A METHOD FOR ASSESSING THE IMPACT OF RAILROAD ABANDONMENT ON RURAL COMMUNITIES

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ABSTRACT

Through deregulation, the railroad industry has rationalized its services across the nation. Since 1980, this has lead to the abandonment of over 33,000 miles of rail line in the United States. While this has improved the efficiency and financial viability of rail carriers, it has adversely affected some rural communities. These effects include an increased cost of transportation to shippers, increased highway damage, reduced business volume, and diminished economic development opportunities.

This study attempted to formulate a consistent method of measuring and quantifying these impacts. Previous impact assessment techniques have been inconsistent in their theory and have tended to rely on biased and unsubstantiated evidence and testimony. This is particularly important to the Interstate Commerce Commission (ICC) who decides the fate of an abandonment application. By law, if the abandonment is investigated, protestants have only 30 days in which to prepare a case.

The developed method takes different aspects of individual assessment techniques and quantifies the results in application to a railroad abandonment. This method was tested using a previous abandonment as a case study. Based on its flexibility and more defined data requirements, the method is applicable within the ICC's 30-day time frame for protest.

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CHAPTER I

INTRODUCTION

Since 1980, approximately 33,000 miles of rail line have been abandoned in the United States.[1] During this time, a number of studies have looked at the effects of specific abandonments; however, none have provided an overall view of abandonments. In review of literature, few attempts have been made to generalize the types or characteristics of the lines that have been abandoned. This is a concern considering that, currently in the United States, there are over 60,000 miles of Class I carrier track with less than 5 MGTMM[2] service (Tolliver, 1994). Present actions within the railroad industry have shown these lines to be potential candidates for abandonment (Burke, 1995).

Although rail restructuring in rural America has improved efficiency and service provided by railroads, it has adversely affected some rural communities. The loss of rail service can increase cost to shippers, increase local highway use, and diminish current and future employment and economic opportunities. While many rural communities have claimed these impacts of abandonment, measuring impacts, whether positive or negative, is difficult and, at times, subjective in nature.

Scope Of Recent Abandonments

Many states that have had large portions of 1979 rail miles abandoned are predominantly agricultural in nature (Appendix Table B.2). Some of the agricultural states included in the top twenty in terms of percent of miles abandoned are Iowa, Montana, South Dakota, Illinois, Washington, Ohio, Minnesota, and Missouri. These values provide evidence for the notion that a larger portion of miles are abandoned in transportation competitive regions. These states have nearby access to barge loading facilities. While some of the states with little transportation competition, such as New Mexico, Colorado,

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[1]This figure represents total miles of track removed from 1980 to 1992.
[2]Million gross ton miles per mile.

While population density was higher in the counties impacted by abandonment, the percentage of population that resided in rural areas in 1980 was more than double in the counties where abandonment has occurred. This leads to the conclusion that abandonments have occurred in more heavily populated rural areas. Although rail rationalization occurs in these rural areas, it may not leave the areas without alternative rail service. Areas in which this type of rationalization may be occurring are primarily used for agriculture, as illustrated by the higher percentage of land used for farming.

Table B.3 provides evidence of a commonly held belief that reductions in business volume lead to the unprofitability and eventual abandonment of the rail line. The value of manufactured products in comparison to farm products is substantially less in areas of abandonment. A small change in farm earnings may have a large effect on the local business volume and may cause local business reductions or closures, which may change traffic patterns and corresponding rail line profitability. However, this example may only be applicable to rail lines abandoned under an exempt proceeding where no railroad traffic has moved in three years. No rail traffic for such a period of time indicates that an economic or sociological factor led to the abandonment.

Objectives of Study

The purposes of this study were to develop a simplified method for analyzing the impacts of rail abandonment on rural communities that can be applied within the 30-day time constraints of an Interstate Commerce Commission (ICC) abandonment proceeding and to test the method regarding the scope and magnitude of community impacts using a selected case study. To support this research, a review of literature is provided to synthesize analyses of previous abandonment cases and their impacts on rural communities, highlight the procedures used by the ICC to judge abandonment cases, and describe how the ICC could use community impacts in deciding abandonment cases.

community impact assessment. However, an objective of the report was to present an integrated method of abandonment impact assessment. Therefore, the ICC's procedures of branch-line profitability analysis are described in the report.

Ability to quantify the effects of abandonment into an overall method is required. The developed method should not utilize traditionally biased and opinionated surveys, should have the flexibility for completion in a 30-day period and should be able to present data concerning the positive or negative aspects of an abandonment. The method developed could have several types of applications:

- States could use it prior to abandonment for analysis of impacts.
- During an abandonment case before the ICC, it could be used by various parties to support granting or denying an abandonment application.
- From the railroad's perspective, it could be used to forecast the potential impacts of abandoning a branch line before an application is filed.

Coupling information on abandonments and the communities affected would be beneficial for future abandonment considerations. Looking at different social, demographic, and economic factors of cities affected would give a before-and-after look at the effects of abandonment. One element of state and community impacts is the change in highway investment cost resulting from increased truck traffic after abandonment. Several recent studies have addressed this issue, but its role in abandonment analysis has not yet been clearly defined.

Research Design

Methods used to develop a better understanding of the impacts of railroad abandonment on rural communities included a literature review, an in-depth analysis of previous abandonments, and development of a simplified method of economic impact assessment. The following specific steps were carried out in the research:

Report Organization

The remainder of this report is divided into four parts. A review of literature is provided in Chapter II. In Chapter III, the research method is developed. A case study testing the developed method is performed in Chapter IV. Summary, conclusions, and areas for further study are presented in Chapter V.

CHAPTER II

REVIEW OF LITERATURE

The review of literature is divided into three sections: Presentation of previous impact assessment studies, impact assessment concerns, and illustration of impact assessment techniques. A transition from the impacts assessment concerns to impact assessment techniques is presented through a qualitative discussion on the types of impacts that are typically felt due to railroad abandonment.

Previous Impact Assessment Studies

The first article reviewed is typical of railroad abandonment impact studies conducted in the middle to late 1970s. Although some studies of community impacts have been attempted in the Midwest, there has not been a consistent, objective method of analyzing abandonment impacts. In some cases when an abandonment proceeding occurred, local community leaders provided the ICC with information about the affected line. In South Dakota, a number of studies on several branch lines were conducted by the University of South Dakota (USD) during the late seventies. One particular study looked at a 48.3 mile line from Doland to Watertown. The study attempted to detail the effects of loss of rail service and predict the potential for more rail service, if improved service was made available.

The data for the study were based on estimates for potential use from business leaders in the area. The trade area encompassed portions of four South Dakota counties including four communities located directly on the line. One of the underlying assumptions of the study was that all products produced within the trade area of the rail line, including coal, grain, wood, and scrap metal, would be shipped by rail. Based on these assumptions, the potential traffic density was 62 rail cars per mile. This number was higher than the 13 cars per mile of actual use during the year of 1973.

issues in rural communities have long been very emotional. More importantly, the ICC, while listening to the concerns of citizens, historically does not overturn abandonment cases based on this information.

A second example of early community impact analysis (CIA) was presented in the North Dakota State University graduate thesis, *The Economic, Social and Energy Impacts of North Dakota Rail Branch Abandonment,* by Rebecca Gudrun Kraft Janski. In this study, Janski identified social, economic, and energy impacts of branch line abandonment and assessed those impacts using a case study: The Sherwood branch line, a 61.2 mile branch line from Granville, North Dakota, to Sherwood, North Dakota.

In her analysis, Janski used thorough shipper and community surveys as well as personal interviews from communities leaders along the Sherwood branch line. While the thoroughness of the approach is not in question, the approach itself leaves something to be desired. Questions were asked of the community leaders and businesses about such items as the impact on jobs, importance of rail to the community, and estimated changes in land values, highways, and church attendance. While these may in fact be impacts of abandonment, the results obtained may not be as significant as the respondents indicated. Janski cited: "Most (respondents) felt abandonment of the line would 'ruin the towns.'" This statement itself questions the objectiveness and value of results obtained.

While Janski's survey was more comprehensive than the University of South Dakota survey, the time and effort needed to organize, conduct and analyze such a survey is both time consuming and financially exhaustive. Furthermore, it is a formidable task to be completed within the ICC's 30-day time frame. More importantly, Janski's study questions the validity of the respondent's comments. While certain questions have merit, others solicit subjective testimony which may portray potential bias.

A more recent impact assessment of branchline abandonment is presented by Babcock, Russell, and Burns (1992). They analyzed the impacts of abandoning three branchlines in south central Kansas. The authors concluded that abandonment would have the greatest shipping cost impact on elevators located more than 100 miles from terminals and flour mills. Also, the abandonments would lead to an 8 percent

Following the Rail Planning Manual, the FRA established guidelines for continued rail operation through the calculation of benefit-cost ratios in *Benefit-Cost Guidelines Rail Branch Line Continuation* (May 1980) and *FRA Simplified Benefit-Cost Methodology* (May 1982). The importance of the benefit-cost ratio was reiterated in 1989 with the Local Rail Service Reauthorizing Act. It stated that in order for a local railroad to receive assistance, the benefit-cost ratio must be greater than 1.0. A benefit-cost ratio is calculated by adding all potential project benefits and dividing by total outlays incurred by the project. A project may be acquisition of a rail line, rehabilitation of a rail line, or construction of rail related facilities.

In calculating the benefit-cost ratio, secondary benefits are included. Secondary benefits can be viewed in the same way as secondary impacts and include continued or increased employment levels, reduced shipper costs, reduced highway maintenance costs, and increased tax revenues. This leads back to the issue of determining secondary benefits. Many states still use the Rail Planners Manual for benefit-cost analysis. However, survey information tends to show bias towards continued rail service. This may skew the results of the benefit-cost analysis and potentially overestimate the benefits of a project.

Impact Assessment Concerns

A concern about impact assessment techniques is reiterated by Schwieterman (1993). Schwieterman illustrated how a state Department of Transportation (DOT) can overestimate the secondary benefits, including expanded employment and reduced layoffs in affected communities. Schwieterman compared the benefit-cost methods of seven different states. He identified three findings concerning the techniques used in employment related benefits. First, relative inconsistency exists among states in computing the benefit of one full time job, ranging from zero to more than $100,000. Second, due to a wide variance among methods, the selection of methodology by the state made the difference in approving a project. Finally, Schwieterman emphasized that states should coordinate efforts to consider "spillover" of project benefits from one state to another.

authors discovered that the new firm only created 30 new jobs. In comparing the two analyses, Feser and Cassidy concluded that an optimistic view of job creation was used in the original analysis.

Feser and Cassidy have also discussed the overestimation of impacts due to the loss of rail service and the subsequent shift in modal share from rail to truck. Shippers in most cases could operate just as profitably as before abandonment. Most commodities can be cost effectively transported by truck as easily as by rail. [4]

The authors concluded that job creation is one of the most often stated, but overestimated, benefits of rail assistance projects. Through their review, they concluded that many projects when scrutinized closely show few economic development benefits. For future studies, they recommended assuming no net change in employment and 100 percent substitution of truck for rail conveyance.

Feser and Cassidy (1995) illustrated the need for a nonsurvey impact analysis. Many nonsurvey techniques deal with dollar value changes within economic structures, but not with changes in numbers of jobs created and lost which can be difficult to estimate.

Impacts of Abandonment

While the railroad industry has realized efficiency and productivity gains through branch line abandonment, rural communities may have been negatively impacted due to the loss of rail service. These impacts have included the following:

- increased transportation costs to shippers,
- increased highway and local road use and associated costs,
- reductions in personal and gross business volume,
- unemployment and job transfer,

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[4] This conclusion may not hold in Midwestern states, since the density of rail service is less than in Southern states.

response, are forced to reduce their own cost by lowering salaries, laying off employees[5], or making other cutbacks.

Finally, diminished economic development opportunities may result due to a loss of rail service. The business attractiveness of the local community is reduced by a loss of rail service. This is especially true in the case of industries, which require shipments of large or heavy equipment or input materials. In the absence of rail service, established industries leave the community and new business may not locate there at all.

Nonsurvey Assessment Techniques

One of the major contributions of this study is the use of nonsurvey techniques in community impact analysis. While several techniques are used and tested regarding the hypothesis, this chapter provides an overview of nonsurvey analysis, with an in-depth development and explanation of input/output theory.

Input/output analysis was developed by Wassily W. Leontief (1986). He presented the general theory behind input/output production based on economic interdependence. "Input/output analysis is a method of systematically quantifying the mutual interrelationships among the various sectors of a complex economic system" (Leontief, 1986). The system may be as large as a country or as small as a county or community. Within the study area, the economy is broken into industries or sectors. Once an economy is broken down into sectors, an interrelationship is drawn between inputs and outputs of each sector. The interrelationship or *interdependence* among these sectors is described in terms of a given set of linear equations. The equations strike a balance between the total input and the output of each commodity and service produced during one time period.

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[5] Note: The FRA does not consider job transfer (i.e., layoff and the re-employment) as an impact, only the associated moving cost is included. It should be recognized though, that a job lost to local community still represents a loss to the community even though the job may have been transferred within the state.

Table 2.2. Technical Coefficients Table for Hypothetical Three Sector Economy

Selling Sector	Industry #1	Industry #2	Industry #3
Industry #1	a_{11}	a_{12}	a_{13}
Industry #2	a_{21}	a_{22}	a_{23}
Industry #3	a_{31}	a_{32}	a_{33}
Imports	W_1/Y_1	W_2/Y_2	W_3/Y_3
Total	1.00	1.00	1.00

Finally, from the technical coefficients, the interdependence table or multiplier matrix is computed using the following relationship (Equation 2.3):

$$Y_i = \sum_{j=1}^{n} a_{ij} Y_j + Z_i \quad . \tag{2.3}$$

Placing this equation in matrix form yields:

$$\begin{aligned} &Y = AY + Z \\ &Y - AY = Z \\ &[I - A]Y = Z \\ &Y = [I - A]^{-1} Z \end{aligned}$$

where $[I-A]^{-1}$ represents the amount from *i*th industry required per unit output for the *j*th industry. This is shown in tabular form in Table 2.3. Each element of m_{ij} represents a multiplier of the effect of row industry on column industry. Summing the columns vertically yields the gross receipts multiplier (M). This represents the dollar value of output of all sectors that results per dollar spent by the column industry.

Table 2.3. Interdependence Coefficients Table for Hypothetical Three Sector Economy

Selling Sector	Industry #1	Industry #2	Industry #3
Industry #1	m_{11}	m_{12}	m_{13}
Industry #2	m_{21}	m_{22}	m_{23}
Industry #3	m_{31}	m_{32}	m_{33}
Total	M_1	M_2	M_3

In particular, the analysis used the Regional Input-Output Modeling System (RIMS II) developed by the U.S. Department of Commerce (1992).

RIMS II uses the Leontief theory discussed previously. In all, RIMS II uses 39 row industries for 528 column industries. There are three different possible tableaus: output multipliers, earnings multipliers, and employment multipliers (U.S. Department of Commerce, 1992).

Barol, cited goods and services purchased by passengers as *primary* impacts of an airport and inputs which are used to produce the goods and services as the *secondary* impacts. The key component in measuring impacts is determining final demand. This consisted of net earnings of labor and proprietors, purchases of inputs into the transportation related service, and payments to the owners of land, capital, and equipment. He warned against the use of revenues to determine final demand of an airline. Barol showed that revenues flow to corporate headquarters and are then redistributed to each airline which makes final demand for inputs independent of revenues collected.

Barol (1989) concluded that RIMS II provides a good estimation of secondary and total impacts of an airport . It is not a difficult tool to use if approached systematically by, first, applying the appropriate multiplier for the given industry and, second, using a correct and accurate estimate of final demand for each sector. The results of this study provide a strong case for the use of input/output analysis in impact assessment concerning railroad abandonment cases.

There are two criticisms of input/output analysis. First, input/output models are relatively static in nature; they do not reflect changes in the economic structure. When interpreting the final results of an input/output analysis, it is important to remember how one reached that result. Adjusting a model to reflect an equilibrium state[7] may take considerable time and effort. By the time the model is adjusted, the equilibrium state may have already changed. Second, given a particular economy, equilibrium may be

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[7] The structure of the economy is constant. In terms of an I/O model, the relationships between the coefficients are held constant.

relevant factors. Since the model is designed to represent an entire economy, attributing an impact to one or two variables may result in miss-specification of the model. Finally, getting detailed data on a particular region may be very difficult, and its consistency may change from region to region (Glickman, 1977).

CHAPTER III

DEVELOPED METHOD

Based on the review of literature and study of other methods of impact assessment, a method was proposed for assessing the impact of rail abandonment. The proposed method is developed and explained in the following paragraphs. Chapter IV will provide a case study to test the proposed method in regards to its value in railroad abandonment impact assessment.

Primary Impacts of Railroad Abandonment

Change in Transportation Cost to Shippers

The primary impact of railroad abandonment is the increase in transportation cost to shippers. Shippers' current rail traffic will likely be diverted to truck in the absence of other rail service. This may occur in two different scenarios. Traffic diverted to truck can take the form of a direct truck shipment to final destination or a truck shipment to the nearest rail head for transshipment.

In performing these calculations, there are several considerations. First, it is necessary to convert rail carloads into truck shipments by commodity (Table 3.1).

Table 3.1. Conversion Factors for Railcars into Truckloads

Commodity	Conversion Factor
Grain	3.5
Coal	3.8
Sand & Gravel	3.8
Industrial Chemicals	3.6
Dry Fertilizer	3.6
Liquid Fertilizer	3.9
Lumber	2.6
Iron Scrap	2.7
Primary Steel Prod.	3.3
Crude Oil	3.1

Source: Unpublished UGPTI Data, 1993.

Table 3.2. Estimated Truck Costs per Loaded Mile

Commodity	0% of Miles Empty			25% of Miles Empty			50% of Miles Empty		
	25 Miles	100 Miles	500 Miles	25 Miles	100 Miles	500 Miles	25 Miles	100 Miles	500 Miles
Grain	$1.26	$1.10	$1.08	$1.68	$1.47	$1.44	$2.52	$2.20	$2.16
Coal	1.18	1.10	1.08	1.57	1.47	1.44	2.36	2.20	2.16
Sand & Gravel	1.39	1.22	1.20	1.85	1.63	1.60	2.78	2.44	2.40
Industrial Chemicals	1.39	1.22	1.20	1.85	1.63	1.60	2.78	2.44	2.40
Dry Fertilizer	1.39	1.22	1.20	1.85	1.63	1.60	2.78	2.44	2.40
Liquid Fertilizer	1.39	1.22	1.20	1.85	1.63	1.60	2.78	2.44	2.40
Lumber	1.31	1.17	1.15	1.75	1.56	1.53	2.62	2.34	2.30
Iron Scrap	1.38	1.22	1.20	1.84	1.63	1.60	2.76	2.44	2.40
Steel Prod.	1.34	1.19	1.17	1.79	1.59	1.56	2.68	2.38	2.34
Crude Oil	1.39	1.22	1.20	1.85	1.63	1.60	2.78	2.44	2.40

Source: Jack Faucett Associates, 1986.

A somewhat more difficult value to determine is the cost associated with transloading. For agricultural commodities, this includes the cost of unloading trucks, handling, short-term storage, and reloading onto rail cars. A 1976 study by the Iowa State Department of Transportation surveyed elevators in Iowa and approximated the transloading cost for grain at 4.2 cents per bushel and the variable handling cost of fertilizer at $1.90 per ton. A 1995 unpublished survey by Washington State University showed the average transloading cost of grain to be about 8 cents per bushel. These two studies represent the majority of research for transloading raw agricultural commodities. Transloading of machinery, kindred food products, wood products, etc. is somewhat more difficult to determine and should be handled on a case by case basis. Probably the best way to obtain an accurate estimate is to call local dealers and firms and computing an average for each commodity or product.

Highway Impacts

A direct result of abandonment is the increase in truck traffic on local roads and highways. This increase in traffic leads to an accelerated deterioration of roads. The cost associated with increased maintenance is passed onto taxpayers and users of the local roads and highways. There are two methods

Increased Highway User Costs

Increased highway damage translates into increased costs for users in terms of time spent traveling and cost of travel. These increased costs can be estimated using a series of equations contained in the Highway Performance Monitoring System (HPMS) (Federal Highway Administration, 1987). These formulas are used to estimate the vehicle operating cost and increased travel time due to a change in the (PSR) of the pavement. Modeling a change in PSR can be a difficult and time consuming procedure. Additionally, these impacts will probably be felt only in areas where traffic densities are higher than in rural areas. This cost should be included only where congestion, high traffic densities, or reductions in traffic speed are observed.

Secondary Impacts of Railroad Abandonment

Decreases in Gross Business Volume

An increase in the cost of transportation as a result of railroad abandonment is reflected in the local economy.[8] In the rural setting, this increased cost may be passed on by shippers (grain elevators) to farmers as a reduction in the price farmers receive for agricultural commodities. However, shippers may only be able to shift part of the financial burden. Since the farms are scattered throughout the counties of abandonment, competition from other elevators, some of which may be located on another rail line, can force elevators on the abandoned line to be competitive. The competitiveness of shippers on the abandoned line would presumably be a function of the truck shipping cost to competing elevators.

The effects of reduced expenditures can be measured as a reduction in gross business volume through the use of an input/output model. The interdependence of the selling and purchasing sectors can be used to measure changes in money brought into or removed from a local economy. In the case of

[8] The term "local" refers to the trade area of an abandonment. Generally, this encompasses the counties in which the abandonment occurs.

employment by sector. This information is available for the input/output model and is shown in Chapter IV.

Some caution is recommended when interpreting the results of change in employment. If the employment decreases by two persons in a particular sector, these persons may be displaced to a different sector of the economy or to a similar position in a different geographic location. This results in a "transfer." Transfers are not considered a negative impact of abandonment by the ICC. However, to the local economy, the transfer represents a job lost. Secondly, the wages of displaced workers are reflected by a decrease in the household sector due to reduced personal income. Employment changes, while calculated in the method, should be followed by a qualitative discussion of the types of jobs that may be lost permanently and those which are possible transfers.

Reduction in Local Tax Revenues

Local tax revenues will likely decrease as a result of the decrease in local property values due to railroad abandonment. In particular, this will affect businesses located along the rail line. If those businesses earned a portion of profit (P) because of the rail service, over infinite time, the land value would be (P/i), where (i) is the interest rate. Assuming the line was abandoned would result in a land value discounted by the increased transportation cost (IC). This relationship is shown by (P-IC)/i. The decline in property value is the present discounted value of the increased cost of transportation (IC/i). This capitalizes the increased cost of transportation into the land's price. Property tax loss is then calculated by multiplying the local property tax rate by the decrease in land value.

Reduced Economic Development Opportunities

The reduction of economic opportunities caused by abandonment is a source of debate. This debate centers around the inability to quantify reduced economic opportunities. Quantifying the lost potential revenue due to lack of rail service may be a more viable approach. The major assumption on

CHAPTER IV

CASE STUDY

To test the method for assessing the impact of railroad abandonment on rural communities, one abandonment was selected as a case study. The line selected was a 91-mile line located in southwestern North Dakota, running from Mandan to Mott. The line was operated by the Burlington Northern Railroad Company and was filed for abandonment under docket No. AB-6 Sub-No. 279 on April 10, 1986. The abandonment was granted by the ICC on May 27, 1986.

This line selected for analysis lies in an area where intramodal and intermodal competition are weak. Principal communities along the line lie more than 35 miles from the nearest rail head. The impacts of an abandonment in such areas are likely more intense, all other factors held constant. Moreover, the area is heavily dependent on the transport of bulk commodities, as the leading commodities produced are grain and coal. The heavy reliance of the region's economy on bulk commodities and the long distance to terminal markets also suggest that the impacts of abandonment may be more severe. Rail has a significant cost advantage in providing long haul shipments. Finally, shipment volumes over time do not appear to show a substantial decline prior to the abandonment decision. Thus, it is likely that the abandonment was a contributing factor in the economic decline, rather than the reverse. Examining the traffic density explains this presumption further.

The principal communities located on the line, their distance to the nearest railhead, and location of the railhead are shown in Table 4.1. A map of southwestern North Dakota with the Mandan to Mott line highlighted is shown in Appendix Figure A.1. Also shown are other rail lines and communities in the Mandan/Mott area.

Traffic increased slightly from 1981 to 1983 but fell sharply in 1984. This sharp fall in traffic was the result of a number of embargoes placed on the line due to large snow fall amounts and wet springs during 1983, 1984, and 1985 (ND PSC, 1986). This resulted in no service, and in some cases limited service to shipments of 220,000 lbs. (gross weight) per carload. During this time, shippers moved a majority of grain by truck directly to market or to a nearby railhead for transshipment. Also during 1984 to 1985, the Burlington Northern restructured rail rates nationwide. The rate on the Mandan to Mott line was left at a disproportionately higher value than rates on other rail lines in the area. This price differential reinforced the shippers' need to move grain by truck (Mielke, 1995).

The case study year used was 1983. In absence of embargo and weight restrictions, 1983 represented typical conditions. Moreover, the rate structure changes suggest that the railroad's abandonment decision was made at that time. If the decision was made at that time, and the change in rate structure was an attempt to divert traffic from the line, then the diversion should be considered as an impact of abandonment. The rates and physical condition of the line gave shippers no other alternative but to ship direct by truck or transship their commodities.

Primary Impacts of Railroad Abandonment

Change In Transportation Cost To Shippers

The change in transportation cost to shippers will occur in two different scenarios. In the absence of rail service, shippers are forced to ship bulk commodities by truck directly to market or to the nearest rail head for transshipment. As illustrated previously, the least expensive of these scenarios will be used by the shippers. Both scenarios are illustrated in the case study for comparative purposes.

Cost to Shippers to Ship by Rail

In 1983, 309 rail cars were transported on the rail line: 301 were forwarded and 8 were received (BN AB-6 Sub. 279). Because the type of commodity for each destination point was not specified, a

Table 4.4. Average Load Factors by Commodity Burlington Northern Railroad, 1983

Wheat	96.71 Ton/carload
Barley	86.96 Ton/carload
Corn	95.68 Ton/carload
Rye	90.94 Ton/carload
Oats	62.76 Ton/carload
Flax	86.03 Ton/carload
Soybeans	97.04 Ton/carload
Sunflowers	52.16 Ton/carload
Fertilizer	96.26 Ton/carload
Machinery	23.77 Ton/carload

The weight per rail car per commodity is computed using a load factor. The load factor is calculated by dividing the total weight of each individual commodity shipments by the number of rail cars for that particular commodity. Using the BN's 1983 QSC Statistics (Burlington Northern, 1983), the average load factor in tons per carload for North Dakota shipments is computed by commodity (Table 4.4). Load factors can be used in conjunction with rates to determine the cost per shipment. These results for elevator A are shown in Table 4.3. The total shipper railroad cost to ship from elevator A in 1983 was estimated in 1994 dollars at $104,860.30.

Direct Truck Versus Transshipment

An important aspect of the analysis considered is whether the grain will be trucked directly to final market or transshipped via the nearest railhead. Generally, the lower cost method is chosen in such an analysis. However, because truck costs are being used as a proxy for truck rates, the relative costs of each method to the shipper are not known with certainty. For the purposes of illustration of the method, both scenarios of transshipment and direct truck are presented. This provides a range to illustrate the large difference in cost involved in both of these operations. The 1983 data provide little insight into the shipping patterns after abandonment. If this case study represented a current abandonment proceeding, information concerning the shipments could be obtained directly from shippers. In light of the abandonment situation, shippers presumably would be more than willing to share this information. If a questionnaire is used, only information relevant to the calculation of the change in transportation cost should be solicited.

Cost to Ship Direct by Truck

Table 4.5. Direct Truck Cost to Market from Elevator A

Destination	Number of Trucks	Distance	Truck Rate	Truck Cost
Duluth	33.37	526	$1.55	$27,165
Minneapolis	10.84	500	$1.61	$8,729
Other MN	1.96	595	$1.44	$1,684
PNW[1]	43.61	1322	$1.25	$72,339
Duluth	11.23	526	$1.55	$9,137
Minneapolis	1.96	500	$1.61	$1,574
Duluth	30.04	526	$1.55	$24,450
TOTAL	133.00			$145,081

[1] Pacific Northwest (PNW)

Cost to Ship by Transshipping

To estimate the cost of transshipment, a cost of trucking to the nearest rail head from each elevator is calculated. Additionally, the cost of transporting the grain by rail to the final market is also computed. When the grain is received at the railhead, additional handling cost is incurred. This transloading cost results from extra handling and storage required to load on to rail cars for delivery. The average handling and storage cost of grain is estimated at 8.4 cents per bushel (Washington State University, 1994). Assuming similar characteristics concerning wage rates and handling technology between North Dakota and Washington, this value is used for calculating the transloading cost.

The distance from each elevator to the nearest railhead was previously shown in Table 4.1. In absence of information concerning shipper behaviors, the nearest railhead was used as the point of transshipment for each elevator. The direct truck distance was estimated using AutoMap, a GIS system which estimates the distance from origin to destination using the highway network of the U.S.

The results of transshipment are shown for Elevator A in Table 4.6. The number of truck loads are multiplied by the truck rate times the distance to the nearest railhead. This yields the truck portion of the cost of transshipment. The transloading cost is calculated by converting truckloads to bushels and then multiplying them by the transloading cost per bushel. Converting the rail rate and carloads into per pound

Using the 1982 ICC Public Use Railroad Waybill, the average rail rate and origin of shipments of fertilizer and farm machinery destined for North Dakota were determined. The waybill represents a sample of railroad shipments. In the sample for farm machinery, 16 individual shipments were recorded in 1982. Of this sample, 14 originated in the state of Illinois at an average rate of $89.223 per ton. In the sample for fertilizer shipments, 20 shipments terminated within North Dakota. Eleven of these shipments originated within the state of Idaho at an average rate of $37.433 per ton. In the absence of more specific information, the average rates of both the machinery and the fertilizer shipments were used for the rate of inbound rail shipments.

Both direct truck and transloading were considered in the analysis of inbound shipments. Transshipped commodities are hauled by rail to the nearest railhead with available facilities for transloading and then trucked to the final destination. For the transshipping analysis, it was assumed that fertilizer was shipped by rail to Mandan, North Dakota, where a fertilizer transloading facility exists. The farm machinery was assumed to be delivered to the nearest railhead. The direct truck analysis involved a direct haul to the final destination.

The cost associated with transloading fertilizer was estimated at $2.00 per loaded ton (Iowa Department of Transportation, 1976). This value was inflated to 1994 dollars ($6.59 per loaded ton) by comparing the increase in handling cost associated with wheat (Iowa DOT, 1976) versus the 1994 Washington state grain handling study. The transloading cost associated with farm machinery was estimated at $42.00 per implement (Fargo Implement, 1995)[10]. It was also estimated that two implements are hauled on each rail car. The total transloading cost is shown in Table 4.7.

The inbound rail rate for fertilizer and farm machinery was multiplied by the average load density of shipments terminating in the North Dakota to obtain pre-abandonment inbound railroad shipment cost.

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10 Fargo Implement pays another Fargo firm this amount for removing each implement from a rail car.

In all cases, the cost of transshipping is less than direct truck shipments. However, in actuality many post-abandonment shipments went directly to market by truck. One of the major reasons for this discrepancy may be the difference between truck cost and truck rates. This was true with wheat moving to Duluth and Minneapolis (Mielke, 1995). In the analysis, truck costs were used as a proxy for truck rates. Truckers may have priced short-haul movements at a higher rate. Longer hauls enticed truckers to obtain backhauls, which in their perception generated increased revenue. Shorter hauls to transloading facilities were unattractive, because they almost never obtained a backhaul. Moreover, truck costs may not reflect the true short-haul truck costs. Time spent waiting at the terminal elevator increases short-haul movement costs.

A second explanation relates to the trucking industry. In 1980, the industry was deregulated. Owner operators who hauled grain to market could now haul a previously regulated commodity on the backhaul. The increased competition caused trucking rates to fall. This again gave truckers an incentive for longer hauls.

Table 4.10. Change in Total Transportation Cost by City[1]

City	Rail Cars	Trucks	Pre-Abandonment Railroad Shipment Cost	Direct Shipments to Final Market	Transshipping to Nearest Railhead and Continued Rail Shipment	Direct Shipments Minus the Pre-Abandonment Rail Cost	Transshipping Minus the Pre-Abandonment Rail Cost
Burt	1	3.6	$3,183.67	$4,590.43	$4,059.88	$1,406.76	$876.21
Carson	39	136.6	$108,043.99	$149,671.86	$115,591.89	$41,627.88	$7,547.90
Elgin	23	76	$51,621.03	$83,444.20	$57,399.87	$31,823.17	$5,778.84
Flasher	50	173.5	$121,643.45	$165,341.45	$126,916.74	$43,698.00	$5,273.30
Heil	3	10.5	$4,290.48	$8,876.01	$5,522.03	$4,585.53	$1,231.55
Mott	193	675.7	$365,960.74	$588,568.98	$399,698.40	$222,608.24	$33,737.65
Total	309	1075.9	$654,743.36	$1,000,492.94	$709,188.81	$345,749.57	$54,445.45

[1]Includes both inbound and outbound transportation.

The ESAL factors were obtained from Appendix D of the AASHTO Guide for Pavement Design, 1986. All traffic is classified in terms of equivalent 18-kip[11] single axle loads. The ESALs are tabulated using the SN for each section of highway, the loaded axle weight, and the terminal pavement serviceability. The results for each section of road for transshipping are shown in Table 4.11. All trucks are assumed to be 5-axle tractor semi-trailer configurations (one single and two tandem axles), with a total loaded weight of 80,000 pounds. The front single axle was assumed to be loaded to 12 kips with each tandem axle loaded to 34 kips. Empty truck weights were assumed to be 9 kips for the front axle, 11 kips for the first tandem axle, and 6 kips for the rear tandem axle.

Table 4.11. Highway Section Characteristics: Transshipping Scenario

Section #	Miles	Trucks	SN[1]	FC[2]	Loaded ESAL-Front Axle	Loaded ESAL Tandem-One Group	Empty ESAL-Front Axle	Empty ESAL Tandem-Total axles	Total ESAL-Loaded	Total ESAL-Empty
1	34.7	675.7	1.933	2	0.176	1.069	0.0607	0.009	54255.8	1634.2
3	9	7.1	2.461	2	0.1825	1.074	0.0625	0.009	148.9	4.6
4	7	7.1	2.190	2	0.1792	1.071	0.0616	0.009	115.4	3.5
5	34.6	73.5	3.176	6	0.1882	1.083	0.0618	0.009	5971.7	180.1
7	7	10.5	2.190	2	0.1792	1.071	0.0616	0.009	170.6	5.2
9	41	171.5	1.521	2	0.1713	1.065	0.0593	0.009	16181.5	480.2
Total									76844.1	2307.8

[1] Structural Number, [2] Functional Class.

Once the total ESALs were determined, the lifecycle ESALs and the cost of reconstruction per ESAL were calculated. The lifecycle ESAL represents the total ESAL life of the highway based on the structural number. The lifecycle ESAL is calculated using the HPMS damage function (Equation 4.1) as explained by Tolliver, 1994.

$$LOG(ESAL) = 9.36\,LOG\left[SN + \sqrt{\frac{6}{SN}}\right] + \frac{G}{\beta}, \tag{4.1}$$

where

[11] One kip is equivalent to 1000 lbs.

The highway impacts caused by direct shipment were calculated the same way as in the transshipment scenario. Using AutoMap, the favorable route of shipment was calculated for shipping to all destinations[12]. For commodities going west, i.e., the Pacific Northwest, the preferred route heads west along N.D. Highway 21 and turns north up N.D. Highway 8. For commodities heading east, the preferred route heads east along N.D. Highway 21 and then turns north up N.D. Highway 6. Inbound shipments were handled in the same way as the transshipment scenario. A summary of highway impact damage caused by routing by direct shipments is shown Table 4.13.

Table 4.13. Total Highway Impacts: Direct Truck Scenario

Shipments West	$42,638.63
Shipments East	$ 5,668.93
Total	$48,307.56

All of the highway impact costs are on an annual basis. While both total cost numbers of transshipping and direct trucking may appear small, when computed over the life of the pavement or the impact, they can become substantial.

In analysis of highway damage for the Mandan to Mott branch line, one of the highways used as a route to the nearest rail head is a non-state highway. This is the 32-mile county road from Carson to New Salem. All of the 133 truck loads from the Carson elevator were assumed to be shipped over this road. In this event, it may be necessary for the state or local government to rehabilitate the highway to handle this increased traffic. Such was the case on a another road in southwestern North Dakota. The road from Regent to Gladstone, North Dakota, was rehabilitated in 1989 due to heavy truck traffic resulting from a grain sub-terminal built near Gladstone on the BN mainline (Tolliver and Zink, 1985). The road at the time was a graveled county road. The cost of grading and paving such a road is approximately $275,000 per mile (Horner, 1995). If upgrading is necessary due to the increased traffic, the cost should be

[12] Interstate highways and circuitous routes around larger urban areas were weighted more favorably.

purposes of regional planning (USDA, 1994). Each state's data are compiled in a consistent manner, which allows for comparison by state. The model uses 528 individual sectors which have been aggregated to two-digit standard industrial classification (SIC) codes.

The aggregation scheme was chosen because the distinctive characteristics of the sectors were still present. Further aggregation simply resulted in the agglomeration of impacts. In particular, the values for job losses would add together with further aggregation. It was therefore difficult to view how a particular industry or business may be affected by the change in gross business volume. More importantly, with further aggregation, whole jobs may be lost to aggregated sectors, yet individual businesses may see only fractional losses. These businesses would likely find means of recouping the reduction in gross business volume, other than laying off employees for hours or days of a year.

In applying input/output analysis to this case study, the change in transportation cost was attributed to the agricultural crops sector of the model. The increase in transportation cost may in part be passed to the end user, the farmer, in the form of lower commodity prices at the local elevator. It is assumed that elevators will attempt to recover the increase cost of transportation by offering a lower price to farmers for their commodities. If the elevator is part of a cooperative, the increased transportation cost may be reflected in lower dividends paid to patrons. It is noted, however, that elevators may not be able to recoup the entire portion of the increased transportation cost. Competition from surrounding elevators ensures that commodity prices remain competitive.

Multiplying the change in transportation cost across the agricultural crops sector yielded the reduction in gross business volume for the economy of the region. The reduction in gross business volume was also reflected through a reduction in employment by dividing the change in gross business volume by the productivity ratio. This is the ratio of total gross business volume divided by the number of employees in each sector.

Table 4.14. Changes in Gross Business Volume and Employment Using IMPLAN

Sector	Multiplier	Productivity Ratio	$54,445.45 Impact		$345,749.57 Impact	
			Change in GBV	Jobs Lost	Change in GBV	Jobs Lost
Ag Livestock	0.030000	50431.86	$1,633.36	0.032388	$10,372.49	0.205673
Ag Crops	1.041640	51419.33	$56,712.56	1.102942	$360,146.58	7.004109
Forestry Products	0.000000	129544.57	$0.00	0.000000	$0.00	0.000000
Commercial Fishing	0.000000	38792.63	$0.00	0.000000	$0.00	0.000000
Ag Services	0.023370	33291.96	$1,272.39	0.038219	$8,080.17	0.242706
Metallic Mining	0.000000	124398.53	$0.00	0.000000	$0.00	0.000000
Coal Mining	0.000250	122028.14	$13.61	0.000112	$86.44	0.000708
Oil & Gas Exploration	0.009830	402868.51	$535.20	0.001328	$3,398.72	0.008436
Sand & Gravel	0.000010	86440.86	$0.54	0.000006	$3.46	0.000040
Construction	0.019570	68034.55	$1,065.50	0.015661	$6,766.32	0.099454
Food & Kindred Products	0.000150	234191.75	$8.17	0.000035	$51.86	0.000221
Textile Mills	0.000210	75622.92	$11.43	0.000151	$72.61	0.000960
Apparel	0.000070	54587.58	$3.81	0.000070	$24.20	0.000443
Lumber & Wood Products	0.000210	55540.97	$11.43	0.000206	$72.61	0.001307
Furniture	0.000010	60232.60	$0.54	0.000009	$3.46	0.000057
Paper Products	0.000040	117182.26	$2.18	0.000019	$13.83	0.000118
Printing & Publishing	0.000800	57698.99	$43.56	0.000755	$276.60	0.004794
Chemical Products	0.002930	286417.22	$159.53	0.000557	$1,013.05	0.003537
Petro Refining	0.052690	1310973.68	$2,868.73	0.002188	$18,217.54	0.013896
Rubber & Plastic	0.000010	95646.12	$0.54	0.000006	$3.46	0.000036
Leather	0.000000	87503.43	$0.00	0.000000	$0.00	0.000000
Glass & Concrete	0.000020	73609.94	$1.09	0.000015	$6.91	0.000094
Primary Metal	0.000090	222695.28	$4.90	0.000022	$31.12	0.000140
Fabricated Metal	0.000390	100184.16	$21.23	0.000212	$134.84	0.001346
Industrial Machines	0.019670	133012.36	$1,070.94	0.008051	$6,800.89	0.051130
Electronic & Electrical Products	0.000380	145324.96	$20.69	0.000142	$131.38	0.000904
Transportation Equipment	0.000930	176160.34	$50.63	0.000287	$321.55	0.001825
Controlling Instruments	0.000020	85265.36	$1.09	0.000013	$6.91	0.000081
Misc. Manufacturing	0.000060	69460.07	$3.27	0.000047	$20.74	0.000299
Railroads & Related Services	0.003750	88896.31	$204.17	0.002297	$1,296.56	0.014585
Passenger Transportation	0.000040	22985.45	$2.18	0.000095	$13.83	0.000602

Table 4.14. (continued)

Sector	Multiplier	Productivity Ratio	$54,445.45 Impact		$345,749.57 Impact	
			Change in GBV	Jobs Lost	Change in GBV	Jobs Lost
Educational Services	0.000120	32721.18	$6.53	0.000200	$41.49	0.001268
Social Services	0.000000	18195.33	$0.00	0.000000	$0.00	0.000000
Other Nonprofit Organizations	0.000010	48004.95	$0.54	0.000011	$3.46	0.000072
Membership Services	0.002760	17996.86	$150.27	0.008350	$954.27	0.053024
Engineering Services	0.007290	42314.66	$396.91	0.009380	$2,520.51	0.059566
State & Local Government	0.006800	25483.08	$370.23	0.014528	$2,351.10	0.092261
Federal Government	0.002040	33647.79	$111.07	0.003301	$705.33	0.020962
Direct and Indirect Effect	1.41		$76,807.83	1.40	$487,759.29	8.88
Induced Effect	0.78		$42,695.77	0.95	$271,136.81	6.06
Total Effect	2.19		$119,503.60	2.35	$758,869.10	14.94

The results of the analysis showed a $119,503.60 to $758,869.10 reduction in the gross business volume. This reduction represented the loss of revenue to each sector due to the change in transportation cost. While this illustrates the impacts of the change in transportation cost, ordinarily the concern in community impact assessment refers to job losses. Job losses ranged from 2.35 jobs to 14.94 jobs. A majority of the job losses were attributed to the agricultural crops sector. The impacts may have forced a reduction in farm labor or other expenditures to recover the increased cost of transportation. This would include farm labor, whether it is hired labor or the farmers themselves.

However, some caution should be used in interpreting primary job losses. If the elevators are assumed to recoup their loss through reduced prices offered to farmers, then they in fact are not losing any profit, but simply transferring the cost to the farmers up to the point where they are still competitive with surrounding elevators.

Further evidence that the farmer will bear the burden was provided by examining the average reduction of elevator board prices along the Mandan to Mott line. From 1976 to 1981, the average combined throughput by 10 elevators located along the line was approximately 4,000,000 bushels per year (ND PSC, 1986). Dividing the change in transportation cost by the average throughput revealed a range of 1.4 to 8.6 cents per bushel (5 cent average). The associated truck rate to haul 35 miles to a transloading facility was 10 cents per bushel. Assuming "ceteris paribus" conditions, the elevators should be able to price to avoid diversion of grain to elevators located on other rail lines.

Conversely, the remainder of job losses from the other sectors can be viewed as secondary job losses. Examining Table 4.14 shows a majority of the secondary job losses to be fractions. These may represent hours and days worth of wages to workers. Therefore, it is probably safe to assume that businesses would find means of recouping the lost revenue other than laying off an employee for several hours or days of a year. The lost revenue translates into reduced expenditures in the local economy and a reduction in the gross business volume.

Table 4.15. Reduction in Local Property Tax Revenues

Shipment Method	Weighted Average Mill Rate[1] (MR)	Change in Trans-portation Cost (TC)	Change in Total Property Values (TC/.08)	Taxable Value of Change in Transportation Cost (TC*0.5*0.1)	Change in Taxable Property Values (TC*0.5*0.1) /0.08	Revenue Lost $MRx\left(\frac{TCx0.5x0.1}{0.08}\right)$
Trans-shipment	382.385	$54,445.45	$680,568	$2,722.25	$34,028.13	$13,011.84
Direct Truck	382.385	$345,749.57	$4,321,869	$17,287.48	$216,093.50	$82,630.91

[1] An average mill rate was estimated by computing a weighted average of the mill rate for the three counties of abandonment based on each county's taxable value.

The results in Table 4.15 show a range of local property tax loss from $13,011.84 for the transshipment scenario to $82,630.91 for the direct truck scenario. Since the change in transportation cost is considered an annual impact, the reduction local property tax revenues is also considered an annual impact.

Diminished Economic Development Opportunities

The diminished economic opportunities due to abandonment in the Mandan to Mott line area were difficult to quantify. Attributing the loss of a potential business or industry solely to abandonment is a subjective argument. Production agriculture in southwestern North Dakota experienced hard times in the early and middle 1980s. Rationalization among farms and the growth in acreage per farm resulted from the depressed economy. Consolidation, however, did not result in increased rail traffic. Instead, grain elevator sub-terminal development in the area changed shipper patterns, which enticed elevators located on the Mandan to Mott line to ship grain via the transshipment method. Today, nearly all grain in the area is shipped by this method. Accordingly, elevators have hired trucking companies to haul the short distance hauls to sub-terminal elevators. It should be recognized that there are some profit as well as job opportunities realized by the increased truck traffic. However, since rail labor was not accounted for in the job and gross business volume reductions, the associated gains from trucking activities were not included.

Table 4.16. Total Impact of Abandonment: Mandan to Mott Line

Cost Category	Transshipment	Direct Truck
Change in Transportation Cost	$54,445.45	$345,749.57
Highway Impact[1]	$32,497.15	$48,307.56
Change in Gross Business Volume[2]	$65,058.60	$413,119.53
Local Property Tax Loss	$13,011.84	$82,630.91
Total	$165,013.04	$889,807.57

1 Does not include the cost of upgrading the Carson road.

2 Results from IMPLAN reflect the change in gross business volume minus the increase in transportation cost to avoid double counting.

The total impact of abandonment ranges from slightly over $165,000 to over $889,000. This represents the dollar value of impact due to abandonment for one year. The results obtained could be used in an actual abandonment proceeding as defined by ICC's abandonment procedure found in CFR 4911.

The question that agencies and concerned groups have asked relates to the time horizon to consider impacts. In abandonment cases, the ICC may look at one year after the line is to be abandoned to weigh the impacts of abandonment. This makes sense, since the railroad's projected revenue is calculated for the forecast year. Therefore, the ICC would presumably want to use the community impacts for the forecast year as well.

However, the community impacts are not limited to only one year. Increased highway damage is a recurring event attributed to the increased truck traffic. It is not unreasonable for the highway impacts to be measured for twenty years, the equivalent to a typical pavement's design-performance period. Changes in gross business volume may be felt until the structure of the economy has sufficient time to adjust to the change in transportation cost.

Tradeoffs of community impacts versus railroad revenue adequacy were clarified in Ex Parte 274 Sub No. 11 (1987). This decision reinforced the ICC's potential use of community impacts to decide the

An illustration of the relationship between opportunity cost and railroad return on investment is shown in Figure 4.3. A summary of the ICC's and community's potential decision process is shown in Figure 4.4.

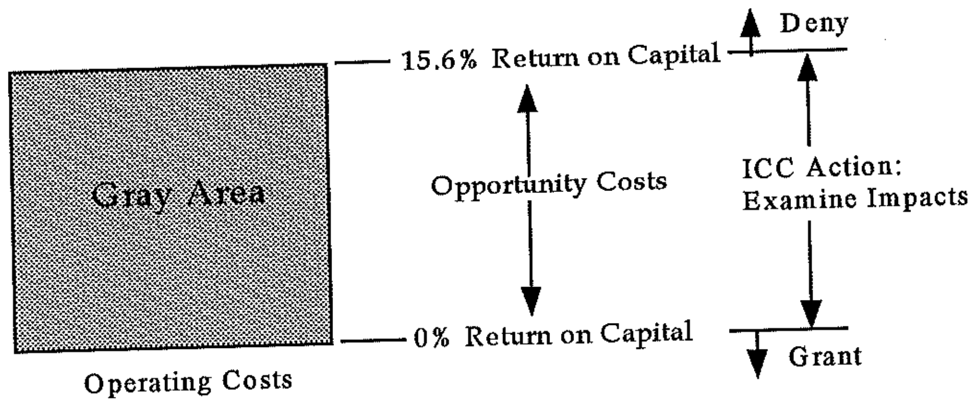

Figure 4.3. ICC's Railroad Cost Breakdown

Community Decision Process:

Subsidy = Railroad avoidable cost (AC) + opportunity cost (OC) - Rail revenues (R)
  If Community Impacts (CIA) > Subsidy, then community should subsidize,
  Else allow abandonment

ICC Decision Process:
  If R< AC, then grant abandonment
  Else if R> (OC + AC), then deny abandonment
  Else {Case = gray area (OC + AC) > R > AC}
    If CIA > OC or CIA > Subsidy, then ICC could deny abandonment:
    Else must approve, consequence of ICC denial:
    railroad receives < Full ROI

Figure 4.4. Community and ICC Potential Decision Process

In the Mandan to Mott case study, the railroad received in the projected base year of 1985 a revenue of $79,438 for shipment of 48 carloads or $1,654.96 per carload. Extrapolating this amount to the 309 carloads shipped in 1983 yields an estimated total railroad revenue of $531,100.12, which includes

CHAPTER V

SUMMARY AND CONCLUSIONS

The railroad industry has experienced major changes since 1980. Through deregulation, large Class I rail carriers have sought to eliminate unprofitable low- traffic density branch lines. The loss of rail service may have a potentially negative impact for the users and their customers. In a nationwide analysis, the groups most affected by abandonment are larger-population rural counties. These counties, in many cases, have maintained rail service through short lines or other large carriers after the abandonment occurred. It has been recognized that while another portion of rural America has lost rail service permanently, nearly 60,000 miles of low-density rail line are still in use in the United States. These lines will be a focus point for years to come as rationalization continues in the rail industry.

The goal of this study was to provide a method of analysis in railroad abandonment cases, which can be applied in a relatively short period of time (30 days). In the review of literature, it was clear that many attempts have been made to quantify the impacts of abandonment; however, due to inconsistencies in application and time and resources involved, no one method has been used as a standard.

The method developed in this study was used to estimate the primary and secondary impacts of abandonment. The primary impacts include the change in transportation cost to shippers and increased highway damage resulting from increased truck traffic. Secondary impacts include changes in gross business volume, increased highway user costs, reductions in local property tax revenue, and reduced economic development opportunities. A thorough search of available information identified the data needed to estimate the total impact of abandonment for a historical case study. A summary of the method is shown in Figure 5.1.

Table 5.1. Total Impact of Abandonment: Mandan to Mott Line

Cost Category	Transshipment	Direct Truck
Change in Transportation Cost	$54,445.45	$345,749.57
Highway Impact	$32,497.15	$48,307.56
Change in Gross Business Volume	$65,058.60	$413,119.53
Local Property Tax Loss	$13,011.84	$82,630.91
Total	$165,013.04	$889,807.57

The total impact due to abandonment ranged from $165,000 to $889,000 for the transshipment scenario to the direct truck scenario, respectively. These impacts covered one year, 1983, and have been inflated to 1994 dollars.

The community impacts could be used by the ICC and the communities to weigh the decision of the abandonment. If the railroad covers the avoidable costs of operation but does not cover the opportunity costs of capital, this represents a gray area in which the ICC decides the fate of an abandonment. The developed method quantifies the impacts into a consistent form that can be applied within the ICC's 30-day time frame. The investigation process by the ICC includes written comments and hearings in the local communities. Many of the comments include subjective, unsubstantiated testimony from local protestants, and this makes the ICC decision process more difficult. The developed method of impact assessment brings consistency to the decision process.

Conclusions

This study has illustrated the usefulness of a quantifiable method to assess the impact of railroad abandonment on rural communities. There are several perspectives from which to apply the developed method.

Abandonment impacts have been judged from a number of time frames of reference: before the abandonment application has been filed, after the abandonment application has been filed, during the ICC's abandonment investigation time period, and after the abandonment has occurred. The development of any impact assessment method should be flexible enough to handle all of these situations. The case study consumers of electricity. However, if the mining operation is unable to sell its coal due to the increase in transportation cost, they would be forced to reduce operations or lay off employees. Each industry, given different circumstances, will have a group which will ultimately bear the burden of the increase in transportation cost.

Areas For Further Study

To measure the secondary community impacts, an input/output model was employed. Because of its ease in application and time involved, it was used in the method. However, input /output models have limitations. Input/output models are generally static in nature: if the abandonment of a rail line causes the structure of an economy to change, then the input/output model in theory should reflect this change. However, input/output dynamic modeling is a difficult task. It requires changing the gross business volume coefficients in the data, rerunning the model, and generating a new set of multipliers. With a new model that reflects the change in transportation cost within the economy, the secondary impacts could then be measured in terms of the changed economy. To improve the developed method, a dynamic modeling procedure should be implemented.

A second aspect of the report warranting further study is the time horizon of abandonment impacts. Anyone who implements the developed model will be questioned about the relative time frame for calculating impacts. This is especially true for the changes in gross business volume. How long will the economy be affected by these impacts? This question has no easy answer. One possible method is to perform a "before-and-after" analysis of the abandonment situation where the predicted impacts are compared to actual impacts after the abandonment has occurred. However, isolating abandonment as the sole factor in the economic situation is a difficult task as well.

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APPENDIX A

Additional Figures and Tables

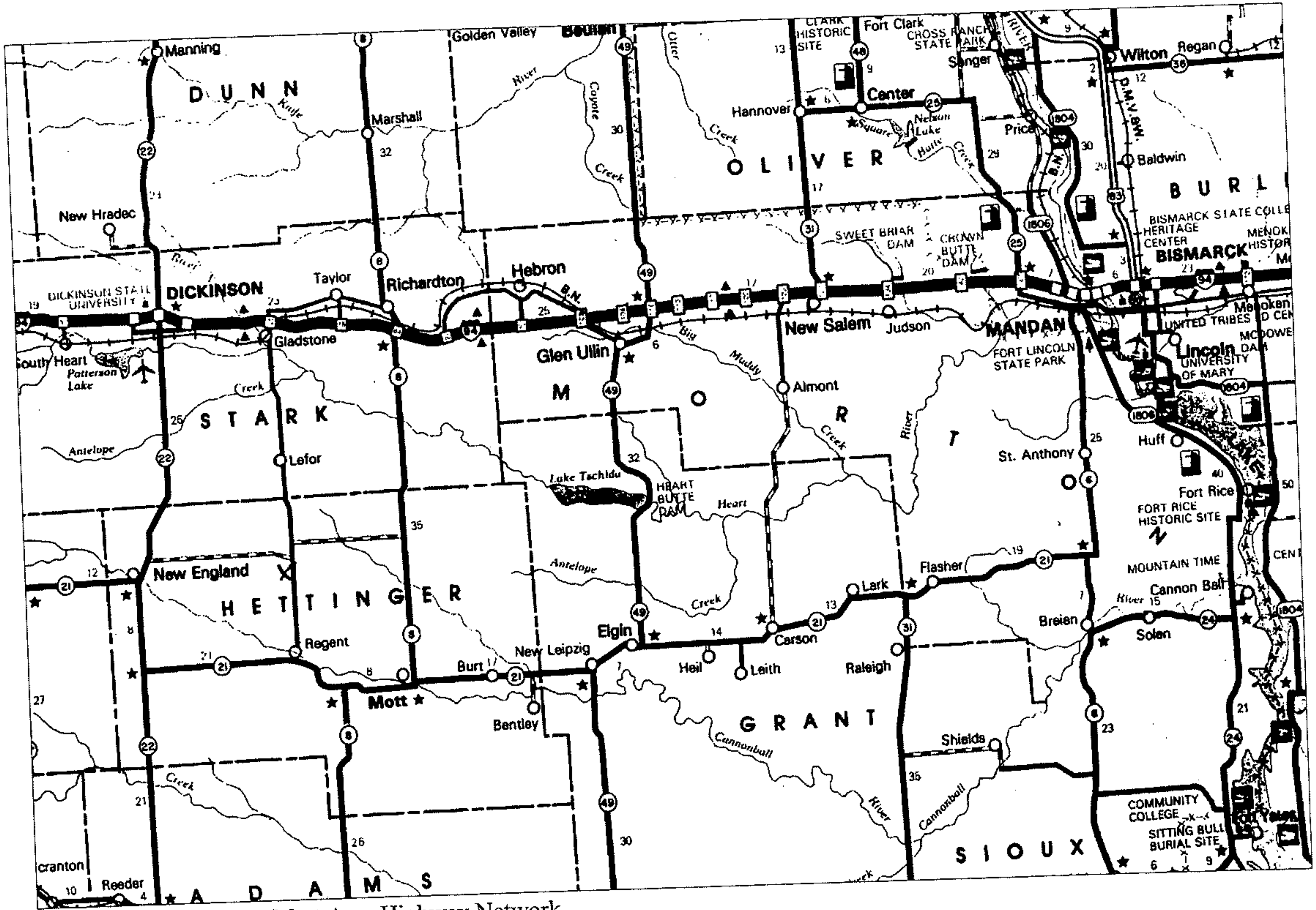

Figure A.2. Mandan to Mott Area Highway Network

Table A.2. Mandan to Mott Elevator Shipments by Direct Truck and Transshipping

City	Equivalent Trucks	Highway Distance to Market	Truck Rate to Market	Direct Haul Truck Cost	Distance to Railhead	Truck Rate to Railhead	Transloading Cost	Rail rate	Rail cost	Total Transshipping Cost
B	6.22	544	$1.55	$5,240.21	33	$2.60	$482.00	$1.24	$4,280.47	$4,848.25
B	1.07	1645	$1.25	$2,217.83	33	$2.60	$83.20	$2.30	$1,365.69	$1,534.67
B	9.69	1308	$1.25	$15,896.75	33	$2.60	$750.03	$2.18	$11,668.61	$12,504.42
B	7.41	544	$1.55	$6,240.47	33	$2.60	$574.00	$1.24	$5,097.53	$5,757.31
B	3.18	544	$1.55	$2,680.76	33	$2.60	$246.58	$1.24	$2,189.78	$2,522.14
B	3.84	518	$1.61	$3,203.72	33	$2.60	$297.41	$1.24	$2,641.23	$3,024.43
B	6.36	613	$1.44	$5,623.46	33	$2.60	$492.29	$1.24	$4,371.87	$4,949.95
B	29.84	544	$1.55	$25,118.73	33	$2.60	$2,670.09	$1.24	$11,065.65	$13,821.52
B	2.38	280	$2.26	$1,508.26	33	$2.60	$213.43	$0.87	$616.26	$915.47
Sub Total	70.00			$67,730.20						$49,878.16
C	50.71	509	$1.61	$41,562.65	41	$2.56	$3,926.66	$1.06	$29,726.34	$33,757.96
C	23.23	483	$1.65	$18,540.51	41	$2.56	$1,799.19	$1.06	$13,620.53	$15,524.83
C	30.45	595	$1.44	$26,141.08	41	$2.56	$2,357.69	$1.06	$17,848.60	$20,311.40
C	28.78	1337	$1.25	$48,278.83	41	$2.56	$2,228.45	$2.18	$34,669.20	$37,002.76
C	25.63	262	$2.26	$15,168.62	41	$2.56	$1,984.95	$0.72	$10,258.71	$12,348.77
C	12.70	509	$1.61	$10,411.76	41	$2.56	$1,136.77	$1.09	$4,131.90	$5,373.78
Sub Total	171.50			$160,103.45						$124,319.51
D	0.20	286	$2.26	$130.03	46	$2.54	$15.59	$1.17	$130.49	$262.96
D	0.94	550	$1.55	$800.25	46	$2.54	$72.80	$1.17	$609.46	$799.15
D	1.96	550	$1.55	$1,665.58	46	$2.54	$175.12	$1.17	$684.10	$976.10
D	6.25	524	$1.59	$5,208.86	46	$2.54	$559.70	$1.17	$2,186.48	$2,863.07
D	1.15	620	$1.51	$1,071.28	46	$2.54	$102.69	$1.17	$401.17	$620.75
Sub Total	10.50			$8,876.01						$5,522.03
E	33.67	566	$1.55	$29,492.19	37	$2.58	$2,607.28	$1.25	$23,344.11	$26,046.96
E	63.67	540	$1.55	$53,205.14	37	$2.58	$4,930.11	$1.25	$44,141.45	$49,167.13
E	3.45	636	$1.51	$3,299.91	37	$2.58	$266.83	$1.29	$2,447.35	$2,809.75
E	18.80	1279	$1.25	$30,175.30	37	$2.58	$1,455.99	$2.18	$22,651.63	$24,203.19
E	76.12	302	$2.26	$51,955.92	37	$2.58	$5,894.85	$0.95	$39,906.22	$45,896.53
E	15.50	566	$1.55	$13,580.62	37	$2.58	$1,200.61	$1.25	$10,749.54	$12,045.71

Appendix B

Overview of Railroad Abandonment 1980-1992

- Miles denied, withdrawn, and transferred,
- Miles actually abandoned, and
- Miles still in use.

The database contains 2,939 entries. This represents all abandonment dockets with decisions rendered between January 1, 1980, and July 1, 1992. Abandonment filings by year are shown in Table B.1.

Table B.1. Railroad Abandonment Filings by Year

Year	Number Filed	% of Total
Pre 1980[16]	94	3.2
1980	133	4.5
1981	433	14.7
1982	98	3.3
1983	252	8.6
1984	610	20.7
1985	281	9.6
1986	262	8.9
1987	159	5.4
1988	182	6.2
1989	157	5.3
1990	140	4.8
1991	130	4.4
1992[17]	9	0.3
TOTAL	2940	100%

Of the 2,940 lines filed for abandonment, 1,425 or 48 percent were under five miles in length and 527 or 18 percent were one mile or less.

16 The database contains all dockets with decisions since January 1, 1980, which means some were originally filed before this date.

17 As of March 27, 1992.

Table B.2. (continued)

State	Total Miles of Class I and II Track at the End of 1979	Total Miles of Track Requested for Abandonment 1980-1992	Total Miles Granted 1980-1992	Total Miles Actually Abandoned 1980-1992	Percent of Class I and II Track Abandoned 1980-1992
NM	1,964	12.6	12.6	12.6	0.6
NV	1,564	299.4	267.4	85.5	5.5
NY	4,582	838.8	636.9	606.3	13.2
OH	7,320	1,988.2	1,850.1	1,499.2	20.5
OK	3,860	972.5	941.2	763.4	19.8
OR	2,957	408.5	387.3	287.2	9.7
PA	7,248	1,940.8	1,739.0	1,532.3	21.2
RI	143	25.3	25.3	25.3	17.7
SC	2,772	503.5	489.2	447.1	16.1
SD	2,829	1,939.4	1,397.6	754.1	26.7
TN	3,136	721.0	648.0	570.5	18.2
TX	13,304	1,558.2	1,282.9	1,148.6	8.6
UT	1,659	218.9	218.9	218.9	13.2
VA	3,511	483.9	483.9	446.4	12.7
VT	384	60.6	59.2	59.2	15.4
WA	5,340	1,661.3	1,282.4	1,126.5	21.1
WI	5,653	1,456.5	1,121.8	1,112.8	19.7
WV	3,513	858.3	815.2	801.9	22.8
WY	1,985	251.8	85.5	85.5	4.3

APPENDIX A

Additional Figures and Tables

Table A.1. Mandan to Mott Elevator Shipments and Railroad Cost to Shippers

Elevator	# of Railcars	Destination	Commodity	Equivalent Trucks	Load Factor	Rail Rate	Rail Cost to Shippers
B	1.78	Duluth	Wheat	6.22	96.711	$1.31	$4,490.99
B	0.31	Minneapolis	Wheat	1.07	96.711	$2.30	$1,365.69
B	2.77	PNW	Wheat	9.69	96.711	$2.18	$11,668.61
B	2.12	Duluth	Wheat	7.41	96.711	$1.31	$5,348.23
B	0.91	Duluth	Durum	3.18	96.711	$1.31	$2,297.47
B	1.10	Minneapolis	Durum	3.84	96.711	$1.31	$2,771.13
B	1.82	Other Minn.	Durum	6.36	96.711	$1.31	$4,586.88
B	8.52	Duluth	Sunflowers	29.84	52.157	$1.26	$11,247.06
B	0.68	West Fargo	Sunflowers	2.38	52.157	$0.95	$674.26
Sub Total	20.00			70.00			$44,450.32
C	14.49	Duluth	Wheat	50.71	96.711	$1.18	$33,156.30
C	6.64	Minneapolis	Wheat	23.23	96.711	$1.18	$15,192.13
C	8.70	Other Minn.	Wheat	30.45	96.711	$1.18	$19,908.06
C	8.22	PNW	Wheat	28.78	96.711	$2.18	$34,669.20
C	7.32	Grand Forks	Wheat	25.63	96.711	$0.84	$11,848.09
C	3.63	Duluth	Sunflowers	12.70	52.157	$1.18	$4,479.44
Sub Total	49.00			171.50			$119,253.21
D	0.06	Grand Forks	Wheat	0.20	96.711	$0.95	$105.53
D	0.27	Duluth	Durum	0.94	96.711	$1.26	$657.15
D	0.56	Duluth	Sunflowers	1.96	52.157	$1.26	$737.64
D	1.79	Minneapolis	Sunflowers	6.25	52.157	$1.26	$2,357.60
D	0.33	Other Minn.	Sunflowers	1.15	52.157	$1.26	$432.57
Sub Total	3.00			10.50			$4,290.48
E	9.62	Duluth	Wheat	33.67	96.711	$1.31	$24,293.06
E	18.19	Minneapolis	Wheat	63.67	96.711	$1.31	$45,935.82
E	0.98	Other Minn.	Wheat	3.45	96.711	$1.31	$2,486.20
E	5.37	PNW	Wheat	18.80	96.711	$2.18	$22,651.63
E	21.75	Grand Forks	Wheat	76.12	96.711	$1.06	$44,626.31
E	4.43	Duluth	Durum	15.50	96.711	$1.31	$11,186.51
E	8.26	Minneapolis	Durum	28.90	96.711	$1.31	$20,852.32
E	5.08	Minneapolis	Rye	17.77	90.939	$1.31	$12,056.84
E	52.68	Duluth	Sunflowers	184.40	52.157	$1.31	$71,752.57
E	33.65	Minneapolis	Sunflowers	117.76	52.157	$1.31	$45,824.06
E	13.70	West Fargo	Sunflowers	47.95	52.157	$1.06	$15,160.80
F	3.99	Duluth	Wheat	13.96	96.711	$1.31	$10,073.33
F	5.11	PNW	Wheat	17.88	96.711	$2.18	$21,539.60
F	8.19	Duluth	Sunflowers	28.67	52.157	$1.31	$11,154.37
Sub Total	191.00			668.50			$359,593.40