery
- quality of rail cars
- quality of rail track
- rail car supply during peak periods

The authors found that the 309 shippers rated all of these rate and service characteristics as better than fair on average.

In examining the perceived change in service quality resulting from a shift in ownership from the Class I to the short line, the authors used a similar five-category Likert scale, with 1 representing service that is much better under short-line operation and 5 representing service that is much worse. The authors found that on average, shippers found improvements in nearly all rate and service characteristics. Moreover, the authors also found that the improved service resulted in increased rail shipments by the affected shippers. 41 percent of the shippers reported an increased volume shipped by rail after the transfer to the short line, and only 15 percent reported a decrease in volume shipped by rail.

The same type of five-category Likert scale was constructed by the authors to compare perceived short-line service quality and rates to those for motor carriers. The authors found that short lines were rated better than motor carriers on rates, but worse on service characteristics of transit time, dependability of transit time, frequency of service, and market access. The authors also found that non-grain shippers (mostly manufacturers) tended to prefer truck, while grain shippers tended to prefer short lines. This is not surprising, since transit times are more important to manufacturers than grain shippers, as inventory costs tend to comprise a much larger portion of total logistics costs for manufacturers than they do for shippers of natural resource-based commodities.

The study by Babcock, et. al provides a more recent and comprehensive assessment of the perceived impacts on service from short-line ownership in comparison to Class I ownership. The findings provide further support for the idea that service improves from short-line ownership, and that some traffic may shift to rail from a switch in ownership of light-density lines to short lines.

Although several studies have examined benefits of short-line operation on a case-by-case basis, the nationwide importance of short lines to the U.S. transportation system and the rural

economy has not been well documented until recently. Bitzan and Benson (1999) estimate that nearly 14,000 customers were served by short-line and regional railroads in 1996. These customers shipped or received more than 9 million carloads comprised of many different products such as chemicals, lumber, farm products, processed food products, metallic ores, paper, and coal. Presumably without short-line railroads, these shippers and receivers would not have direct access to the U.S. rail transportation network. This is especially important for those shippers located in areas with few transportation options.

Further illustration of the important role played by short-line and regional railroads in the U.S. transportation system can be made by estimating the proportion of all U.S. rail carloadings where short-line and regional railroads have some form of participation, the proportion of carloadings originated by short-line and regional railroads, and the proportion terminated by short-line and regional railroads. Bitzan and Benson (1999) developed a methodology to make these estimates.²⁴ This section will describe the methodology used in the 1999 study, and update the estimates using more recent data.

In 1999, there were 555 railroads in operation in the U.S. (Figure 1). Only nine of these railroads were Class I railroads, while the remaining railroads were short lines. Of the short lines, 36 were regional railroads, 305 were local line-haul railroads, and 205 were switching and terminal railroads.²⁵

²⁴Bitzan and Benson. "The Importance of Short-Line and Regional Railroads to Rural and Agricultural America," Unpublished USDA Report, 1999.

²⁵Association of American Railroads, *Railroad Ten-Year Trends, 1990-1999*.

Railroad Industry Consist - 1999

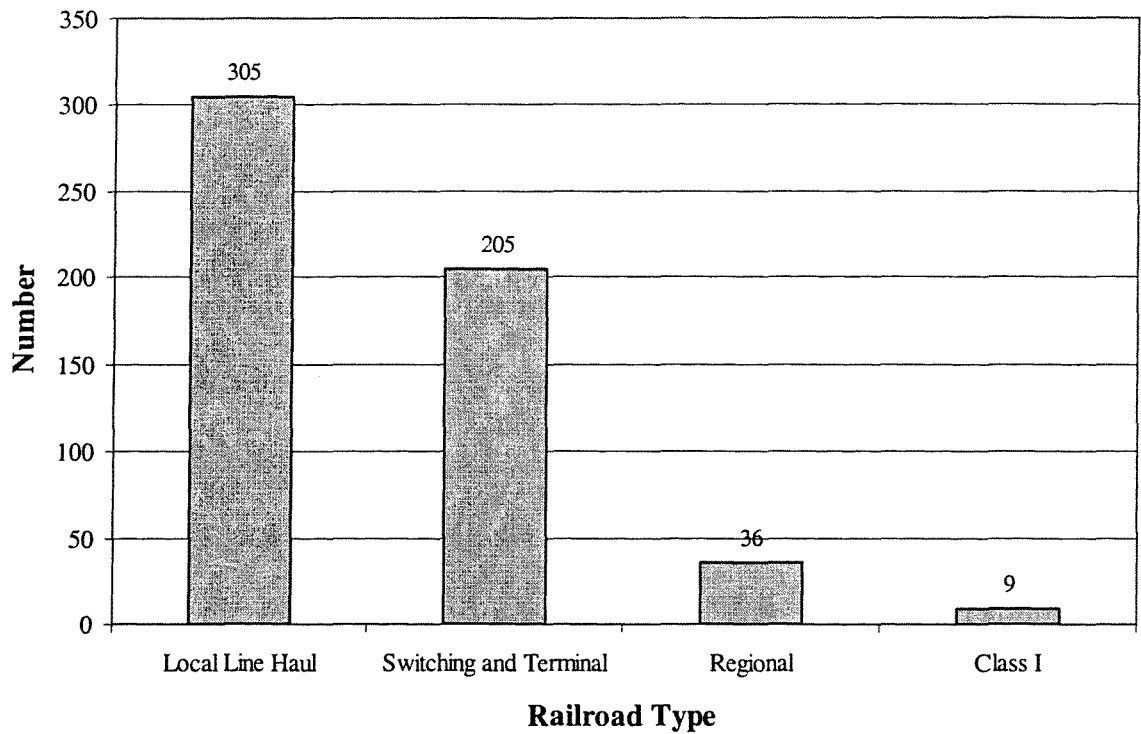


Figure 1 - Source: Association of American Railroads, *Railroad Ten-Year Trends 1990-1999*.

Short Lines account for more than 29 percent of all railroad route miles operated, nearly 12 percent of all railroad employees, and 9 percent of all railroad freight revenues in the U.S. (Figure 2). Moreover, they account for significant portions of mileage operated in many states (Figure 3).

Miles Operated, Employees, and Revenues of U.S. Railroads - 1999

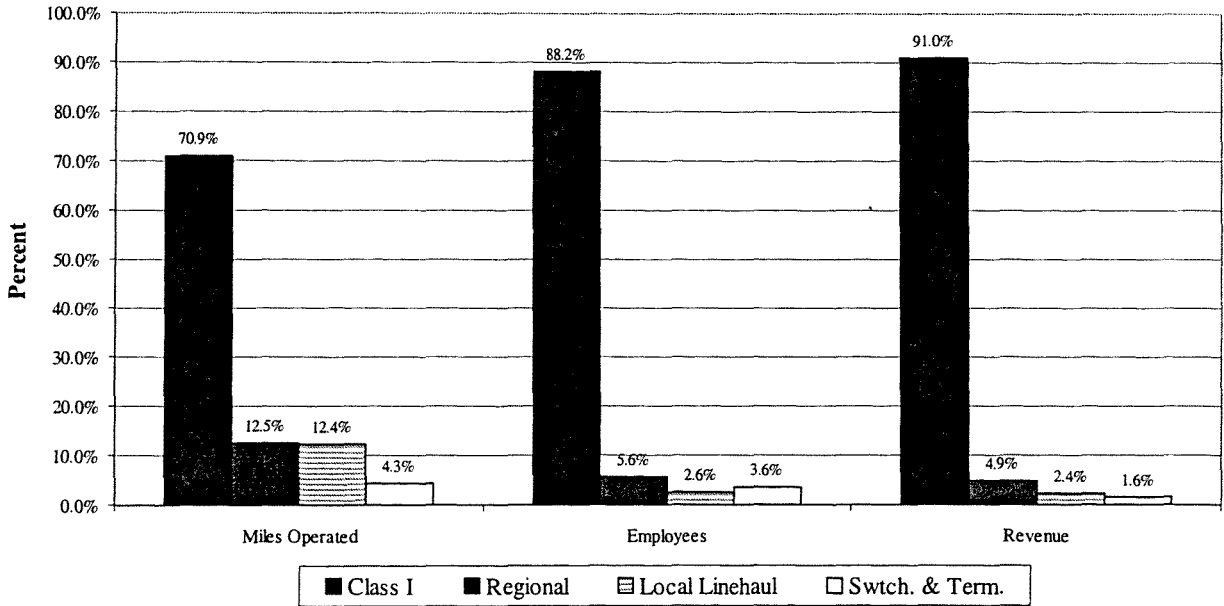


Figure 2 - Source: Association of American Railroads, *Railroad Ten-Year Trends 1990-1999*.

Percent of Rail Miles Operated by Short Lines - 1999

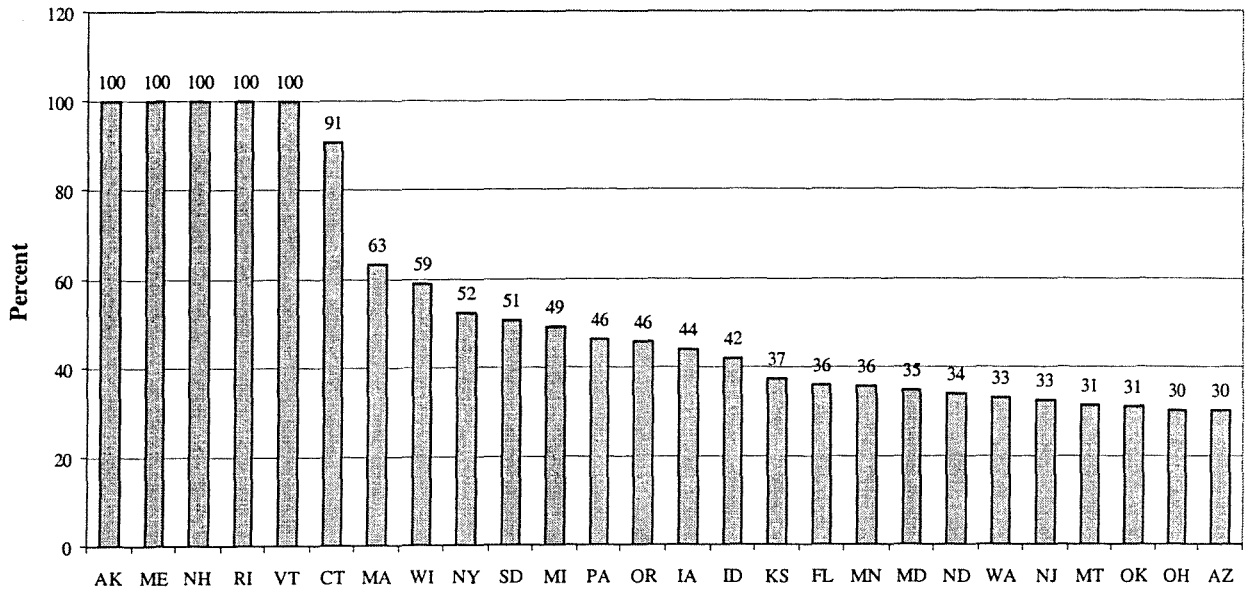


Figure 3 - Source: Association of American Railroads, *Railroad Ten-Year Trends, 1990-1999*.

While statistics showing the proportions of railroad miles, employees, and revenues are useful in assessing the importance of short-line railroads to the U.S. rail industry, they do not give an indication of the important role played by short lines in hauling railroad traffic. The following section provides estimates of short-line participation in U.S. railroad traffic, highlighting the types of commodities hauled by short lines, and the types of customers served by short lines.

Estimating Rail Car Loadings by Commodity

One of the most basic measures of short-line participation in hauling U.S. railroad traffic is the number of carloads handled. Participation can be measured based on the proportion of all U.S. rail carloads that are originated by short lines, the proportion that are terminated by short lines, or the proportion of U.S. carloads that were handled during some portion of the movement by short lines (i.e. they were (1) originated and forwarded; (2) received and forwarded; (3) received and terminated; or (4) originated and terminated). Each of these statistics provides a unique perspective on the degree of short-line participation in rail movements of various commodities. The proportion originated gives some indication of the dependence on short lines by those shipping products out by rail on short lines (e.g. grain producers), the proportion terminated provides an indication of the dependence on short lines of those receiving products by rail, and the proportion handled at some point by short lines gives some indication of the dependence of all shippers of a given commodity on short line railroads.

Although the number of carloads handled by short lines is a basic measure, and therefore, one that seemingly is easy to obtain, several problems are associated with measuring the number of carloads handled with public and private data sources. One of the most frequently used data

sources to estimate traffic volumes and characteristics is the Carload Waybill Sample (CWS). The Carload Waybill Sample is a source of data on railroad freight movement statistics. All railroads that terminate at least 4,500 carloads of freight per year or terminate at least 5 percent of all rail traffic terminated in any state are required to sample their movements for the CWS. The sample provides information on the commodity carried, the number of cars in the shipment, the revenues charged on the shipment, the railroads involved in the shipment, origins and destinations of the shipment, and other various data. Moreover, the sample is performed in such a manner that reliable estimates of traffic at the industry level can be obtained.

Ideally, the CWS could be used to obtain estimates of short-line and regional railroad participation in carloads, ton-miles, and movements of various types. However, the CWS greatly understates short-line and regional participation for at least two reasons: 1) affiliated Class I railroads often perform billing functions and the short-line movement shows up as a Class I movement on the waybill²⁶, and 2) the CWS only is collected from railroads terminating at least 4,500 carloads per year, leaving most short lines out of the sample (less than one-half of the non-Class I railroads carry more than 4,500 carloads per year, and a much smaller portion terminates 4,500 carloads per year). In addition, because the CWS samples movements from railroads that are terminating shipments, estimates of carloads originated by railroad are not necessarily accurate. For example, a short-line railroad that originates one out of every 200 shipments terminated by a reporting railroad may represent one out of every 100 in the sample, because

²⁶The 1993 user guide for the CWS states: "Some railroads are both reported for by other railroads and completely hidden from waybill routes (i.e., they are shown neither as reporting railroads nor as terminating carriers). Examples include the Apache Railroad (reported for by ATSF) and the Somerset Railroad (reported for by Conrail)." See *User Guide for the 1993 ICC Waybill Sample*, Association of American Railroads, Economic & Finance Division, 1994.

there is no sampling procedure to assure that originating railroads are represented accurately. Because of these problems, the CWS is not used as a primary data source in the rest of this study.

To estimate the proportion of rail carloads of various commodities that short-line railroads handled at some point between their origin and destination, two primary sources of data are used. These data sources include the Association of American Railroad's (AAR's) Profiles of U.S. Railroads database, and the American Short Line and Regional Railroad Association's Annual Data Profile. As described above, the Carload Waybill Sample, was considered, but eventually eliminated as a primary data source due to major deficiencies.

When used alone, each of the two primary data sources have potential deficiencies for making an assessment of short-line participation in rail carloadings. However, when used in conjunction with one another, the data sources complement each other to provide a reasonable assessment of short-line carloadings. The following paragraphs describe each data source, the data items used in each to make an assessment of rail carloads, the potential deficiencies in using each as a stand-alone source for carloads, and the methods used to combine data sources to provide improved estimates of carloadings by short-line railroads.

The first data source used is the American Short Line and Regional Railroad Association's (ASLRRA's) Annual Data Profile (ADP). The ADP is an annual data compilation of financial and operating data for the short-line and regional railroad industry (1993-1996, 1998-1999). Data are collected from a sample of local, regional, and switching & terminal (S&T) railroads through a detailed survey. Responding railroads report the number of carloads originated and terminated, originated and forwarded, received and forwarded, and received and terminated, by commodity. Because the railroads are asked to report actual carloads of each type

rather than percentages, it is believed that data on carloadings of various commodities are more accurate than similar data from other sources.

However, because the ADP only captures a sample of all the local, regional, and S&T railroads in the U.S., it cannot be used as a sole source for estimating the number of commodity carloadings by short-line and regional railroads. Figure 4 shows the estimated portion of the industry captured by railroads responding to the survey in 1993-1999. As the figure shows, the ADP only captures about one-half of the industry totals of carloads in each of these years.

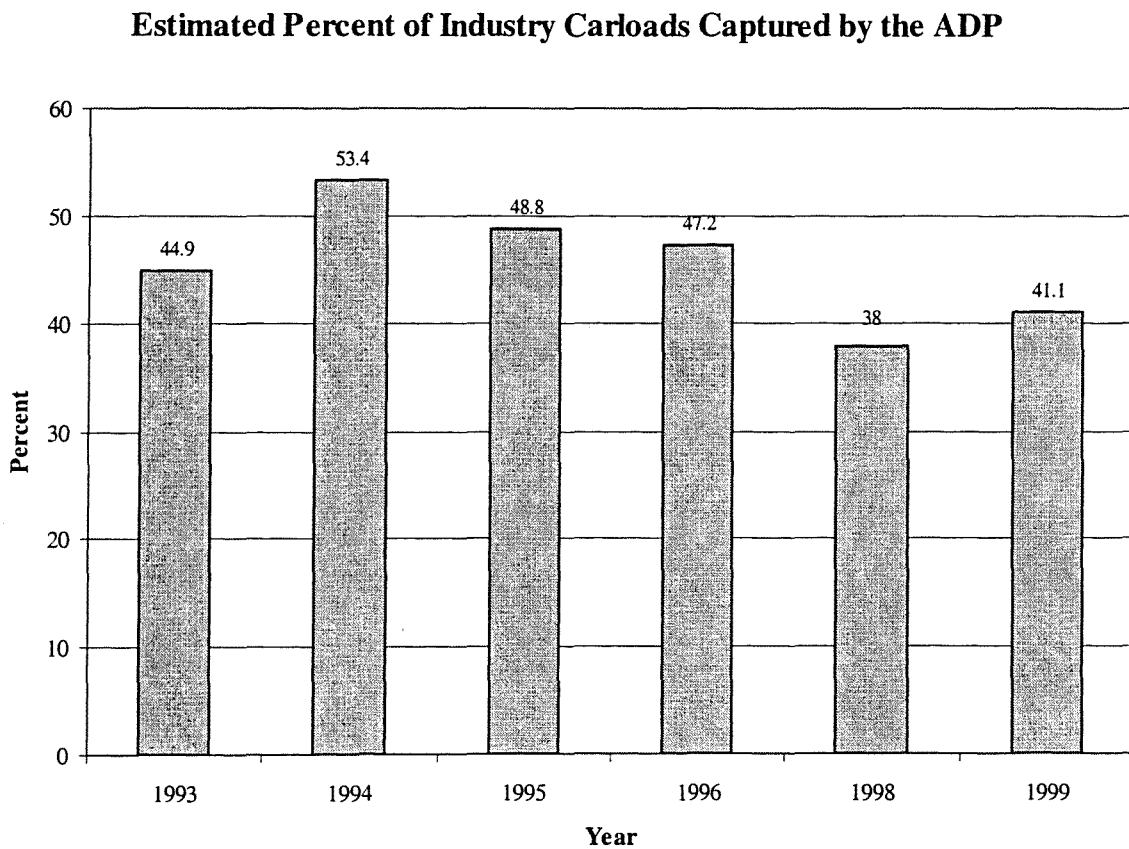


Figure 4 - Source: ASLRRA Annual Data Profile and AAR Profiles of U.S. Railroads, Various Years

One complementary data source to the ADP is the AAR's Profiles of U.S. Railroads database. The AAR's Profiles of U.S. Railroads (Profiles) database is a yearly compilation of carloads, miles of road, states served, top three commodities of carloads hauled and percentages of each, and various other data items for every railroad in the U.S. The main advantage that Profiles has over the ADP is that it collects data from the entire population of local, regional, and S&T railroads, rather than a sampling.

However, a disadvantage of Profiles, when compared to the ADP, is a decrease in the number of data items collected, and a decrease in the precision of various data items. For example, while the ADP collects data on the number of carloads originated and terminated, originated and forwarded, received and forwarded, and received and terminated for each commodity, the Profiles database surveys railroads on the number of carloads hauled, the top three commodities hauled, estimated percentages of traffic accounted by each of the top three commodities, and estimated percentages of carloads originated and terminated, originated and forwarded, received and forwarded, and received and terminated. It is likely that a listing of actual carloads in various traffic categories leads to a more precise estimate than a listing of overall carloads, with various estimated percentages attached to different types of traffic.

Data from these sources can be combined in various ways to provide improved estimates of short-line and regional railroad participation in shipping various commodities. However, even the combination of the two sources may understate participation of short-line and regional railroads in shipping various commodities. This is the case because some carloadings of a specific commodity may be made by railroads that 1) do not respond to the ADP survey, 2) do not report their top three commodities or percentages to the AAR (in 1999, 51 out of 546 non-Class I railroads did not report top three commodities and/or percentages), or 3) do not haul the

particular commodity as one of their top three (in 1999, only 68 percent of non-Class I railroads had at least 75 percent of their carloadings in the top three commodities as reported in Profiles). Because of the potential understatement, this study adds an estimate of unknown commodity carloads to estimates of carloads by commodity. Thus, the traffic reported by commodity in this study shows a conservative estimate of short-line participation in railroad movements.

Figure 5 shows the estimated carloads originated by short-line and regional railroads using the CWS, the ADP, and Profiles in 1995. As the figure shows, the ADP shows 54 percent more originating carloads than the CWS. Moreover, the originating carloads in Profiles are more than 50 percent higher than the amount shown in the ADP. As mentioned previously, the small figure for the CWS reflects a lack of small railroad sampling by that source, while the small figure for the ADP in comparison to profiles reflects the fact that ADP is a sample and Profiles is the population. Because the CWS may not accurately represent the traffic of included short lines, it is excluded from consideration. The other two data sources are retained, however, as they have complementary features that make their combined use desirable.

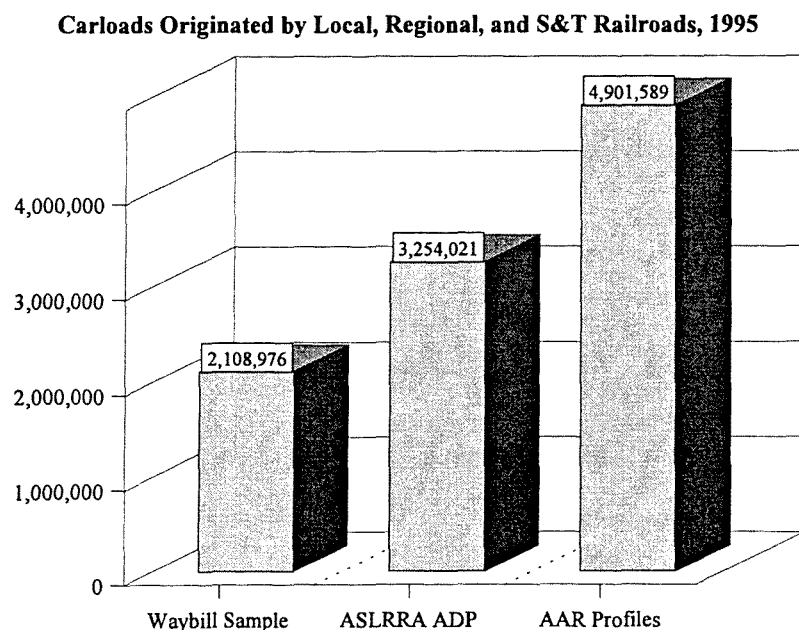


Figure 5

Methodology for Estimating Carloads

In this study, a multi-step approach was used to estimate the carloadings of each commodity hauled by short lines. The multi-step approach is described in the following paragraphs.²⁷

First, estimates of Profiles and ADP carloadings of a particular commodity were compared for railroads that responded to both surveys. Most of these estimates were close to one another, although there were some cases where inaccurate reporting affected one or the other database.

In cases where large discrepancies existed between the two data bases, previous years of carload data were examined from both sources, original survey forms from the ADP were examined to check for data entry errors or unentered notes associated with data, and/or railroad officials were contacted to explain discrepancies. These inquiries provided information that allowed one of the estimates to be eliminated in these cases of large discrepancies.²⁸ In the cases where either the ADP or the Profiles estimate was found to be in error, its value was eliminated by setting the carloadings of that commodity equal to missing for the estimate that was in error.

Once the inaccurate estimates were eliminated, a comparison was made between the sum of the commodity carloadings from each data source for those railroads that did not have missing

²⁷The approach uses a combination of Profiles and ADP data. As highlighted previously, neither one of these data sources alone will give an accurate estimate of carloadings by commodity - Profiles will miss many commodity carloadings because it only shows percentages of the top three commodities, while the ADP will miss many carloadings because there are a number of railroads that do not respond to the survey every year.

²⁸Several reasons for the discrepancies were found. These included: (1) double counting of carloads in the ADP survey, (2) the exclusion of some miscellaneous mixed shipments from the ADP, (3) reporting only interchange cars to Profiles and not local cars, (4) the inclusion of empty or storage cars in the traffic figures reported to the ADP or Profiles, and other various reasons.

observations for the commodity under either data source.²⁹ The sums of the commodity carloadings under each data source (where railroads respond to both surveys and did not report an error to either survey) form the base for two possible estimates - that is, an ADP-based estimate that uses the sum of the ADP carloadings for these railroads, and a Profiles based estimate that uses the sum of the Profiles carloadings for these railroads.

Added to each estimate are the ADP carloadings where the Profiles carloadings are missing, and the Profiles carloadings where the ADP carloadings are missing. The sum of the ADP base, the ADP carloadings where the Profiles carloadings are missing, and the Profiles carloadings where the ADP carloadings are missing gives the initial ADP-based estimate of carloadings where short lines participated in some way.³⁰ That is, they originated the shipment and forwarded it to another railroad, or they received the shipment and forwarded it, or they received the shipment and terminated it, or they originated and terminated the shipment. However, this initial estimate overstates short-line participation since a short line could have participated in more than one segment of the movement.

Thus, the next step in formulating an ADP or a Profiles-based estimate was to reduce the initial estimate to eliminate double counting. The estimated double counting for each type of commodity was obtained from a waybill estimation. The waybill estimation of double counting used the following procedure (this was done separately for each commodity): (1) eliminate all observations where short lines did not haul any portion of the movement, (2) for the remaining observations, determine the number of legs in the shipment in which short lines participated (e.g.

²⁹In 1999, the difference between the sums of ADP and profiles carloads for common railroads was less than one percent for all commodities (after inaccurate estimates were eliminated).

³⁰Because there is little difference between the ADP-based estimate and the Profiles-based estimate, only the ADP-based estimate is reported.

if a short line originated the shipment, forwarded it to a Class I, and then the Class I forwarded it to a short line to be terminated, then short lines participated in two legs of the shipment), (3) add up the total carloads hauled where short lines had some form of participation, (4) determine the total number of carloads that would be reported by short lines if they were reporting separately – this is the number of carloads for movements where short lines participated in any leg times the number of legs where short lines participated, and (5) determine the percentage difference between the number of carloads where short lines had some form of participation and the number of carloads that would be reported if they were reporting separately. This percentage was used to adjust reported carloadings by short lines in an attempt to eliminate double counting.³¹

The adjustment for double counting was the final step in estimating the number of carloadings where short lines had some form of participation (i.e. originated and terminated the move, originated and forwarded it, received and forwarded it, or received and terminated the move). However, to estimate the portion of total industry carloadings where some form of short-line participation took place, it also was necessary to estimate the total number of industry carloadings originated. The estimate of the number of short-line carloadings originated used the same process as the estimate of total short-line carloadings hauled, except the adjustment for double counting was unnecessary.³² This estimate of short-line carloadings originated was added

³¹This procedure used the 1995 Carload Waybill Sample. This data source was made available through USDA for the 1999 study. It is assumed that the portion of short-line shipments where multiple short lines participated in the shipments stayed the same over the 1993-1999 period.

³²Estimates of carloads originated by commodity from the Profiles database use the same originated percentages for all commodities for a given railroad. This assumption is necessary because separate originated percentages by commodity are not provided in the Profiles database .

to the Class I estimate of carloadings originated by commodity provided by the Freight Commodity Statistics.³³ This provided the total number of industry carloadings.

Estimates of Short Line Participation, Origination, and Termination

One important measure in assessing the role played by short lines in the rail industry is carload participation. Carload participation shows the proportion of carloads where short lines participate in some portion of the movement. Figure 6 shows the percent of all U.S. carloadings where short line railroads had some form of participation between 1993 and 1999. As the figure shows, short lines originated and forwarded, originated and terminated, received and terminated, or bridged between 30 and 33 percent of all U.S. carloads for these years. That is, 1/3 of all U.S. railroad carload movements rely on short lines for completing some portion of the move between their origin and destination. The number of carloads that were handled by short lines at some

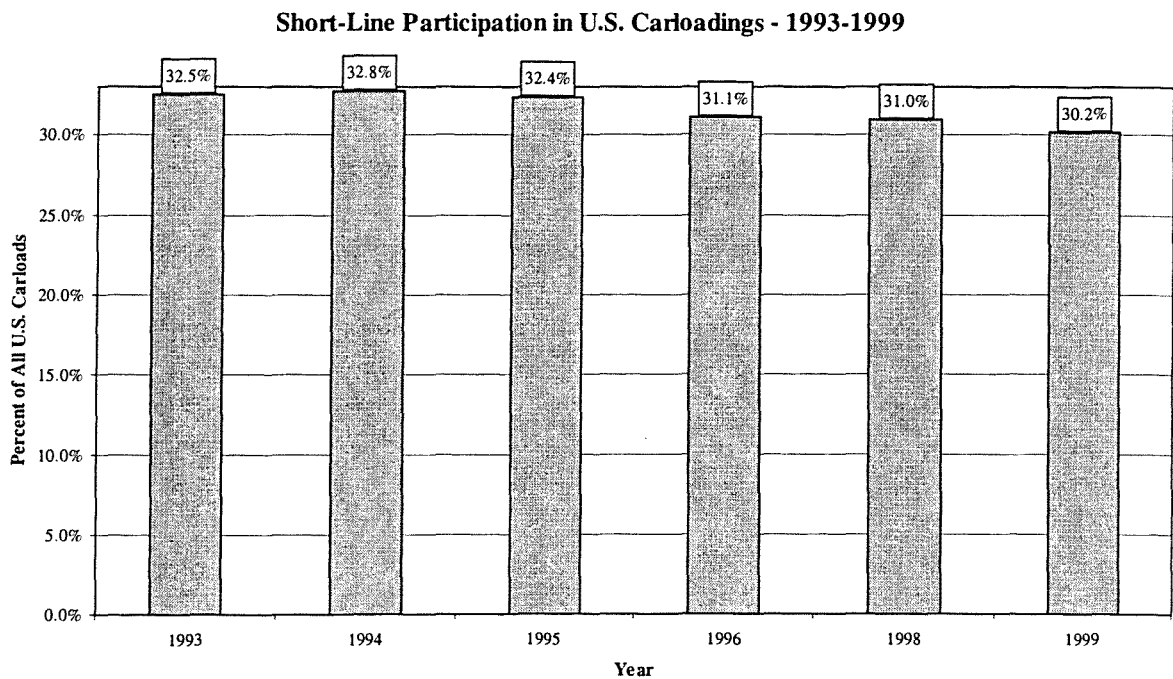


Figure 6 - Short-line participation is defined as a move where the short line hauls the commodity at some point during its movement (originate, terminate, or bridge).

³³ Association of American Railroads. *Railroad Facts*, various years.

point during the shipment ranged from a low of 9.0 million in 1993 to a high of 9.8 million in 1995 and 1999.

Figure 7 shows short-line participation by commodity group in 1999, classified at the two-digit STCC code level. As the figure shows, several commodities relied heavily on short lines for completing a portion of their movement from origin to destination in 1999. For example, more than 870,000 carloads of metallic ores (over 75 percent of all U.S. rail carloadings of metallic ores) relied on short lines for making some portion of the movement. Other commodities relying heavily on short-lines for a portion of their movement included primary metal products, paper, lumber, petroleum, and farm products, with at least 40 percent of each commodity's carloads using short lines for some portion of the movement.

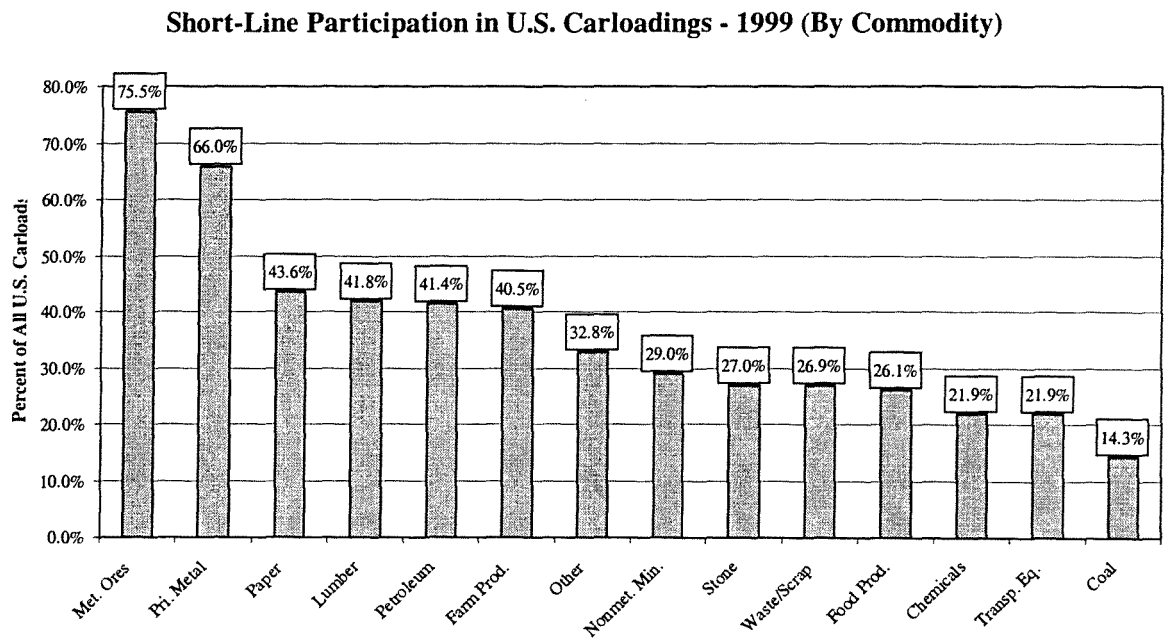


Figure 7 - Short-line participation is defined as a move where the short line hauls the commodity at some point during its movement (originate, terminate, or bridge).
 Note: The other category may capture some carloadings that should be listed in other categories. Other is defined as short-line carloadings where the commodity is unknown.

Another important measure of the role that short lines play in rural and agricultural America is the portion of all carloadings that are originated by such railroads. Many rural and agricultural areas rely on short lines for access to the U.S. rail system. Short lines provide a means for rural shippers, located on light-density lines, to haul their product to long-distance markets using a low-cost form of transportation.³⁴ Figure 8 shows the percentage of all U.S. carloadings that were originated by short lines from 1993 to 1999. As the figure shows, between 16 and 19 percent of all U.S. rail carloadings were originated by short lines in these years. This amounts to approximately five million carloads originated by short lines per year.

Short-Line Origination of U.S. Carloadings - 1993-1999

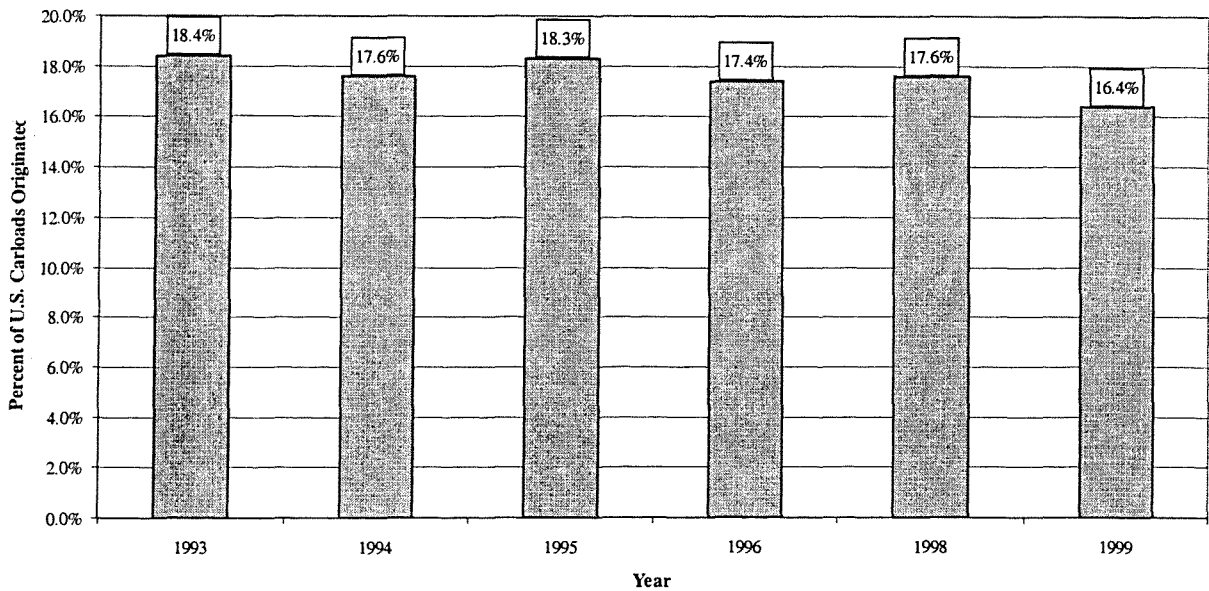


Figure 8

³⁴For many low-valued, bulky commodities that travel long distances to markets, rail has an inherent cost advantage over trucking.

Figure 9 shows the percent of U.S. rail carloadings of all commodities hauled by short lines in 1999. As the figure shows, eight out of the 13 two-digit STCC code commodities relied on short lines for at least 21 percent of their originations. Moreover, seven commodities relied on short lines for at least one-fourth of their carload originations.

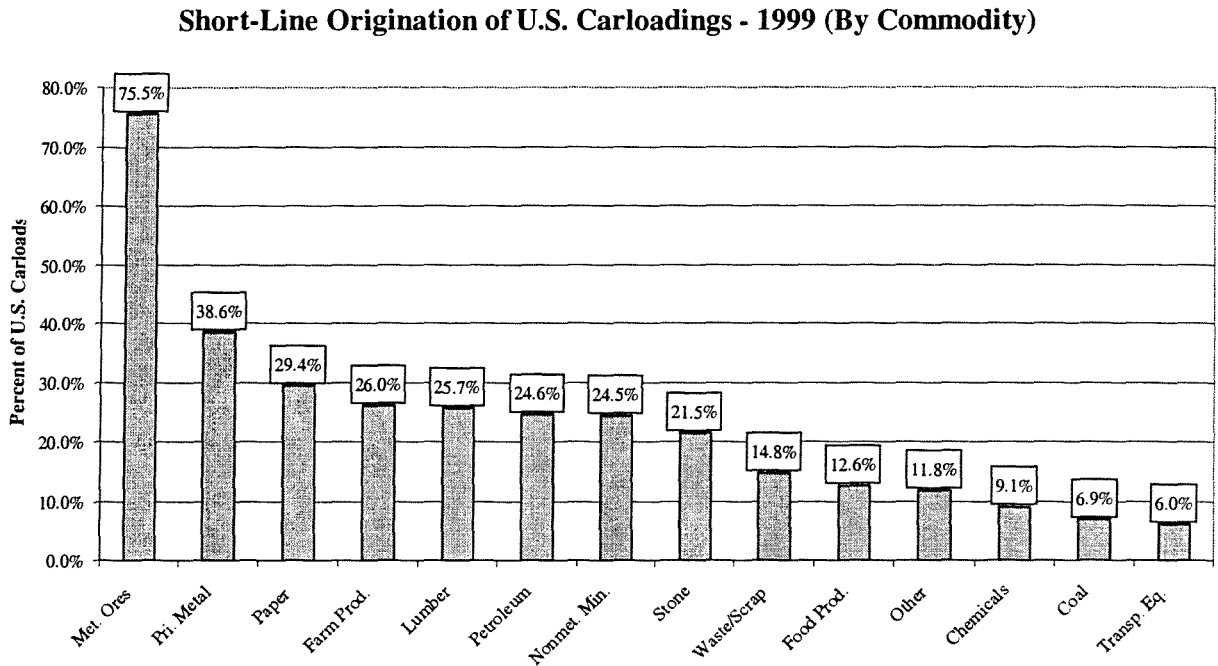


Figure 9 - Note: The other category may capture some carloadings that should be listed in the other categories. Other is defined as short-line carloadings where the commodity is unknown.

In addition to participation and origination statistics regarding short-line carloadings, termination statistics also are important. Just as many rural and agricultural shippers rely on short lines for access to the U.S. rail system, many processors located on light-density lines rely on short lines for access to the rail system for receiving their raw materials. Moreover, farmers rely on short lines to deliver chemicals, and some rural electric utilities rely on short lines to deliver coal. Figure 10 shows the percentage of all U.S. carloadings terminated on short-line

railroads between 1993 and 1999. As the figure shows, nearly one-fifth of all U.S. rail carloadings were terminated by short lines during these years. This was approximately five million carloads per year.

Short-Line Termination of U.S. Carloadings - 1993-1999

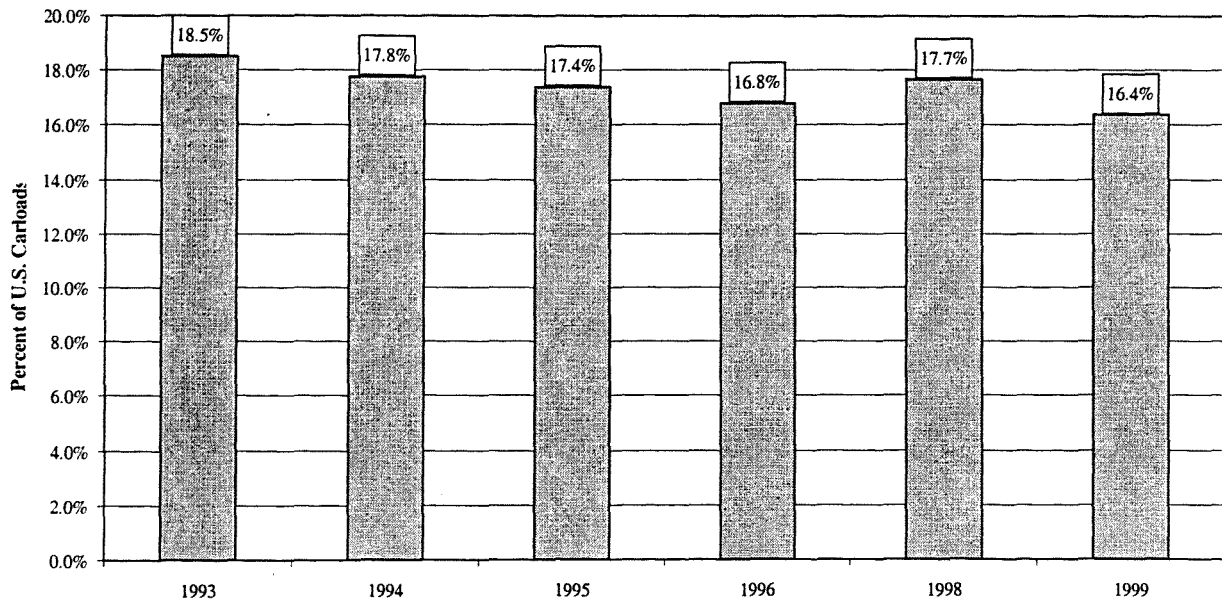


Figure 10

Figure 11 shows the percentage of U.S. rail carloadings terminated by short lines for each commodity in 1999. As the figure shows, 8 out of the 13 commodities relied on short lines for at least 19 percent of their carloads terminated. Moreover, although short lines play a slightly smaller role in terminations than in originations overall, they play a more important role for some commodities. Short lines terminate a larger percentage of coal, chemicals, waste/scrap materials, and petroleum products than they originate.

Short-Line Termination of U.S. Carloadings - 1999 (By Commodity)

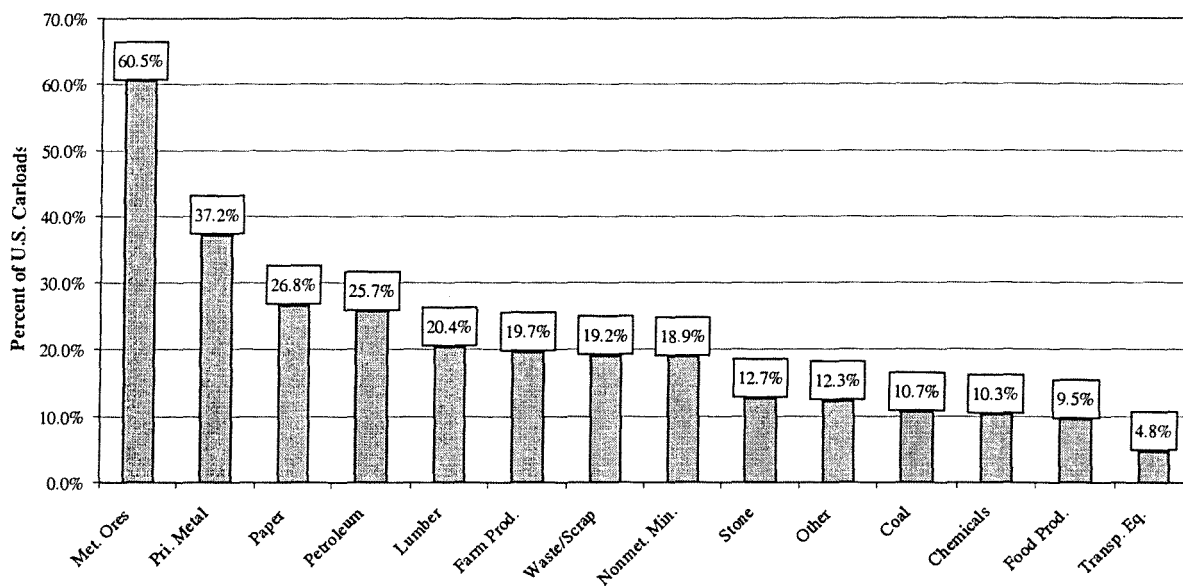


Figure 11 - Note: The other category may capture some carloadings that should be listed in the other categories. Other is defined as short-line carloadings where the commodity is unknown.

Revenue Ton-Miles

Another measure of the role played by short lines in the U.S. rail system is the proportion of revenue ton-miles accounted for by such railroads. Revenue ton-miles are defined as the number of commodity tons carried multiplied by the length of haul.

To estimate the revenue ton-miles of each commodity carried by short lines, the number of carloadings of each commodity are multiplied by an average load factor for that commodity, and then multiplied by the average length of haul for the railroad.^{35 36} The proportion of ton-

³⁵ Average load factors at the two-digit commodity level are obtained from *Railroad Ten-Year Trends*, by dividing Class I tonnage by Class I carloadings by commodity.

³⁶ The ton-mile estimates for short lines could be misleading if there are systematic differences in length of haul between large and small shipments. For example, if the length of haul is greater for large shipments than for small shipments, multiplying all tonnages carried by the simple average length of haul will understate the total ton-miles carried by short lines. However, in the absence of more detailed data, these are reasonable estimates.

miles carried by short lines is then estimated by dividing the short-line ton-miles by the total of short-line and Class I ton-miles for each commodity. Class I ton-miles are estimated by dividing revenue by revenue per ton-mile for each commodity.³⁷

Figure 12 shows the percentage of total revenue ton-miles accounted for by short lines between 1993 and 1999.³⁸ As the figure shows, short lines accounted for a much smaller portion of U.S. ton-miles in 1993-1999 than carloadings. In fact, short lines only accounted for between 4 and 6 percent of ton-miles in these years. This is not surprising, as the length of haul of a typical short-line movement is much less than that of a typical Class I movement. Moreover, in

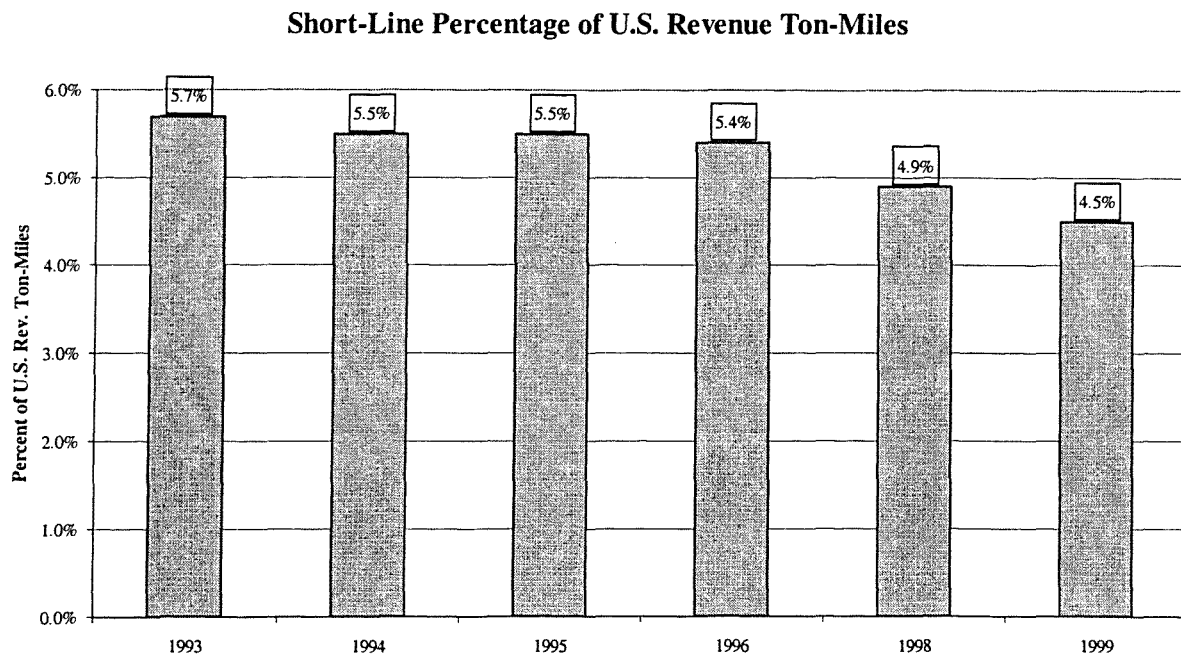


Figure 12

³⁷From AAR, *Railroad Ten Year Trends: 1990-1999*.

³⁸Time series estimates of the percentage of ton-miles carried by short lines for every commodity are presented in Appendix C.

terms of assessing the importance of short lines to rural and agricultural America, revenue ton-miles should not carry as much weight. For rural and agricultural shippers, short lines play the important role of providing access to the U.S. rail system. In many cases, such shippers would be required to truck their products to a transloading facility at much higher costs, in the absence of short-line rail service. The length that short lines carry shipments is less important than the degree of access they provide.

Figure 13 shows the percent of ton-miles carried by short lines for each commodity in 1999. As the figure shows, short lines accounted for large portions of ton-miles for some commodities such as metallic ores and nonmetallic minerals.

**Short-Line Percentage of U.S. Ton Miles - 1999
(By Commodity)**

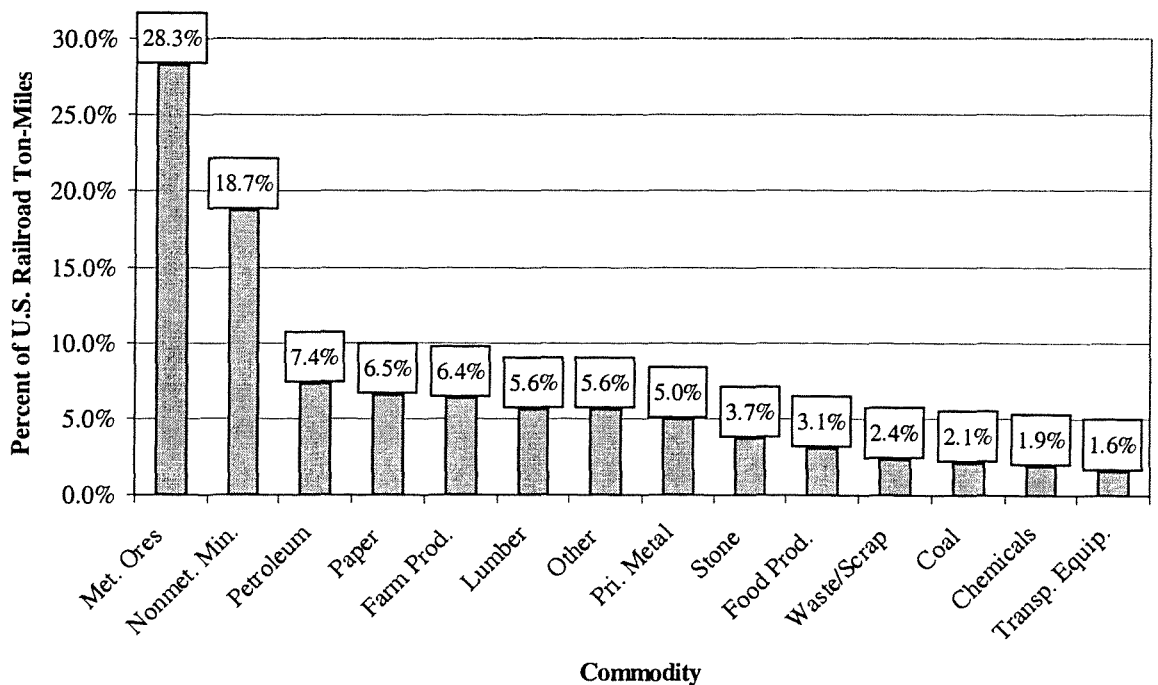


Figure 13 - Note: The other category may capture some carloadings in other listed categories. Other is defined as the short-line carloadings where the commodity is unknown.

Customers

Another useful measure of the importance of short lines to rural and agricultural America is the number of customers that they directly serve. While short-lines also have an impact on other shippers that are not directly served by short lines: (1) through their participation in other segments of the shipment, and (2) through their impact on intramodal and intermodal competition, the number of shippers directly served by short lines provides a measure of the increased rail system access provided to shippers by short lines.

To estimate the number of shippers of various commodities directly served by short-lines, the ADP and Profiles databases were used. In addition to the carload, miles of road, and length of haul data provided by the ADP and Profiles databases, the ADP collects information on the number of shippers of different commodities. However, because data on the number of shippers are not provided by Profiles, the numbers of shippers for all railroads not responding to the ADP had to be estimated. Statistical models were estimated for customers in each commodity class, and parameter estimates were used in conjunction with Profiles data to estimate the customers of each commodity class. Specifically, the following model was estimated for customers in each commodity class:

$$\begin{aligned} \text{Customers}_i &= \beta_0 + \beta_1 \text{Carloads}_i + \beta_2 \text{Miles Oper.} + \beta_3 (\text{Carloads}_i)^2 \\ &+ \beta_4 (\text{Miles Oper.})^2 + \text{Regional Dummy} + \text{S\&T Dummy} \\ \text{where: } i &= \text{commodity} \end{aligned}$$

Figure 14 shows the estimated number of customers served by short lines in 1999 for each type of commodity.³⁹ As the figure shows, there were more than 2,000 customers in each of the commodity classes of chemicals and farm products served by short lines. There also were more than 1,700 lumber products customers, more than 1,000 food products customers,

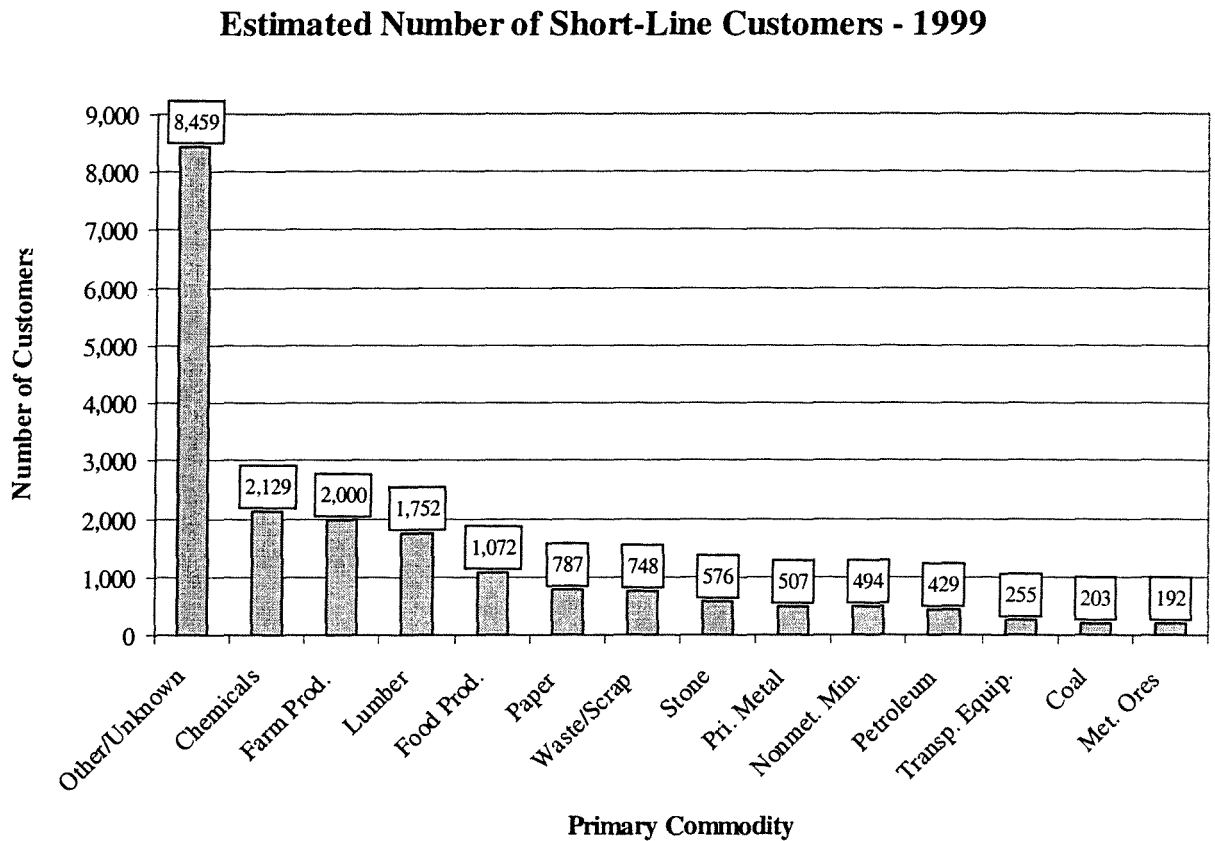


Figure 14 - Note: The other/unknown category may capture some carloadings in the other listed categories. Other/unknown is defined as the customers served by short-lines whose primary commodity is not known.

³⁹Because some commodity carloadings are unknown, the number of customers in each commodity class is understated.

and hundreds of customers in each of the other commodity classes. Total customers served by short lines in 1999 are estimated at just under 14,000.⁴⁰

RELATIONSHIP OF LIGHT-DENSITY RAILROAD SERVICES TO STATUTORY RESPONSIBILITIES OF THE SECRETARY OF TRANSPORTATION

In addition to the important role played by short lines in providing access to the nation's rail transportation system, they also enhance the energy efficiency, safety, and environmental friendliness of the nation's transportation system. This section of the report provides some evidence regarding the relative safety and energy efficiency of short lines and railroads in general, in comparison to trucking.

One of the potential benefits provided by short-line railroads is a reduction in traffic fatalities due to carrying heavy freight that would otherwise be carried by truck from rural areas. Although there are no recent studies that make a comparison between short-line railroad safety and truck safety, we can make use of two population databases that compile the number of fatalities experienced in railroad operations and in trucking operations. Highway fatalities involving trucks are obtained from the Fatal Accident Reporting System (FARS), which provides detailed statistics on all U.S. highway fatalities by year.⁴¹ Rail fatalities on right-of-ways or at

⁴⁰Because some customers haul multiple products, the total number of customers is less than the sum of customers in each commodity class.

⁴¹The FARS is designed and developed by the National Center for Statistics and Analysis, National Highway Traffic Safety Administration, U.S. Department of Transportation. Highway fatalities involving trucks are all fatalities involving single-unit straight trucks, combination trucks, or unknown trucks.

grade crossings are obtained from the Railroad Accident/Incident Reporting System, which provides detailed railroad accident data by year.⁴²

To use these data to gain insight into the safety impacts that maintaining service on short-line railroads has, however, fatalities must be normalized by some common divisor. Presumably, short-line traffic would be diverted to truck in the absence of such service. A common measure of the traffic carried by any mode is ton-miles. Ton-miles takes into account the volume handled and the distance shipped, with one ton-mile representing one ton hauled for a distance of one mile. For comparison purposes, fatalities could be compiled on a per ton-mile basis for rail and truck modes. However, although ton-mile figures are published for rail and truck, the accuracy of such statistics are somewhat questionable.⁴³

Two commonly used divisors of truck and rail accidents, for which reliable data exist are truck miles and train miles.⁴⁴ While calculating truck fatality rates on a truck-mile basis and rail accident rates on a train-mile basis is a good way to examine fatal accident exposure on each mode, the two rates are not directly comparable. The reason is that the number of train miles to

⁴²The Railroad Accident/Incident Reporting System is designed and developed by the Federal Railroad Administration, U.S. Department of Transportation.

⁴³Ton-miles by mode are published by the Eno Transportation Foundation, Inc., *Transportation in America*, various years. The truck ton-mile figures in the Eno data appear to understate total U.S. truck ton-miles when compared to *U.S. Highway Statistics* truck mile data. In particular, when these truck ton-mile figures are divided by *U.S. Highway Statistics* truck mile figures, the average load per truck is estimated at less than seven tons between 1995 and 1999. Moreover, the U.S. Highway Statistics truck mile figures do not include truck miles on rural or urban collectors, or rural local roads. This understatement of truck miles makes truck safety rates look worse than actual.

⁴⁴Truck miles are obtained from U.S. Highway Statistics, where the percent of miles traveled on rural collectors and local roads attributable to truck are assumed to be the same as the percent of miles traveled on rural minor arterial highways that are attributable to truck, and where the percent of miles traveled on urban collector and local roads attributable to truck are assumed to be the same as the percent of miles traveled on urban minor arterial highways that are attributable to truck. Train miles are obtained from the Railroad Accident/Incident Reporting System.

transport a given volume of a commodity is not the same as the number of truck miles to transport the same volume.

To make a direct comparison between the two fatality rates for making an assessment of the change in risk associated with shifting rail traffic to truck, or vice versa, we can make use of average rail cars per train, an estimated portion of miles that are empty, and average commodity weight per railcar and truck to put truck fatality rates and rail fatality rates on an estimated ton-mile basis. Figure 15 shows estimated fatality rates per ton-mile for five-axle 80,000 pound trucks and for rail in handling grain, coal, or other dense products between 1995 and 1999.⁴⁵

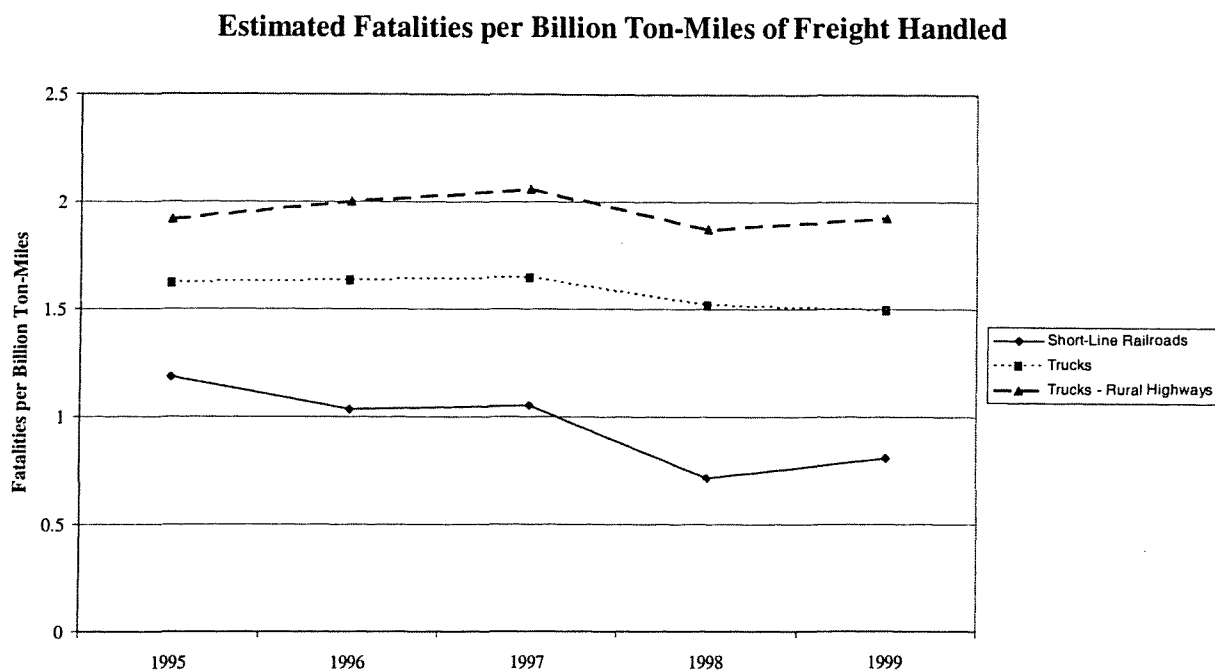


Figure 15: Assumes trucks handle 26.6 tons of freight, short lines handle 28 cars per train, rail cars handle 100 tons per car, and 50 percent of rail and truck miles are empty.

⁴⁵To estimate these fatality rates, a truck load of 26.6 tons is assumed, a rail load of 2800 tons is assumed (28 cars * 100 tons per car), and 50 percent of miles are assumed empty. The average cars per train of 28 is estimated from Class I railroad average way train shipment size (from the industry composite of railroad annual reports for 2000). Although less than 50 percent of miles are empty on both modes, the use of an empty backhaul provides a reasonable measure of comparison for examining safety impacts of originating traffic shifting modes.

As the figure shows, the fatality rate per billion ton-miles of freight handled is lower for short-line railroads than for trucks. Since short-line railroads often are located in rural areas, a comparison between motor carrier fatality rates on rural highways and short-line fatality rates might be the most appropriate comparison for evaluating the safety benefits provided by short lines. When such a comparison is made, the relative risk associated with handling commodities by truck and rail ranges between 1.6 in 1995 and 2.6 in 1998. This means that on average, it is estimated that the risk of a fatal accident for handling a ton-mile on a rural highway is between 1.6 and 2.6 times the risk of such an accident for handling a ton-mile on a short-line railroad. Although the relative risk associated with shifting traffic from a short line to truck will depend on the specific circumstances, including the highway traffic density in the area, the highway conditions, the number of grade crossings for the short line, and a variety of other factors, this comparison suggests that there are safety benefits associated with continued short-line operation. Moreover, injuries per ton-mile calculated in the same manner show an injury rate for truck that ranges from 2.5 times that for rail in 1995 to 3.4 times that for rail in 1999.⁴⁶ Thus, it appears that the overall safety benefits of continued short-line operation are substantial.⁴⁷

In addition to the safety benefits of short-line railroad operation, there also may be benefits in terms of increased energy efficiency. One common way to examine the energy efficiency implications of shifting modes is to examine the revenue ton-miles per gallon

⁴⁶Railroad injuries are obtained from The Railroad Accident/Incident Reporting System, Federal Railroad Administration, U.S. Department of Transportation. Truck injuries are obtained from a summary report prepared by the National Highway Traffic Safety Administration, U.S. Department of Transportation, using the General Estimates System.

⁴⁷Safety benefits of continued short-line operation may be even greater with additional capital investment due to higher quality rail infrastructure. However, increased speed may offset these additional benefits somewhat.

associated with making shipments on each mode.⁴⁸ In the same way that dividing fatalities by ton-miles provides a valid fatality rate for comparison across modes, dividing ton-miles by gallons of fuel provides a measure of fuel efficiency that is valid for an intermodal comparison. Specifically, ton-miles per gallon show the amount of traffic that can be handled for each gallon of fuel consumed. Thus, higher numbers for ton-miles per gallon suggest improved fuel efficiency, and fewer gallons of fuel consumed for transporting a given product volume.

Several studies have examined the energy efficiency of various transportation modes. Tolliver (2000) provides an extensive review of different studies that have examined energy efficiency across modes by using revenue ton-miles per gallon. These studies have used many approaches to examine modal fuel efficiency, including the use of: industry averages, engineering equations, computer simulations, and statistical models. As Tolliver shows, all these approaches provide useful information, but the usefulness of each approach depends on the type of comparison being made.

For the purpose of examining generalized fuel efficiency implications of shifting short-line railroad traffic to truck, a statistical model is used. The unique operations of short-lines in comparison to Class I railroads suggest that the use of industry averages for examining short-line fuel efficiency would not be appropriate. Further, although the use of computer simulations and engineering equations provide a useful comparison for specific movements, they are not as useful for generalized comparisons. Conversely, a statistical model will provide estimates of fuel efficiency that reflect the unique nature of the short-line railroad industry and allow for

⁴⁸Revenue ton-miles are the same as the ton-mile definition given earlier. A revenue ton-mile is one ton of commodity hauled for one mile. The reason such ton-miles are often referred to as revenue ton-miles is to distinguish commodity ton-miles from ton-miles associated with handling the weight of the equipment. In this study, the term ton-miles is used to refer to revenue ton-miles.

comparisons of short-lines with varying traffic densities, but are general enough to apply to many short-line railroad operations.

This study makes use of the American Shortline and Regional Railroad Association's Annual Data Profile to estimate a statistical model of short-line fuel efficiency. This model is used to simulate fuel efficiency for various traffic configurations and lengths of haul. These fuel efficiencies are then compared to an average truck fuel efficiency factor to examine the generalized fuel efficiency impacts of shifting short-line rail traffic to truck. The following paragraphs describe the statistical model.

Statistical Model

The following model is used to estimate revenue ton-miles per gallon of fuel consumed by short-line railroads:⁴⁹

$$RTM / GAL = f(ALH, CARSPM, CUST)$$

where : *ALH* = average length of haul

CARSPM = carloads per mile of road

CUST = number of customers

In this model, ALH and CARSPM are expected to have positive signs, reflecting fuel economies associated with longer hauls and higher traffic density. CUST is expected to have a negative sign, reflecting increased car switching (and thus fuel consumption) needed to handle a given amount of cars. This model is specified in natural logarithms. Thus, parameter estimates can be interpreted as elasticities. Table 7 shows the estimation results.

⁴⁹Speed also is important. However, the ADP shows that most short lines use track that is rated as FRA Class 2 (25 MPH) or less. Thus, there is not much variation in speed between short lines.

Table 7. Estimation of the Natural Logarithm of Short-Line Revenue Ton-Miles per Gallon	
Variable	Parameter Estimate
Intercept	2.4559* (0.3425)
ln ALH	0.6175* (0.0613)
ln CARSPM	0.1629* (0.0507)
ln TOTCUST	-0.0892** (0.0521)
Adjusted R ² = .5179 F = 39.67 N = 109 standard errors in parentheses. * significant at the 1 percent level. ** significant at the 10 percent level	

As the table shows, fuel efficiency increases with longer hauls and with greater traffic density, as expected. The parameter estimates show that a 1 percent increase in the average length of haul leads to a .62 percent increase in fuel efficiency, while a 1 percent increase in cars per mile leads to a .16 percent increase in fuel efficiency. The parameter estimate for the total number of customers is negative, reflecting the increased amount of switching required to serve more customers for a given amount of traffic. The parameter estimate implies that a 1 percent increase in the number of customers for a short line leads to a .08 percent drop in ton-miles per gallon.

Insight into the fuel efficiency obtainable by short lines with varying traffic levels, shipment distances, and customers can be obtained by using parameter estimates to obtain estimated fuel efficiencies for short lines of varying characteristics. However, before estimating revenue ton-miles per gallon for different short-line configurations, it is necessary to develop an estimate of revenue ton-miles per gallon for trucks for comparison purposes. Because data don't exist to estimate a statistical model of truck fuel efficiency, a range of estimates is developed for a five-axle 80,000 pound truck, by considering average fuel efficiency of loaded and empty trucks.⁵⁰ Using a load factor of 26.6 tons per truck, revenue ton-miles per gallon are predicted to range from a low of 88.32 if the backhaul is completely empty to a high of 154.81 if the backhaul is completely loaded.

Table 8 shows the estimated revenue ton-miles per gallon for short lines with varying traffic levels, while holding average length of haul and the number of customers at mean levels for short lines in the 1999 ASLRRRA Annual Data Profile. The table also shows the estimated cutoff point where truck carriage is more fuel efficient than rail carriage. As the table shows, for railroads that have an average of 45 customers and haul an average distance of 48 miles, short line operation results in fuel efficiency improvements as long as traffic is at least 50 cars per mile. At lower traffic levels, trucks may result in improved fuel efficiency with full back hauls. However, for many areas served by short lines, fully loaded back hauls may be unlikely.

⁵⁰According to a truck costing model developed by Berwick (1999), an average five-axle 80,000 pound semi-truck gets 5.82 miles per gallon while fully loaded and 7.73 miles per gallon while empty.

Table 8. Estimated Revenue Ton-Miles per Gallon for Short Lines with Varying Traffic Levels			
Cars per Mile		RTM per Gallon	
350		235.35	
300		229.51	
200		214.84	
100		191.90	
50		171.41	
25	↓ Trucks with Full Back Haul are More Fuel Efficient	153.11	
10		131.88	
Assumes an average length of haul of 48 miles and 45 customers. ⁵¹			

Table 9 shows estimated revenue ton-miles per gallon for short lines with different lengths of haul, while holding cars per mile and the number of customers at mean levels. As the table shows, for short lines with an average of 350 cars per mile of traffic and 45 customers, fuel efficiency is higher than that for trucks with full back hauls as long as the average length of haul is greater than 25 miles. For an average length of haul of 5 miles or less, trucks with empty back hauls are more fuel efficient than short lines.

⁵¹These are mean levels of miles, customers, and miles of road in the 1999 ASLRRA Annual Data profile, for those railroads that did not omit average length of haul, the number of customers, the number of carloads, the average weight per car, the amount of fuel consumed, or the miles of road operated.

Table 9. Estimated Revenue Ton-Miles per Gallon for Short Lines with Varying Lengths of Haul			
Average Length of Haul		RTM per Gallon	
48		235.35	
40		210.29	
30		176.06	
25		157.32	
20	↓	Trucks with Full Back Haul are More Fuel Efficient	137.07
10	↓	Trucks with Empty Back Haul are More Fuel Efficient	89.34
5	↓	Trucks with Empty Back Haul are More Fuel Efficient	58.23
Assumes 45 customers and 350 cars per mile.			

Table 10 shows estimated revenue ton-miles per gallon for short lines with varying lengths of haul, traffic levels, and customer numbers. As the table shows, trucks are more fuel efficient than short lines only on lines with low traffic levels, customers, and lengths of haul.

All these tables show that on lines with moderate traffic levels and lengths of haul, continued operation of short lines leads to fuel efficiency gains when the alternative is truck transportation. However, when lengths of haul and/or traffic levels are extremely low, continued short-line operation may lead to fuel efficiency losses when the alternative is truck transportation.

Table 10. Estimated Revenue Ton-Miles per Gallon for Short Lines with Varying Lengths of Haul, Traffic Levels, and Customers

Average Length of Haul	Cars per Mile	Customers	RTM per Gallon
48	350	45	235.35
40	250	38	207.71
30	200	26	168.78
20	100	13	124.86
↓ Trucks with Full Back Haul are More Fuel Efficient			
10	50	6	77.88
5	25	3	48.24
↓ Trucks with Empty Back Haul are More Fuel Efficient			
Customers are set so that the total number of carloads handled per customer are approximately equal for each traffic level.			

CONCLUSION

This study examines the capital investment needs facing the short-line industry, the financing terms available to short lines for meeting these needs, the public interest benefits of short-line railroads, and the relationship of short-line railroad services to the statutory responsibilities of the Secretary of Transportation. 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. The following paragraphs discuss each of these findings.

A recent change in the industry standard for the size of rail cars interchanged between railroads from 263,000 pound cars to 286,000 pound cars will result in large capital investment needs for the short-line industry in the near future. Studies by AASHTO and ZETA-TECH Associates estimate that capital investment needs for the short-line industry are in excess of \$6.8 billion, largely as a result of this change in standards. Other studies at the state level in Iowa, Kansas, North Dakota, and Washington also predict large capital investment needs for the industry as a result of this change.

In examining the ability of short-lines to obtain financing to meet these capital investment needs, we find several potential problems. These include: (1) few major banks that have a specialization in small railroad financing, (2) a need for better public information regarding small railroads (specifically, audited financial statement data), (3) short financing terms offered to small railroads for financing track and bridge improvements (5 to 8 years), and (4) some unwillingness by banks to make loans for track and bridge improvements because of an inability to liquidate these assets. However, on the positive side, we also find that (1) banks are interested

in taking on more small railroad loans, and (2) Four of the six banks surveyed do not require large minimums for loans to short-line railroads.

We also find that short-line railroads confer large benefits to U.S. shippers, local communities, and states. In preventing railroad abandonment, short lines provide reduced transportation costs to shippers, increased local business volume, reduced highway maintenance costs, decreased highway user costs, and increased economic development opportunities. In addition, short lines often provide improved service to shippers. Moreover, small railroads provide access to the U.S. rail system for more than 19,000 U.S. shippers.

Finally, in examining the role of short lines in meeting the statutory responsibilities of the Secretary of Transportation, we find that there are substantial safety benefits from short-line rail operation in comparison to truck hauls, and that, for rail lines with moderate traffic levels and lengths of haul, continued short-line operation leads to fuel efficiency gains when the alternative is truck transportation. However, when lengths of haul and/or traffic levels are extremely low, continued short-line operation may lead to fuel efficiency losses when the alternative is truck transportation.

REFERENCES

- Allen, B.J. "The Economic Effects of Rail Abandonment on Communities: A Case Study," *Transportation Journal*, 15(1), 1975.
- American Association of State Highway and Transportation Officials, *The Ten Year Needs of Short Line and Regional Railroads*, December 1999.
- American Short-Line and Regional Railroad Association and Upper Great Plains Transportation Institute, *1998 Annual Data Profile of the American Short-Line & Regional Railroad Industry*, December, 2000.
- Association of American Railroads, *Railroad Ten-Year Trends 1990-1999*.
- Association of American Railroads, Economic & Finance Division. *User Guide for the 1993 ICC Waybill Sample*, 1994.
- Babcock, M.W., Russell, E.R., and R.E. Burns. *Economic Development and Transportation Impacts of Railroad Branchline Abandonment in South Central Kansas*. Topeka, KS: Kansas Department of Transportation, 1992.
- Babcock, M.W., Prater, M., Morrill, J., and E.R. Russell, "Competitiveness of Short Line Railroads," *Journal of the Transportation Research Forum*, 34(2), 1995.
- Bitzan, John and Douglas Benson, *The Importance of Short-Line and Regional Railroads to Rural and Agricultural America*, unpublished U.S. Department of Agriculture Study, 1999.
- Bitzan, John and Denver Tolliver, *North Dakota Strategic Freight Analysis - Heavier Loading Rail Cars*, MPC Report No. 01-127.4, Mountain Plains Consortium, Fargo 2001.
- Bitzan, John, Honeyman, Joel, Tolliver, Denver, Casavant, Ken, and Marvin Prater. *The Impact of Rail Restructuring on Rural And Agricultural America*, unpublished U.S. Department of Agriculture Study, 1995.
- Dooley, F.J. and J.M. Rodriguez, "Rail Service Levels for Grain Shippers Under Class I and Short Line Ownership," *Journal of the Transportation Research Forum*, 29(1), 1988.

- Eusebio, V.E. and S.J. Rindom, "Methodology for Estimating Road Damage Cost Resulting from Potential Rail Branch Line Abandonment: The Case of South Central Kansas," *Transportation Research Record*, No. 1305, 1991.
- Federal Railroad Administration, U.S. Department of Transportation. *Small Railroad Investment Goals and Financial Options - A Report to Congress*, January 1993.
- Iowa Department of Transportation, Office of Program Management, "*Iowa in Motion*" Report for Upgrading Rail Lines for Heavy Cars, July 1998.
- Janski, Rebecca Gudrun Kraft. *The Economic, Social, and Energy Impacts of North Dakota Rail Branch Line Abandonment*. M.S. Thesis, Department of Economics, North Dakota State University, Fargo, 1975.
- Kalay, Semih and Tom Guins, "Heavy Axle Loads: The Dollars and Sense Case," *Railway Age*, March 1998, pp. 59-63.
- Kalay, Semih and Albert Reinschmidt, "An Overview of the Wheel/Rail Load Environment Caused by Freight Car Suspension Dynamics," A Paper Presented at the 68th Annual Meeting of the Transportation Research Board, Washington, D.C., January 1989.
- Kansas Department of Transportation, Bureau of Transportation Planning, *286,000 Pound Rail Cars and their Effects on Shortlines*, 1999.
- Klindworth, K. and J. Batson. *Economic Impact of Proposed Kansas Rail Abandonments*, U.S. Department of Agriculture, 1991.
- Kuehn, J.W. "Rail Abandonments and their Effects on Iowa Grain Shippers: Are Abandoned Shippers 'Captive Shippers'?" *Journal of the Transportation Research Forum*, 29(2), 1989.
- Martens, Bobby J. *An Economic Analysis of Heavy Axle Loads: The Effects on Short-Line Railroads and the Tradeoffs Associated with Heavy Cars*, M.S. Thesis, North Dakota State University, 1999.
- Schwieterman and Crowley, "Keeping Track: An Inventory of Rail Service to U.S. Urban Areas," *Transportation Quarterly*, 50(1), 1996.

- Toliver, Denver. *An Analysis of the Energy, Emission, and Safety Impacts of Alternative Improvements to the Upper Mississippi and Illinois Waterway System*, prepared for the U.S. Army Corps of Engineers, 2000.
- Tolliver, D. D. *The Benefits and Costs of Local and Regional Railroads*, UGPTI Publication No. 90, Upper Great Plains Transportation Institute, North Dakota State University, Fargo, 1989.
- Tolliver, Denver. *Washington State Heavy Axle Load Study: Technical Report*, Washington State Department of Transportation, 2001.
- U.S. Department of Transportation, Bureau of Transportation Statistics and U.S. Department of Commerce, Economics and Statistics Administration, Census Bureau, *1997 Economic Census of Transportation - 1997 Commodity Flow Survey*.
- U.S. Department of Transportation/Federal Highway Administration, *Comprehensive Truck Size and Weight Study*, Draft Report, Washington, D.C., 1997.
- U.S. Department of Transportation/Federal Highway Administration, *Highway Cost Allocation Study*, Washington, D.C., 1997.
- University of South Dakota School of Business. *Railroad Impact Study - Dolan/Watertown Impact Study*. Bulletin #114, Business Research Bureau, Vermillion, S.D., 1975.
- Weinblatt, H., Matzzie, D.E., and J. Harman, "Effects of Railroad Abandonment on the Modal Distribution of Traffic and Related Costs," *Transportation Journal*, 17(4), 1978.
- ZETA-TECH Associates, *An Estimation of the Investment In Track and Structures Needed to Handle 286,000 lb. Rail Cars*, prepared for the American Short Line and Regional Railroad Association, 2000.

APPENDIX A

Survey to Banks Specializing in Small Railroad Financing

All individual bank data obtained will be confidential. No individual bank data will be released in any form.

- Name of Bank (Finance Company) _____

- Does your bank (finance company) provide loans to small railroads (local, regional, S&T)?

- How much lending experience does your bank (finance company) have with small railroads?
Number of Loans _____
Size of Loan Portfolio _____
Number of RR's _____
Years of Lending _____

- 4. What types of loans will your bank (finance company) provide small railroads?
Loans for track and bridge improvements _____
Loans for rolling stock and locomotives _____
Loans for acquisition of railroad property _____
Loans for refinancing _____

- 5. If yes, what terms will your bank (finance company) provide for RR loans (for railroads that have revenues of less than \$40 million) used for:
track and bridge improvements
maximum term _____
interest rate
-Fixed or Floating? _____
-What is the baseline rate? LIBOR (1 mo., 3 mo., 6 mo., yr.) _____
Prime Rate _____
T-Bill Index (3 mo., 6 mo., yr.) _____
Constant Maturity Treasury (CMT) Index _____
12 Month Treasury Average (TMA) _____
CD Indexes (1 mo., 3 mo., 6 mo., yr.) _____
-Interest rate in relation to baseline rate (range) _____

collateral requirements (range) _____

is there a minimum loan amount? _____

are there up-front fees? _____ Amount (range) _____

rolling stock (cars and locomotives)

maximum term _____

interest rate

-Fixed or Floating? _____

-What is the baseline rate? LIBOR (1 mo., 3 mo., 6 mo., yr.) _____

Prime Rate _____

T-Bill Index (3 mo., 6 mo., yr.) _____

Constant Maturity Treasury (CMT) Index _____

12 Month Treasury Average (TMA) _____

CD Indexes (1 mo., 3 mo., 6 mo., yr.) _____

-Interest rate in relation to baseline rate (range) _____

collateral requirements (range) _____

is there a minimum loan amount? _____

are there up-front fees? _____ Amount (range) _____

acquisition of railroad property that was previously Class I property (e.g. a branch line)

maximum term _____

interest rate

-Fixed or Floating?

-What is the baseline rate? LIBOR (1 mo., 3 mo., 6 mo., yr.) _____

Prime Rate _____

T-Bill Index (3 mo., 6 mo., yr.) _____

Constant Maturity Treasury (CMT) Index _____

12 Month Treasury Average (TMA) _____

CD Indexes (1 mo., 3 mo., 6 mo., yr.) _____

-Interest rate in relation to baseline rate (range) _____

collateral requirements (range) _____

is there a minimum loan amount? _____

are there up-front fees? _____ Amount (range) _____

acquisition of railroad property that was previously small railroad owned e.g. an existing short line)

maximum term _____

interest rate

-Fixed or Floating? _____

-What is the baseline rate? LIBOR (1 mo., 3 mo., 6 mo., yr.) _____

Prime Rate _____

T-Bill Index (3 mo., 6 mo., yr.) _____

Constant Maturity Treasury (CMT) Index _____

12 Month Treasury Average (TMA) _____

CD Indexes (1 mo., 3 mo., 6 mo., yr.) _____

-Interest rate in relation to baseline rate (range) _____

collateral requirements (range) _____

is there a minimum loan amount? _____

are there up-front fees? _____ Amount (range) _____

refinancing

maximum term _____

interest rate

-Fixed or Floating? _____

-What is the baseline rate? LIBOR (1 mo., 3 mo., 6 mo., yr.) _____

Prime Rate _____

T-Bill Index (3 mo., 6 mo., yr.) _____

Constant Maturity Treasury (CMT) Index _____

12 Month Treasury Average (TMA) _____

CD Indexes (1 mo., 3 mo., 6 mo., yr.) _____

-Interest rate in relation to baseline rate (range) _____

collateral requirements (range) _____

is there a minimum loan amount? _____

are there up-front fees? _____ Amount (range) _____

6. An industry that has many similarities to the rail industry is the electric utility industry. It has a large amount of fixed and immobile assets that are not easily liquidated, and has a wide range of firm sizes. For firms that are similar in size to small railroads in this industry (e.g. less than \$40 million in annual sales), what terms does your bank (finance company) provide for loans used for:

major infrastructure improvements

maximum term _____

interest rate

-Fixed or Floating? _____

-What is the baseline rate? LIBOR (1 mo., 3 mo., 6 mo., yr.) _____

Prime Rate _____

T-Bill Index (3 mo., 6 mo., yr.) _____

Constant Maturity Treasury (CMT) Index _____

12 Month Treasury Average (TMA) _____

CD Indexes (1 mo., 3 mo., 6 mo., yr.) _____

-Interest rate in relation to baseline rate (range) _____

collateral requirements (range) _____

is there a minimum loan amount? _____

are there up-front fees? _____ Amount (range) _____

equipment that can easily be transferred among firms

maximum term _____

interest rate

-Fixed or Floating? _____

-What is the baseline rate? LIBOR (1 mo., 3 mo., 6 mo., yr.) _____

Prime Rate _____

T-Bill Index (3 mo., 6 mo., yr.) _____

Constant Maturity Treasury (CMT) Index _____

12 Month Treasury Average (TMA) _____

CD Indexes (1 mo., 3 mo., 6 mo., yr.) _____

-Interest rate in relation to baseline rate (range) _____

collateral requirements (range) _____

is there a minimum loan amount? _____

are there up-front fees? _____ Amount (range) _____

acquisition

maximum term _____

interest rate

-Fixed or Floating? _____

-What is the baseline rate? LIBOR (1 mo., 3 mo., 6 mo., yr.) _____

Prime Rate _____
T-Bill Index (3 mo., 6 mo., yr.) _____
Constant Maturity Treasury (CMT) Index _____
12 Month Treasury Average (TMA) _____
CD Indexes (1 mo., 3 mo., 6 mo., yr.) _____

-Interest rate in relation to baseline rate (range) _____
collateral requirements (range) _____
is there a minimum loan amount? _____
are there up-front fees? _____ Amount (range) _____

refinancing

maximum term _____

interest rate

-Fixed or Floating? _____

-What is the baseline rate? LIBOR (1 mo., 3 mo., 6 mo., yr.) _____

Prime Rate _____

T-Bill Index (3 mo., 6 mo., yr.) _____

Constant Maturity Treasury (CMT) Index _____

12 Month Treasury Average (TMA) _____

CD Indexes (1 mo., 3 mo., 6 mo., yr.) _____

-Interest rate in relation to baseline rate (range) _____
collateral requirements (range) _____
is there a minimum loan amount? _____
are there up-front fees? _____ Amount (range) _____

7. Are the data you need to evaluate the credit worthiness of a railroad usually available for railroads that are not publicly traded? _____

How do you obtain these data? _____

Sources _____

8. What data are used for a comparison to those of the applying railroad?

Are financial ratios compared with those in other industries? _____

Are they compared with those of other short lines? _____

Are they compared with those of Class I's? _____

Other comparisons? _____

9. In your opinion, are there information barriers to determining the credit quality of a small railroad? _____
10. Please rank the following information barriers in terms of the value that the elimination of each would have in improving your ability to determine the credit quality of small railroads (1 = most important):
- Lack of Benchmarks _____
 - Lack of Audited Financial Statements _____
 - Lack of Public Ratings by S&P or some other organization _____
 - Other (Specify) _____
11. What types of information would improve the likelihood that more favorable terms could be provided to railroads that are credit worthy?
- Industry data? _____
 - what types of data? _____
 - what financial ratios? _____
 - More data from applying firms? _____
 - what data? _____
 - Research showing the relationship between operational characteristics and financial ratios for small railroads? _____
 - Other information? _____
12. Please rank the importance of the following financial ratios in evaluating the credit worthiness of a small railroad applying for a loan.
- A. Fixed Charge Coverage Ratio (earnings before interest, taxes, deprec., and ammort. divided by fixed charges such as interest and long-term leases) _____
 - B. Total Debt to EBITDA (earnings before interest, taxes, deprec., ammort.) _____
 - C. EBITDA to Total Revenue _____
 - D. Debt/Equity Ratio _____
 - E. Current Ratio (current assets/current liabilities) _____
 - F. Other financial ratios _____
13. What do you consider acceptable ranges for these ratios?
- A. Fixed Charge Coverage Ratio _____
 - B. Total Debt to EBITDA _____

- C. EBITDA to Total Revenue _____
- D. Debt/Equity Ratio _____
- E. Current Ratio _____
- F. Other financial ratios _____
14. Please rank the following factors in terms of their importance in evaluating the credit worthiness of a small railroad.
- A. Traffic projections _____
- B. Future capital spending requirements _____
- C. Arrangements with Class I's _____
- D. Net Liquidation Value _____
- E. Commodity Concentration/Shipper Concentration _____
- F. Labor issues _____
- G. Environmental Concerns _____
- H. Real Estate in Operating vs. Non-Operating Property _____
- I. Other Factors _____
15. Rate the importance of each of the following as a barrier to financing small railroads for your institution (1 = major barrier, 2 = minor barrier, 3 = not a barrier):
- A. A short-line that has a long-term lease, rather than ownership of the rail line _____
- B. A short-line that has funding from a state grant (assume state has priority claim on RR property) _____
- C. Inability to liquidate railroad property _____
- D. A lack of expertise to understand the small railroad industry _____
- E. Others (specific examples) _____
16. When a railroad that is part of a consolidated system applies for a loan, are the financial performance, operations, and condition of the entire consolidated system considered in the credit decision? _____

17. When a railroad is part of a consolidated system (e.g. Rail America), what role does being part of such a system play in the decision to finance such a railroad? (i.e. being part of such a system may be viewed as a positive due to size advantages, but may also be viewed as a negative due to concerns over an inability of management to control such a large system) _____

18 What default rate has your bank (finance co.) experienced with railroad loans? _____
How does this compare to other commercial loan default rates? _____

19 Are your bank's (finance co's) terms different for railroads that it has already dealt with than for those it has not? _____

20. Do you know of other banks (finance co's) that provide financing for small railroads?

Names _____

APPENDIX B

Hypothetical Example of the Internal Rate of Return to

Line Upgrading for Short Lines with Various Lengths of Financing Availability

Short-Line Internal Rate of Return

This appendix provides an estimate of the internal rate of return to upgrading rail lines to handle larger rail cars for short-line railroads under various financing terms.⁵² The internal rate of return to an upgrading investment depends on incremental annual profits resulting from upgrading a rail line, the upgrading cost, and the length of time over which incremental profits are realized. The internal rate of return to an investment in upgrading a rail line is calculated as:

$$C_{UPGRADE} = \sum_{i=0}^N \frac{R_i}{(1 + \rho)^i} \quad (1)$$

where: $C_{UPGRADE}$ = *Upgrading Cost*

R_i = *Incremental Profits in period i resulting from upgrade*

ρ = *Internal Rate of Return*

N = *number of periods over which the upgrade is expected to yield benefits*

Although the length of loan provided by the bank does not necessarily coincide with the number of periods over which the railroad expects to obtain benefits from the railroad, it influences the decision of the railroad to obtain financing, since it determines the period over which the loan must be repaid. Thus, the relevant time period for considering expected benefits in calculating the internal rate of return is the loan term provided by the bank. An internal rate of return over the loan period that is higher than the interest rate paid to the bank will allow the railroad to repay the loan.

⁵²The example is from a case study of North Dakota rail lines.

The incremental profits from the upgrade for short-line railroads are estimated from data obtained from the American Short Line and Regional Railroad Association's (ASLRRA's) Annual Data Profile, and from a modified version of the short-line cost model presented by Martens (1999).

Incremental annual revenues are estimated by taking the average revenue per car and multiplying it by the assumed number of cars per mile and by the average number of miles owned.⁵³ This is done for a variety of carload per mile traffic densities.

Incremental annual costs are estimated by using a modified version of the spreadsheet-based short-line cost model presented by Martens (1999). The spreadsheet-based model is an economic-engineering model that estimates equipment and transportation costs associated with carrying a given amount of grain traffic in 263,000-pound and 286,000-pound cars.⁵⁴

The incremental profits in a given period resulting from the upgrading investment are estimated as the incremental revenues less the incremental equipment, transportation, and maintenance of way costs from short-line operation. Incremental maintenance of way costs only include those encompassed by routine activities such as vegetation control, snow removal, and signal maintenance. Capitalized maintenance of way costs are not considered since they are encompassed by the upgrading investment. For example, tie replacement, rail replacement, and ballast replacement all are included in the upgrading cost.

⁵³Average revenue per car and average number of miles owned are obtained from the ASLRRA's Annual Data Profile (1998). Average revenue per car for local line-haul railroads is \$288, and the average number of miles owned is 111.

⁵⁴All short-line costs are based on an assumed average length of haul of 44 miles (Average for local line-haul railroads in the ASLRRA's Annual Data Profile, 1998).

Table B1 presents a modified version of the spreadsheet-based short-line cost model used by Martens (1999). As the table shows, the costs per car for shipping at a density of 50 cars per mile is estimated at \$179 per car for 263,000-pound cars and \$197 per car for 286,000-pound cars. The transportation and equipment costs per car are \$119 and \$130 for the 263,000-pound and 286,000-pound cars, respectively. These estimates are similar to the estimated average transportation and equipment costs of \$127 per car for local line-haul railroads reporting to the American Short Line and Regional Railroad Association's (ASLRRA's) Annual Data Profile in 1996.⁵⁵

Table B1 also includes an estimate of the incremental profit per ton and the total annual incremental profit from line operation (excluding administrative costs). This total incremental annual profit of \$617,861 for 286,000-pound car shipment can be used as an estimate of the annual incremental benefit to a short line of upgrading the rail line, when traffic density is 50 cars per mile.⁵⁶ Similar estimates of incremental benefits from upgrading are developed for other traffic densities, as well.

⁵⁵These data were not available in subsequent versions of the ASLRRA's Annual Data Profile.

⁵⁶Different incremental benefits are obtained for different traffic densities.

Table 19: Spreadsheet-Based Short-Line Cost Model
 (Modified Version of the Model Presented by Martens, 1999)

	263,000 Pound	286,000 Pound Car	
1. Tons Shipped	527,250	527,250	50 Cars per Mile with 263 K
2. Carloads	5,550	4,974	#1 / Tons per car
3. Average Haul	44	44	Average for Local Line-Haul RRs from ASLRRR Database
4. Avg. Service Frequency (per week)	4.11	3.68	#2 / (#6 * 52)
5. Shipments per Year	213	191	#4 * 52
6. Avg. Cars per Train	26.00	26.00	Assumed
7. Tons per Car	95	106	Assumed
8. Tons per Train	2,470	2,756	#6 * #7
9. Ton-Miles	108,680	121,264	#8 * #3
10. Speed	25	25	Assumed
11. Total Running Time (Hours) - per shipment	3.52	3.52	(#3 * 2) / #10
12. Switch Time per Car (Min)	9.3	9.3	From Martens (1999)
13. Total Switch Time (Hours) - per shipment	8.06	8.06	(#12 * #6 * 2) / 60
14. Total Hours (per shipment)	11.58	11.58	#11 + #13
15. Total Hours (per Year)	2,472	2,215	#14 * #5
Crew Costs			
16. Crew Size	2	2	Assumed
17. Wages per Hour	\$16.00	\$16.00	Discussions with Industry Personnel
18. Payroll Tax	25%	25%	Discussions with Industry Personnel
19. Benefits	20%	20%	Discussions with Industry Personnel
20. Compensation per Crew Person	\$57,347.72	\$51,396.54	#17 * (1 + #18 + #19) * #15
21. Total Crew Cost (per year)	\$114,695	\$102,793	#20 * #16
Locomotive Ownership Costs			
22. Replacement	\$200,000	\$200,000	Discussions with Industry Personnel
23. Useful Life	15	15	Discussions with Industry Personnel
24. Salvage Value	\$50,000	\$50,000	Discussions with Industry Personnel
25. Dep. Cost per Year	\$10,000	\$10,000	(#22 - #24) / #23

26. Average Locomotive Value	\$125,000	\$125,000	(#22 + #24) / 2
27. ROI	11%	11%	Martens (1999)
28. ROI Cost Per Loc. Per Year - per Loc.	\$13,750	\$13,750	#27 * #26
29. Total Cost per Year - per Loc.	\$23,750	\$23,750	#25 + #28
30. Locomotives	1	1	Martens (1999)
31. Locomotive Ownership Cost (per year)	\$23,750.00	\$23,750.00	#29 * #30
Fuel Cost			
32. Total Shipment Weight Loaded (Tons)	3,419	3,718	#6 * (131.5 or 143 Tons per Car)
33. Gallon / Freight Mile	4.39	4.77	4.39 from Martens, 4.77 est. based on weight difference
34. Cost per Gallon	\$0.98	\$0.98	Discussions with Industry Personnel
35. Cost per Mile	\$4.30	\$4.68	#34 * #33
36. Total Fuel Cost (per shipment)	\$378.59	\$411.70	#35 * #3 * 2
37. Total Fuel Cost (per year)	\$80,815	\$78,763	#36 * #5
Locomotive Repair			
38. Cost per Locomotive per Day	\$120	\$120	Discussions with Industry Personnel
39. Total Locomotive Repair Cost (per year)	\$43,800	\$43,800	#38 * 365
Car Ownership Costs			
40. Car Replacement Cost	\$55,000	\$63,000	Trinity Industries (From Martens,
41. Useful Life - Years	35	35	Trinity Industries (From Martens, 1999)
42. Salvage Value	\$4000	\$4580	Discussions with Industry Personnel
43. Deprec. Per Year	\$1,457	\$1,669	(#40 - #42) / #41
44. Average Value	\$29,500	\$33,790	(#40 + #42) / 2
45. ROI	11%	11%	Martens (1999)
46. ROI per Car per Year	\$3,245	\$3,717	#45 * #44
47. Cost per Year (per car)	\$4,702	\$5,386	#43 + #46
48. Cost per Day	\$12.88	\$14.76	#47 / 365
49. Average Car Days per Car per shipment	4.5	4.5	Martens (1999)
50. Car Days per Train	117	117	#49 * #6
51. Car Days in Service on SL - Year	24,975	22,383	#50 * #5

52. Total Car Ownership Cost (per Year)	\$321,743	\$330,294	#51 * #48
Car Repair Costs			
53. Cost per Car Mile	\$0.043	\$0.043	Avg. for SOO Line (2000)
54. Car Miles	488,400	437,717	#3 * #5 * #6 * 2
55. Total Car Repair Costs	\$21,001	\$18,822	#54 * #53
Other Transportation Costs*			
56. Other Transportation Costs per Train Mile	\$2.88	\$2.88	Discussions with Industry Personnel
57. Total Other Transportation Costs	\$54,099.69	\$48,485.57	#56 * #3 * #5 * 2
58. Total Transportation Cost	\$659,904	\$646,708	#57 + #55 + #52 + #39 + #37 + #31 + #21
59. Maint.of Way - Non Capitalized (per mile)	\$3,000.00	\$3,000.00	Discussions with Industry Personnel
60. Total MOW - Non Capitalized	\$333,000	\$333,000	#59 * 111
61. Total Cost	\$992,904	\$979,708	#60 + #58
62. Cost Per Ton	\$1.88	\$1.86	#61 / #1
63. Cost Per Car	\$179	\$197	#61 / #2
64. Revenue per Car	\$288	\$321	Average for Local Line-Haul RRs
65. Revenue per Ton	\$3.03	\$3.03	#64 / 95 (assumes current rev per ton
66. Profit per Ton - Short Line	\$1.15	\$1.17	#65 - #62
67. Total Profits - Short Line (excluding	\$604,664	\$617,860	#66 * #1

*Derail Costs, Vehicles for Deadheading Crews, Utilities and Communications, Crew Supplies, Property and Liability Insurance

In addition to the annual incremental profit, the other important piece of information needed to estimate the internal rate of return to an upgrading investment is the amount of the upgrading investment. Bitzan and Tolliver (2001) estimated that the minimum upgrading cost needed for lines that have less than 90-pound per yard rail is \$205,000 per mile (after subtracting salvage value of materials). The total upgrading cost is estimated by multiplying the \$205,000 per mile by the number of miles (111).

Table B2 provides estimates of the internal rate of return to upgrading a hypothetical short-line railroad at various traffic levels, and with various time frames for considering the benefits of an upgrade. Although the internal rate of return to upgrading will vary somewhat by individual railroad based on cost characteristics and revenue splits, the internal rates of return shown in the table are likely to approximate those for North Dakota short lines.

Table B2: Estimates of the Internal Rate of Return to Upgrading for a Hypothetical Short-Line Railroad

Years for Considering Benefits	50 Cars per Mile	75 Cars per Mile	100 Cars per Mile	150 Cars per Mile	200 Cars per Mile
8	-29.5%	-20.3%	-13.3%	-1.9%	8.1%
15	-10.6%	-4.0%	1.1%	9.5%	17.2%
20	-5.7%	-0.1%	4.2%	11.6%	18.5%
25	-3.0%	1.9%	5.7%	12.4%	19.0%

As the table shows, under current revenue splits, it appears unlikely that short-line railroads would upgrade lines with less than 200 cars per mile.⁵⁷ However, if some government agency were to provide a mechanism that allowed longer term financing, it is possible that such upgrades would be considered at lower traffic levels (e.g. 150 cars per mile). One example of such a mechanism may be a loan guarantee program that eliminated risk to lenders from making such long-term loans.

Another factor that may increase the likelihood that short lines would upgrade lines to handle larger hopper cars would be an increase in the revenue split provided to short line railroads from Class I railroads. In cases where the Class I railroad perceives that traffic lost by their feeding short line results in traffic lost to a competitor, the Class I may be willing to increase the revenue paid to its short-line partner in an attempt to maintain profitable traffic. The following section estimates the internal rate of return available to Class I railroads from upgrading rail lines to handle larger hopper cars. Because of the possibility of Class I railroads providing revenue incentives to short lines for upgrading lines, the internal rates of return available to Class I railroads at various traffic levels may have important implications for the viability of short-line rail lines that need upgrading. Thus, when making a generalized assessment of rail lines that may be abandoned, a range of traffic levels will be used – i.e. between those where Class I's would upgrade and those where short-lines would upgrade at current revenue levels.

⁵⁷Recall that seven to eight years is the longest time frame banks would consider for financing such improvements.

Waite Library
Dept. of Applied Economics
University of Minnesota
1994 Buford Ave - 232 ClaOff
St. Paul, MN 55108-6040 USA