Highway Safety Effects from Rail Line Closure in Kansas

This paper develops a methodology for estimating the highway safety effects resulting from rail line closure. It improves upon the previously developed methodology by recognizing both the highway safety costs and the highway safety benefits of rail line closure. The methodology is applied to a region of western Kansas with potentially endangered short line railroads. The author finds that short line abandonment in the western two-thirds of Kansas would result in net annual highway safety benefits of $1.4 million.

by Jay Witt

Following passage of the Staggers Rail Act in 1980, U.S. Class I railroads adopted a cost-reduction strategy to increase profitability. Part of that strategy was the sale or lease of their rural area branch lines to short line railroads.[1] In the year 2001, Class II and III railroads operated 45,000 miles of track or 32% of the U.S. rail system (AAR, 2002).[2] In Kansas, short lines operate 2,145 miles of track which is about 44% of total Kansas railroad mileage.[3] Short lines play a significant role in the transportation systems of many other states as well. Thus, the economic viability of these railroads is an important issue for rural area shippers.

Railroad abandonment in Kansas has increased in recent decades. In the 1970-79 period, 415 miles of rail line were abandoned; in the 1980-89 interval an additional 815 miles, and in the 1990-2000 period, 1,246 miles.[4] In 2001 alone, 335 miles were abandoned.[5] The significant change since 1990 is the growing proportion of abandonment by short line railroads. In the 1990-2000 period nearly half of the 1,246 miles were abandoned by short lines.[6] In 2001, 86% of the 335 miles abandoned were due to short lines.[7]

As abandonment of short lines has increased, an increasing amount of Kansas grain tonnage has been diverted from short line railroad shipment to truck shipment. According to the publication *Kansas Grain Transportation* (2001), published by Kansas Agricultural Statistics, the motor carrier share of wheat shipped from Kansas grain elevators increased from 37% in 1990 to 47% in 1999. The corresponding percentages for corn shipped from Kansas grain elevators by truck were 62% in 1990 and 72% in 1999. In 1990, motor carriers accounted for 35% of the sorghum shipments which rose to 56% in 1999. For soybeans, the motor carrier shares were 35% and 53% for 1990 and 1999, respectively.

Changes have occurred in the Kansas grain transportation system that have contributed to increased trucking of grain. Class I railroads are encouraging the construction of unit-train (100 or more railcars) loading facilities (shuttle train locations) on their main lines. Due to the scale economies of unit trains, Class I railroads offer lower prices to shuttle train shippers. In turn, this enables shuttle train shippers to pay a relatively high price for wheat. According to Rindom, Rosacker and Wulfkuhle (1997, p. ii), Kansas farmers will truck their grain a much greater distance to obtain a higher grain price at the shuttle train location. Farmers will bypass the local grain elevator and the short line railroad serving it in order to truck grain to shuttle train facilities.

Changes have also occurred in the Kansas grain production system resulting in fewer, larger farms. With the increased scale of operations, farmer ownership of semi-trailer trucks has increased.[8] These trucks enable farmers to bypass the local elevator and the short line railroad serving it, and deliver grain directly to more distant markets.

According to Babcock et al. (1993, p. 80), grain is the principal commodity of most Kansas short lines, and Babcock, Prater and Russell (1997, p. 12) found that the most important determinant of short line railroad profitability is carloads per mile of track. Thus, increased grain trucking threatens the economic viability of short lines, possibly resulting in abandonment of these railroads. This would cause a large diversion of grain traffic to highways and a concomitant increase in highway safety costs.

Abandonment could have negative effects on rural areas. The price paid to farmers by grain buyers is obtained by subtracting the cost of transportation from the market price. Abandonment would cause grain shippers to switch to more expensive truck transportation and the more costly freight would result in a lower price paid to farmers for their grain. For example, if the price of wheat at export ports is $3.30 per bushel and the transport cost to the ports is 30 cents per bushel, the net price paid to the farmer is $3.00 per bushel ($3.30 minus $0.30). If the transport cost to the ports rises to 40 cents per bushel, the farmer only receives $2.90. Of course, the loss of rail service may increase transport cost and reduce profits of other rural rail shippers as well.

In addition to higher transport costs, abandonment would result in a reduction of market options for rural shippers. Markets that are best served by rail (i.e. large volume shipments over long distances) are less available to the rural shipper after abandonment. Instead, shippers are limited to local truck-served markets. Abandonment would result in a loss of economic development opportunities for rural communities. Firms that require railroads for inbound and/or outbound transport (e.g. shippers of food, lumber, paper, chemicals, and steel products) would not consider locating in a community that has no rail service. Since railroads are also taxpayers, abandonment would result in a loss of tax revenue needed to fund basic government services.

Increased trucking of grain could have other negative impacts. For example, increased road congestion may produce more vehicle accidents and reduce average speeds, resulting in a rise in the opportunity cost of time in transit. The significant increase in heavy truck movements will also increase the frequency and magnitude of rutting and cracking of roads, causing additional vehicle maintenance costs for passenger vehicle owners.

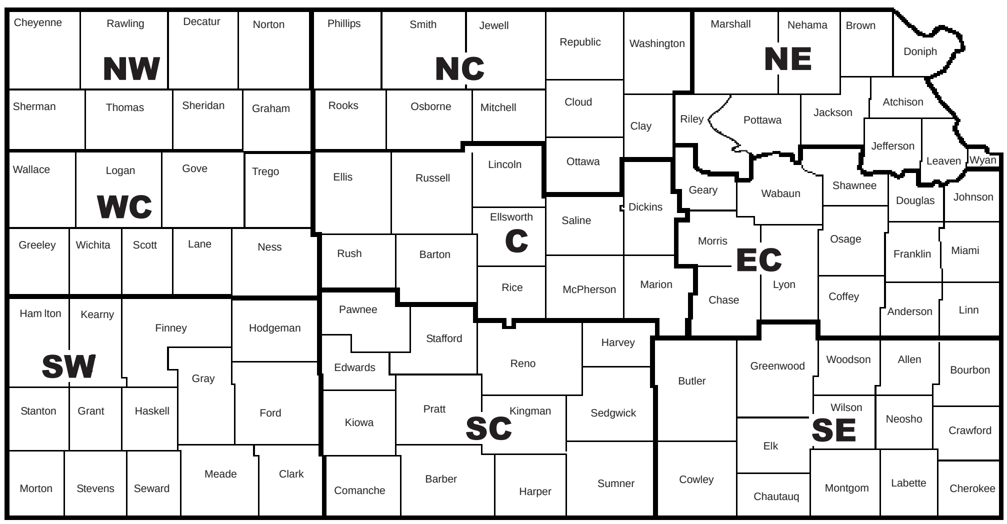
Changes in the grain logistics system discussed above are not unique to Kansas. Similar structural changes in grain transportation have been documented for Texas (Fuller et al. 2001), Iowa (Baumel et al. 1996), North Dakota (UGPTI 2001 and Machalaba 2001), and the Canadian prairie provinces (Nolan et al. 2000). Since the Great Plains states and the Canadian prairie provinces have similar grain logistics systems, the results of this paper have wide geographical scope.

Given the possible negative effects of short line railroad abandonment, it is important to measure the quantifiable impacts of abandonment. The objective of this paper is to measure the highway safety benefits and costs resulting from assumed abandonment of short line railroads. This study extends the Tolliver and HDR Engineering (2000) study of the impact of railroad abandonment on highway safety benefits and costs.

THE STUDY AREA

The study area corresponds to the western two-thirds of Kansas encompassing the three central and three western crop reporting districts (see Figure 1). During the 1998-2001 period, the study area accounted for 91.2% of total Kansas wheat production, 79.6% of the state's sorghum production, 80.9% of Kansas corn production, and 38.9% of the state's soybean output. The study area produced 81.6% of Kansas production for the four crops combined (see Table 1).

Figure 1. Kansas Crop Reporting Districts



Kansas is divided into nine agricultural statistics districts for convenience in compiling and presenting statistical information on crops and livestock. These nine districts are outlined on the above map. The districts are designated as: Northwest (NW), West Central (WC), Southwest (SW), North Central (NC), Central (C), South Central (SC), Northeast (NE), East Central (EC), and Southeast (SE).

Table 1. Study Area Grain Production, 1998 – 2001 (Thousands of Bushels)

Year	Wheat	Corn	Sorghum	Soybeans	Total
1998	452,488	342,565	206,672	26,277	1,028,002
1999	407,378	359,505	210,216	33,025	1,010,124
2000	311,785	325,745	142,322	23,738	803,590
2001	290,910	297,710	192,135	31,069	811,824
Total	1,426,561	1,325,525	751,345	114,109	3,653,540

Sources: (1998) Kansas Department of Agriculture, *Kansas Farm Facts 2000.* (1999 and 2000) Kansas Department of Agriculture, *Kansas Farm Facts 2001.* (2001) Kansas Department of Agriculture, *Kansas Farm Facts 2002.*

Four short line railroads serve the study area: Kansas and Oklahoma Railroad, Kyle Railroad, Cimarron Valley Railroad, and Nebraska, Kansas and Colorado Railnet. The Kansas Southwestern Railroad began operations in 1991, and the Central Kansas Railroad inaugurated service in 1993. These two railroads merged in June 2000 and became the Central Kansas Railway (CKR). The CKR sold its Kansas system to Kansas and Oklahoma Railroad which began operating on June 29, 2001. The Kansas and Oklahoma serves the central part of the study area from Wichita west to the Colorado border. It also serves south central Kansas and has a line in north central Kansas as well. The Kansas and Oklahoma Railroad has 971 route miles in Kansas and has 108 employees.

The Kyle Railroad serves the northern part of the study area with a 482-mile system. The Kyle began operations in 1982 and has 110 full-time employees. The Cimarron Valley Railroad (CV) has 260 route miles with 186 miles in southwest Kansas. The CV was purchased from the Santa Fe Railroad and began operations in February 1996. The CV has 15 full-time employees in Kansas. The Nebraska, Kansas and Colorado Railnet (NKC) serves five Kansas counties in the northwest part of the study area. The railroad has 122 miles in Kansas and 17 miles of trackage rights on the Kyle Railroad. The NKC began operations in December 1996 and has 30 full-time employees.

The study area is also served by two Class I railroads, the Burlington Northern Santa Fe (BNSF) and the Union Pacific System (UP). The BNSF has 1,072 miles of main line track in Kansas and 188 branch line miles. The UP has 1,378 main line miles and 127 branch line miles.

DESCRIPTION OF THE KANSAS WHEAT LOGISTICS SYSTEM

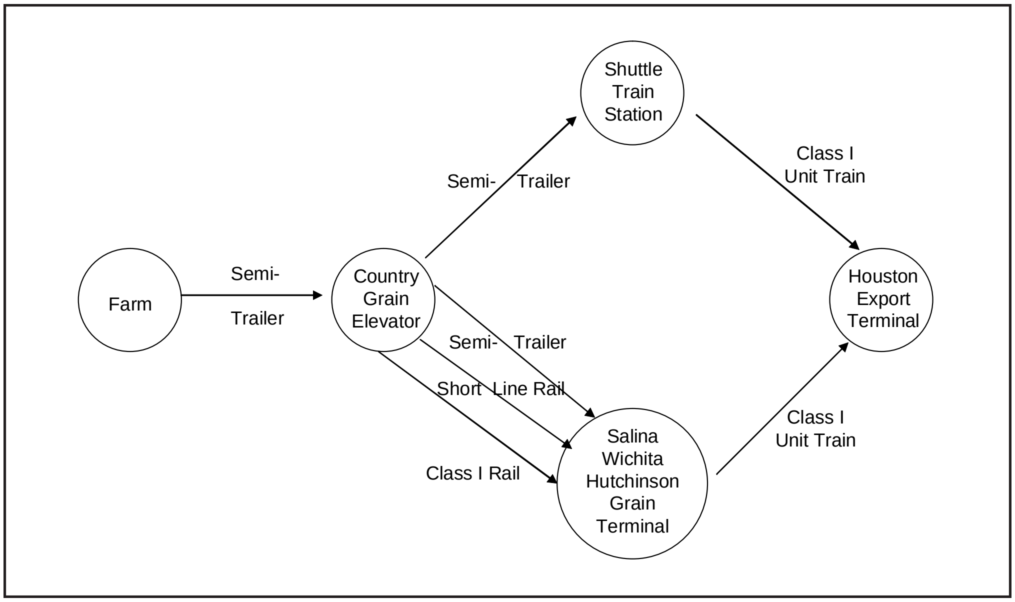
Figure 2 portrays a simplified version of the Kansas wheat logistics system. Wheat is shipped from farms in five-axle, 80,000-pound semi-tractor trailer trucks (hereafter referred to as semi-truck) to country grain elevators, which are usually no more than 10 to 15 miles from the farm origin. Wheat is shipped from country grain elevators to either shuttle train stations (100-railcar shipping facilities at former country elevator locations) or the terminal elevators at Salina, Wichita and Hutchinson, Kansas. Wheat moves exclusively by semi-truck to shuttle train stations, but movements to Salina, Wichita and Hutchinson can be by semi-truck, short line railroad, or Class I railroad. Wheat is then shipped by Class I unit train from the shuttle train facilities and the grain terminal elevators in Salina, Wichita and Hutchinson to Houston, Texas, for export.

As noted above, this is a simplified version of the wheat logistics system. In some cases, farmers deliver wheat by semi-trailer directly to shuttle train stations or Salina, Wichita and Hutchinson grain terminals. This occurs if the farms are relatively close to one of these facilities. Also, Kansas wheat is shipped to many domestic flour milling locations as well as the Texas Gulf region for export.

THE WHEAT LOGISTICS MODEL

The highway safety cost and benefit analysis discussed in this paper is part of a larger study that measured changes in wheat transportation and handling costs, road damage costs, and

Figure 2. Wheat Logistics System



highway safety effects resulting from simulated short line railroad abandonment in Kansas. Thus, in order to understand the highway safety cost and benefit analysis, it is necessary to discuss the wheat logistics model which generated data inputs for the safety cost/ benefit analysis.

The movement of Kansas wheat is modeled as a transshipment network model with individual farms serving as supply nodes, grain elevators and unit train loading facilities serving as transshipment nodes, and the final demand node being the export terminals at Houston, Texas. The county and state road networks, short line railroads, and Class I railroads constitute the arcs which connect these nodes.

Given the magnitude and complexity of the wheat logistics system, the movement of Kansas wheat through the various possible network routes is most clearly analyzed in four distinct steps. Step I involves the collection of wheat from production origins, or farms, into an intermediate storage facility (grain elevator) which can ship wheat to the terminal node represented by Houston in the wheat logistics model. Since it is not economically feasible for firms to ship wheat by truck from Kansas to Houston, Step I consists of moving wheat from the farm to an elevator that has rail access capable of reaching Houston. Step II involves the handling of wheat at intermediate storage facilities. Step III analyzes the shipment of wheat from Kansas unit train shipping facilities to the network model final demand node represented by the Port of Houston. Step IV is the same as Steps I to III except short line railroads are assumed abandoned.

Although profit maximization is assumed to be the main goal of all agents (farmers, elevators, transport firms) in the wheat logistics system, costs serve as the most consistent influence on agents' behavior. Thus, it is assumed that all agents in the system seek to minimize the costs involved in shipping wheat to market. Farmers attempt to minimize both the financial and time costs of getting wheat from the field to the grain elevator or unit train facility; grain elevators and unit train shipping facilities operate so as to minimize the cost of handling wheat and shipping it to various market destinations. Thus, the goal of the model is to determine the least cost transport route for Kansas wheat from production origin to final destination utilizing the available transportation network. The Port of Houston is assumed to approximate the cost of shipping Kansas wheat to the many destinations to which it is normally shipped in a given year.[9] Thus, it is assumed that all agents minimize the costs involved in shipping wheat to market. This relationship is summarized mathematically by the objective function:

$$(1)\quad \text{Minimize } TSC = \sum_i (H_i + T_i + R_i)X_i$$

Subject to the following constraints:

- $H_i, T_i, R_i \geq 0$
- Total Wheat Demanded = Total Wheat Supplied
- Actual Wheat Stored at Elevator i ≤ Maximum Storage Capacity of Elevator i
- Actual Transport by Truck i ≤ Maximum Transport Capacity of Truck i
- Actual Transport by Railcar i ≤ Maximum Transport Capacity of Railcar i
- Flow of wheat into Elevator i = Flow of wheat out of Elevator i

Where:

- TSC is the total wheat logistics system transportation and handling costs
- H_i is the sum of all handling costs of unit of wheat i
- T_i is the sum of all trucking costs of unit of wheat i
- R_i is the sum of all rail costs of unit of wheat i
- X_i is the total units of wheat shipped from Kansas farms to the Port of Houston

See Babcock, Bunch, Sanderson and Witt (2003) for a detailed discussion of the wheat logistics model.

THE HIGHWAY SAFETY COSTS AND BENEFITS MODEL

Traffic accidents can be linked with numerous variables such as the vehicle's speed, time of day, driver's age, and vehicle type (Cerrelli, 1997). On the most general level, however, there are two primary factors. The first is the opportunity for accidents to occur. A non-moving vehicle will never strike a tree, roll in a ditch, or otherwise initiate an accident. As a vehicle increases its amount of travel, the opportunity for that vehicle to be involved in an accident increases (proportionately to variables such as Cerrelli has identified). The influence of this factor on the probability of accidents on a fixed system of roads can be considered the "distance factor" because it is principally determined by the distance traveled by a vehicle. The second fundamental factor is the interaction factor. The interaction factor involves the probability of accidents resulting from vehicular interplay. If a single vehicle travels on a road, there is no chance of it hitting another car, encountering debris from another vehicle or meeting a drunk driver. As the number of vehicles traveling on the same road increases, opportunities for dangerous interactions increase. For example, vehicles enter and leave a road system via access points such as driveways. As traffic density increases, the probability of accidents at access points increases.

While the distance and interaction factors are related, it is useful to distinguish between them. The distance factor is a relationship between vehicle miles traveled and accidents; it is independent of whether the miles are traveled by a single vehicle or a large fleet of vehicles. The interaction factor is a relationship between traffic density and accidents; it is independent of the distance traveled by individual vehicles. Thus, the distance factor is controlled by the individual driver when deciding his distance of travel;

the interaction factor is external to the individual's control.

Events that result in substantial changes in traffic density and/or vehicle miles traveled will have significant safety impacts. One event that can have substantial safety consequences is railroad abandonment.

Railroads are the least-cost mode for long distance transport of large volumes of freight. Hoover (1963, p. 20) explains that rail transport generally supplants truck traffic as the lowest cost transport mode for shipments exceeding 35 miles in distance. Hoover's 35-mile rule was based upon trucks hauling 10 ton (20,000 pound) loads. Motor carrier technological advances and sturdier road structures have enabled trucks to haul substantially larger loads. Berwick (2002) finds that five-axle grain semi-trailers are currently hauling payloads of 28.3 tons (56,600 pounds). The increase in truck payloads has expanded the distance over which trucks are the lowest cost mode of transport beyond Hoover's 35-mile range. Park et al., (1999, p. 278) estimated that commercial trucks have a cost advantage relative to railroads for distances up to 50 miles.

The expansion of distance over which trucks have a cost advantage is one of several factors contributing to rail service being increasingly supplanted by trucks. Babcock and Bunch (2002, p.38) find that frequency and dependability of truck service relative to rail service, competitiveness of truck rates, and availability of service are cited by shippers located on short lines as reasons for increased trucking of grain relative to rail. Reduced rail transportation of grain has been documented in Kansas (Babcock and Bunch, 2002), Texas (Fuller et al., 2001), Iowa (Baumel et al., 1996), North Dakota (UGPTI, 2001 and Machalaba, 2001) and the Canadian prairie provinces (Nolan et al., 2000).

When trucks replace railroads for transporting grain, there will be increased highway safety costs due to increased traffic density and vehicle miles traveled. Prior to Tolliver (2000), however, no methodology for estimating the highway safety impact of rail abandonment had been developed. Clarifying the appropriate methodology for quantifying these safety effects will promote more accurate impact analysis of short line railroad abandonment.

METHODOLOGY

The safety impact of rail abandonment is conceptually straightforward. Grain that was formerly transported by rail must instead be transported by another mode. In practice, reduced rail transport will be replaced by increased truck shipments. It is important to note that rail cars are substantially larger than truck trailers. In general, every rail car must be replaced by about four trucks in order to transport the same amount of grain. Thus, when rail service is terminated, the total increase in truck miles traveled can be found by equation (2).

(2) Increased Truck Miles = (Rail Carloads Terminated) • (4 Trucks per Railcar) • (Distance Traveled per Truck)

This increase in truck miles consists entirely of new traffic introduced onto an existing road system resulting in a highway safety impact.

To estimate the safety impact, a rate is needed that specifies the accidents which occur from an increment in traffic. This rate can be determined on a per-mile basis by dividing the total number of accidents that occur in a given time period by the total number of miles traveled in the same time period for a particular road system. That is:

(3) Accidents per Mile Traveled = (Accidents per Time Period) ÷ (Miles Traveled per Time Period)

When making this calculation, it is important to use a long time period and a large road system so that a representative average is obtained. A three-day period of observation would fail to capture significant weather variations and seasonal driving patterns. A time period should be used that reflects the time frame for which an impact case is being estimated. For rail abandonments a period of at least one year should be used. Similarly, a road system of two city blocks would not be used to estimate traffic impacts on a statewide level because there would be substantial distortions from drivers and road characteristics that are unrepresentative. In order to avoid distortions, the road system used to determine an accident rate should be the same system for which an impact case is being determined or a larger system with similar geographic and traffic features.

If time and road system considerations are observed, it is reasonable to make the implicit assumption that the short line railroad abandonment case will continue to have the same rate of accidents per mile traveled as the no-abandonment case.[10] This enables the accidents resulting from rail abandonment to be estimated by equation (4).

(4) Increased Traffic Accidents = (Increased Truck Miles) • (Accidents per Mile Traveled)

This increase in accidents is given economic significance by multiplying the result by a cost for each accident as in equation (5).

(5) Safety Cost of Rail Abandonment = (Increased Truck Miles) • (Accidents per Mile Traveled) • (Cost per Accident)

When making this computation, it is important to capture all of the economic costs involved in accidents. This includes explicit accident costs like medical expenses and vehicle repairs and also other costs such as lost wages and reduced quality of life.

An estimate of the safety cost of rail abandonment has been obtained by determining the increase in traffic, the additional traffic accidents, and the cost of each traffic accident that would result from rail abandonment. However, this cost does not express the entire safety consequence of rail abandonment. There is also a safety benefit to consider.

Though previously unrecognized, rail abandonment provides a safety benefit for highway users. Highway-rail crossings (HRCs) can no longer produce train-vehicle collisions if there are no trains at the crossings. The highway safety benefit of rail abandonment can be found by determining the total number of active HRCs that will be eliminated, estimating the number of collisions that would occur if the HRCs remain active, and multiplying these collisions by the costs they would generate. That is:

(6) Safety Benefit of Rail Abandonment = (HRCs Eliminated) • (Accidents per HRC) • (Cost per Accident)

The net highway safety effect of rail line abandonment is the difference between the safety costs and the safety benefits generated:

(7) Net Highway Safety Effect of Rail Abandonment = Safety Costs - Safety Benefits

DATA

Estimating the highway safety impact of short line railroad abandonment in the study area requires four data inputs.

1. Increased truck miles: The methodology used to determine the origin locations and quantities of wheat produced in the study area can be found in Chapter 4 of Babcock, Bunch, Sanderson and Witt (2003). A computerized network model employing ArcView GIS software predicts the movement of wheat to shipment destinations, yielding the truck miles traveled under scenarios where short line railroads are abandoned and not abandoned. By taking the difference between these scenarios, a total increase of 8,078,868 truck miles was generated by short line railroad abandonments in the study area.

2. Rate of truck accidents: The National Highway Traffic Safety Administration (NHTSA) annually reports information about all vehicle accidents in the United States. The information is classified by vehicle type and accident severity. The safety impact methodology uses the average number of fatality, injury, and property damage only (PDO) accidents reported for large trucks (vehicles exceeding 20,000 pounds) in the three-year period, 1998-2000 (NHTSA, 2002). These accident averages are divided by a three year average (1998-2000) of the estimated vehicle miles traveled (VMT) by trucks (NHTSA, 2002). This VMT estimate is developed annually by the Federal Highway Administration (FHWA) based on 4,000 observation points throughout the United States and collected by the NHTSA. Using these sources, the fatality, injury, and PDO rates were found to be 0.25, 4.83, and 15.82, respectively, per 10 million vehicle miles traveled by trucks.

3. Highway-rail crossing accidents: The National Inventory of Highway-Rail Grade Crossings is a database of all public HRCs in the United States and is maintained by the Federal Railroad Administration (FRA). This database is used to determine the location of all HRCs on short lines in the study area. For each HRC the Web Accident Prediction System (WBAPS), developed by the FRA and available for public use (http://safetydata fra.dot.gov/officeofsafety), predicts annual collisions. This prediction is based upon data about the crossing's physical and operating characteristics (type of warning device, trains passing through daily, total number of tracks, maximum train speed, number of traffic lanes, paved/unpaved road, and average annual daily traffic count of vehicles using the crossing) and a five-year accident history for the crossing. In total, there are 1,914 public HRCs on 1,863 miles of short line track in the study area. Each crossing has a uniquely generated probability (from WBAPS) of producing an accident during a 12-month period with an average probability of 0.006492 accidents per HRC per year for the crossings in the study area. When all 1,914 probabilities are summed, a total of 12.42 accidents are predicted to occur at short line HRCs in the study area per year. FRA's records of collisions that historically occurred at these same HRCs reveals that 112 collisions involving 117 motorists actually occurred over the 10-year period from 1990-1999. Given an historic average of 11.2 collisions per year, the WBAPS prediction of 12.42 accidents per year is a reasonable estimate. The records of accidents that actually occurred report six fatalities, 37 non-fatal injuries, and 74 property damage only accidents. Using this 10-year history as a representative distribution of short line rail accidents by category, 5.1% of highway-rail collisions result in fatalities, 31.6% of highway-rail collisions result in non-fatal injuries, and 63.3% of highway-rail collisions result in PDOs. Therefore, the 12.42 predicted accidents are expected to produce 0.64 fatal, 3.93 non-fatal injury, and 7.86 PDO accidents per year on study area short lines.[11]

4. Cost per accident: The National Safety Council annually estimates the costs of unintentional injuries resulting from motor vehicle crashes and reports the findings at http://www.nsc.org/lrs/ statinfo/estcost0.htm. Their estimates include explicit economic costs (lost wages, medical expenses, property repairs, etc.) and a measure of the lost quality of life, obtained through studies of what people actually pay to reduce their safety and health risks. In 2000, the average comprehensive costs per individual fatality, non-fatal injury, and PDO were $3,214,290, $159,499, and $1,861 respectively.

EMPIRICAL RESULTS

The highway safety consequence of abandoning short line rail service in the study area can now be calculated. The total highway safety cost is given by equation (8).

(8) Safety Cost = [(Increased Truck Miles) • (Rate of Truck Fatalities) • (Cost per Fatality)] + [(Increased Truck Miles) •

(Rate of Truck Injuries) • (Cost per Injury)] + [(Increased Truck Miles) • (Rate of Truck PDOs) • (Cost per PDO)] = 8,078,868 miles • 0.25 fatalities per 10 million miles • $3,214,290 per fatality + 8,078,868 miles • 4.83 injuries per 10 million miles • $159,499 per injury + 8,078,868 miles • 15.82 PDOs per 10 million miles • $1,861 per PDO = $1,295,361

Abandoning all short line railroads in the study area would result in annual highway safety costs of $1.3 million resulting from an increase of 0.20 fatal, 3.90 non-fatal injury, and 12.78 PDO accidents on the study area's road system each year.[12] This cost must be compared to the highway safety benefits conferred from closing the short line HRCs in the study area:

(9) Safety Benefit = (Reduced HRC Fatalities) • (Cost per Fatality) + (Reduced HRC Injuries) • (Cost per Injury) + (Reduced HRC PDOs) • (Cost per PDO) = 0.64 fatalities • $3,214,290 per fatality + 3.93 injuries • $159,499 per injury + 7.86 PDOs • $1,861 per PDO = $2.70 million

Eliminating all short line rail crossing accidents in the study area would confer an annual highway safety benefit of $2.7 million. Thus, the net safety impact of short line rail abandonment in the study area is:

(10) Net Annual Safety Impact = Annual Safety Costs - Annual Safety Benefits = $1.3 million - $2.7 million = -$1.4 million

The abandonment of all short line railroads in the study area is estimated to result in increased annual highway safety *benefits* of $1.4 million.

CONCLUSION

Abandonment of short lines has been rising in Kansas due to construction of shuttle train facilities on Class I main lines, consolidation of wheat production on fewer, larger farms, and increasing use of heavy axle load (HAL) railcars to move wheat. As short lines lose market share in their principal commodity market (grain), their long-term viability is threatened. Abandonment of short lines would have negative effects on rural areas including:

- lower grain prices for farmers
- increased transport cost and lower profits for rural rail shippers
- reduction in market options for rural shippers
- loss of economic development opportunities for rural communities
- loss of tax revenue needed to fund basic government services
- increased road damage on county roads and state highways
- increases in highway accidents due to increased truck traffic

Given the potential negative effects of short line abandonment, it is important to measure the quantifiable impacts. This paper measured the highway safety costs and benefits resulting from assumed short line railroad abandonment.

The safety cost of rail abandonment is found by multiplying the abandonment-related truck miles by the rate of accidents which occur per mile and multiplying the result by the cost per accident. The safety benefit of rail abandonment is found by multiplying eliminated HRCs by the number of accidents which would have occurred at those HRCs without abandonment and multiplying the result by the cost per accident. The net highway safety effect of rail abandonment is found by subtracting the safety benefits from the safety costs. This analysis requires four data inputs:

- abandonment-related truck miles (Babcock et al., 2003)
- rate of truck accidents per mile (National Highway Traffic Safety Administration)
- highway rail crossing accidents (Federal Railroad Administration)
- cost per accident (National Safety Council)

Rail line abandonments generate a significant highway safety impact. This impact can be separated into safety costs and safety benefits. The highway safety costs are estimated by determining the amount of additional truck traffic that will be generated by the abandonments, estimating the accidents that will be generated by this traffic, and multiplying these accidents by their costs. Applying this methodology to short lines in the study area results in annual safety costs of $1.3 million. The highway safety benefits are estimated by determining the number of collisions that are averted by eliminating highway-rail crossing accidents on study area short lines and multiplying these avoided accidents by what they would have cost. Utilizing this approach results in annual safety benefits of $2.7 million in the study area. Thus the abandonment of all short line railroads in the study area would result in annual highway safety benefits of $1.4 million.

Endnotes

1. In this study, short line railroads are defined as including Class II and III railroads as defined by the Surface Transportation Board. In 2001, Class II railroads were classified as railroads with operating revenue of $21.3 - $266.6 million and Class III railroads were those with less than $21.3 million of operating revenue (Association of American Railroads 2002, p. 3).

2. See Association of American Railroads (2002, p. 3).

3. KDOT (2002, p. 35).

4. KDOT (2002, pp. 82-85).

5. KDOT (2002, p. 85).

6. KDOT (2002, pp. 84-85).

7. KDOT (2002, p. 85).

8. Babcock and Bunch (2002, pp. 34-35).

9. Texas Gulf ports, of which Houston is the largest, are the most important single destination of Kansas wheat, accounting for about 50% of the shipments. [Kansas Agricultural Statistics (2001, pp. 13 and 15), and Kansas Agricultural Statistics (2002, pp. 13 and 15)].

10. This assumes a static interaction factor in the pre- and post-abandonment scenarios. In actuality, the post-abandonment scenario will include more vehicle miles on the same road system, thus having higher traffic density. The change in traffic density is not addressed in this study due to data considerations.

11. 0.64 fatalities = (12.42 accidents) · (5.1% fatality rate of accidents)
3.93 non-fatal injuries = (12.42 accidents) · (31.6% injury rate of accidents)
7.86 PDO accidents = (12.42 accidents) · (63.3% PDO rate of accidents)

12. 0.25 fatalities per 10 million miles implies 0.20 fatalities per 8,078,868 miles; 4.83 injuries per 10 million miles implies 3.90 non-fatal injuries per 8,078,868 miles; 15.82 PDOs per 10 million miles implies 12.78 PDO’s per 8,078,868 miles.

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