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16. Abstract Short line railroads employ more than 20,000 persons, serve 11,500 customer facilities, and originate or terminate approximately 25 percent of all rail movements. A good portion of short lines also operate on rail lines that were previously unprofitable and are often the lifeline for many rural agriculture communities. Texas currently has 41 short line railroads that operate on more than 2,600 miles of track, which represents almost 20 percent of the state rail infrastructure. The remainder of the track is operated by the three Class I railroads in the state. Nationwide, there are seven Class I and 545 short line railroads. The Class I railroads are characterized by long distance movement of freight over high-density rail lines between major markets. The major commodities are usually transported over a few major lines that stretch across the country, similar to perhaps the interstate highway system. On the other hand, the short lines operate shorter distances with the primary focus being on serving the customers on the line. Short line railroads face many obstacles to efficient, profitable operations. But they also hold great potential, especially with their ability to work closely with shippers to quickly meet changing needs and provide high levels of customer service. This project examines the issues facing short line railroads, future opportunities, and the importance of these railroads to the state of Texas.					
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IMPORTANCE OF SHORT LINE RAILROADS TO TEXAS

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ABSTRACT

Short line railroads employ more than 20,000 persons, serve 11,500 customer facilities, and originate or terminate approximately 25 percent of all rail movements. A good portion of short lines also operate on rail lines that were previously unprofitable and are often the lifeline for many rural agriculture communities. Texas currently has 41 short line railroads that operate on more than 2,600 miles of track, which represents almost 20 percent of the state rail infrastructure. The remainder of the track is operated by the three Class I railroads in the state. Nationwide, there are seven Class I and 545 short line railroads.

The Class I railroads are characterized by long distance movement of freight over high-density rail lines between major markets. The major commodities are usually transported over a few major lines that stretch across the country, similar to perhaps the interstate highway system. On the other hand, the short lines operate shorter distances with the primary focus being on serving the customers on the line.

Short line railroads face many obstacles to efficient, profitable operations. But they also hold great potential, especially with their ability to work closely with shippers to quickly meet changing needs and provide high levels of customer service. This project examines the issues facing short line railroads, future opportunities, and the importance of these railroads to the state of Texas.

EXECUTIVE SUMMARY

Texas currently has 41 short line railroads that operate on more than 2,600 miles of track, which represents almost 20 percent of the state rail infrastructure. The remainder of the track is operated by the three Class I railroads in the state. Nationwide, there are seven Class I and 545 short line railroads.

Within the past couple of years in several of the Class I railroads, including BNSF Railway Company that operates more than 4,600 miles of track in Texas, have indicated the likelihood of spinning off additional track not part of the major trunk system. The remaining lines would either be abandoned if extremely unprofitable or transferred to a short line operated via lease or purchase. This will make many of the lines serving predominantly smaller customers, and especially those in rural parts of the state, part of a short line operated system.

Short line railroads in the U.S. employ more than 20,000 persons, serve 11,500 customer facilities, and originate or terminate approximately 25 percent of all rail movements. A good portion of short lines also operate on rail lines that were previously unprofitable and are often the lifeline for many rural agriculture communities. Railroads emit fewer harmful emissions than that of trucks and provide shippers with a vital option in choosing a shipping method, which helps reduce shipping rates. Short line operators are known for their customer service and ability to quickly adjust to changing shipper needs. Their specialized operations have the potential to better utilize the system and better serve the shippers and communities located along the route.

FINDINGS

This document examined the critical role the short line railroads play in Texas. Short lines provide an additional transportation option for goods throughout many rural parts of Texas, keeping trucks off rural highways. They also perform important switching operations within many of the Texas urban centers.

In this document, Chapter 2 provides an overview of the U.S. rail industry, including the definitions of the different railroad classes. There are only seven Class I railroads operating in

the U.S. The remaining 542 railroads operating in the U.S. are short lines, which include regional, local, and switching and terminal railroads. Some of the existing short lines have been around for more than a century, but approximately 60 percent of the current short lines in the U.S. are under 25 years old as a result of the Staggers Rail Act of 1980. This legislation allowed railroads to unload unprofitable line segments, either through rail line abandonment or selling the line for short line operations. In Texas, 28 of the short lines, or 68 percent, formed after 1980. The total miles operated by Texas short lines currently exceeds 3,200 miles.

Some of the major challenges for short line railroads are covered in Chapter 3. These include the significant challenge of accommodating 286,000 pound railcars on their systems, deferred maintenance, capital investment needs, and infrastructure funding. The analysis performed for the 286,000 pound railcars found that more than 600 miles of Texas short line track consists of lightweight rail (less than 90 pounds per cubic yard). The approximate cost to upgrade the light rail track with rail replacement is up to \$410,000 per mile. However, those costs greatly reduce to only \$60,000 if the rail is adequate and only the other track components need upgrading. Total short line investment needs in Texas are calculated to be up to \$250 million.

Chapter 4 examines the viability of Texas short line railroads. Utilizing the density of the railroads as an indicator, the analysis categorized the Texas short lines into three density levels: low, middle, and high. Based on the density, a higher density level means there is a better chance for success. The analysis in Chapter 4 indicates 1,516 miles (51 percent) of Texas short lines have an excellent chance of success according to the density parameters. However, 1,387 miles (47 percent) of Texas short lines are not able to handle the 286,000 pound railcars. From these 1,387 miles:

- 713 miles (51 percent) have low traffic density and account for 66 percent of the investment needs (\$166 million);
- 305 miles (22 percent) have medium traffic density and account for 17 percent of the investment needs (\$41 million); and
- 369 miles (27 percent) have high traffic density and account for 17 percent of the investment needs (\$43 million).

One of the major questions to ask refers to the public interest in short line railroads. Chapter 5 examines how some of the area's short lines affect the public. One of the major areas is continued rail service of a previously unprofitable Class I railroad line segment. As stated in Chapter 2, 60 percent of the current short line miles have been added since 1980, when reduced regulation made it easier to abandon line segments. Not all lines were saved, and many of the short line operated lines are subject to future abandonment. The loss of rail service may be a serious issue for rural communities that rely on rail service for agriculture shipments. This is especially important considering a couple of challenges currently facing rural Texas. These include the trend toward slight rural population growth, while the urban areas in Texas have grown significantly. As a result, rural areas continue to lose agricultural land and struggle to maintain economic opportunities. Another challenge for rural Texas is the rural transportation system. More and more trucks are being used to move agricultural goods over deficient roadways in need of major improvements. The rail network, especially in areas serving rural communities, has reduced in size from 17,000 miles in 1932 to approximately 10,000 miles at present.

In order to communicate the effects of short line rail service on Texas roadways, researchers analyzed the pavement cost savings provided by the short line operations in Texas. Chapter 5 presents the results. The annual pavement damage savings associated with the Texas short lines is up to \$35.3 million. Most of these savings (80 percent) belong to the mid-range traffic density short lines. The pavement damage savings do not cover Texas short lines' investment needs. The low traffic density class represents 66 percent of the total expenditure but account for a small share of the pavement damage savings. The low traffic density lines are often located in rural areas, where the impact of abandonment would negatively affect rural communities. So the decision of funding these lines should consider not only direct saving of pavement damage but also secondary effects such as increased shipping costs and their effects on rural economics.

Chapter 6 presents several conclusions regarding short line operations, viability, and importance to Texas:

- **The Relationship with the Class I Railroads is Vital** – The reality for most short lines is that shipments do not originate and terminate on their line, which means they have to interchange with another railroad, usually a Class I railroad. So despite what the short line does on its line, the interchange and relationship with the Class I railroad may be the most important aspect.
- **Short Lines are Adapting to Maintain and Grow Business** – Short line railroads focus on value-added services to meet shipper needs. This customer-focused approach benefits the shipper by adding services that improve operations, reduce transportation costs, and potentially expand their business. This, in turn, increases services for the short line railroads. These services may include working with shippers to better manage rail car availability and turnaround, which reduces demurrage charges and more effectively manages inventory, or developing transload or warehouse storage facilities.
- **Texas Short Lines Positively Benefit the State** – The findings show that by removing trucks off highways the short line railroads operating in Texas increase safety on the roadways, reduce emissions, and extend the life of roadways, especially those in rural areas. The estimated \$35 million in annual pavement savings acts as an increase in funding that can be spent on other transportation needs around the state. Short lines also employ a significant amount of people throughout the state; pay considerable amounts of local, state, and federal taxes; and provide an economic development tool critical to many parts of the state. According to the survey, short lines now serve 76 new customer facilities, with an additional 81 industrial development locations planned.

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CHAPTER 1: OVERVIEW

INTRODUCTION

The Class I railroads are characterized by long distance movement of freight over high-density rail lines between major markets. The major commodities are usually transported over a few major lines that stretch across the country, similar to perhaps the interstate highway system. On the other hand, the short lines operate shorter distances with the primary focus being on serving the customers on the line; thus, acting as a feeder system to many parts of the country.

Within the past couple of years several of the Class I railroads, including BNSF Railway Company that operates more than 4,600 miles of track in Texas, have indicated the likelihood of spinning off additional track not part of the major trunk system. The remaining lines would either be abandoned if extremely unprofitable or transferred to a short line operated via lease or purchase. This will make many of the lines serving predominantly smaller customers, and especially those in rural parts of the state, part of a short line operated system.

The major issue facing short line railroads today is the new standard for rail car capacity from 263,000 pounds to 286,000 pounds. This increased weight strains the current system's ability to handle these railcars and increases maintenance costs. Most short lines in operation today do not generate enough revenue necessary to fully upgrade their system to handle the new standard.

Short line railroads face many obstacles to efficient, profitable operations, but they also hold great potential, especially with their ability to work closely with shippers to quickly meet changing needs and provide high levels of customer service. This project examines the issues facing short line railroads, future opportunities, and the importance of these railroads to the state of Texas.

BACKGROUND

Texas currently has 41 short line railroads that operate on more than 2,600 miles of track, which represents almost 20 percent of the state rail infrastructure. The remainder of the track is

operated by the three Class I railroads in the state. Nationwide, there are seven Class I and 545 short line railroads. Short line railroads are defined as those railroads not classified as a Class I railroad. The Surface Transportation Board (STB) classifies railroads by annual revenue numbers into three categories. Class I railroads are defined as those railroads generating more than \$250 million in annual revenue for three consecutive years. Class II and Class III railroads are generally considered short lines. The Association of American Railroads (AAR) classifies railroads by revenue and operational characteristics, particularly miles of track. The AAR classification for Class I railroads is the same as that of the STB definition. The non-Class I railroads include regional, short line, and switching railroads. All of the non-Class I railroads will be examined during this project.

Short line railroads in the U.S. employ more than 20,000 persons, serve 11,500 customer facilities, and originate or terminate approximately 25 percent of all rail movements. A good portion of short lines also operate on rail lines that were previously unprofitable and are often the lifeline for many rural agriculture communities. Railroads emit fewer harmful emissions than that of trucks and provide shippers with a vital option in choosing a shipping method, which helps reduce shipping rates. Short line operators are known for their customer service and ability to quickly adjust to changing shipper needs. Their specialized operations have the potential to better utilize the system and better serve the shippers and communities located along the route.

ORGANIZATION OF REPORT

This report consists of six chapters, including this introductory chapter. Chapter 2 provides an overview of the U.S. rail industry, the short line industry, and the Texas short line system. Chapter 3 covers some of the major challenges facing short line railroads. Chapter 4 examines the viability of Texas short line railroads. Chapter 5 discusses the public interest in short line railroads, including quantifying the benefit of short lines keeping trucks off Texas highways. Chapter 6 closes the document with the findings and conclusions.

CHAPTER 2: TEXAS SHORT LINE RAILROAD CHARACTERISTICS

INTRODUCTION

The short line railroads in Texas and the entire U.S. represent a small component of the overall freight transportation system. Freight levels in terms of tons in the U.S. over the past decade have increased 18 percent, with the 2002 Commodity Flow Survey (CFS) reporting tons of freight of 15.8 billion tons, a value of \$10.5 trillion, and ton-miles of 4.5 billion ton-miles (1). The CFS indicates that a typical day in 2002, “about 43 million tons of goods valued at about \$29 billion moved nearly 12 billion ton-miles on the nation’s interconnected transportation network” (1). Trucks transported almost 60 percent, but the railroads handled 1.9 billion tons valued at approximately \$388 billion (1).

Texas is rich with freight activities with major seaports, international border gateways, distribution centers, and manufacturing centers. According to the 2002 CFS, over 1.0 billion tons valued at \$589 billion moved throughout Texas in 2002 (2). Texas is particularly involved in international movements between the U.S. and Mexico. In 2003, the portion of U.S.-Mexico freight traveling through Texas was 67 percent for truck movements and 91 percent for rail movements (3).

This chapter discusses the overall U.S. rail system, reviews the U.S. short line industry, and characterizes the Texas short line network.

U.S. RAIL SYSTEM

The U.S. rail system is comprised of more than 550 railroads with operations on more than 141,000 miles of track (4). The majority of that track is owned and operated by the seven Class I railroads. The short line railroads operate the remainder of the track. The Surface Transportation Board (STB) categorizes the railroads in terms of adjusted annual revenue earnings (1991 dollars) for three consecutive years. The railroad classes include:

- Class I – \$250 million or more annual operating revenues;
- Class II – \$20 to \$250 million annual operating revenues; and
- Class III – Less than \$20 million annual operating revenues (5).

The Association of American Railroads (AAR) categorizes the railroads in terms of both annual operating revenue and types of operations. The AAR descriptions of these categories are provided below:

- *Class I railroads* are those with operating revenue of at least \$277.7 million in 2003. Class I carriers typically operate in many different states and concentrate largely (though not exclusively) on long-haul, high-density intercity traffic lanes.
- *Regional railroads* are linehaul railroads with at least 350 route miles and/or revenue of between \$40 million and the Class I threshold.
- *Local linehaul* carriers operate less than 350 miles and earn less than \$40 million per year. They generally perform point-to-point service over short distances.
- *Switching and Terminal (S&T)* carriers are railroads, regardless of revenue, that primarily provide switching and/or terminal services. Rather than point-to-point transportation, they perform pickup and delivery service within a specified area for one or more connecting linehaul carriers, often in exchange for a flat per-car fee. In some cases, S&T carriers funnel traffic between linehaul railroads (6).

The more-detailed definitions from the AAR are utilized during this project to better define the railroads. Table 1 provides the 2003 statistics for the U.S. railroads, according to the AAR.

Table 1. Types of U.S. Freight Railroads in 2003 (4)

Type of Railroad	Number	Miles Operated*	Employees	Revenue (\$ billions)
Class I	7	98,944	154,652	35.41
Non-Class I	542	41,995	19,410	2.86
Regional	32	15,648	7,877	1.35
Local Linehaul	304	19,706	5,045	0.91
Switching & Terminal	206	6,641	6,488	0.60
Canadian**	2	570	n/a	n/a
Total	551	141,509	174,062	\$38.27
* Excludes trackage rights				
**Canadian-owned lines not affiliated with a U.S. rail subsidiary				

Although comprising only seven of the 551 railroads, Class I railroads account for almost 70 percent of the miles operated and 93 percent of the total revenue. It is interesting to note that, according to the AAR, more than 90 percent of the U.S. freight railroads are privately owned and

operated (6). Almost all of the publicly-owned railroads are local linehaul and switching and terminal short lines.

Freight railroads are the primary transporter of coal, which powers many of the nation’s power plants. Other top commodities include nonmetallic minerals, such as aggregates used for road construction, chemicals, farm products, and intermodal shipments. Intermodal traffic is the fastest growing traffic segment, tripling over the past 20 years from 3.1 million trailers and containers in 1980 to nearly 11 million in 2004 (6).

The rail system of Texas is a major component of the national rail system—playing a significant role in the movement of goods by rail east to west and north to south from all parts of the U.S., and to and from Mexico. Texas ranks first in total rail miles, second in the number of railroad companies, and in the top five states in several other categories as shown in Table 2. The top terminating commodity is coal, representing 28 percent of the terminating traffic; while chemicals (34 percent of the originating traffic) represent the top originating commodity.

Table 2. Ranking Texas on Key Statistical Indicators, 2002 (7)

Key Indicator	Number	Rank
Freight Railroads	44	2nd
Class I	3	
Class II	1	
Class III	40	
Total Rail Miles		
Excl. Trackage Rights	10,347	1st
Incl. Trackage Rights	14,008	-
Total Rail Tons	335,525,461	5th
Originating	112,755,992	4th
Terminating	195,310,987	1st
Total Rail Carloads	8,010,579	2nd
Originating	1,991,492	4th
Terminating	2,936,827	2nd
Total Rail Employment	15,056	1st
Total Wages	\$917,296,000	1st

U.S. SHORT LINE RAILROAD SYSTEM

Railroads have been prominent fixtures in the U.S. since the late 1800s. The major railroads we have today are to some degree related to the early railroads. Even some of the existing short lines operating in the U.S. have been in operation for more than 100 years. The short line railroads with a long history are usually owned by a specific company, such as a lumber or aggregate company, or serve a specific customer base or service area, such as urban switching.

In addition to the short lines that have existed for many years, many of today's short lines originated due to the shedding of lines by Class I railroads. These may be lines that did not meet company strategic goals or were unprofitable and would have otherwise been abandoned. By the late 1970s many of the U.S. railroads were facing financial problems. In order to allow the railroads to operate in a profitable manner, the Staggers Rail Act of 1980 was passed. This act eliminated many of the regulatory restrictions in which the railroads operated and allowed the railroads to shed unprofitable line segments. In other words, the Staggers Act made it easier for railroads to abandon rail lines. As a result of the major increase in rail line abandonment, many new short line railroads were formed to operate specific line segments or a system of segments. Before 1980 approximately 220 short lines operated in the U.S (8). That number has doubled since then to more than 550. According to Richard Timmons, President of the American Short Line and Regional Railroad Association, 81 percent of the total short line mileage is operated by railroads established since 1980 (9).

Today, there are not significant numbers of Class I rail line segments remaining to abandon because of profitability. But the likelihood of additional short lines or additional rail miles operated by short lines certainly exists. As described above, the Class I railroads mostly operate long-haul movements over high-density intercity corridors. The Class I railroads are more competitive and more profitable carrying large volumes over longer distances. This is done over fewer, high-quality corridors, usually with unit trains. Good examples of this are intermodal traffic that primarily travels from the West Coast ports to Chicago or the East Coast and coal traffic from Wyoming to other parts of the U.S. This trend to move high-volume unit-train traffic long distances over an interstate highway-type network provides opportunities

for short lines to serve the local carload traffic over the shorter, lower-density segments. This is currently being realized through purchase and lease agreements.

Matt Rose, President and Chief Executive Officer of BNSF Railway Company (BNSF Railway) recently described in a speech their carload network redesign and line rationalization program. He describes a scenario where both big and small railroads focus on what they do best.

“We run unit trains to/from high throughput terminals and carload traffic over high-speed, high-volume main lines and through automated state-of-the-art classification terminals. Our short line partners can potentially do most of everything else. We said [for our line rationalization program] we were aiming to eliminate about 4,000 route miles over the next four or five years. In 2001, 250 route miles were sold, leased, donated, or abandoned. Another 1,000 miles are slated for 2002. About 250 miles have already been turned over and several other deals are well underway. Another 3,000 miles are under review for possible outsourcing in 2003 and beyond. It should be obvious that we are counting on our short lines to both play a major role in and benefit from this extensive, largely carload network rationalization (10).”

Additionally, several news articles discuss the lease or purchase of Class I line segments by short lines. Below are some headlines and brief descriptions of the articles:

- “CSX Sells Two Branch Lines” – M&B Railroad bought 94 route miles from the CSX Transportation, Inc. (CSX) in Alabama (11);
- “Canadian Pacific Sells Wisconsin Branch” – Wisconsin & Southern Railroad purchases 32.5-mile line segment (12);
- “Buffalo & Pittsburgh Leases CSX Line” – Buffalo & Pittsburgh Railway converted operations along a 41-mile line from trackage rights to a long-term lease (13);
- “Progressive Rail Files to Lease Two UP Lines” – Progressive Rail, Inc. will lease and take over operation of two Union Pacific Railroad (UP) lines in Minnesota (14);

- “CSX to Lease Virginia Line” – Buckingham Branch Railroad will lease 200 miles of track in Virginia (15); and
- “Progressive Rail to Acquire Some Wisconsin Lines from UP, CN” – Progressive Rail, Inc., has formed a subsidiary company, Wisconsin Northern Railroad, to operate lines leased and purchased from Canadian National and UP (16).

A prominent example in Texas is the Timber Rock Railroad Co. (TIBR), which purchased 170 miles of track from BNSF in 1998 and has since leased an additional 130 miles (17).

TEXAS SHORT LINE SYSTEM

Several sources discuss the number of short line railroads operating in the U.S. and Texas. As previously stated, the AAR specifies 542 short lines in the U.S., but the American Short Line and Regional Railroad Association (ASLRRRA) indicates that number is now more than 560. Mergers, changes to holding companies, leases, and purchases leave these total numbers slightly fluctuating. This has some implications for this project, but is not considered a major concern. The data utilized for this project comes from the study commissioned by the ASLRRRA, *The Short Line and Regional Railroad Survey*, to represent the short line railroad industry for the year 2002. The number of railroads and miles of operations closely resemble the AAR statistics for that year in Texas. The Texas short line rail network is shown in Figure 1. Table 3 breaks down the miles operated by the Texas short lines for each category.

Table 3. Miles Operated by Texas Short Line Railroads

Type of Railroad	Number	Total Miles Operated	Miles Operated in Texas	Texas Miles Owned or Leased	Texas Trackage Rights Miles	Texas Miles Other
Regional	2	937	937	157	400	380
Local Linehaul	19	1,221	686	592	28	66
Switching & Terminal	20	1,069	978	501	92	385
Total	41	3,227	2,601	1,250	520	831

There are 41 short lines in Texas: 2 regional, 19 local linehaul, and 20 switching and terminal railroads. These 41 short lines operate on a total of 3,227 miles including trackage rights. Of the total system miles, 2,601 miles is within Texas. The remainder involves operations that extend beyond the Texas border. Out of the 41 short line railroads that operate in Texas, 35 have their lines entirely inside the state. It is important to note that for the analyses conducted in the study, the total railroad system miles were utilized, not just the miles in Texas. Researchers concluded that no good way exists to account for only the Texas portion for such statistics as total annual carloads that operate over the entire railroad system. Also, within Table 3 is the miles operated on their own track, either by ownership or lease, versus the additional operations over other railroads via trackage rights. Trackage rights add an additional 520 miles of operations.

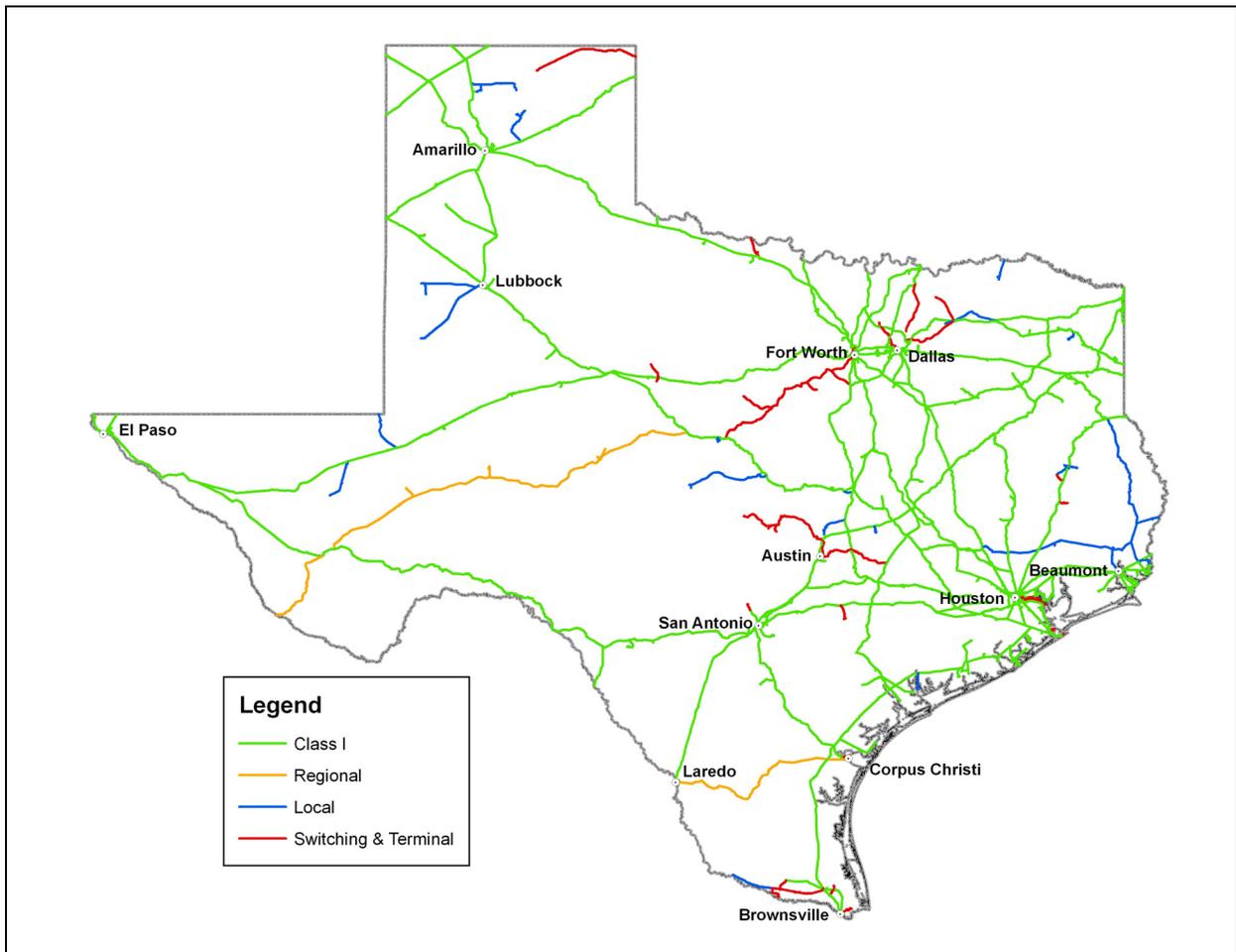


Figure 1. Texas Rail System by Classification

Despite the large geographical area of Texas and the total statewide track miles, Texas only has two regional railroads, both of which connect with Mexico. The Texas Mexican Railway (TM) stretches 157 miles from Laredo to Corpus Christi. Trackage rights extend their reach an additional 387 miles to Beaumont where the short line interchanges with its parent company, Kansas City Southern Railway (KCS). The Texas Mexican Railway has been in operation since 1881.

The other regional railway is the Texas Pacifico Transportation Ltd. (TXPF), with track running from the Presidio, Texas-Ojinaga, Mexico border crossing to San Angelo Junction, near Coleman. The railroad can interchange with either BNSF Railway or fellow short line Fort Worth and Western Railroad (FWWR) at the northern junction and UP in Alpine, north of the border. The TXPF operations run over what is known as the South Orient rail line. This line has a long history of high expectations, potential abandonment, and narrow escapes. Perhaps the most stabilizing event for the South Orient line was the purchase of the rail line by the State of Texas. In 1999 the Texas legislature appropriated \$6.0 million for the purchase of the segment between the border and San Angelo Junction. Managed by the Texas Department of Transportation, this segment experiences operation by way of a \$3.5 million lease and operating agreement with Texas Pacifico Transportation Ltd. Together with the \$6.0 million from the state, the \$3.5 million from the Texas Pacifico Transportation Ltd. agreement raised the necessary \$9.5 million to purchase the rail line (18). Texas Pacifico Transportation Ltd. is a subsidiary of Grupo Mexico, which is the primary owner of the Mexican railroad Ferromex. This is important since Ferromex operates the rail line in Mexico that connects with TXPF at Presidio. The FWWR now operates the northern segment from Brownwood to Fort Worth.

The remaining local linehaul and switching and terminal railroads operate over rail lines that vary from 1 mile to more than 200 miles. Altogether, short line railroads operate approximately 20 percent of the rail network in Texas. The major commodities carried by short lines in Texas include nonmetallic minerals, farm products, crushed and broken stone, and chemicals. Based on *The Short Line and Regional Railroad Survey*, an estimated 585,000 carloads were moved by short lines in Texas in 2002.

The survey also points out some of the other characteristics of the Texas short lines and provides an opportunity to see their contributions to the state economy. The following bullets demonstrate information for only those railroads who responded to the particular question in most cases:

- 28 of the 41 (68 percent) of the short lines have formed since 1980.
- The earliest indicated start date is 1881 for the Texas Mexican Railway.
- The short line network in Texas contains almost 1,000 bridges.
- Texas short lines employ more than 1,200 persons.
- Short lines serve 713 customer facilities, 701 of which are only served by the short lines.
- The workers at the facilities served exceed 20,300 persons.
- Of the 713 facilities served, 76 are considered new customer facilities (within three years of the survey).
- These new customer facilities employ an estimated 1,140 workers.
- The number of planned industrial development locations along Texas short lines is 81 sites.
- Texas short lines paid an estimated \$19.5 million in state and local taxes, according to 17 of 41 railroads.
- The state taxes portion was more than \$3.5 million.
- Almost 90 percent of the short line rail traffic only originates or terminates on their railroad, which means almost 90 percent of the rail traffic interchanged with at least one other railroad (most likely a Class I railroad).
- Only 23 short lines indicated they handle carload unit trains of 50 cars or more.
- That number drops to only 3 short lines for intermodal unit trains of 50 cars or more.

Approximately 60 percent of the short lines were formed over the past 25 years. Those short lines now comprise 81 percent of the total U.S. short line track mileage. Texas short lines operate on more than 3,200 miles of rail and provide service to many rural parts of Texas that would have otherwise lost rail service.

CHAPTER 3: MAJOR CHALLENGES FOR TEXAS SHORT LINE RAILROADS

INTRODUCTION

As mentioned in the previous chapter, short line railroads operate approximately 3,000 miles in Texas. Most of them were previously owned by the major Class I railroads who discarded them from their networks as a consequence of low traffic volumes and/or a detriment in revenues. In comparison with the well-maintained high-volume corridors of the Class I railroads, a high percentage of the short lines have old light rails, little ballast, and have experienced deferred maintenance.

In contrast, the interaction between the Class I railroads and the short lines is a very important matter to both of them. Short line railroads do not originate and terminate most of their shipments and serve as the first/last link in the business to business delivery (19). In addition, the current trend toward the use of the 286,000 pound railcars is making this railcar the standard in the railroad industry. Although the use of these railcars can reduce the operating costs, it adds extra complexities in the interaction between classes.

In order to accommodate the 286,000 pound railcars and benefit from their costs savings, short line railroads must carry out major capital investments to upgrade their infrastructure. This chapter will describe the minimal requirements in order to support the 286,000 pound railcar, calculate the investment needed for that upgrade in Texas short line railroads, and describe the current available funding methods that might assist the railroads to overcome the upgrade investment.

286,000 POUND RAILCAR

The introduction of the 286,000 pound railcar, for transporting heavy bulk materials, has improved the overall efficiency of the rail industry through the reduction of some operating costs. The use of this type of car for transport heavy bulk materials, like coal, grains, and lumber, has considerably reduced some of the operating costs.

Examples of these reductions are:

- The amount of cars that are needed to transport the same volume of cargo is smaller. This reduces the amount of trains needed and, consequently, the number of locomotives and railcars (20).
- The reduction of locomotives and rail cars represent savings in ownership, maintenance, and crew costs (20).
- The improved net-to-tare ratio (ratio of goods carried to empty car weight) and the decrement of the train resistance (fewer axles needed for equivalent car weight) translates into a reduction in fuel consumption per moved ton of cargo (21).

According to a study done by Zeta-Tech Associates, if the total costs of the 286,000 pound railcar are compared with the 263,000 pound railcar, the implementation of the first one can produce a net benefit of the order of 3 to 8 percent. But to be able to obtain this important benefit, the existing infrastructure must be in good state (20).

The high-quality, high-density corridors owned by Class I railroads can effectively handle these railcars. On the other hand, many of the short line rail tracks were built decades ago when the maximum loads were significantly smaller. As an example, the 286,000 pound railcar is 9 percent heavier than the 263,000 pound car and 30 percent heavier than the 220,000 pound railcar. These new Heavy Axle Load (HAL) cars will demand not only an increase in maintenance cost but also, in many cases, the necessity of upgrading the entire infrastructure.

According to the report conducted by Zeta-Tech Associates, the expected increase in maintenance costs is in the order of 5 to 25 percent and will depend on the percentage of the traffic that is moved in this type of railcar (20). In the case that the infrastructure is not adequate, some investments should be made in some or all of the following track components:

- Rail and joints,
- Ties and fastenings,
- Ballast and surfacing,
- Turnouts, and
- Bridge structures.

From all the possible investments, the most expensive one is the rail upgrade, usually accounting for more than half of the total expenditure.

Requirements for the 286,000 Pound Railcar

Several studies were reviewed in order to get the minimum requirements for the HAL cars. Most of them agreed that the minimum weight for the rail is 90 pounds per yard, but that is not the only requirement. All the components of the track contribute to the final overall resistance. The malfunction of any of them is detrimental to the overall performance of the track. This section analyzes the interaction between all the components and states the minimum requirements of all the track components necessary to handle 286,000 pound railcars.

The track is an elastic structure whose main objective is to transfer the loads from the wheels into the natural ground in a decreasing function of pressure. Loads are transferred from the wheels to the rail, where they are distributed through the tie plate and the tie pad into several ties. The ties distribute the vertical and lateral loads from the rail to the ballast. Subsequently, the ballast distributes the loads from the ties to the subgrade. Finally, the subgrade distributes the load to the natural ground (22). To guarantee the overall quality of the system, it is indispensable to ensure the quality of all the track components.

In order to find the performance of the track, it is important to know its resilience. The resilience, or elasticity, is the capability of the materials to return to their original shape after a load has been applied and removed (23). An accurate indicator of the resilience of the track is the deflection of its components. The total deflection is the summation of the deflection and the interaction of the type of rail, the condition and spatial distribution of the ties, the quality and depth of the ballast, and the quality of the subgrade. High values of deflection cause differential movement and wear of the track components. On the other hand, some deflection is needed to ensure a smooth ride for the cars preventing the failure of the different component of the cars and to absorb the impact of vertical oscillations, vibrations, and shocks (22). The maximum values for deflection range from 0.25 inch for heavy tracks to 0.36 inch for light tracks. Deflections of more than 0.40 inch would cause a rapid deterioration of the track components (23).

One of the most important factors that influence the deflection of the rail is its moment of inertia. The moment of inertia of the rail depends on the shape of its cross section. Therefore, the weight of the rail, which is directly related with its cross section, is a good indicator of the stiffness or bending resistance of the rail. For example, 115 pound per yard rail has double the stiffness than 85 pound per yard rail (23). This is why the weight of the rail has such a big impact in the final resistance of the track.

In a study conducted by Zeta-Tech Associates, it is stated that the minimum acceptable rail capable of supporting the 286,000 pound car is the 90 pound per yard rail (24). Rails with lower weight per yard would suffer permanent deformations. The following table shows a breakdown of rail by weight and miles of the short line railroads that are currently operating in Texas. These data were obtained from *The Short Line and Regional Railroad Survey* sponsored by the ASLRRA in 2003 (25). As observed in Table 4, 21 percent of the miles of the railroads that currently operate in Texas have rails with lower weight than 90 pounds per yard. The total number of miles differs from what was previously stated (3,227 miles) because one railroad was not considered in this calculation since it only has trackage rights inside Texas and those miles represent 5 percent of its network.

Table 4. Type of Rail and Mileage of Texas Short Line Railroads

Weight Category	Miles	Percent
Less than 90 lb/yd	616	21
90 – 112 lb/yd	1,202	40
Greater than 112 lb/yd	385	13
Data N/A	768	26
Total	2,971	100%

As shown in Table 4, there are more than 600 miles of light rail. This fact will negatively affect the investment needs because in order to be able to support the 286,000 pound railcar, the rail weight has to be at least 90 pounds per yard.

A good measure of the track stability and its expected life is the modulus of the track elasticity. The modulus is defined as “the load per unit length of rail required to depress the rail by one unit” (22). The contributors to the value of the modulus are the rails, the fastenings,

cross ties, ballast, sub-ballast, and subgrade, but the most important ones are those supporting the rail, including:

- Ties quality and spacing,
- Ballast depth and quality, and
- subgrade characteristics and quality (22).

In other words, the resulting deflection of the track will depend on the weight of the rail and the modulus of the track elasticity. Depending on the state of the different components of the track, in some cases, a better output is achieved by increasing the modulus instead of increasing the weight of the rail. The replacement of the rail with a heavier one may increase the stiffness of the track but may not fix possible problems of other components like ballast or ties (23). According to the Zeta-Tech Associates study, the cross ties and the ballast should meet the following minimum requirements in order to be capable of supporting the 286,000 pound railcar:

- 10 good cross ties per rail length, which is 10 good cross ties every 39 feet, or approximately 1,350 good cross ties per mile; and
- 2 inches of clean, good quality ballast (24).

Speed and track irregularities cause dynamic loads to be bigger than the static loads. As a consequence, speed (through the dynamic loads) increases the deflection of the track. The factor that accounts for the increase on the deflection caused by the speed is called the dynamic factor. This factor is influenced by the speed and also by the overall performance of the track. In poor track conditions, the dynamic factor can be 1.5 times higher than in good track conditions (23). A short-term solution to mitigate this phenomenon is to reduce the operating speed. But these speed restrictions may create conditions where trains are no longer efficient, causing additional opportunity costs, making this option an infeasible long-term solution (21).

In conclusion, the minimum requirements to support the 286,000 pound railcar are not just those addressed by the type of rail. In addition to a good rail, 90 pounds per yard or more, ties and ballast must also comply with minimum requirements. But all these minimum requirements are applicable only in those lines with low density (less than 1 million gross tons of

annual traffic) and operating speeds not greater than 10 mph. Any changes in the operating conditions would also change the minimum requirements (24).

State of Texas Short Line Railroads

In 2003 the ASLRRA sponsored *The Short Line and Regional Railroad Survey*; the results of this survey show that within the non-Class I railroads that are currently operating in Texas, there are 616 miles with less than 90 pounds per yard. This represents approximately 21 percent of their network (25).

In that survey, railroads were asked if they would need an upgrade of the infrastructure in order to support the 286,000 pound railcar. The results show that 42 percent of the miles of the railroads that are currently operating in Texas have been upgraded already, 9 percent will not need an upgrade, and 47 percent will need an upgrade. This represents an approximate distance of 1,387 miles. The costs of upgrading the infrastructure will be shown later in this chapter.

DEFERRED MAINTENANCE

Most of the short line railroads were created after the Staggers Rail Act of 1980. Some of the most common characteristics among them were:

- Aged infrastructures,
- Light rails,
- Little ballast, and
- Deferred maintenance.

The principal cause of a decrease in the maintenance of lines is a decrease in the revenue. In an eventual decrease in revenue, railroads have two alternatives. The first option is to reduce the frequency of the service. This will reduce some of the variable costs as fuel and crew costs, but might decrease the traffic since the attractiveness of the mode and the offered service are negatively affected. The second option is to reduce the rail maintenance costs. This decrease in maintenance will also decline the level of service of the track since, as previously mentioned, the dynamic impacts of the loads are greater on tracks with deferred maintenance than in well-maintained tracks, causing a reduction in the operating speed. But this decrease in the

quality of service, through the reduction in the operating speed, could discourage business activity causing further reductions in revenues, and thereby, intensifying the maintenance problems (26).

In the case in which deferred maintenance has occurred, the cost of upgrading the tracks on light density lines, calculated on a per carload basis, can be very high. This means that the possibilities of recovering the investment are low since the revenue is directly related with the number of carloads transported (21).

CAPITAL INVESTMENT NEEDS

Several studies have addressed the investment needs in the short line industry. Some of the most important are:

- 1) *The Ten-Year Needs of Short Line and Regional Railroads* published by American Association of State Highway and Transportation Officials in December 1999,
- 2) *An Economic Analysis of Heavy Axle Loads: The Effects on Short Line Railroads and the Tradeoffs Associated with Heavy Cars* by Bobby Martens, March 1999,
- 3) *An Estimation of the Investment in Track and Structures Needed to Handle 129,844 kg (286,000 lb.) Rail Cars on Short Line Railroads* by Zeta-Tech Associates; and
- 4) *The Short Line and Regional Railroad Survey* sponsored by the ASLRRA in 2003.

A brief description and comparison between them is given in this section. All these studies are based on national averages or were estimated to particular cases or states. The study that best reflects Texas' current situation will be used in order to estimate the investment needs in Texas.

- 1) *The Ten-Year Needs of Short Line and Regional Railroads* published by AASHTO (27).

This report is based on a survey conducted by the American Short Line and Regional Railroad Association performed in 1998-1999 with data from 1997. The survey was sent to the 500 short lines that existed at that time and with a response rate of 37 percent.

The most important results from that report are:

- 41 percent of the respondents could handle 286,000 pound railcars.
- 87 percent of the respondents would need to accommodate 286,000 pound railcars. This means that 46 percent of the responding railroads will have to accommodate the new heavier railcar, but they are not capable yet.
- The cost of track rehabilitation and/or construction was \$92,071 per mile (without bridges upgrade).
- Some other upgrading costs are:
 - Signals \$969,483 per railroad;
 - Bridges \$2,795,476 per railroad; and
 - Equipment needs \$1,776,000 per railroad.
- A very important finding of that report is that only 23 percent of the upgrading needs can be funded by non-public sources. This means that without any financial help from public sources, short line railroads will continue deferring the maintenance of their lines or will not be able to accommodate 286,000 pound railcars.

2) *An Economic Analysis of Heavy Axle Loads: The Effects on Short Line Railroads and the Tradeoffs Associated with Heavy Cars* by Bobby Joel Martens (21).

In this study, a survey was conducted with the help of the American Short Line and Regional Railroad Association. The survey was sent to those railroads that have at least 15 percent of their shipments originating as farm products. As a consequence, many of those railroads were situated in the Mid-western region. The survey was sent to 88 railroads and it had a response rate of 44 percent. The most important results obtained in that study were:

- Nearly 30 percent of the route miles could handle the 286,000 pound railcar efficiently at current operating speeds.
- The necessary investment for track upgrading was \$118,662 per mile.
- 32 percent of the bridges were not capable of handling the heavy railcar. Only 10 percent of those bridges that need an upgrade could be done without any aid. This is a major issue because the upgrading of the bridges increases the investment needs tremendously.

- The necessary investment for bridge upgrading was \$226,607 per bridge or \$51,776 per mile. So, the total investment needs per mile calculates to \$170,438.
- Nearly 26 percent of total route miles would close without federal, state, or local aid.

3) *An Estimation of the Investment in Track and Structures Needed to Handle 129,844 kg (286,000 lb.) Rail Cars on Short Line Railroads* by Zeta-Tech Associates (24).

For this study, researchers used a sample of 55 railroads, accounting for approximately 5,000 route miles. The response rate was 84 percent distributed throughout the country. The most important findings of that study were:

- The minimum weight of rail capable of supporting the 286,000 pound railcar is the 90 pounds per yard.
- 23 percent of the rail mileage used in the study had less than 90 pounds per yard rail.
- 43 percent of the track-miles require some replacement of crossties.
- 23 percent of the track-miles need ballasting/surfacing.
- 22 percent of the bridges require replacement, and 27 percent need upgrading.
- The cost of replacing only the rail is approximately \$345.966 per mile.
- The average cost of upgrading the track only is \$102,017 per mile.

This study breaks down the cost of upgrading the track by component. This information is very useful because when the rail does not have to be replaced, the upgrading cost is significantly smaller.

4) *The Short Line and Regional Railroad Survey* sponsored by the ASLRRA in 2003 (25).

This survey was conducted during 2003-2004, and it contains data for 2002. The survey was sent to all the railroads and had a response rate of almost 100 percent. But when considering only those responses who answered the investment needs, the number of responses falls to 34 percent. Some of the most important findings are:

- The cost of upgrading the track only is \$135,747 per mile.
- The cost of upgrading the bridges is \$85,234 per bridge or \$75,689 per track mile.

- The percentage of Texas miles of rail that are less than 90 pounds per yard is approximately 21 percent.

After reviewing all the studies and surveys, researchers decided to use the results from the study conducted by Zeta-Tech Associates in this report. First, it is a good representative of Texas short line railroads since it includes railroads with different traffic characteristics and different length of lines, and secondly, it is the only study that states the percentage of miles of the sample in which the weight of the rail is less than 90 pounds per yard. This fact adds accuracy to the estimation of the investment needs because, as mentioned before, the change of the rail increases the upgrade cost significantly.

The Zeta-Tech Associates study assumes that there is not enough used rail to replace the network needs; so, the upgrading of the rail would be done with a new 115 pounds per yard rail. The cost of the replacement of the rail is approximately \$346,000 per mile. Also, the unit cost of the remaining track components is provided. The cost of a new crosstie is \$39 per unit, the cost of the ballast is \$10 per cubic yard, and the cost of surfacing is \$5,636 per mile.

This differentiation of the unit costs of the track components allows the division into two sections: one that accounts for those miles where the rail has to be replaced and another one for those miles in which the rail does not have to be changed. In both cases, the worst case scenario is supposed, this means that the minimum requirements for supporting the 286,000 pound railcar are taken as the required upgrade. The minimum requirements are:

- 10 good crossties per rail length (adds to approximately 1,350 ties per mile);
- 2 inches of good clean ballast (adds to 200 cubic yards per mile); and
- 90 pounds per yard rail.

In cases where the rail has to be replaced, it will be done with a new 115 pounds per yard rail, and there is no monetary value assigned to the old rail. All the assumptions rely on the fact that any attempt to estimate the amount of crossties that are needed, the ballast needs, or the assignment of a monetary value to the used rail would add uncertainty to the results. In this way, the total investment need will be on the conservative side.

Infrastructure Upgrade Costs

Table 5 shows the cost per mile for upgrading the track for the case where the rail is upgraded.

Table 5. Track Upgrade Cost with Rail Replacement (24)

Track Component	Quantity/ Mile	Unit Cost	Cost Per Mile
115 lb/yd Rail	1	345,966	345,966
Wooden Crosstie	1,350	39	52,650
Ballast	200	10	2,000
Surfacing		5,636	5,636
Total			\$406,252

As previously mentioned, the cost of replacing the rail is significantly high compared to the other requirements. Table 6 shows the cost of upgrading the track but without changing the rail. It can be observed that the investment needs are reduced by 85 percent.

Table 6. Track Upgrade Cost without Rail Replacement (24)

Track Component	Quantity	Unit Cost	Cost Per Mile
Wooden Crosstie	1,350	39	52,650
Ballast	200	10	2,000
Surfacing		5,636	5,636
Total			\$460,286

Now that the upgrading costs were calculated for both cases, the total investment needs for the Texas short line railroad network can be estimated. Table 7 shows that the miles that need to replace the rail differ from the number of miles with light rail shown in Table 4. The reason for this is that there are some miles where the railroads do not need to upgrade their lines. It also can be observed that the total investment needs of all the short line railroads that operate in Texas can be up to approximately \$250 million. This total amount does not consider the upgrading of the bridges in view of the fact that there is not enough information in order to do an accurate estimation of the upgrade needs for bridges.

Table 7. Texas Short Line Railroads Investment Needs

Type of Upgrade	Number of Miles	Investment Needs (\$/mile)	Total Investment Needs (\$M)
With Rail Replacement	483	406,252	196
Without Rail Replacement	904	60,286	54
Total			\$250

Since the replacement of the rail accounts for more than 85 percent of the total investment, it is important to analyze this matter with higher level of detail. This analysis is done in the next chapter, after introducing some additional concepts.

FUNDING

To be able to do the upgrading of their infrastructures, short line railroads must carry out major investments. As stated in many reports, railroads do not receive enough revenue to do that, thus government loans, credits, and grants programs are essential.

Although federal expenditures on passenger and freight rail have been increasing during the last 30 years, they are minor compared with the expenditures on highways. The *Freight-Rail Bottom Line Report* conducted by AASHTO states that government expenditures on highways were 31 times greater than the expenditures on passenger and freight rail. Moreover, most of those expenditures were applied to passenger rail (19). As a result, freight railroads receive very little government funding.

Federal Funding Sources

There are a number of federal programs that can support freight rail improvements. Most of them are contained in the Transportation Equity Act for the 21st Century (TEA-21) and are described in the *California State Rail Plan 2003-2004 to 2013-2014* (28). Some of them are:

- The Light Density Line Pilot Program (§ 7202): The main objective of this section is to fund capital improvements and rehabilitation for light density lines. This can be private or publicly owned. Even when a total annual amount of \$17.5 million was authorized, the funds were never appropriated.

- The Rail Rehabilitation and Improvement Program (RRIF) (§ 7203): Loans and loan guarantees are provided, under this section, for the acquisition, development, improvement, or rehabilitation of intermodal or rail equipment or facilities.
- The Transportation Infrastructure Finance and Innovation Act of 1998 (TIFIA): This program made three forms of credit assistance available: direct loans, loans guaranties, and standby lines of credit. These funds are applicable for major transportation projects of critical national or regional significance. Its main goal is to leverage federal funds by attracting substantial private and other non-federal investments.
- Congestion Mitigation and Air Quality Improvement Program (CMAQ) (§ 1110): The purpose of this program is to fund transportation projects that reduce transportation-related emissions. The potential projects have to be located in a non-attainment or maintenance area. The total available funding is \$8.1 million within the 1998-2003 period.
- Coordinated Border Infrastructure and Safety Program (§ 1119): To be eligible for this program, improvements to the existing infrastructure and operation have to improve and facilitate international trade. Its objective is to improve the safe movement of people and goods in the borders with Canada and Mexico and their surroundings. \$700 million are available for this purpose, and they are coordinated with the National Corridor Planning.
- Transportation and Community and System Preservation Pilot Program (TCSP) (§ 1221): The main objective of this program is to fund initiatives regarding relationships between transportation, community and system preservation, and the private-sector initiatives. This program provides \$25 million annually.
- Highway Rail Grade Crossing Program (§ 1108): This is a continuation of the program of the Federal Highway Act. This program provides funds to eliminate hazards at public highway-railroad grade crossings. Approximately \$150 million is allocated each year in this program.
- Local Rail Freight Assistance (LRFA): This program was established in 1976 and amended in 1978 and 1981. It used to fund four types of projects: rehabilitation, new construction, substitute service, and acquisition. In 1995 the name changed to

Local Rail Freight Assistance. Funds decreased tremendously, and in 1995 congressional appropriation ceased.

- Tax Credit for Maintenance of Railroad Track: This section of The American Jobs Creation Act of 2004 provides Class II and Class III railroads with the potential to earn tax credits against their federal tax liability. In order to obtain these benefits, tax payers have to make “qualified railroad track maintenance investments.” Qualified investments are those expenditures made to maintain track that is owned or leased by a Class II or Class III railroad. Only “eligible taxpayers” can earn credits for the qualified investments. Eligible taxpayers are railroads, shippers, suppliers, and contractors. Fifty percent of the qualified investment can be earned as a tax credit. This tax credit is up to \$3,500 per mile owned or leased (29).

This year a new federal transportation authorization legislation was issued. The Safe, Accountable, Flexible, Efficient Transportation Equity Act for the 21st Century – A Legacy for Users (SAFETEA-LU) provides new sources for funding rail projects. Those are described in the final draft of the *Texas Rail System Plan* released by the Texas Department of Transportation (TxDOT) and include (30):

- Sec 9001: High Speed Rail Corridor Development. This section is a reauthorization of the Swift Rail Development Act. It provides \$100 million per year from FY 06 to FY 13.
- Sec 9002: Capital Grants for Rail Line Relocation Projects. This section provides grants and financial assistance to rail relocation and improvement projects that: mitigate the adverse effects of rail traffic or relocate (vertically or horizontally) any portion of the rail line. It will provide \$350 million per year from FY 06 to FY 09. The costs of the selected projects must be shared with eligible entities. These entities must provide at least 10 percent of the cost of the project.
- Sec 9003: Rail Rehabilitation and Improvement Financing . Although this has been described already, this new legislation changed some of the procedures in order to simplify the participation of the railroads, state and local governments, government-sponsored authorities and corporations, and joint ventures that include at least one railroad. This section provides \$35 billion.

State Funding Sources

The Texas rail network reached its peak in 1932 with a total number of miles of 17,078. Since then, the network has suffered a significant and continuous reduction in size. After the Staggers Rail Act was passed in 1980, many lines were either sold to the short line railroads or were abandoned, causing significant damages to the state's rural areas. As a consequence, the Texas Legislature passed legislation in 1981 that allowed the creation of Rural Rail Transportation Districts (RRTD) (30).

These RRTD are special public districts created by the action of county commissioners' courts. The Texas state government considers these districts as political subdivisions (26). The main objectives of the RRTD are to develop, maintain, and diversify the economy of the state. They have the power of eminent domain and the capability of issuing bonds in order to preserve the rail infrastructure and encourage the economic growth of the state. Since its creation, 28 RRTD have been formed. In some of the cases, they were able to successfully meet their objectives (30).

Some other rail funding methods are those included in the 78th and 79th Texas Legislatures. These legislatures provide funds for rail projects by using the following methods and sources (30):

- Non-dedicated funds from the state highway funds;
- Bonds secured by the Texas Mobility Fund for passenger rail projects;
- Donations;
- Loans from the State Infrastructure Bank (SIB);
- Pass-through fares; and
- Grants or loans from the federal government or public or private entities.

Particularly, in the 79th Texas Legislature, the creation of the Railroad Relocation and Improvement Fund was authorized. In order to implement this fund, a constitutional amendment has to be approved by Texas voters in the 2007 legislative session.

CHAPTER 4: SHORT LINE RAILROAD VIABILITY

INTRODUCTION

There is an enormous difference among the short line railroads in terms of traffic, length of lines, and infrastructure conditions. That is why, even if some short line railroads have succeeded, there are others that face abandonment and bankruptcy. Therefore, it is necessary to classify the short line railroads in terms of viability or success probability.

Two different issues are treated in this chapter. First, the continuance of the railroad is studied. Second, the viability of an upgrade in the infrastructure is studied. In this case, the upgrade is considered as the one that makes the transportation of 286,000 pound railcars possible. Although many viability metrics are described in literature, the traffic density will be used to estimate likelihood of the railroads permanence and the feasibility of the upgrade investment.

Chapter 3 described investment needs system-wide. In this chapter, after the traffic density classes are defined, a new estimate of the investment needs by traffic density class is calculated.

CONTINUANCE OF SHORT LINE RAILROADS

There are several factors that indicate the viability of the short line railroads. These include (31):

- Backhaul traffic: Those railroads that have backhaul traffic have lower cost per unit of traffic since they better utilize their equipment.
- Revenue and capital availability: The railroad industry demands high capital investment in track, right-of-way, and facilities like rail yards. The ability to obtain capital has a direct impact on the viability of the railroad.
- Reliance on several industries or commodity mix: Long-term viability can be improved if the railroad serves different types of industries. Railroads that serve different types of industries and different commodities reduce the impact of the market fluctuations of a particular commodity or industry.

- Number of shippers: The number of shippers causes conflicting effects on the viability of the railroad. On one side, the increase in the number of served shippers increases the transaction costs. But on the other hand, increased shippers could increase traffic. A good indicator of the impact that shippers have on the transaction costs is the number of customers per carload handled.
- Flexibility of labor: In contrast with the Class I railroads, unionized and non-unionized workers of short line railroads perform multiple tasks. This results in large improvements in labor productivities.
- Rehabilitation requirements, track conditions: The condition of the track at the beginning of the operation (when the rail line is purchased) determines the investment needs for the upgrading of the track. The inability to obtain the capital needs might be the cause of the failure of the railroad.
- Competitive modes: The existence of competitive modes has a big impact on the revenues and the traffic that the railroads can obtain. The proximity to barge loading facilities or terminal markets, a high density of railroads (measured in rail miles per square mile), and a high density of highways (measured in highway miles per square mile) affects the viability of the railroad by increasing the price elasticity of demand of that railroad.

Some factors related to railroad viability are difficult to estimate. Therefore, to facilitate the understanding of the field under discussion and to estimate the viability of the railroads as a whole, a better indicator of the viability of the line is needed. This indicator has to be easy to calculate, and it has to be calculated with commonly available information. Thus, a good estimate of the status of the railroad often applied is the railroad traffic density.

Traffic density is defined as the total number of carloads divided by the number of miles that the railroad operates (carloads/miles) or the total number of tons multiplied by the length of haul and divided by the number of miles that the railroad operates (ton-miles/mile). A study conducted by the Upper Great Plains Transportation Institute (UGPTI) at North Dakota State University states that the railroad viability is determined by its traffic density. The following table, Table 8, summarizes their results.

Table 8. Railroad Viability Depending on the Traffic Density Measured in Carloads Per Mile (31)

Density (carloads per mile)	Probability of Success
Less than 10	Hopeless
10 to 20	Marginal and doubtful
20 to 40	Marginal to better
40 to 100	Good chance of success
More than 100	Excellent chance of success

In the study done by the UGPTI, a different classification of the railroad viability is stated. In this case, it is based on density measured in ton-miles per mile. Table 9 shows this classification.

Table 9. Railroad Viability Depending on Traffic Density (32)

Density (ton-miles per mile)	Probability of Success
Less than 50,000	Typically have higher costs and likely to be justified only if the line is short (under 10 miles) or under special conditions
Between 50,000 to 200,000	May be justifiable depending on the mainline haul, length of the line, and the railroad's ability to control costs
Between 200,000 to 800,000	If under 25 miles, these lines are economically justifiable unless the mainline is short or the transfer from truck to rail is low
More than 800,000	Likely to be profitable even without a mainline haul

Table 10 shows the density of the short line railroads that are currently operating in Texas (this information was obtained from *The Short Line and Regional Railroad Survey* and accounts for the total miles of the railroad that are currently operating in Texas).

Table 10. Miles of Texas Short Line Railroads by Density Class

Density (carloads per mile)	Probability of Success	Miles in Texas	Percentage
Less than 10	Hopeless	406	14
10 to 20	Marginal and doubtful	151	5
20 to 40	Marginal to better	481	16
40 to 100	Good chance of success	363	12
More than 100	Excellent chance of success	1,516	51
Data N/A		54	2
<i>Total</i>		<i>2,971</i>	<i>100%</i>

As shown in Table 10, in terms of the probability of success of the railroad, more than 50 percent of the miles of Texas short line railroads have excellent chances of success.

FEASIBILITY OF THE LINE UPGRADE

The number of carloads and the number of miles within the short line railroads vary immensely. That is why it is difficult to estimate the viability of an upgrade in the infrastructure. As a primary approach, the upgrade in the infrastructure will be viable or not, depending on the internal rate of return of the investment. The upgrade will be complete if the internal rate of return is higher than the rate of return that the railroad can get from an alternative investment and if the railroad has access to a source of funding. According to the study done by the Upper Great Plains Transportation Institute, the internal rate of return is influenced by five factors:

- 1) *The number of periods over which the upgrade is expected to yield benefits.*

Although the expected life of the physical assets is very long (at least 20 years), due to the uncertainty of traffic, uncertainty of revenues, and the immobility of the railroad assets, a commonly used time period is 7 years.

- 2) *The incremental traffic expected as a result of the upgrade.* In this case, the incremental traffic is compared with the scenario in which the line is abandoned. So, it is the sum of the maintained traffic due to the continued service, the traffic gained due to the improvement in the service (safety and speed improvements), and the traffic gained due to the abandonment of competitor's lines.
- 3) *Incremental revenues and costs as a result of the increment in traffic caused by the upgrade.* The increment in revenue is the corresponding increment in revenue due to the increment on traffic for the entire time that the cargo travels through the system. This might include the movement through the Class I railroad(s). The increments in costs are those attributable to the upgrade: the upgrade cost itself, the routine maintenance costs of the track, and transportation costs related to the increment of traffic. It is important to state that the operating costs will decrease after the infrastructure upgrade allowing the use of heavier railcars. Examples of those reductions in the operation costs include reduction in railcars and locomotive

ownership and maintenance costs, reduction in labor costs, increase in the capacity of the system, and a decrease in the probability of a derailment.

- 4) *Service improvements as a result of the upgrade that increase revenues.* It is clear that the infrastructure upgrade will improve the provided service. This would allow an increase on the price since now the service is more reliable and may be faster.
- 5) *The cost of the upgrade (23).*

In order to identify if the infrastructure upgrade is a good investment or not, every short line railroad would need a separate study. Therefore, as it was used in the previous section, traffic density will be used in order to estimate the viability of the upgrade investment.

It is evident that the traffic density required to upgrade the track to support the 286,000 pound railcars is significantly higher than the traffic density required for the continuance of the railroad. As stated in the study done by the Upper Great Plains Transportation Institute, the minimal traffic density is approximately 200 carloads per mile. But this number can be smaller depending on intrinsic characteristics of every railroad. For example, the possibility of increasing the rate to the railroad partner, usually a Class I railroad, can significantly reduce the required traffic density. According to that report, the minimum density can be as low as 35 carloads per mile (23).

Taking this into consideration, Texas short line railroads were divided into three traffic density categories: low (less than 40 carloads per mile), medium (between 40 and 200 carloads per mile) and high (more than 200 carloads per mile). This classification stands for the likelihood of the railroad of making the upgrade investment. In the low-density range, it is likely that the internal rate of return on the investment will not be acceptable and the upgrade would not be done unless the railroad obtains significant external funding. In the medium-density range, the internal rate of return on the investment will be acceptable or not depending on the railroad and on some other factors like the relationship between the short line and its railroad partner(s). Finally, the high-density range indicates that under this scenario, the internal rate of return on the investment will be acceptable.

Table 11 shows the density of the short line railroads that are currently operating in Texas and their upgrading needs.

Table 11. Classification of Texas Short Lines by Density

	Density						Totals	
	Low		Medium		High			
	Miles	%	Miles	%	Miles	%	Miles	%
286 k Pound Ready	118	11	822	73	302	41	1,242	42
Do Not Need Upgrade	192	19	-	0	66	9	258	9
Need Upgrade	713	70	305	27	369	50	1,387	47
Data N/A							84	2
Total	1,023	100%	1,127	100%	737	100%	2,971	100%

Several observations can be deduced from the information in Table 11:

- 42 percent of the miles of the short line railroads that are currently operating in Texas can already handle the 286,000 pound railcar.
- 47 percent of the miles of the short line railroads that are currently operating in Texas need an upgrade in order to be able to support the 286,000 pound railcar.
- 70 percent of the miles within the low-density range need to be upgraded.
- More than half of the miles (713 out of 1,387 or 51 percent) that need an upgrade belong to railroads with a traffic density that is lower than 40 cars per mile.
- 22 percent of the miles needing an upgrade (305 out of 1,387) belong to short line railroads with a traffic density between 40 and 200 carloads per mile. This is the category in which the upgrade might be feasible depending on specific railroad conditions.
- 27 percent of the miles needing an upgrade (369 out 1,387) fall into the high-density group.

TEXAS SHORT LINE VIABILITY CONSIDERATIONS

Now that the investment needs are known (refer to Chapter 3) and the railroads are divided into three traffic density classes, the upgrade investment needs can be obtained for every traffic density class.

Table 12 shows the investment needs divided by traffic density. It also divides the investment needs by miles with rail upgrade and miles without rail upgrade. In this way, a better understanding of the resources needed is obtained.

Table 12. Texas Short Line Railroads Investment Needs by Traffic Density

	Miles	%	Investment Cost (\$/mile)	Total Cost (\$M)	Total Cost/Density Class (\$M)	% of Total
High Density						
With Rail Upgrade	60	16	406,252	24		
Without Rail Upgrade	309	84	60,286	19		
	<i>369</i>	<i>100%</i>			43	17
Medium Density						
With Rail Upgrade	66	22	406,252	27		
Without Rail Upgrade	239	78	60,286	14		
	<i>305</i>	<i>100%</i>			41	17
Low Density						
With Rail Upgrade	357	50	406,252	145		
Without Rail Upgrade	356	50	60,286	21		
	<i>713</i>	<i>100%</i>			166	66
Total	1,387	100%			\$ 250	100%

Several conclusions can be obtained from the results shown in Table 12:

- The two highest density classes have approximately the same investment needs. When combined, they account for 34 percent of the total investment needs.
- In contrast, the low-density class accounts for two-thirds of the total amount. The main reason for this is the number of miles that need rail upgrades. These miles need an investment of \$145 million, representing 87 percent of the needs of that class or 58 percent of the total needs of Texas short line railroads.

Further discussion is addressed in Chapter 5, where the costs and benefits of abandoning Texas short line railroads lines are calculated. If these lines are not abandoned, they will prevent diverting their traffic to the state highways. This will cause savings in terms of pavement damages.

CHAPTER 5: PUBLIC INTEREST IN SHORT LINE RAILROADS

INTRODUCTION

As previously mentioned, short line railroads play a very important role in the rail industry and in the national freight transportation system. They produce benefits to shippers, rural communities, and government agencies. Most of these benefits are connected to the base principle that short lines are able to operate on low-density lines. As a consequence of that, thousands of miles have been operated by these railroads during the last two decades, eluding the abandonment of lines throughout the country. This chapter discusses two challenges facing rural Texas that could affect short line viability in those regions, discusses some of the impacts of rail line abandonment, and develops a benefit-cost analysis comparing pavement savings from short line operations.

RURAL TEXAS CHALLENGES

Two significant issues in rural Texas may have an impact on short line operations. These issues include trends in rural economic and socio-economic conditions and the state of rural transportation.

Rural Texas Population and Economic Trends

Texas was once a state consisting primarily of many rural, agriculture communities with a few modest-sized urban areas. Today, the state population is located primarily in the urban areas, much of which is located in the triangle formed by Dallas-Fort Worth, San Antonio, and Houston. Although growing as a whole, the rural population has grown only modestly compared to the urban population in Texas.

According to the 2000 Census, Texas has 20.85 million people in the state, which represents an increase of 22.8 percent from 1990 (33). The Office of Rural Community Affairs (ORCA) reports that of the total state population, more than 15 percent (3.2 million), lives in areas designated as rural. That 15 percent lives on approximately 80 percent of the land area or 213,297 of Texas' 267,277 square miles of land area. They also report that of the 1,196 incorporated cities in Texas, 1,012 have fewer than 10,000 residents. The

non-metropolitan areas in Texas experienced a 12 percent population increase between 1990 and 2000 (33).

In comparison, during that same time the metropolitan areas experienced growth close to 25 percent. The metropolitan population is currently over 17.69 million persons. The Office of Rural Community Affairs indicates that the state's 27 metropolitan areas accounted for more than 91 percent of Texas' population growth between 1990 and 2000 (33). This shows how Texas has become much more of an urbanized state over the last couple of decades.

Traditionally, the two major industries for rural Texas are oil and gas production and agriculture. Unfortunately, the dependence on a limited number of industries ties rural communities to the ups and downs of those specific industries. So, if oil and gas production experiences a significant downturn, rural communities tied to oil and gas production will also experience economic hardships. According to ORCA, rural counties accounted for 75 percent of the state's oil and gas production in 1999. Over 500,000 Texans are employed by the oil and gas industry. In 2001 the oil and gas industry contributed \$75 billion into the Texas economy (33).

Agriculture is the second largest industry in Texas, producing 16 percent of the gross state product, according to ORCA. With 227,000 farms, Texas has more than twice as many farms as any other state. Agriculture is the principal land use in Texas, and 15 percent of all Texans work on farms or in farm-related jobs (33). Unfortunately, continued fragmentation of rural land greatly hinders efficient agriculture operations and changes the land-use patterns. The Office of Rural Community Affairs considers the continued breakup of family-owned property "one of the most significant factors affecting Texas' rural landscape (33)." They state that Texas has lost more agricultural land than any state in the country and is now experiencing an average annual loss of acreage of 67,000 acres per year.

Texas is much more of an urban state now. The continued loss of rural agricultural land and the struggle to maintain, much less expand, economic opportunities make the current economic conditions in rural Texas more important now than ever. In its report, ORCA indicates "many rural Texas communities are faced with educational funding shortfalls, the possibility of

consolidation, loss of medical services, deteriorating infrastructure, and declining tax values (33).”

Rural Transportation Trends

Transportation is critical to the viability of rural communities and economic viability. The Texas Department of Transportation maintains almost 80,000 highway centerline miles in Texas. Of that 57,000 the interstate and U.S. highways consist of only 19 percent of the miles, while the remaining 57,000 centerline miles consist of state highways, Farm or Ranch-to-market roads, frontage roads, and park roads. Farm or Ranch-to-market roads account for almost 41,000 centerline miles (34). Statewide, 44 percent of the total highway miles are in rural counties, 18 percent are in micropolitan counties, and the remaining 38 percent are in urban counties (35).

Also important to rural transportation is the county road system, which has many critical issues. According to ORCA, many rural counties in Texas have “hundreds of miles of roads to maintain, aging bridges, low population densities, and small tax bases. In many instances, current road and bridge revenue cannot support the cost of rebuilding the road base, topping the surface, and maintaining a suitable finish (33).”

As stated above, agriculture remains one of the most important industries for rural Texas. Much of the agricultural industry revolves around receiving grains for livestock and shipping grains from harvest. Transportation is critical to both of these activities. In 2001 the *Texas Grain Transportation Study* revealed the importance of grain to Texas and the transportation concerns related to the agriculture community in Texas. According to the study, Texas farmers produce in excess of 500 million bushels of corn, grain sorghum, wheat, and rice and consume in excess of 415 million bushels by the livestock, poultry, and dairy populations (36). The study investigated the characteristics of grain movements for several regions in Texas. They summarized these characteristics below:

“In the High Plains, a leading feed grain producing and consuming region, most feed grain is marketed to regional livestock populations; all such feed grain is

truck transported. However, High Plains wheat production is dependent on motor carriers and railroads. Motor carriers assemble important quantities of wheat from country elevators to regional terminal elevators, while railroads are central for transport of wheat from country elevators and terminal elevators to Texas Gulf ports and Arizona/California markets. A similar dependency on truck and rail modes is shown in Texas' other wheat producing regions (Low Plains and North Central regions). Corn production in the eastern half of Texas is primarily destined for livestock, poultry, and dairy consumption (where truck haulage dominates) and, to a lesser extent, for Texas Gulf ports and Mexico (where motor carriers and railroads play important roles). Grain sorghum production in the eastern half of Texas is largely destined for Texas Gulf ports, Texas feeders and processors, and Mexico. Sorghum shipments to Texas feeders and processors are primarily truck transported, while trucks and railroads are important for movements to Gulf ports and Mexico. All rough rice shipments to Texas mills and Gulf ports are carried by truck, while shipments to Mexico are primarily transported by railroads. In summary, the truck mode is central to the marketing of Texas-produced grain; however, rail is very important for selected grains on particular corridors (36)."

In addition, the study provides the following observations regarding grain transportation in Texas:

- Large quantities of rail-transported grain are received in Texas from out-of-state origins for consumption by its livestock, poultry, and dairy populations and for export via Gulf ports and Texas-Mexico border crossing sites - hence, the importance of this transportation and imported grain supplies to Texas agribusiness.
- Trends in Texas feed grain production suggest a continued dependence on
- Out-of-state grain supplies.
- Because Mexico is an increasingly important market for Texas-produced grain, efficient transportation systems are critical for Texas' competitiveness in this market.

- Motor carriers are (a) central to transportation of Texas feed grain production (corn, grain sorghum), since most is consumed in state; (b) the primary transporter of Texas rice production; and (c) important for Texas wheat production. But because principal markets are at extended distances, there is a dependence on railroads to access these long-haul markets.
- Texas rural highways are critical for the marketing of Texas grain production.
- Texas grain handlers believe service offered by motor carriers is satisfactory, while many are dissatisfied with service offered by Class I railroads.
- Class I railroad companies in Texas are striving to improve grain service schedules (with varying success); however, trucks have the competitive advantage on trips less than 250 miles in length. On those routes where trains remain competitive, larger grain shippers are able to take advantage of the lower rates offered on unit and shuttle train operations, while smaller shippers can take up guaranteed delivery programs.

These conclusions show that trucking is very important to both grain production and consumption, although rail can still play a role.

An additional study in 2003 also states an increased use of trucks in rural Texas and quantified the condition of rural Texas roadways. In the report *Rural Truck Traffic and Pavement Conditions in Texas*, the authors reveal that the increased scale of farming operations has brought about farm ownership and increased use of semi-trailer trucks and that the trend toward preserving the identity of agricultural produce from field to consumer requires the movement of smaller shipment sizes, careful handling to prevent damage, and reduced transit time favors trucking (37).

The trend to utilize trucking more in rural areas further strains the rural roadway network. According to the report, TxDOT estimates that approximately \$1.9 billion will be needed to maintain and repair the road system, including approximately 35 percent (\$651 million) for the farm-to-market system. The total preventative maintenance needs calculated by the authors for the farm-to-market road system accounts for 47 percent (\$168 million) and accounts for

66 percent of the total light rehabilitation needs calculated (\$189 million). In addition, the calculated ride score in 2003 revealed that almost 44 percent of the farm-to-market roadbed section-miles are rated fair to very poor as compared to 18 percent, 6 percent, and 13 percent for interstate highways, U.S. highways, and state highways, respectively. They conclude that “increasing truck numbers and axle loads on rural pavements and the identified pavement maintenance needs might mean that TxDOT will find it increasingly challenging to maintain and repair its extensive rural road system in the future” (37).

One reason for increased trucking is the decreased availability and changes to rail service. The peak of the Texas rail network was in 1932 when the state had more than 17,000 miles of track (30). Since that time, abandonment of line segments has reduced that mileage to more than 10,000 miles. Rail line abandonment accelerated with the passage of the Staggers Rail Act, discussed previously. Some rail line segments were saved by the onset of operations by a short line railroad. Even with the doubling of short lines in the state over the past 25 years, abandonment still affected much of rural Texas.

Rail operations of the major, Class I railroads continues to evolve into a more efficient, high-speed network. One way to improve efficiency has been to place large load centers on main routes and operate shuttle trains. This reduces rail operations on branch lines and may require increased trucking of product to these major centers. The *Texas Grain Transportation Study* indicates the “advent of unit trains, loaded rapidly at major terminals for load centers and moved efficiently to other points in the system, is a feature of the new grain policy” (36).

EFFECTS OF LOSS OF RAIL SERVICE

The elimination of short line service causes a transfer from rail to a competing mode, such as highways or waterways. As a result of Texas’ natural resources and waterways, most of the traffic would be transferred to highways, via truck. This produces several possible consequences including the following:

- Increase in shipping costs,
- Decrease in local gross business volume,
- Decrease in local employment and property value,

- Discouragement of economic development opportunities,
- Increase in highway maintenance costs,
- Increase in highway user costs,
- Environmental impacts, and
- Safety impacts.

The following paragraphs describe these impacts in more detail.

Rail has a natural cost advantage over trucks in those cases where the hauling distance is considerable and/or low-valued, bulk products are transported. Good examples of these are natural resources like coal or grain, where their location is far away from the market. The loss of rail service in locations where water transportation is not a feasible option causes an unavoidable shift of loads from train to truck, increasing shipping costs (38).

The increased cost is caused basically by two factors. First, as previously mentioned, rail is more competitive than truck in long distances. This factor is even more important in those cases where the goods that were transported are bulk commodities like coal and grain. Second, if the rail line is abandoned, trucks do not have any other competitor. This results in increased shipping rates. Only in those cases in which water transportation is available, or an alternative rail line is close enough to justify the use of it, the cost of transportation may not suffer a substantial increase (38).

Very commonly, the price of the products at the market is fixed. As a consequence, the increase in the cost of transportation produces a decrease in the net income of the shippers. This reduction in the shipper's benefits has an effect on the value of their property. Lower incomes produce an inevitable decrease on the value of the properties and on the gross business volume. As a result, some existing commerce may go out of business causing a decrease in the employment and a reduction in the tax revenue (38).

In addition to all these impacts to shippers and local communities, the abandonment of rail lines reduces economic development chances for these communities since the feasibility of

many industries depend on the existence of rail. If rail service is lost, the attractiveness of the communities is reduced (38).

TRAIN VS. TRUCK BENEFIT-COST ANALYSIS

Even if the additional truck traffic volume produced by the abandonment of short lines is not extremely big, it needs to be considered. Rail transportation might be the only way to limit the growth of truck traffic, especially in those cases where water transportation is unavailable and roadways are becoming more congested. It is imperative to change the perspective of how rail transportation is considered; it has to be measured in terms of the value received per each dollar that is spent (26).

The analysis of the additional costs covers three main areas.

1. The extra costs incurred by the government agencies because of the increased maintenance cost on roadways, especially pavement deterioration costs.
2. The increased costs incurred by the highway users, such as congestion cost and collision costs.
3. The extra costs incurred by society as a whole, such as air and noise pollution costs.

A description of these three areas is provided, including an estimation of the pavement deterioration cost in Texas.

Government Costs

The load capacity of a railcar is three to four times larger than the load capacity of a truck. As a consequence, even on light density lines, the shift from train to truck can produce a significant increase in the volume of trucks. In the case of branch lines, this increase in traffic is added to rural roadways, facilities that were designed for lighter and less frequent loads. This accelerates the deterioration of the pavement, making repairs and rehabilitations more frequent (26).

If the marginal pavement cost per mile traveled is compared between a rural interstate highway and a minor collector highway, the results show that the latter is 21 times greater. The ratio becomes 13.5 if the comparison is done with a major collector highway (38). Moreover,

the damage caused by one 80,000 pound truck is approximately equivalent to the damage of 9,600 cars. As a result of that, roads that were designed and constructed with an expected life of 25 to 30 years need to be replaced in 10 to 15 years. This unexpected increase in maintenance restrains the capabilities of the government agencies to provide increased highway capacity or better quality to the existing infrastructure (26).

Numerical Analysis

As with the previous analysis, the information used in this study was obtained from *The Short Line and Regional Railroad Survey* sponsored by the ASLRRA in 2003. The pavement damage was calculated based on the method used by the Upper Great Plains Transportation Institute in the study *North Dakota Strategic Freight Analysis. Item IV. Heavier Loading Rail Cars* (23). In this case, the three different density ranges used in previous chapters are used during this calculation. In order to calculate the pavement costs, researchers performed the following steps:

- 1) The number of carloads of each railroad was obtained from the survey.
- 2) The number of carloads of every railroad was multiplied by the average length of haul of the railroad to obtain the carloads per mile.
- 3) The carloads per mile were converted into truckloads per mile by applying a conversion factor. In this case, the factor is 3.0. The factor was obtained from *The Short Line and Regional Railroad Survey* report. It is assumed that the type of truck that is used is the 5-axle, 80,000-pound truck.
- 4) After the truckloads-miles were obtained, they were multiplied by the cost per mile caused by trucks due to their highway damage in order to find the additional cost of transferring loads from rail to highway. To estimate this, two types of highways were considered, the first one is a rural interstate highway, and the second one is a rural major collector. In the first case, the pavement damage is 12.7 cents per mile while with the rural major collector, the pavement damage is 30.5 cents per mile (23). On the other hand, a portion of the pavement damage that is caused by trucks is paid through federal and state gas taxes. The 20 cents per gallon of the state gas tax and the state's 87.4 percent share of the 21 cents per gallon of the federal tax are converted into cents per mile by multiplying them by the average

truck fuel efficiency of 5.0 miles per gallon. The resulting 7.67 cents per mile is the corresponding share of the pavement damage that is paid by trucks and thus subtracted from the pavement damage costs (39). In other words, the total savings for using rail instead of trucks is 5.03 cents per truck mile traveled on a rural interstate highway and 22.83 cents per truck mile traveled on a rural major collector.

Table 13 shows the results of the calculation.

Table 13. Annual Pavement Damage Savings in Texas

Density	Carloads X miles	Truckloads X miles	Rural Interstate (\$M)	Rural Major Collector (\$M)
High	8,947,367	26,842,101	1.4	6.1
Medium	41,391,060	124,173,180	6.2	28.3
Low	1,260,957	3,782,871	0.2	0.9
Total	51,599,384	154,798,152	\$7.8	\$35.3

The real total annual pavement damage savings ranges between \$7.8 million and \$35.3 million. This value will depend on which type of highway is used, and therefore, it depends on the location of each railroad. Table 13 shows that the middle-density class accounts for 80 percent of the pavement damage savings. This result reflects the fact that one of the regional railroads is included in this density class and therefore it increases significantly the carloads-miles of that class.

In order to perform a benefit-cost analysis, the benefits and costs need to be considered during the entire expected life of the project. Since the public sector will be affected by the benefits (pavement damage savings) and costs (upgrade investment needs) of the abandonment or not of these lines, the analysis is presented from the public sector perspective. Usually in public sector projects, the expected life of these investments is 20 to 30 years but, as mentioned in Chapter 4, due to the uncertainty of traffic, uncertainty of revenues, and the immobility of the railroad assets, the expected life of these investments is 7 years. The discount rate used in this study was obtained from the Office of Management and Budget of The Executive Office of the President. The discount rate used was 2.3 percent (40).

Table 14 shows the total pavement damage savings over a 7-year period per density class and the investment needs to support the 286,000 pound railcar.

Table 14. Comparison Between Pavement Savings and Upgrade Costs

Density	7-year Rural Interstate Pavement Damage Savings (\$M)	7-year Rural Major Collector Pavement Damage Savings (\$M)	Potential Abandoned Miles	Upgrading Cost (\$M)	B/C Ratio
High	8.6	39.2	752	43	0.91
Medium	40.0	181.4	1,127	41	4.40
Low	1.2	5.5	1,092	166	0.03
Total	\$49	\$226	2,971	\$250	0.90

Table 14 shows that the total savings obtained from avoiding pavement damage do not cover the investment needs even if all the traffic is transferred to rural major collectors. It also can be observed that the medium-density class has a benefit cost ratio of 4.4. This means that the savings obtained from preventing the transfer of traffic from rail to highway are more than four times higher than the cost of upgrading their infrastructure.

On the other hand, the low-density class represents only 2.5 percent of the benefits but accounts for 66 percent of the costs. This means that the investment on this density class railroads would not result in significant avoided pavement damage. But most of the railroads that belong to this low-density class are branch lines located in rural areas, and the abandonment of these lines would most likely negatively affect the rural communities. The questions are then how important are these communities to the public sector, and how much support is the public sector willing to provide to them? The analysis of these topics exceeds the objective of this report and represents an important theme of study.

Highway User Costs

The growth in both automobile and truck traffic is producing an increase on the levels of congestion on many highways. A higher truck traffic volume increases the volume to capacity ratio (v/c) of the highways mainly because of its size and operational characteristics (39). This higher v/c ratio impacts highway users in two main ways, vehicle operating costs and travel time costs:

- The operating costs are divided into fuel, oil, tires, insurance, maintenance, repairs, and use-related depreciation. The increase in the cost is caused by the frequent start-stop cycles and the idling time and by the deteriorated roadway quality (41).
- Travel time cost, or congestion cost, is the monetary value resulting from the additional travel time due to the increase in automobile and truck traffic volumes.

Society Costs

The society costs are those where the affected party is the entire society and not just a particular group like the highway user. Some of the society costs discussed in literature include:

- *Environment costs.* This category is divided into air pollution costs and energy savings costs. Air pollution costs are the costs of premature death and illness due to vehicular emissions. It can be calculated by assigning a price for every ton of pollutant. This technique is commonly used in industrial emissions. The value of the pollutant will change depending on the area in which the emissions are produced. The energy savings costs are related to the fact that trains are three times more fuel efficient than trucks (39). This is of an enormous importance with current volatility of oil prices. Fuel represents approximately 15 percent of the variable costs of truck operations. A significant change in the price of oil can change drastically the profits of a company (36).
- *Noise pollution costs.* This is the change in the value of the properties located next to the highways caused by the vehicular noise. In this case, it would be the change in value due to the increase in the truck volume traffic. Sometimes, it is also calculated as the cost of installing sound barriers.
- *Collision costs.* This cost can be considered also as a highway user cost because it harms all of society. In this report, it is treated as a society cost. It is composed of the medical cost, property damage, and lost productivity of the survivors.

CHAPTER 6: FINDINGS AND CONCLUSIONS

FINDINGS

This document examines the critical role the short line railroads play in Texas. Short lines provide an additional transportation option for goods throughout many rural parts of Texas, keeping trucks off rural highways. They also perform important switching operations within many of the Texas urban centers.

In this document, Chapter 2 provides an overview of the U.S. rail industry, including the definitions of the different railroad classes. There are only seven Class I railroads operating in the U.S. The remaining 542 railroads operating in the U.S. are short lines, which include regional, local, and switching and terminal railroads. Some of the existing short lines have been around for more than a century, but approximately 60 percent of the current short lines in the U.S. are less than 25 years old as a result of the Staggers Rail Act of 1980. This legislation allowed railroads to unload unprofitable line segments, either through rail line abandonment or selling the line for short line operations. In Texas, 28 of the short lines, or 68 percent, formed after 1980. The total miles operated by Texas short lines currently exceed 3,200 miles.

Some of the major challenges for short line railroads are covered in Chapter 3. These include the significant challenge of accommodating 286,000 pound railcars on their systems, deferred maintenance, capital investment needs, and infrastructure funding. The analysis performed for the 286,000 pound railcars found that more than 600 miles of Texas short line track consists of lightweight rail (less than 90 pounds per cubic yard). The approximate cost to upgrade the light rail track with rail replacement is up to \$410,000 per mile. However, those costs greatly reduce to only \$60,000 if the rail is adequate and only the other track components need upgrading. Total short line investment needs in Texas are calculated to be up to \$250 million.

Chapter 4 examines the viability of Texas short line railroads. Utilizing the density of the railroads as an indicator, the analysis categorized the Texas short lines into three density levels: low, middle, and high. Based on the density, a higher density level means there is a better

chance for success. The analysis in Chapter 4 indicates 1,516 miles (51 percent) of Texas short lines have an excellent chance of success according to the density parameters. However, 1,387 miles (47 percent) of Texas short lines are not able to handle the 286,000 pound railcars. From these 1,387 miles:

- 713 miles (51 percent) have low traffic density and account for 66 percent of the investment needs (\$166 million).
- 305 miles (22 percent) have medium traffic density and account for 17 percent of the investment needs (\$41 million).
- 369 miles (27 percent) have high traffic density and account for 17 percent of the investment needs (\$43 million).

One of the major questions to ask refers to the public interest in short line railroads. Chapter 5 examines some of the areas in which short lines affect the public. One of the major areas is continued rail service of a previously unprofitable Class I railroad line segment. As stated in Chapter 2, 60 percent of the current short line miles have been added since 1980, when reduced regulation made it easier to abandon line segments. Not all lines were saved, and many of the short line operated lines are subject to future abandonment. The loss of rail service may be a serious issue for rural communities that rely on rail service for agriculture shipments. This is especially important considering a couple of challenges currently facing rural Texas. These include the trend toward meager rural population growth, while the urban areas in Texas have grown significantly. As a result, rural areas continue to lose agricultural land and struggle to maintain economic opportunities. Another challenge for rural Texas is the rural transportation system. More and more trucks are being used to move agricultural goods over deficient roadways in need of major improvements. The rail network, especially in areas serving rural communities, has reduced in size from 17,000 miles in 1932 to approximately 10,000 miles at present.

In order to communicate the effects of short line rail service on Texas roadways, researchers analyzed the pavement cost savings provided by the short line operations in Texas. Chapter 5 presents the results. The annual pavement damage savings associated with the Texas short lines' is up to \$35.3 million. Most of these savings (80 percent) belong to the mid-range

traffic density short lines. The pavement damage savings do not cover Texas short lines' investment needs. The low traffic density class represents 66 percent of the total expenditure but account for a small share of the pavement damage savings. The low traffic density lines are often located in rural areas, where the impact of abandonment would negatively affect rural communities. So, the decision making process of funding these lines should include not only direct saving of pavement damage but also those secondary effects like increased shipping costs and their effects on rural economics.

CONCLUSIONS

Over the course of this research project, several findings became apparent as to short line operations, viability, and importance to Texas. The following section discusses these conclusions.

The Relationship with the Class I Railroads is Vital

The reality for most short lines is that shipments do not originate and terminate on their line, which means they have to interchange with another railroad, usually a Class I railroad. Babcock et al. provides this statement about this relationship:

“It is argued that the short line may provide superior service on its own system, but since the short line is dependent on the Class I railroad for ultimate delivery, it is unable to guarantee quality service for the entire movement. Also, the short line will usually have to interline with a Class I railroad, and the resulting switching charges may cause the short line to become non-competitive. Also, the critics point to the near total dependence of short lines on Class I railroads for rail cars” (42).

Basically, despite what the short line does on its line, the interchange and relationship with the Class I railroad may be the most important aspect. Short lines are working to improve the interchange with the Class I railroads. One major way is by creating unit-type trains that improve operations and reduce operating costs. This allows the Class I to stop and pick up the entire train and not spending critical resources picking up only a few cars. Additionally, some short lines are acting as reliever routes where capacity constraints exist on the Class I network.

Short Lines are Adapting to Maintain and Grow Business

Short line railroads focus on value-added services to meet shipper needs. This customer-focused approach benefits the shipper by adding services that improve operations, reduce transportation costs, and potentially expand their business. This, in turn, increases services for the short line railroads. These services may include working with shippers to better manage rail car availability and turnaround, which reduces demurrage charges and more effectively manages inventory, or developing transload or warehouse storage facilities.

Texas Short Lines Positively Benefit the State

The findings show that by removing trucks off highways the short line railroads operating in Texas increase safety on the roadways, reduce emissions, and extend the life of roadways, especially those in rural areas. The estimated \$35 million in annual pavement savings acts as an increase in funding that can be spent on other transportation needs around the state.

Short lines also employ a significant amount of people throughout the state; pay considerable amounts of local, state, and federal taxes; and provide an economic development tool critical to many parts of the state. According to the survey, short lines now serve 76 new customer facilities, with an additional 81 industrial development locations planned.

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