THE ECONOMICS OF SHORT-LINE RAILROADS IN NORTH DAKOTA

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Preface

This document is one of several reports which will be generated as part of the North Dakota Rail Services Planning Study. It documents a comparison of costs and profitability of light-density branch lines under large railroad ownership (Burlington Northern) and short line railroad ownership. Several other reports analyzing effects of short line railroad development in North Dakota are forthcoming. Reports which are or will be available from this study include:

1. Light Density Rail Line Costing Methodology (available in print).
2. Costs and Profitability of Light Density Branch Lines (this summary available, detailed report forthcoming)
3. Short Line Railroad Development Impacts on Rail Labor (forthcoming)
4. Short Line Impacts on Inter- and Intramodal Competition (forthcoming)
5. Short Line Impacts on Shipper Service Levels (forthcoming)

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HIGHLIGHTS

Three sets of light density lines in North Dakota were analyzed with respect to the potential economies to be gained from short line operation. The three networks consisted of: (1) a single, 81-mile branch line with a density of nine cars per mile; (2) a 667-mile regional network with 20 cars per mile; and (3) a 211-mile network with 35 cars per mile. Each network was analyzed first as a light density subsystem of the Burlington Northern Railroad, and then as an independent short line operation.

The results of the study in general suggest that some economies of size and/or density are necessary in order to operate short line networks profitability. The single, light density branch line failed to show any improvement in profitability under short line operation. However, the regional network showed a simulated cost savings of 26% in on-line operating, maintenance, and capital cost. The 211-mile network with a relatively high traffic density also fared well under simulated short line operations, showing a potential gain of 31% in on-line costs. The conclusions of the comparative analysis are that short line operations are not likely to make a substantial difference in profitability on single branch lines of very light density. But on larger, regional networks or medium-sized networks with sufficient economies of density, short line operations can offer significant gains in railroad efficiency.

The principal gains in efficiency under short line operations came from a reduction in train crew size and crew wage rates. Other simulated efficiencies were derived from maintenance of way costs, a lower cost of capital, and other transportation costs. Some increases in operating costs were noted. These included primarily administrative costs, but were overshadowed by efficiencies in other areas.

The industrial organization of American railroads is currently in a state of transition. Since 1980, over 150 short line and regional railroads have been organized (Wastler and Keeney). Many of these new railroads have been organized to operate light-density line segments abandoned or spun-off by Class I Carriers. As Class I Carriers attempt to sell most if not all of their light density trackage to independent short line operators, a new pattern of railroad organization is emerging. In the future, the railroad industry might be characterized as a "short line/trunk line" system. Under such a pattern, short line operators will provide local service over light-density portions of the network, while trunk line carriers will provide through freight service over high-density main lines and principal feeder lines.

From a public policy perspective, one of the fundamental questions which needs to be answered is what type and level of efficiency gains are generated from short-line operation. If significant efficiency gains occur, overall societal welfare will be enhanced. If short-lines can operate light-density branch lines profitability, they may present an alternative to abandonment. The preservation of rail service in rural areas of North Dakota can have a spin-off effect on shippers and state and local governments. Shippers benefit because service is maintained, and governments benefit from the avoidance of incremental highway costs. But these indirect benefits depend

upon the efficiency of operations.

The objective of this study is to estimate the potential efficiencies gains from short-line operation of branch lines in North Dakota. Cost and revenue estimates are developed in the study for three potential short-line networks on Burlington Northern's system. The research methods employed are detailed in the following section of the report.

RESEARCH METHOD

Three case studies of potential short line operations in North Dakota were undertaken. The case studies consisted of three different sized systems, ranging from a large regional railroad of approximately 667 miles to a single branch line of 81 miles in length. Potential economies or diseconomies of scale and density were evaluated by analyzing the different short line system sizes and configurations.

System costs and revenues were estimated for the three configurations of lines under two different scenarios. Under the first scenario, each set of lines was analyzed as a light-density subsystem of BN's network. Under the second scenario, the same set of lines was analyzed as a short line component of a short line/trunk line network. As a result, it was necessary to develop both a light density Class I Carrier and a short line railroad costing methodology. The costing procedures were translated into a computer model which estimated railroad system costs from grain movement statistics maintained by the Upper

Great Plains Transportation Institute. (See UGPTI Staff Paper No. 84 for a detailed review of the costing methodology.)

System costs consist of two basic components: "on-line" cost and "off-line" costs. On-line costs comprise the operating, capital, and opportunity costs associated with serving and maintaining the set of light-density lines. Off-line costs reflect the variable expense associated with moving the traffic generated from the light-density network over other portions of the Class I Carrier's network.

Under the Class I scenario, on-line costs have been based on the train operating and work-rule environemtn and fixed cost characteristics of a Class I Carrier. Under Scenario 2, on-line costs have been estimated to reflect the potential labor economies and scale of operation of a short line railroad.

System revenues represent the revenues generated by the traffic with originates on the light density network of lines. System revenues have been determined under each scenario by multiplying the BN's tariff rates for each commodity, market, and service level by the volume of traffic. System revenues were compared to system costs under each alternative to determine the operating profit or loss.

CASE STUDIES

The three light density branch line networks which were analyzed included:

1. a "single branch line" network (the Regan to Pingree line - 81 miles),
2. a series of parallel "stub-end" branch lines in northern North Dakota (211 miles), and
3. a network of several branch lines in southeastern and central North Dakota (667 miles).

Background information for the individual systems is provided in the next section. Results of each analysis are presented thereafter.

Regan to Pingree Line

A single branch line was selected for analysis to determine its economic feasibility as a stand-alone entity. This type of analysis may be important in that the viability of a branch line as a short line may be analyzed if proposed for abandonment. The potential for operation as a short line may be critical in determining the future of rail service on individual lines.

The line chosen for analysis is located in central North Dakota, running from Pingree to Regan. The line is 81 miles long and extends through Burleigh, Kidder and Stutsman counties (Figure 1). Six grain shippers on the line are currently served

by the Burlington Northern with weekly service. Approximately 725 carloads of grain, primarily wheat and barley, were pulled off the line in the 1985-86 crop year. All stations on the line are single and three car shippers. Cars are assumed to be interchanged with the Burlington Northern at Jamestown, with trackage rights granted to the short line between Jamestown and Pingree.

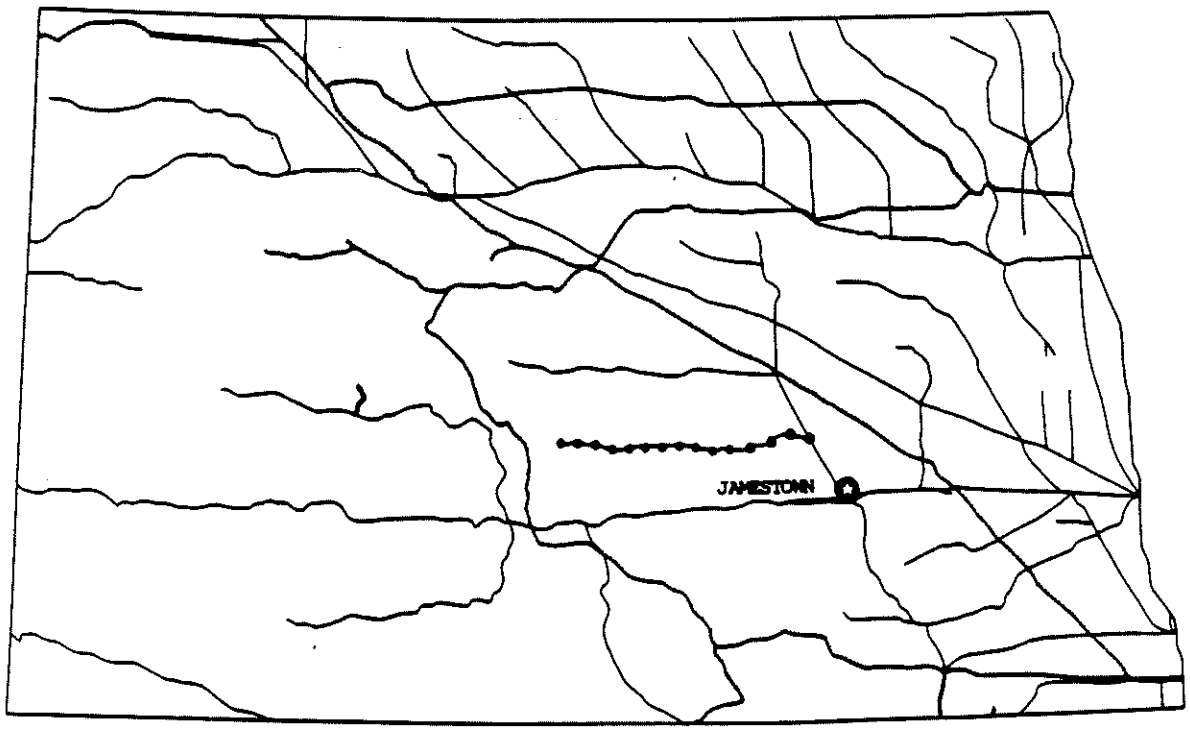

Figure 1.

Northern Tier Lines

The second network selected for analysis includes four branch lines in northeastern North Dakota. The system includes the York to Wolford line, the Churchs Ferry to Rolla line, the Devils Lake to Hansboro line, and the Lakota to Sarles line (Figure 2). The network includes 211 miles of Burlington Northern trackage in a primarily grain producing region. Cars are assumed to be interchanged with the Burlington Northern at Devils Lake, with trackage rights granted to the short line on the BN main line between York and Lakota. In addition, shippers on the Burlington Northern main line between York and Lakota are assumed to receive service from the short line.

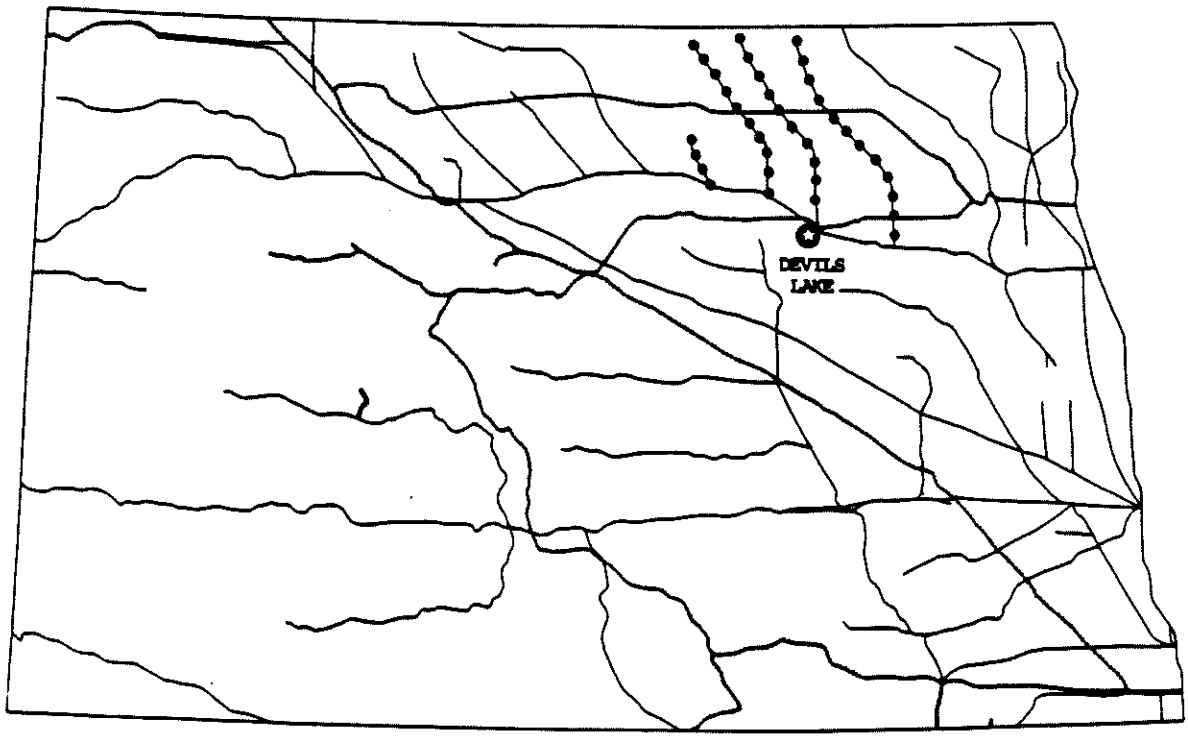

Figure 2.

Approximately 7300 carloads of grain, consisting of wheat, durum, barley, flax and sunflower, originated on the lines in 1985-86. There are 25 shippers on the network, of which 17 are single car stations, seven are 26 car shippers and one is a 52 car shipper.

Southeast - Central Lines

The third network chosen for analysis is a system of nine branch lines and one secondary main line in southeast and central North Dakota (Figure 3). The network includes a variety of types of shippers, commodities and line densities. This system consists of approximately 667 miles of track and constitutes

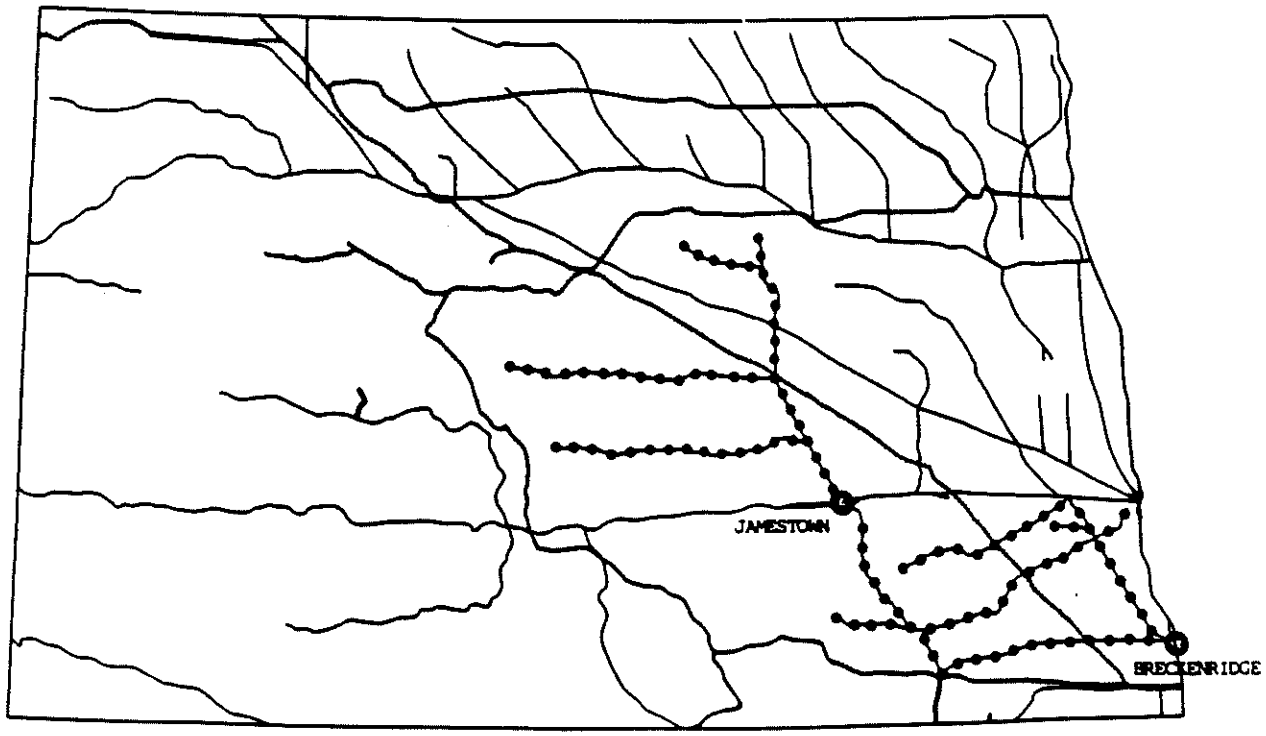

Figure 3.

approximately 15% of the entire North Dakota rail network. This short line network would interchange cars with the Burlington Northern at Jamestown, New Rockford, and Breckenridge, Minnesota, and would require 12 miles of trackage rights over the Soo Line near Enderlin.

Approximately 13,000 carloads of grain originated on this set of lines in crop year 1985-86, consisting of wheat, barley, sunflowers, corn and soybeans. The short line would serve 57 rail shippers, including a mix of single, 26-car and 52-car shippers.

It is important to note that each of these three analyses include only grain and oilseed originating traffic. Any terminating or bridge traffic may add to financial viability of the systems. Also, non-grain shipments such as coal or other products may comprise an important portion of the traffic mix for a particular short line operation.

RESULTS OF THE CASE STUDIES

Each of the three networks described above were analyzed in terms of operating costs and profitability. Costs and profitability were estimated first under BN ownership, then under two separate short line ownership scenarios. Results of the first short line analysis reflect costs after adjusting crew size from four (BN ownership) to 2.5 (short line ownership); train crew wages remained the same. Under the second short line

analysis, both crew size and wage rates were adjusted to reflect short line operating conditions. Results of each analysis are presented below.

Regan Line

The smallest network analyzed was the 81 mile Regan to Pingree branch line in central North Dakota. Estimates of the operating costs under BN and short line ownership are presented in Table 1. Short line operating costs after train crew size was reduced are presented in column (3) of Table 1. Short line costs after both crew size and wage rates were adjusted are presented in column (4) of Table 1. Short line operation of this segment offered substantial cost savings in train crew expenses due to reductions in crew size and wage rates. However, diseconomies were exhibited in other areas. Both locomotive costs and administrative expenses increased substantially under short line operation.

The net operating position of this segment under BN ownership was positive, but deteriorated to a net loss under short line operation. The reasons for a greater operating loss by the short line can be attributed to the indivisibility of locomotive units and a smaller traffic base over which to spread administrative and other fixed costs.

Table 1. Regan Line Comparative Profitability

(1) Cost Category	Annual Costs (2) BN Ownership	(3) Short Line Ownership[a]	(4) Short Line Ownership[b]
Train Crew Costs	91,458	52,582	20,729
Locomotive Costs	43,309	126,012	126,012
Car Costs	77,769	69,845	69,845
Transportation Costs	68,034	36,343	36,343
Maintenance of Way Costs	284,200	241,976	241,976
Administrative Costs	5,810	145,600	145,600
Property Taxes	36,864	36,864	36,864
Ownership Costs on NLV	96,337	60,972	60,972
Other Costs[c]	3,386	110,000	110,000
Total On-Branch Costs	707,167	880,194	848,341
Total Off-Branch Costs	576,358	576,358	576,358
Total Costs	1,283,525	1,456,552	1,424,699
Total Revenue	1,311,351	1,311,351	1,311,351
Net Oper. Profit(Loss)	27,826	(145,201)	(113,348)

[a]Assumes short line pays Class I train crew wage rate of $20.72/hr.
[b]Assumes short line train crew wage rate of $8.50/hr.
[c]Includes opportunity cost on working capital and insurance expense.

Northern Tier Lines

The intermediate size network of lines analyzed was the system of four stub end branch lines in northeastern North Dakota. Estimates of the operating costs under both ownership structures are presented in Table 2. Substantial savings were achieved in train crew costs due to the reduction in crew size and wage rates. Administrative costs were higher under short line ownership than under Burlington Northern ownership. Profitability of this network was enhanced due to the density of

traffic exhibited on the system. Over 7,000 cars were originated on the 211 mile network.

Table 2. Northern Tier Lines Comparative Profitability.

(1) Cost Category	(2) BN Ownership	Annual Costs (3) Short Line Ownership[a]	Annual Costs (4) Short Line Ownership[b]
Train Crew Costs	1,607,268	888,768	360,437
Locomotive Costs	743,581	700,778	700,778
Car Costs	715,679	642,762	642,762
Transportation Costs	230,702	123,239	123,239
Maintenance of Way Costs	738,150	628,482	628,482
Administrative Costs	60,508	257,400	257,400
Property Taxes	95,749	95,749	95,749
Opportunity Cost on NLV	739,686	468,156	468,156
Other Costs[c]	38,133	150,000	150,000
Total On-Branch Costs	4,969,456	3,955,334	3,427,003
Total Off-Branch Costs	6,899,203	6,899,203	6,899,203
Total Costs	11,868,659	10,854,537	10,326,206
Total Revenue	13,286,798	13,286,798	13,286,798
Net Oper. Profit(Loss)	1,418,139	2,432,261	2,960,592

[a]Assumes short line pays Class I train crew wage rate of $20.72/hr.
[b]Assumes short line train crew wage rate of $8.50/hr.
[c]Includes opportunity cost on working capital and insurance expense.

Southeast-Central Lines

The results of the analysis of the southeast-central group of lines indicates that the network is of sufficient size to achieve some economies of size. Substantial savings were again achieved in train crew costs due to the reduction in both crew

size and wages. Savings achieved by adjusting crew size were approximately equivalent to those attained by adjusting wage rates to levels reflective of short line operations. Cost increases were noted in locomotive expenses and administrative overhead, but these increases were overshadowed by labor savings. The net result is that the network of lines is transformed from a marginally profitable system under BN ownership to a more favorable financial position under short line operation.

Table 3. Southeast-Central Lines Comparative Profitability

(1) Cost Category	Annual Costs (2) BN Ownership	(3) Short Line Ownership[a]	(4) Short Line Ownership[b]
Train Crew Costs	2,374,878	1,337,685	543,716
Locomotive Costs	1,260,337	1,432,261	1,432,261
Car Costs	1,087,633	993,906	993,906
Transportation Costs	599,533	345,930	345,930
Maintenance of Way Costs	2,338,000	1,990,640	1,990,640
Administrative Costs	107,191	434,000	434,000
Property Taxes	303,272	303,272	303,272
Opportunity Costs on NLV	2,337,905	1,479,687	1,479,687
Other Costs[c]	63,570	250,000	250,000
Total On-Branch Costs	10,472,319	8,567,381	7,773,412
Total Off-Branch Costs	12,721,556	12,721,556	12,721,556
Total Costs	23,193,875	21,288,937	20,494,968
Total Revenue	22,741,824	22,741,824	22,741,824
Net Oper. Profit(Loss)	(452,051)	1,452,887	2,246,856

[a]Assumes short line pays Class I train crew wage rate of $20.72/hr.
[b]Assumes short line train crew wage rate of $8.50/hr.
[c]Includes opportunity cost on working capital and insurance expense.

CONCLUSIONS

The potential economies offered by short line railroad operations in North Dakota can be significant if the scale of the system and the density of traffic are sufficient. Table 5 depicts the scale and density of the three configurations, along with the short line cost per carload. Column (f) of Table 5 shows the increase/(decrease) in on-line or network costs associated with going from a Burlington Northern light density operation to a short line network.

Table 5. Comparison of Scale, Traffic Density, and Potential Short Line Economies Among Networks.

(a) System	(b) Miles of Road	(c) Carloads	(d) Cars per mile	(e) Short line network Cost/car	(f) Network Cost Increase/ (Decrease)
Regan Line	81	721	9	$1,176	20%
SE-Central	667	13,092	20	594	(26%)
Northern Tier	211	7,332	35	467	(31%)

As the results suggest, operating a single, light density branch line as a short line railroad may not provide the scale or density necessary to gain operating economies or generate a profit. A larger regional railroad, even with only limited economies of density, may offer short line operating economies due to reduced labor costs and more efficient way train operations. A medium sized system with only moderate scale effects but with increased economies of density may offer

substantial cost reductions, as exemplified by the Northern Tier case study.

This analysis points out some of the sensitivities of light density rail operations to changes in key variables such as wage rates and train crew size. The success or failure of these operations will depend on many factors. As shown in Table 3, a large portion of total costs are composed of train crew costs, maintenance of way costs, and opportunity costs on roadway. Profitability will therefore be extremely sensitive to variables such as wage rates, track condition, and costs of capital. Indeed, financial viability may well depend on track rehabilitation needs, annual track maintenance costs, and the operating conditions associated with a particular track condition. In conclusion, the viability of short line railroads in North Dakota is dependent upon developing networks which offer some potential for economies of scale and/or density, and do not require substantial capital investment in roadway prior to normal operations.

APPENDIX A

DATA SOURCES

	Item	Source
1.	BN off-line unit costs	BN Rail Form A
2.	BN Locomotive Maintenance Unit Costs	BN R-1 Report
3.	BN Locomotive Ownership Unit Costs	BN R-1 Report
4.	Short line Locomotive Overhead Unit Costs	
5.	Locomotive Fuel Unit Cost	BN R-1 Report
6.	BN Locomotive Servicing Unit Cost	BN R-1 Report
7.	Short line Locomotive Servicing Unit Costs	
8.	Car Day and Car Mile Ownership Unit Cost	Burlington Northern
9.	BN Train Crew Wages	BN Wage Form A
10.	Short Line Train Crew Wage Rate	Red River Valley and Western ND Job Service Burlington Northern Gohman & Assoc., Chicago
11.	Maintenance of Way Per Mile of Track	UGPTI Engineering Estimate
12.	Net Liquidation Value per Mile of Track	UGPTI Engineering Estimate
13.	Cost of Capital - BN	Interstate Commerce Commission
14.	Cost of Capital - Short Line	UGPTI Estimate
15.	General and Administrative Overhead Unit Cost - BN	BN R-1 Report
16.	General & Administrative Cost - Short Line	UGPTI Estimate
17.	BN Train Operations Unit Costs	BN R-1 Report
18.	Short Line Train Operations Unit Costs	Adjusted BN Unit Costs
19.	Property Taxes per Mile	UGPTI Estimate
20.	Grain & Oilseed Traffic Data	UGPTI
21.	Scheduled Frequency of Service	BN Trainmasters
22.	Train Routing and Operations	BN Trainmasters
23.	Car Loading/Unloading Times	BN Tariffs
24.	Average Load per Car	BN Tariffs and Waybill Data
25.	Revenue per Carload	BN 4022-E
26.	Line Densities	BN Gross Tonnage Density Charts