AgEcon SEARCH
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

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

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

Help ensure our sustainability.

Give to AgEcon Search

AgEcon Search
http://ageconsearch.umn.edu
aesearch@umn.edu

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

378.784
U664
D-144

Analysis of Revenues and Costs for Wheat Shipments Originated in North Dakota on the BNSF Railroad

Denver Tolliver
John Bitzan

UGPTI Departmental Publication No. 144

March 2002

UPPER GREAT PLAINS TRANSPORTATION INSTITUTE
NORTH DAKOTA STATE UNIVERSITY

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

NDSU

378.784
U664
D-144

Analysis of Revenues and Costs for Wheat Shipments Originated in North Dakota on the BNSF Railroad

Denver Tolliver
John Bitzan

Upper Great Plains Transportation Institute
North Dakota State University

March 2002

Disclaimer

This report includes a series of estimates of revenue-to-variable cost ratios. The estimates use the best available data given the short time frame for the study. More accurate estimates of revenue-to-variable cost ratios may be obtained by using detailed operational characteristics of specific movements. However, a higher level of detail would require a longer time frame. Moreover, the revenue-to-variable cost ratio estimates provided in this report are not intended to be used as evidence in any proceeding.

TABLE OF CONTENTS

INTRODUCTION 1

THE UNIFORM RAILROAD COSTING SYSTEM 2
- Fully Allocated and Variable Costs 2
- URCS Minimal Parameters 3
- URCS Detailed Parameters 6
  - Way and Through Train Miles 7
  - Intertrain and Intratrain Switches 7
  - Car-Days at Industry 8
  - Average Trains Weights 8
  - Locomotive Units per Train 9

WAYBILL REVENUE TO VARIABLE COST RATIOS FOR BNSF WHEAT SHIPMENTS 9

DETAILED ANALYSIS OF WHEAT MOVEMENTS TO PORTLAND 16
- Pacific Northwest Destinations 18
- Origin Classification Yards and Way-Train Miles 19
- Intertrain or Intratrain Switches 20
- Origin Co-Loading 22
- Industry Switching 23
- Car Days 24
- Train Weights and Power 25
- Rate-Cost Ratios for Wheat Shipments from North Dakota to Portland 27

REVENUE-COST RATIOS FOR WHEAT SHIPMENTS FROM NORTH DAKOTA TO MINNEAPOLIS 50

CAVEATS REGARDING REVENUE-COST ESTIMATES 66

PLACING REVENUE-TO-VARIABLE COST RATIOS IN THE CONTEXT OF RATE REASONABLENESS 68

SUMMARY AND CONCLUSION 73

TECHNICAL SUPPLEMENT 75

LIST OF FIGURES

Figure 1. URCS Line-Haul Movement Type Codes 4

Figure 2. Sequence of Movement Codes for Line-Haul Movements 4

Figure 3. Rail Network in Grand Forks Area 22

LIST OF TABLES

Table 1. Revenue-to-Variable Cost Ratios for BNSF Wheat Shipments from North Dakota CRDS - 2000 Waybill Sample 12

Table 2. Revenue-to-Variable Cost Ratios for BNSF Wheat Shipments from North Dakota - 2000 Waybill Sample 15

Table 3. Average Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Portland by Service Level 17

Table 4. Estimated Costs of BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level 27

Table 5. Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level 39

Table 6. Average Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Minneapolis by Service Level 51

Table 7. Estimated Costs of BNSF Wheat Shipments from North Dakota to Minneapolis by Station and Service Level 52

Table 8. Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Minneapolis by Station and Service Level 59

Table 9. BNSF RSAM and for the 4 Years Most Recently Computed by the STB 71

Table 10. Calculation of Train Resistance for Loaded 286,000-pound Covered Hopper Car 76

Table 11. Calculation of Train Resistance for Empty Covered Hopper Car 77

Table 12. Calculation of Train Resistance for 195-Ton 6-Axle Locomotive 78

Table 13. Calculation of Power Requirements for a 110-Car Unit Train and a 100-Car Grain Train on Moderate Grades 79

INTRODUCTION

An analysis of railroad revenues and costs has been conducted for this hearing. The revenue-cost study is restricted to wheat movements originated in North Dakota by the BNSF railroad. The purpose of the study is to provide background information about the rates and costs of various railroad service levels. The primary objectives are to:

1. Analyze the costs and revenue-cost ratios of wheat movements from North Dakota to major markets
2. Assess the relative efficiencies of BNSF service levels and shipment sizes
3. Place BNSF revenue-cost ratios in the context of rate reasonableness

This report is organized into four main parts. Part 1 describes the Uniform Railroad Costing System (URCS), the costing model used in this study. Part 2 presents revenue-to-variable cost ratios computed from the 2000 waybill sample. A state version of the sample was provided to the North Dakota Public Service Commission by the Surface Transportation Board (STB). This file includes the variable cost of each sample movement, as computed by the STB. In Part 3, revenue-cost estimates are presented for wheat movements from North Dakota to Portland and Minneapolis based on March 2002 rates. In addition, the costs of various BNSF service options are compared, including the 110-car single-origin and 110-car two-origin options. Finally, in Part 4 the revenue-to-variable cost ratios are placed in the context of rate reasonableness.

THE UNIFORM RAILROAD COSTING SYSTEM

The Uniform Railroad Costing System (URCS) is the general purpose costing system of the Surface Transportation Board. The focus in this study is on applications of URCS, not its design. However, a general understanding of URCS is necessary to discern how the movement costs were obtained. The Uniform Railroad Costing System includes three phases. Phase I is a statistical analysis phase. Periodically, statistical studies are performed by the STB to determine how groups of railroad expenses (e.g., running track maintenance) vary with activity (e.g., gross ton-miles). This information is used in Phase II to compute the annual percent variable of expense account groups.

Each year, the STB applies Phase II of URCS to each Class I railroad's expense and operating statistics using the most recent year of validated data. The result of the Phase II analysis is a series of variable unit costs and cost factors that are stored in Worktable E. Worktable E is the starting point for a cost analysis. Phase III of URCS uses Worktable E factors to estimate the variable and fully allocated costs of particular movements.

Fully Allocated and Variable Costs

URCS variable costs reflect an intermediate-run time period. During this period, equipment investment is considered to be 100 percent variable. A return on equipment investment is included in the URCS variable costs based on the current cost of capital. However, roadway investment costs are considered to be 50 percent variable with traffic. Thus, the URCS variable costs reflect a return on investment for half of the railroad's roadway, track, and structures.

URCS fully allocated costs reflect a long-run time period during which all investment costs are variable. The fully allocated cost of a shipment includes the variable cost plus a percentage allocation of common and fixed costs to each shipment. Theoretically, if the rate for each movement on a railroad's system equals its fully allocated cost, the carrier will earn adequate revenues including a return on all equipment and roadway investment equal to the current cost of capital rate. However, since many railroad costs cannot be attributed to individual shipments, the method of assigning these common and fixed costs is arbitrary. Thus, in examining revenue-cost ratios, more weight should be placed on revenue-to-variable cost ratios than revenue-to-fully-allocated cost ratios.

URCS Minimal Parameters

A certain number of parameters must be specified before URCS can be used to analyze a movement. These minimal parameters include:

(1) The carrier code

(2) The distance of the shipment

(3) The type of shipment, as related to the carrier's role

(4) The type of freight car

(5) The number of freight cars

(6) The type of movement, as related to service level

(7) The car owner (private or railroad)

(8) The commodity type (the STCC Code)[1]

---

[1]The Standard Transportation Commodity Codes used in URCS are a combination of 3-,4-, and 5-digit codes. The code used in this study is 0113: grain. The STCC is used only to estimate loss and damage costs.

(9) The weight of the shipment (in tons per car)

Most of these parameters are self-explanatory. However, some require a brief explanation.

The type of shipment describes a carrier's participation in the movement. URCS approaches the problem of interline cost calculations by analyzing each carrier's movement and tabulating the results. A carrier's movement is referred as a "leg" of the trip. URCS will calculate costs for as many as 4 legs. In a URCS analysis, each railroad is assigned one of the movement codes shown in Figure 1. Figure 2 illustrates the expected sequence of movement codes for various single-line and interline movements and the number of legs in the movement.

Figure 1. URCS Line-Haul Movement Type Codes

Originated & Terminated	OT
Originated & Delivered	OD
Received & Delivered	RD
Received & Terminated	RT

Figure 2. Sequence of Movement Codes for Line-Haul Movements

Number of Legs	Sequence of Movement Types
1	OT
2	OD RT
3	OD RD RT
4	OD RD RD RT

The URCS costing approach is governed by the type of movement. One of three choices must be specified:

1. Individual or single car
2. Multi-car
3. Unit train

URCS calculates "unit train" costs on a trainload basis. The shipment is assumed to comprise the entire train. According to the URCS Users Guide, a shipment must include at least 50 cars before it can be costed as a unit train. Presumably, this criterion was used by the STB when estimating the costs of waybill movements. A multi-car movement must include at least six cars.

When a multi-car or a unit-train movement is specified, URCS automatically incorporates a series of adjustments developed in Ex Parte No. 270.[2] These adjustments recognize that multi-car and unit-train movements do not utilize yard and clerical services to the same degree as single-car shipments.[3] Clerical costs are adjusted by assuming that 25 percent of the cost is associated with the shipment while the remaining 75 percent varies with the number of carloads. The clerical cost per carload declines as the fixed portion of the expense is spread over more carloads.

URCS also reduces car-day cost at origin and destination by 50 percent when a multi-car or unit-train movement is specified, reflecting reduced loading/unloading, switching, and waiting time per car. Locomotive switching costs at origin and destination are reduced by 50 percent for

---

[2]Ex Parte 270 (Sub-No. 9).

[3]Surface Transportation Board. *Uniform Railroad Costing System User Guide.*

a multi-car shipment and 75 percent for a unit train. In addition, URCS eliminates intertrain and intratrain switching costs for unit-train shipments.[4]

If unit-train and multi-car costs are lower than the system average, then single-car costs must be greater than the system average. Therefore, the cost reductions given to unit-train and multi-car shipments must be balanced with offsetting increases in single-car costs. After this "make-whole" adjustment, the weighted-average of a railroad's single-car, multi-car, and unit-train industry switching costs should agree with an unweighted estimate developed using the average switching minutes from the carrier's Worktable E. Similar reconciliations are performed for car day and clerical costs. Line-haul switching adjustments are made to single and multi-car shipments on a car-mile basis to offset the elimination of intertrain and intratrain switching costs for unit-train shipments.

URCS Detailed Parameters

URCS allows the specification of 64 additional parameters. When values are not specified for these inputs, URCS uses default values. Some of the most important parameters are:

- Distances traveled by type of train service (way, through, and unit train)
- Frequency of intertrain/intratrain switches
- Car-days consumed during certain railroad activities (e.g., loading or unloading, industry switching, intertrain or intratrain switching, and running)
- Train weights and power units

[4]Interchange switching costs are included for unit-train shipments but at a reduced level.

Way and Through Train Miles

Way trains operate primarily between freight stations located on branch lines and railroad classification yards. The STB defines way trains as "trains operated primarily to gather and distribute cars in road service and to move them between way stations or way points."[5] A way train movement does not occur when a shipment is picked up or delivered within a terminal area served by a yard switching crew. Through trains are primarily operated between two or more major concentration or distribution points.[6] As illustrated later, the average way train tends to be much smaller than the average through or unit train. Train size is an important cost factor. Crew train-mile costs don't vary much with the size of the train. Thus, larger trains yield lower labor costs per ton-mile. Train size also results in economies of utilization of locomotive power and train supplies.

Intertrain and Intratrain Switches

A single-car shipment is typically switched and classified several times enroute. It may be switched from one train to another or repositioned within the same train. A minimum of two intertrain switches usually occur, one each at the originating and terminating classification yards. In addition, a single-car shipment may require several additional intratrain or intertrain switches at intermediate locations. In a series of special studies, the ICC determined that the average single carload receives an intratrain or intertrain switch every 200 miles. Each intratrain or intertrain switch requires one-half day of yard time plus locomotive switching expenses. These

---

[5]Surface Transportation Board: Reporting Instructions for Schedule 755 of the R-1 Report.

[6]Ibid.

intermediate events can become a costly item on a lengthy trip – e.g., from North Dakota to Portland.

Car-Days at Industry

Car days at industry consist of loading, unloading, and switching time. The URCS default value is 2 days for each loading or unloading event, which is consistent with the 48 hours of free time typically allotted for single-car shipments. URCS reduces the loading or unloading time to 1 day for multi-car and unit-train shipments. Car days in industry switching reflect the time required for a car to be spotted or pulled at an industry location, including the time waiting to be switched. URCS allows 1 day for each switching event for individual cars, and one-half day for multi-car and unit-train switching events. For an individual covered hopper car shipment, URCS assigns a total of 8 industry days at origin and destination (2 days loading or unloading at the origin and destination, 1 day spotting cars at each, and 1 day pulling cars from each).

Average Trains Weights

This parameter, which is often referred to as average trailing tons, includes the commodity, freight car, trailer, and container weights. It is the average weight of the loaded and empty train movements. In 2000, the average BNSF unit-train consisted of 9,224 trailing tons. A 110-car train results in an average trailing weight of 9,598 tons. In comparison, the average BNSF through train weighs 5,026 tons, while the average way train weighs only 1,739 tons. As noted earlier, train crew and locomotive costs per ton-mile are typically lower in larger trains.

Locomotive Units per Train

URCS estimates road locomotive ownership, fuel, servicing, and related costs based on the average number of power units per train. In 2000, the average BNSF unit train was powered by 2.8 locomotive units. In comparison, the average through train was powered by 3.2 locomotives, in spite of the fact that the average through train weight was only 55 percent of the average unit-train weight. In 2000, the average BNSF way train was powered by 2.2 units.

With this brief background description of URCS, the main topic of the report is introduced – revenue-cost ratios for wheat movements from North Dakota to various markets.

WAYBILL REVENUE TO VARIABLE COST RATIOS FOR BNSF WHEAT SHIPMENTS

In addition to examining the revenue-to-variable cost ratios to Minneapolis and Portland using the current BNSF rate structure and operationally-specific costing techniques, this statement also examines revenue-to-variable cost ratios for BNSF wheat shipments from North Dakota to all major markets using the 2000 railroad waybill sample.[7] The railroad waybill sample is a stratified random sample of terminating railroad traffic in the United States. The sample includes data on individual railroad shipments, including the shipment origin, the shipment destination, the commodity shipped, the number of cars in the movement, the weight per car, the distance of the movement, the reported revenue for the shipment, the STB estimated cost for the movement, the railroads involved in the movement, and other various data items.

[7]All wheat markets that have at least three receivers are examined.

The variable costs in the waybill sample reflect a mixture of shipment weights, including both 100-ton and 111-ton weights. In estimating the costs of interline movements, the STB applies individual Class I carrier Worktable E files to individual legs of the movement. If a short-line or regional railroad is included in a movement, the STB applies regional URCS costs to the railroad's leg of the movement.

An examination of revenue-to-variable cost (RVC) ratios from the railroad waybill sample provides a useful measure of the profitability realized by the BNSF on North Dakota wheat shipments.[8] The costs encompassed in the railroad revenue-to-variable cost ratios from the waybill sample serve as a comparison for the revenue-to-variable cost ratios calculated using movement specific characteristics. Moreover, the waybill revenue-to-variable cost ratios reflect a rate structure more representative of the traditional BNSF rate structure, when the so-called inverse rate structure was not in place. Finally, the revenue-to-variable cost ratios from the railroad waybill sample include all major markets, providing a representative view of the profitability of all BNSF wheat shipments originating in North Dakota.

Before examining the revenue-to-variable cost ratios, a few caveats should be mentioned. First, waybill revenues do not necessarily reflect contract revenues for those shipments made under a confidential contract. Thus, to the extent that shipments are occurring under a confidential contract rate, the revenue-to-variable cost ratios may overstate actual revenue-to-variable cost ratios. Moreover, it is unclear whether COT premiums or discounts are reflected in the waybill revenues. Second, the costs calculated by the Surface Transportation Board on the

[8]The revenue-to-variable cost ratios calculated are for the entire movement and may reflect profits realized by other railroads in addition to the BNSF. Reported revenue-to-variable cost ratios include those for all wheat movements originating on the BNSF system.

railroad waybill sample reflect average BNSF system operational characteristics. These costs may not be as accurate as costs calculated using operational characteristics specific to individual movements. Nonetheless, the waybill reported revenue-to-variable cost ratios still provide insight into the profitability realized by the BNSF on North Dakota wheat shipments.

Table 1 shows weighted average waybill sample revenue-to-variable cost ratios by destination region (Bureau of Economic Analysis Region (BEA)), crop reporting district, and shipment size.[9] Similarly, Table 2 shows the weighted average waybill sample revenue-to-variable cost ratios by destination region and shipment size, without separating the crop reporting districts. As the tables show, the revenue-to-variable cost ratios for several destination markets suggest profitable shipments. For example, all shipment sizes of wheat traveling from North Dakota to Duluth show a weighted average revenue-to-variable cost ratio in excess of 2.8, with multi-car shipment and unit-train shipments to this market showing weighted average revenue-to-variable cost ratios in excess of 3 and 4, respectively. Another profitable market is Minneapolis with a weighted average revenue-to-variable cost ratio of nearly 2.4 for single car shipments, and in excess of 3 and 4 for multi-car and unit-train shipments. Portland shows a weighted average revenue-to-variable cost ratio of 2.16 for single-car shipments, 2.67 for multiple-car shipments, 2.81 for 52-car shipments, and 3.17 for shipments of more than 110 cars. Finally, shipments to Fargo-Moorhead and Omaha also show high revenue-to-variable cost ratios.

[9]Only crop reporting districts with at least three shippers capable of handling the particular shipment size are included, and only destination BEAs with at least three receivers are included. Thus, the statistics shown do not violate any confidentiality restrictions.

Table 1: Revenue-to-Variable Cost Ratios for BNSF Wheat Shipments from North Dakota CRDS - 2000 Waybill Sample (Weighted Average by Carloads)					
Destination BEA	**Crop Reporting District**	**(1-25 Cars)**	**(26-51 Cars)**	**(52-109 Cars)**	**(110+ Cars)**
Chicago-Gary-Kenosha, IL-IN-WI	1-North West	2.39	2.20	2.88	.
Chicago-Gary-Kenosha, IL-IN-WI	2-North Central	2.04	.	.	.
Chicago-Gary-Kenosha, IL-IN-WI	3 North East	1.62	1.71	2.03	.
Chicago-Gary-Kenosha, IL-IN-WI	4-West Central	1.67	.	.	.
Chicago-Gary-Kenosha, IL-IN-WI	5-Central	1.55	1.99	2.45	.
Chicago-Gary-Kenosha, IL-IN-WI	6-East Central	1.78	1.72	.	.
Chicago-Gary-Kenosha, IL-IN-WI	7-South West	2.29	2.10	2.67	.
Chicago-Gary-Kenosha, IL-IN-WI	8-South Central	1.65	2.14	.	.
Chicago-Gary-Kenosha, IL-IN-WI	9-South East	1.65	1.70	.	.
Des Moines, IA-IL-MO	3 North East	.	1.88	.	.
Des Moines, IA-IL-MO	6-East Central	.	1.92	.	.
Duluth-Superior, MN-WI	1-North West	.	3.73	4.12	.
Duluth-Superior, MN-WI	2-North Central	2.65	.	.	.
Duluth-Superior, MN-WI	3 North East	2.92	2.86	.	.
Duluth-Superior, MN-WI	4-West Central	2.28	.	.	.
Duluth-Superior, MN-WI	5-Central	2.52	3.27	.	.
Duluth-Superior, MN-WI	6-East Central	2.73	3.04	4.14	.
Duluth-Superior, MN-WI	7-South West	2.42	2.71		
Duluth-Superior, MN-WI	8-South Central	2.98	3.13	.	.
Duluth-Superior, MN-WI	9-South East	2.69	.	.	.
Fargo-Moorhead, ND-MN	1-North West	.	2.30	.	.
Fargo-Moorhead, ND-MN	2-North Central	2.16	.	.	.
Fargo-Moorhead, ND-MN	3 North East	.	2.62	.	.
Houston-Galveston-Brazoria, TX	2-North Central	1.33	.	.	.
Houston-Galveston-Brazoria, TX	3 North East	1.25	1.34	.	.
Houston-Galveston-Brazoria, TX	6-East Central	.	1.14	.	.
Kansas City, MO-KS	1-North West	2.42	.	.	.
Kansas City, MO-KS	3 North East	2.04	2.08	.	.
Kansas City, MO-KS	5-Central	1.87	.	.	.
Kansas City, MO-KS	8-South Central	2.00	.	.	.
Kansas City, MO-KS	9-South East	1.53	.	.	.
Los Angeles-Riverside-Orange County, CA-AZ	1-North West	1.37	.	.	.

Table 1: Revenue-to-Variable Cost Ratios for BNSF Wheat Shipments from North Dakota CRDS - 2000 Waybill Sample (Weighted Average by Carloads)					
Destination BEA	**Crop Reporting District**	**(1-25 Cars)**	**(26-51 Cars)**	**(52-109 Cars)**	**(110+ Cars)**
Los Angeles-Riverside-Orange County, CA-AZ	8-South Central	.	1.36	.	.
Minneapolis-St. Paul, MN-WI-IA	1-North West	2.76	2.81	.	.
Minneapolis-St. Paul, MN-WI-IA	3 North East	2.31	3.13	.	.
Minneapolis-St. Paul, MN-WI-IA	4-West Central	1.80	3.14	.	.
Minneapolis-St. Paul, MN-WI-IA	5-Central	2.21	.	4.16	.
Minneapolis-St. Paul, MN-WI-IA	6-East Central	2.36	.	.	.
Minneapolis-St. Paul, MN-WI-IA	8-South Central	2.14	3.09		
Minneapolis-St. Paul, MN-WI-IA	9-South East	2.40	.	.	.
New Orleans, LA-MS	3 North East	1.36	.	1.46	.
New Orleans, LA-MS	5-Central	.	.	1.90	.
New Orleans, LA-MS	7-South West	1.75	.	1.77	.
New Orleans, LA-MS	Unidentified	.	.	.	1.69
Oklahoma City, OK	2-North Central	1.68	.	.	.
Oklahoma City, OK	3 North East	1.72	.	.	.
Omaha, NE-IA-MO	3 North East	2.43	2.19	.	.
Omaha, NE-IA-MO	6-East Central	.	2.45	.	.
Portland-Salem, OR-WA	1-North West	2.32	2.91	3.00	.
Portland-Salem, OR-WA	3 North East	1.59	.	.	.
Portland-Salem, OR-WA	6-East Central	2.08	1.95	.	.
Portland-Salem, OR-WA	7-South West	2.21	2.67	2.74	.
Portland-Salem, OR-WA	8-South Central	1.86	.	.	.
Portland-Salem, OR-WA	Unidentified	.	.	.	3.17
Salt Lake City-Ogden, UT-ID	1-North West	.	1.35	.	.
San Antonio, TX	8-South Central	.	1.08	.	.
San Francisco-Oakland-San Jose, CA	1-North West	1.60	.	.	.
San Francisco-Oakland-San Jose, CA	3 North East	1.49	.	.	.
St. Louis, MO-IL	1-North West	.	2.34	2.54	.
St. Louis, MO-IL	2-North Central	1.61	.	.	.
St. Louis, MO-IL	3 North East	1.46	1.64	2.09	.
St. Louis, MO-IL	5-Central	1.38	1.62	.	.
St. Louis, MO-IL	6-East Central	1.50	1.67	1.85	.
St. Louis, MO-IL	7-South West	1.80	.	.	.

Table 1: Revenue-to-Variable Cost Ratios for BNSF Wheat Shipments from North Dakota CRDS - 2000 Waybill Sample (Weighted Average by Carloads)					
Destination BEA	**Crop Reporting District**	**(1-25 Cars)**	**(26-51 Cars)**	**(52-109 Cars)**	**(110+ Cars)**
St. Louis, MO-IL	8-South Central	1.76	2.11	.	.
St. Louis, MO-IL	9-South East	.	1.50	.	.
Wichita, KS-OK	3 North East	1.85	.	.	.

Table 2: Revenue-to-Variable Cost Ratios for BNSF Wheat Shipments from North Dakota 2000 Waybill Sample (Weighted Average by Carloads)				
Destination BEA	**(1-25 Cars)**	**(26-51 Cars)**	**(52-109 Cars)**	**(110+ Cars)**
Chicago-Gary-Kenosha, IL-IN-WI	1.76	1.83	2.52	.
Des Moines, IA-IL-MO	.	1.90	.	.
Duluth-Superior, MN-WI	2.82	3.09	4.13	.
Fargo-Moorhead, ND-MN	2.16	2.37	.	.
Houston-Galveston-Brazoria, TX	1.28	1.24	.	.
Kansas City, MO-KS	1.99	2.08	.	.
Los Angeles-Riverside-Orange County, CA-AZ	1.37	1.36	.	.
Minneapolis-St. Paul, MN-WI-IA	2.38	3.00	4.16	.
New Orleans, LA-MS	1.54	.	1.71	1.69
Oklahoma City, OK	1.70	.	.	.
Omaha, NE-IA-MO	2.43	2.32	.	.
Portland-Salem, OR-WA	2.16	2.67	2.81	3.17
Salt Lake City-Ogden, UT-ID	.	1.35	.	.
San Antonio, TX	.	1.08	.	.
San Francisco-Oakland-San Jose, CA	1.58	.	.	.
St. Louis, MO-IL	1.53	1.77	2.25	.
Wichita, KS-OK	1.85	.	.	.

DETAILED ANALYSIS OF WHEAT MOVEMENTS TO PORTLAND

The waybill analysis has painted a comprehensive picture of revenue-cost ratios for North Dakota shipments to major markets. This section of the statement focuses on current rates to Portland. It also includes an analysis of 110-car unit trains and 110-car co-loading service levels. Shipment costs are computed using the 2000 Uniform Railroad Costing System (URCS) and BNSF cost factors.[10] Rates are derived from Item 43538 of the BNSF's current rate book, which is effective as of March 2, 2002. These rates are applicable to wheat movements in 286,000-pound rail cars, which appear to offer the greatest mainline efficiency and profit potential for the BNSF. The following service levels are analyzed for movements from North Dakota to Portland:

- 1-car
- 26-car
- 52-car
- 110-car multiple-origin (55 cars per station)
- 110-car single-origin unit train

Only a few stations in North Dakota currently originate 110-car shipments. However, rate-cost relationships are analyzed for all stations in order to present a meaningful comparison of the relative efficiencies of BNSF service levels. Because few stations currently originate 110-car shipments, the summary statistics presented in Table 3 are not weighted by shipment volumes -

[10]The 2000 URCS costs used in this study are not indexed for price inflation. For many years, railroad productivity gains have exceeded price inflation, thus resulting in a negative productivity-adjusted RCAF.

i.e., they represent simple averages or means. The standard deviations and minimum and maximum values describe the variation in RVC ratios among stations.

Table 3
Average Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Portland by Service Level

Service Level	Average Revenue-Variable Cost Ratio	Minimum Revenue-Variable Cost Ratio	Maximum Revenue-Variable Cost Ratio	Standard Deviation of RVC Ratio
1-Car	1.85	1.72	2.11	0.09
26-Car	2.44	2.24	2.85	0.14
52-Car	2.71	2.49	3.09	0.15
55-Car	3.07	2.80	3.55	0.18
110-Car	3.11	2.83	3.54	0.18

The statistics shown in Table 3 reflect 84 individual stations. These stations are a subset of the 92 stations listed in the latest revision of Item 43538. Stations located on the Red River Valley & Western Railroad are excluded from the analysis, as are stations for which routes could not be determined. As Table 3 shows, the average revenue-to-variable cost ratios computed from current rates are very similar to the revenue-variable cost (RVC) ratios computed from the waybill sample.

The variable costs shown in Table 3 reflect the governing provisions of the tariff. For example, all of the 52-car and 110-car service options require 24 hour loading and unloading. Apparently, shuttle loaders and unloaders receive origin-destination efficiency discounts if they load and unload in 15 hours. However, these arrangements are not analyzed because they are not specified in BNSF's public tariff. Moreover, given the data available for this study, it is not possible to analyze the efficiencies attributable to shipper volume commitments associated with the BNSF's shuttle program.

Using 15 hours for loading and unloading times would reduce the estimated URCS variable costs. However, some offsetting reductions in the tariff rate would also occur. Thus, it cannot be assumed that the revenue-cost ratios for the 110-car train would be greater than those shown in Table 3 if the origin-destination efficiency gains and discounts were included.

The simple means shown in Table 3 reflect an average cost difference between the single-origin and two-origin 110-car service levels of approximately $55 per car. The costing methods and parameters used in deriving these estimates are included in the description of key movement parameters and assumptions presented next.

Pacific Northwest Destinations

Because of time limitations, only shipments destined for Portland are analyzed. Shipments to other coastal destinations—such as Kalama, Tacoma, or Seattle—are not reflected in the revenue-cost comparisons presented in this section. However, shipments to many coastal destinations are reflected in the waybill statistics presented earlier.

The BNSF 110-car receiver in the Portland area is located at Terminal 5 in the River Gate Industrial Complex.[11] It is owned and operated by Columbia Grain, Inc. Two Cargill facilities and a facility owned by Louis Dreyfus Corporation are located at Terminal 4, southeast of East St. John's. The main BNSF yard is located in Vancouver, Washington. It is approximately 6 miles from the Vancouver yard to either Terminal 5 in River Gate or Terminal 4, where the other elevators are located.

[11]Another shuttle unloader is located in Vancouver, Washington. However, in this study the movements are assumed to terminate in Portland.

All 110-car train distances are computed directly from North Dakota origins to River Gate. Distances for other shipments are computed to Vancouver, Washington. Six miles are added for delivery to port terminals. [12]

Origin Classification Yards and Way-Train Miles

Without adjustments, URCS would assign 18 loaded way-train miles to each shipment. This is the BNSF's system average. As noted above, 6 way train miles may be incurred at destination, thus allowing only 12 way-train miles at origin. The use of this default factor may significantly understate way-train miles for BNSF wheat shipments from North Dakota. North Dakota has an extensive branch-line system. With the exception of 110-car trains, all shipments probably require some classification and train blocking near the origin. Most of these origin classification yards (also known as division or transition points) are readily apparent – e.g., Minot and Grand Forks. Others (such as Lakota and Dickinson) have been identified by shippers who receive service from these yards.

Table 4 (shown later) lists the loaded way-train miles assigned to each station, based on distances to specific classification yards for westward movements.[13] As a result of this adjustment, an average of 58 origin way-train miles are assigned to non-unit train shipments. This distance accounts for situations where a car destined for Portland must first be hauled east to a classification yard. These circuitous movements are necessary in order for the railroad to operate large through trains between classification yards. Because origin circuity is taken into

---

[12]The total distance to Portland terminals is the same for all types of shipments when they are originated at a mainline division point such as Jamestown or Minot. However, the shuttle-train movement consists of all "unit-train miles" while distances for other classes of shipments reflect way and/or through train miles.

[13]Shipments originated at mainline classification yards are assigned no way-train miles at origin.

account and shipments are routed from the origin classification yard to Vancouver, a circuity multiplier is not applied to the trip distance.

Intertrain or Intratrain Switches

A 110-car unit train is assumed to run through classification yards, stopping only for crew changes. In effect, a unit train does not require intertrain or intratrain switching. URCS automatically eliminates these switches from the cost calculation. However, a 110-car train that is co-loaded at origin requires a train switch in North Dakota. Conceivably, this switch may occur at one of the stations if the co-loaders are located on the same line segment so that the second block can be picked-up enroute to Portland. If the co-loaders are not situated in a direct line of movement to Portland, the two 55-car blocks may be switched together in the nearest classification yard. Afterwards, the co-loaded shipment should function in much the same manner as a unit train, passing through intermediate yards and moving directly to River Gate.

Although individual 52-car and 26-car shipments are often referred to as "unit trains," in actuality they are large multi-car shipments. The intermediate yard switches required for multi-car and single-car shipments are unknown. In a default analysis, URCS computes a switch every 200 miles. This means that eight intertrain switches will be assigned to a loaded multiple-car shipment from Grafton to Portland. This is too many switches for a 52-car or 26-car block. The only way to determine the average number of intertrain switches enroute to Portland is to perform a detailed analysis of internal BNSF records, which is not possible for this study. However, some logical assumptions can be drawn from operational and traffic data.

If grain flows from North Dakota to the Pacific Northwest (PNW) are sufficient, a 52-car block may be matched with other multiple-car shipments to form a large grain train (e.g., 100

cars or more) headed for the Pacific Coast. Since nearly 90 percent of the carloads of wheat shipped from North Dakota to the PNW are consigned in 25 car blocks or greater, it seems feasible for BNSF to assemble 52-car and 26-car blocks into large grain trains.[14] After such a train leaves Minot, the cars may remain intact until they reach Pasco or Vancouver.

The following factors are reflected in the estimated intertrain or intratrain switches for 26-car and 52-car shipments shown later in Table 4: (1) the location of the station and the origin classification yard, (2) the distance from the classification yard to Portland, and (3) whether the shortest movement path follows the northern or southern route through Montana. Shipments originated from stations assigned to the Minot, Williston, Glendive, or Terry classification yards are allocated 3 intertrain/intratrain switches, except for shipments originated at these locations. This allocation allows for an intertrain switch between the origin transition point and Vancouver – e.g., at Spokane or Pasco. Shipments originated at one of the origin transition points are assigned only 2 switches.

Shipments originated from stations assigned to Dickinson, Mandan, Jamestown, Dilworth, or Grand Forks classification yards are allotted 4 intertrain/intratrain switches except for shipments originated at these cities, which are assigned 3 switches. As a general rule, 26-car shipments are assigned an additional intertrain switch. These smaller blocks may move farther from origin before being consolidated into a through grain train. No adjustment in intertrain or intratrain switching is made for single-car shipments. Thus, each single-car shipment is assigned an intertrain or intratrain switch every 200 miles.

---

[14]This weighted-average was computed from the North Dakota waybill sample.

Origin Co-Loading

Figure 3 shows a portion of the rail network in northeastern North Dakota. This network is used to illustrate potential train operations in a co-loading scenario. In this example, Thompson and Reynolds are assumed to originate a 110-car shipment. Local trains operate regularly between Grand Forks and Fargo. In this scenario, a train from Grand Forks drops 55 empty cars at Thompson. The same train (or another local) drops 55 cars at Reynolds. After the cars are loaded at the two stations, they are hauled to Grand Forks and consolidated into a single 110-car train. Thus, an intertrain switch occurs in Grand Forks. However, when the 110-car train departs the yard in Grand Forks, it moves directly to Portland as a unit train.

The primary assumption underlying the co-loading cost analysis is that each 55-car block is moved to and from the origin classification yard in a local train, where it is matched with another 55-car block. This abstraction is necessary in order for a cost to be assigned to each station. In this costing approach, the co-loader for Reynolds could be located at Thompson, Grand Forks, or at a station north of Grand Forks (such as Grafton or Crystal). The cost assigned to the shipment from Reynolds consists of:

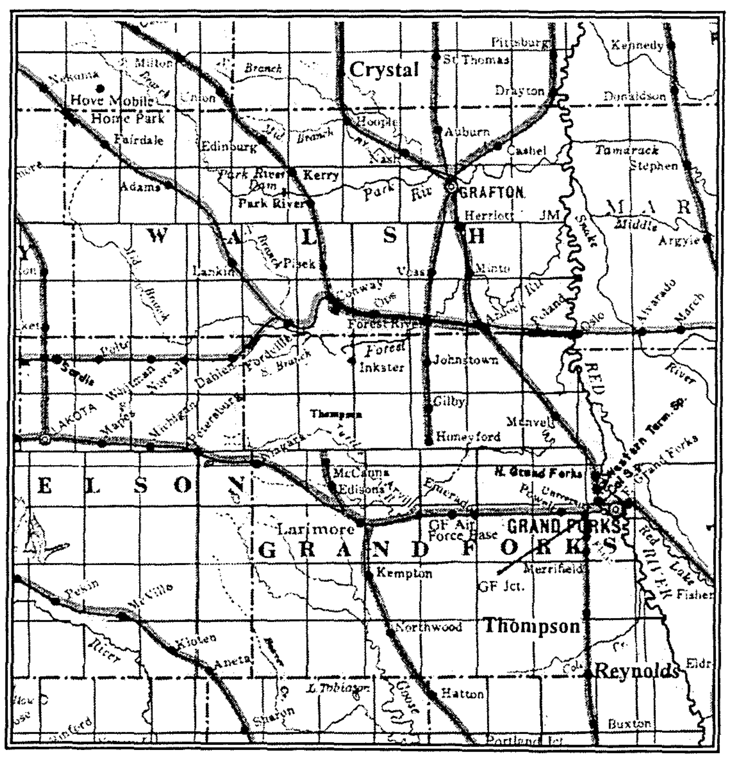

Figure 3. Rail Network in Grand Forks Area

1. The origin switching, car ownership, and clerical cost applicable to a 55-car shipment
2. Way train costs to and from the Grand Forks yard
3. Unit train costs for a 110-car train from the classification yard to destination

The costing approach allows a revenue-cost ratio to be computed for individual stations. However, it must be noted that more efficient origin train operations are possible. In one scenario, a 110-car train from Grand Forks drops 55 empty cars at Thompson and 55 cars at Reynolds. The cars dropped at each station must be loaded within 24 hours. In the interim, the locomotives may return to Grand Forks or remain at Reynolds with the cars. After the cars are loaded, the cars at Reynolds are pulled by a locomotive set and moved to Thompson where the other 55 cars are switched into the train. When the train departs Thompson, it consists of 110 loaded cars destined for the same location, and is operated as a unit train from that time forth. For this type of analysis, a weighted-average RVC ratio must be computed. Because of the detailed assumptions required, specific scenarios such as this one are not analyzed in this study.

Industry Switching

As noted earlier, URCS reduces average industry switching minutes by 75 percent for "unit train" shipments. This adjustment is typically applied to consignments of 50 cars or more. In this study, 52-car and 55-car shipments are given this reduction, as well as 110-car shipments. The adjustment results in an average of 1.38 minutes per car per switch. This factor allows about 1 hour and 10 minutes for BNSF to spot or pull a 52-car block at origin or destination. This is ample time if only one switch is required.

The URCS switching factor probably overstates the 110-car train switching time. It allows two and one-half hours. The true average is probably less than a minute per car.

However, further reductions to the URCS average cannot be justified without documented field studies. An error of one minute per car means about a $20 difference in the variable cost per car.

Car Days

URCS computes car days based on long-standing operational estimates and typical tariff free times. The BNSF tariff requires that all 110-car and 52-car shipments be loaded within 24 hours. The same time limit is assumed for unloading at Portland. However, 48 hours of loading or unloading time is assumed for 26-car and single-car shipments at origin and destination.

Car days running reflect the average speed for BNSF road trains (approximately 22.25 mph). In URCS, each intertrain switch is assumed to require one-half day. Based on these factors, URCS computes a movement cycle of about 21 car days for a single-car shipment from Grand Forks to Portland. In comparison, URCS computes 8 days for a 110-car unit-train movement from Grand Forks to Portland.

These cycle times cannot be verified at present. Apparently, 3 or 4 car trips per month have been achieved in 110-car unit-train service from North Dakota to the PNW. The URCS 110-car unit-train estimate is very close to these rules-of-thumb. The 21 day cycle for the single car is equivalent to about 1.4 trips per month. Actual single-car cycle times are rumored to be greater than 21 days. However, these longer cycle times can be verified only through a study of BNSF data. Given the uncertainty that exists regarding cycle times, the URCS car ownership costs for single-car and 26-car shipments should be interpreted cautiously. Each additional covered hopper car-day is equivalent to about $13.30 in variable cost.

Train Weights and Power

The cost analysis focuses on 286,000-pound cars. The statistics presented in this section of the statement are specific to these heavier cars. A 110-car train of 143-ton covered hopper cars weighs 15,730 tons. The average trailing weight of this train is approximately 9,600 tons, loaded and empty. This is a true unit train in terms of consist and weight. In 2000, the average BNSF unit train consisted of 103 cars weighing an average of 9,224 trailing tons. Thus, the BNSF unit train statistics used in URCS accurately describe the characteristics of a 110-car train of 286,000-pound cars. Therefore, no adjustments to train weights or power are needed for the 110-car trains.

However, a 52-car shipment of 286,000-pound cars results in an average trailing weight of approximately 4,500 tons, which is nearly as heavy as the BNSF's average through train. On average, a 26-car shipment of 286,000-pound cars weighs 2,250 tons. In essence, a 26-car shipment of 286,000-pound cars is heavier than BNSF's average way train, which averages 1,739 tons. For these reasons, some adjustments are needed to the default URCS parameters to more accurately represent the economies of train size offered by these larger shipments.

As noted earlier, BNSF tries to consolidate multi-car and single-car grain shipments headed for the Pacific Northwest into large grain trains. This is the most cost-effective operational scenario. The exact size of these trains is unknown. However, they are believed to include at least 100 cars. This nominal train size is used to estimate an adjusted through train cost for 52-car and 26-car shipments traveling to the PNW.

In addition to adjusting the default through-train weight, it is necessary to adjust the average number of through-train power units to fit the heavier train. The Davis Formula is used

for this purpose. It is described later in a technical supplement. The Davis Formula is used to estimate the train resistance of grain and unit train consists and the tonnage ratings of locomotives typically used on these trains.

As noted earlier, approximately 2.78 locomotive units are used to haul the system-average BNSF unit train of 9,224 average trailing tons. These units are assumed to be in the 4,000- to 4,500-horsepower (hp) range, with a median rating of 4,400-hp.[15] The locomotives used on a through grain train are typically less powerful than the newer unit-train locomotives. For example, the SD40-2 and GP40 units frequently used in grain and mixed freight service are rated at 3,000-hp.

The Davis Formula predicts that 1.28 3,000-horsepower units would be required for each 4,400-hp unit at moderate grades of less than 1 percent.[16] Assuming that the number of helper unit-miles is the same for both types of trains, a 100-car grain train weighing 8,300 tons would require an average of 3.55 units for the loaded and empty movement from North Dakota to Portland.

The calculations underlying this adjustment are shown in the technical supplement. A similar calculation is used to adjust the number of way train locomotives needed to haul a loaded 52-car block to the classification yard.[17]

The background discussion of costing techniques is now concluded. The following section of the report presents detailed RVC ratios for individual stations.

---

[15]These locomotives could be SD70, SD75, DASH-8, DASH-9, AC-4400, or other high performance units.

[16]The analysis also considers the fact that the hypothetical 100-car grain train weighs less than the 103-car unit train being pulled by the 4,400-hp units.

[17]Three 2,000-2,500 horsepower units would be needed.

Rate-Cost Ratios for Wheat Shipments from North Dakota to Portland

Tables 4 and 5 show the estimated variable costs, fully allocated costs, and the revenue-cost ratios of wheat shipments for each of five BNSF rate and service levels. The distance from each station to Portland is shown in Table 4, as well as the loaded way-train miles and computed intertrain or intratrain switches.

Table 4
Estimated Costs of BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level

Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Intertrain/ Intratrain Switches	Variable Cost per Car	Fully-Allocated Cost per Car
ALAMO	1	1,322	137	7	$2,477	$3,379
ALAMO	26	1,322	137	5	$1,815	$2,475
ALAMO	52	1,322	137	4	$1,501	$2,048
ALAMO	55	1,322	131	1	$1,312	$1,790
ALAMO	110	1,322	0	0	$1,251	$1,706
ALTON	1	1,557	50	8	$2,741	$3,738
ALTON	26	1,557	50	5	$1,983	$2,705
ALTON	52	1,557	50	4	$1,715	$2,339
ALTON	55	1,557	44	1	$1,502	$2,049
ALTON	110	1,551	0	0	$1,458	$1,989
ARVILLA	1	1,535	28	8	$2,692	$3,673
ARVILLA	26	1,535	28	5	$1,938	$2,643
ARVILLA	52	1,535	28	4	$1,689	$2,303
ARVILLA	55	1,535	22	1	$1,477	$2,014
ARVILLA	110	1,491	0	0	$1,404	$1,915
AYR	1	1,585	47	8	$2,778	$3,789
AYR	26	1,585	47	5	$2,010	$2,742
AYR	52	1,585	47	4	$1,741	$2,375
AYR	55	1,585	41	1	$1,527	$2,082
AYR	110	1,505	0	0	$1,416	$1,932
BEACH	1	1,261	47	6	$2,321	$3,166
BEACH	26	1,261	47	5	$1,660	$2,265
BEACH	52	1,261	47	4	$1,425	$1,944
BEACH	55	1,261	41	1	$1,234	$1,684
BEACH	110	1,261	0	0	$1,196	$1,631
BELFIELD	1	1,304	90	7	$2,415	$3,294

Table 4 Estimated Costs of BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level						
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Intertrain/ Intratrain Switches	Variable Cost per Car	Fully-Allocated Cost per Car
BELFIELD	26	1,304	90	5	$1,749	$2,385
BELFIELD	52	1,304	90	4	$1,475	$2,012
BELFIELD	55	1,304	84	1	$1,284	$1,751
BELFIELD	110	1,304	0	0	$1,235	$1,684
BEREA	1	1,505	37	8	$2,657	$3,624
BEREA	26	1,505	37	5	$1,914	$2,611
BEREA	52	1,505	37	4	$1,661	$2,266
BEREA	55	1,505	31	1	$1,452	$1,981
BEREA	110	1,505	0	0	$1,416	$1,932
BERTHOLD	1	1,288	103	6	$2,403	$3,278
BERTHOLD	26	1,288	103	5	$1,744	$2,379
BERTHOLD	52	1,288	103	4	$1,462	$1,994
BERTHOLD	55	1,288	97	1	$1,273	$1,736
BERTHOLD	110	1,288	0	0	$1,220	$1,664
BISBEE	1	1,521	78	8	$2,712	$3,699
BISBEE	26	1,521	78	5	$1,971	$2,689
BISBEE	52	1,521	78	4	$1,685	$2,298
BISBEE	55	1,521	72	1	$1,477	$2,014
BISBEE	110	1,433	0	0	$1,351	$1,843
BISMARCK	1	1,431	12	7	$2,533	$3,455
BISMARCK	26	1,431	12	5	$1,810	$2,469
BISMARCK	52	1,431	12	4	$1,584	$2,161
BISMARCK	55	1,431	6	1	$1,379	$1,881
BISMARCK	110	1,431	0	0	$1,349	$1,841
BOTTINEAU	1	1,404	99	7	$2,563	$3,496
BOTTINEAU	26	1,404	99	5	$1,866	$2,545
BOTTINEAU	52	1,404	99	4	$1,574	$2,148
BOTTINEAU	55	1,404	93	1	$1,376	$1,877
BOTTINEAU	110	1,404	0	0	$1,325	$1,807
BOWBELLS	1	1,376	71	7	$2,502	$3,413
BOWBELLS	26	1,376	71	5	$1,808	$2,466
BOWBELLS	52	1,376	71	4	$1,542	$2,103
BOWBELLS	55	1,376	65	1	$1,344	$1,834
BOWBELLS	110	1,330	0	0	$1,258	$1,716
BOWMAN	1	1,291	116	6	$2,417	$3,297
BOWMAN	26	1,291	116	5	$1,760	$2,401
BOWMAN	52	1,291	116	4	$1,467	$2,001

Table 4 Estimated Costs of BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level						
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Intertrain/ Intratrain Switches	Variable Cost per Car	Fully-Allocated Cost per Car
BOWMAN	55	1,291	110	1	$1,279	$1,744
BOWMAN	110	1,291	0	0	$1,223	$1,668
BOYLE	1	1,339	21	7	$2,411	$3,288
BOYLE	26	1,339	21	5	$1,719	$2,345
BOYLE	52	1,339	21	4	$1,496	$2,041
BOYLE	55	1,339	15	1	$1,298	$1,771
BOYLE	110	1,339	0	0	$1,266	$1,727
BREMEN	1	1,402	97	7	$2,559	$3,490
BREMEN	26	1,402	97	5	$1,862	$2,539
BREMEN	52	1,402	97	4	$1,572	$2,144
BREMEN	55	1,402	91	1	$1,374	$1,874
BREMEN	110	1,402	0	0	$1,323	$1,805
BUFFALO	1	1,531	63	8	$2,714	$3,702
BUFFALO	26	1,531	63	5	$1,968	$2,684
BUFFALO	52	1,531	63	4	$1,691	$2,307
BUFFALO	55	1,531	57	1	$1,482	$2,021
BUFFALO	110	1,531	0	0	$1,440	$1,964
BUXTON	1	1,539	32	8	$2,701	$3,685
BUXTON	26	1,539	32	5	$1,946	$2,654
BUXTON	52	1,539	32	4	$1,693	$2,310
BUXTON	55	1,539	26	1	$1,481	$2,021
BUXTON	110	1,533	0	0	$1,442	$1,966
CANDO	1	1,508	65	8	$2,683	$3,660
CANDO	26	1,508	65	5	$1,944	$2,652
CANDO	52	1,508	65	4	$1,669	$2,277
CANDO	55	1,508	59	1	$1,462	$1,994
CANDO	110	1,420	0	0	$1,339	$1,827
CASSELTON	1	1,548	80	8	$2,751	$3,753
CASSELTON	26	1,548	80	5	$2,002	$2,731
CASSELTON	52	1,548	80	4	$1,711	$2,334
CASSELTON	55	1,548	74	1	$1,502	$2,048
CASSELTON	110	1,522	0	0	$1,432	$1,953
CHURCHS FERRY	1	1,493	50	7	$2,650	$3,615
CHURCHS FERRY	26	1,493	50	5	$1,914	$2,610
CHURCHS FERRY	52	1,493	50	4	$1,652	$2,253
CHURCHS FERRY	55	1,493	44	1	$1,444	$1,970
CHURCHS FERRY	110	1,405	0	0	$1,326	$1,809

Table 4 Estimated Costs of BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level						
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Intertrain/ Intratrain Switches	Variable Cost per Car	Fully-Allocated Cost per Car
CLEVELAND	1	1,512	93	8	$2,711	$3,698
CLEVELAND	26	1,512	93	5	$1,977	$2,696
CLEVELAND	52	1,512	93	4	$1,679	$2,290
CLEVELAND	55	1,512	87	1	$1,472	$2,008
CLEVELAND	110	1,493	0	0	$1,405	$1,917
DEVILS LAKE	1	1,474	31	7	$2,609	$3,558
DEVILS LAKE	26	1,474	31	5	$1,875	$2,557
DEVILS LAKE	52	1,474	31	4	$1,630	$2,223
DEVILS LAKE	55	1,474	25	1	$1,423	$1,940
DEVILS LAKE	110	1,424	0	0	$1,343	$1,832
DICKINSON	1	1,324	6	7	$2,378	$3,243
DICKINSON	26	1,324	6	5	$1,688	$2,303
DICKINSON	52	1,324	6	4	$1,478	$2,017
DICKINSON	55	1,324	0	1	$1,281	$1,747
DICKINSON	110	1,324	0	0	$1,253	$1,709
DOYON	1	1,458	15	7	$2,574	$3,511
DOYON	26	1,458	15	5	$1,842	$2,512
DOYON	52	1,458	15	4	$1,611	$2,197
DOYON	55	1,458	9	1	$1,404	$1,915
DOYON	110	1,440	0	0	$1,358	$1,852
ELDRIDGE	1	1,525	106	8	$2,739	$3,737
ELDRIDGE	26	1,525	106	5	$2,003	$2,732
ELDRIDGE	52	1,525	106	4	$1,694	$2,311
ELDRIDGE	55	1,525	100	1	$1,487	$2,029
ELDRIDGE	110	1,480	0	0	$1,394	$1,901
EPPING	1	1,208	23	6	$2,227	$3,038
EPPING	26	1,208	23	5	$1,579	$2,154
EPPING	52	1,208	23	4	$1,368	$1,867
EPPING	55	1,208	17	1	$1,181	$1,610
EPPING	110	1,208	0	0	$1,148	$1,565
FARGO	1	1,567	99	8	$2,793	$3,810
FARGO	26	1,567	99	5	$2,042	$2,785
FARGO	52	1,567	99	4	$1,734	$2,365
FARGO	55	1,567	93	1	$1,523	$2,078
FARGO	110	1,539	0	0	$1,447	$1,974
GARDNER	1	1,570	32	8	$2,745	$3,744
GARDNER	26	1,570	32	5	$1,979	$2,700

Table 4 Estimated Costs of BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level						
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Intertrain/ Intratrain Switches	Variable Cost per Car	Fully-Allocated Cost per Car
GARDNER	52	1,570	32	4	$1,724	$2,351
GARDNER	55	1,570	26	1	$1,509	$2,059
GARDNER	110	1,560	0	0	$1,466	$2,000
GLADSTONE	1	1,336	18	7	$2,404	$3,279
GLADSTONE	26	1,336	18	5	$1,713	$2,337
GLADSTONE	52	1,336	18	4	$1,493	$2,036
GLADSTONE	55	1,336	12	1	$1,295	$1,766
GLADSTONE	110	1,336	0	0	$1,263	$1,723
GLEN ULLIN	1	1,377	59	7	$2,494	$3,402
GLEN ULLIN	26	1,377	59	5	$1,798	$2,452
GLEN ULLIN	52	1,377	59	4	$1,540	$2,101
GLEN ULLIN	55	1,377	53	1	$1,342	$1,831
GLEN ULLIN	110	1,377	0	0	$1,301	$1,774
GLENFIELD	1	1,446	141	7	$2,655	$3,622
GLENFIELD	26	1,446	141	5	$1,952	$2,663
GLENFIELD	52	1,446	141	4	$1,623	$2,214
GLENFIELD	55	1,446	135	1	$1,425	$1,943
GLENFIELD	110	1,446	0	0	$1,363	$1,859
GRACE CITY	1	1,433	128	7	$2,627	$3,583
GRACE CITY	26	1,433	128	5	$1,925	$2,626
GRACE CITY	52	1,433	128	4	$1,608	$2,194
GRACE CITY	55	1,433	122	1	$1,410	$1,923
GRACE CITY	110	1,433	0	0	$1,351	$1,843
GRAND FORKS	1	1,513	6	8	$2,644	$3,607
GRAND FORKS	26	1,513	6	5	$1,892	$2,581
GRAND FORKS	52	1,513	6	4	$1,663	$2,269
GRAND FORKS	55	1,513	0	1	$1,451	$1,980
GRAND FORKS	110	1,513	0	0	$1,424	$1,942
HAMBERG	1	1,396	91	7	$2,546	$3,472
HAMBERG	26	1,396	91	5	$1,849	$2,522
HAMBERG	52	1,396	91	4	$1,565	$2,135
HAMBERG	55	1,396	85	1	$1,367	$1,865
HAMBERG	110	1,396	0	0	$1,318	$1,797
HAMLET	1	1,304	119	7	$2,438	$3,325
HAMLET	26	1,304	119	5	$1,777	$2,424
HAMLET	52	1,304	119	4	$1,481	$2,020
HAMLET	55	1,304	113	1	$1,291	$1,761

Table 4 Estimated Costs of BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level						
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Intertrain/ Intratrain Switches	Variable Cost per Car	Fully-Allocated Cost per Car
HAMLET	110	1,304	0	0	$1,235	$1,684
HANNAFORD	1	1,466	161	7	$2,699	$3,682
HANNAFORD	26	1,466	161	5	$1,993	$2,719
HANNAFORD	52	1,466	161	4	$1,647	$2,246
HANNAFORD	55	1,466	155	1	$1,448	$1,975
HANNAFORD	110	1,466	0	0	$1,381	$1,884
HARWOOD	1	1,558	20	8	$2,719	$3,708
HARWOOD	26	1,558	20	5	$1,954	$2,666
HARWOOD	52	1,558	20	4	$1,710	$2,332
HARWOOD	55	1,558	14	1	$1,496	$2,040
HARWOOD	110	1,548	0	0	$1,455	$1,985
HEBRON	1	1,365	47	7	$2,468	$3,366
HEBRON	26	1,365	47	5	$1,773	$2,418
HEBRON	52	1,365	47	4	$1,526	$2,082
HEBRON	55	1,365	41	1	$1,328	$1,812
HEBRON	110	1,365	0	0	$1,290	$1,759
HETTINGER	1	1,332	157	7	$2,507	$3,420
HETTINGER	26	1,332	157	5	$1,845	$2,517
HETTINGER	52	1,332	157	4	$1,515	$2,067
HETTINGER	55	1,332	151	1	$1,326	$1,809
HETTINGER	110	1,332	0	0	$1,260	$1,718
HILLSBORO	1	1,553	46	8	$2,732	$3,726
HILLSBORO	26	1,553	46	5	$1,974	$2,693
HILLSBORO	52	1,553	46	4	$1,710	$2,332
HILLSBORO	55	1,553	40	1	$1,498	$2,043
HILLSBORO	110	1,547	0	0	$1,454	$1,984
JAMESTOWN	1	1,474	6	7	$2,589	$3,532
JAMESTOWN	26	1,474	6	5	$1,850	$2,524
JAMESTOWN	52	1,474	6	4	$1,625	$2,216
JAMESTOWN	55	1,474	0	1	$1,416	$1,932
JAMESTOWN	110	1,474	0	0	$1,388	$1,894
KELSO	1	1,559	52	8	$2,745	$3,744
KELSO	26	1,559	52	5	$1,987	$2,710
KELSO	52	1,559	52	4	$1,717	$2,342
KELSO	55	1,559	46	1	$1,504	$2,052
KELSO	110	1,553	0	0	$1,460	$1,991
LAKOTA	1	1,449	6	7	$2,554	$3,484

Table 4 Estimated Costs of BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level						
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Intertrain/ Intratrain Switches	Variable Cost per Car	Fully-Allocated Cost per Car
LAKOTA	26	1,449	6	5	$1,823	$2,487
LAKOTA	52	1,449	6	4	$1,601	$2,183
LAKOTA	55	1,449	0	1	$1,394	$1,901
LAKOTA	110	1,449	0	0	$1,366	$1,863
LARIMORE	1	1,541	34	8	$2,706	$3,690
LARIMORE	26	1,541	34	5	$1,950	$2,660
LARIMORE	52	1,541	34	4	$1,696	$2,313
LARIMORE	55	1,541	28	1	$1,484	$2,024
LARIMORE	110	1,485	0	0	$1,398	$1,907
LEEDS	1	1,505	62	8	$2,677	$3,651
LEEDS	26	1,505	62	5	$1,938	$2,644
LEEDS	52	1,505	62	4	$1,666	$2,273
LEEDS	55	1,505	56	1	$1,458	$1,989
LEEDS	110	1,393	0	0	$1,315	$1,794
LUVERNE	1	1,479	174	7	$2,728	$3,721
LUVERNE	26	1,479	174	5	$2,020	$2,755
LUVERNE	52	1,479	174	4	$1,662	$2,267
LUVERNE	55	1,479	168	1	$1,463	$1,995
LUVERNE	110	1,479	0	0	$1,393	$1,900
MEDINA	1	1,503	84	8	$2,691	$3,671
MEDINA	26	1,503	84	5	$1,958	$2,670
MEDINA	52	1,503	84	4	$1,668	$2,275
MEDINA	55	1,503	78	1	$1,462	$1,994
MEDINA	110	1,502	0	0	$1,414	$1,928
MINOT	1	1,311	6	7	$2,359	$3,218
MINOT	26	1,311	6	5	$1,674	$2,284
MINOT	52	1,311	6	4	$1,466	$1,999
MINOT	55	1,311	0	1	$1,269	$1,731
MINOT	110	1,311	0	0	$1,241	$1,693
NEW SALEM	1	1,398	80	7	$2,540	$3,465
NEW SALEM	26	1,398	80	5	$1,840	$2,510
NEW SALEM	52	1,398	80	4	$1,565	$2,134
NEW SALEM	55	1,398	74	1	$1,366	$1,864
NEW SALEM	110	1,398	0	0	$1,320	$1,800
NIAGARA	1	1,472	29	7	$2,604	$3,552
NIAGARA	26	1,472	29	5	$1,871	$2,552
NIAGARA	52	1,472	29	4	$1,627	$2,220

Table 4 Estimated Costs of BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level						
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Intertrain/ Intratrain Switches	Variable Cost per Car	Fully-Allocated Cost per Car
NIAGARA	55	1,472	23	1	$1,420	$1,937
NIAGARA	110	1,472	0	0	$1,386	$1,891
NORTH GRAND FORKS	1	1,520	13	8	$2,660	$3,628
NORTH GRAND FORKS	26	1,520	13	5	$1,907	$2,601
NORTH GRAND FORKS	52	1,520	13	4	$1,671	$2,280
NORTH GRAND FORKS	55	1,520	7	1	$1,460	$1,991
NORTH GRAND FORKS	110	1,520	0	0	$1,430	$1,950
NORTHGATE	1	1,389	84	7	$2,530	$3,452
NORTHGATE	26	1,389	84	5	$1,835	$2,503
NORTHGATE	52	1,389	84	4	$1,557	$2,124
NORTHGATE	55	1,389	78	1	$1,359	$1,854
NORTHGATE	110	1,343	0	0	$1,270	$1,732
NORWICH	1	1,320	15	7	$2,379	$3,245
NORWICH	26	1,320	15	5	$1,693	$2,309
NORWICH	52	1,320	15	4	$1,476	$2,014
NORWICH	55	1,320	9	1	$1,280	$1,746
NORWICH	110	1,320	0	0	$1,249	$1,704
PALERMO	1	1,265	80	6	$2,352	$3,209
PALERMO	26	1,265	80	5	$1,697	$2,315
PALERMO	52	1,265	80	4	$1,435	$1,958
PALERMO	55	1,265	74	1	$1,246	$1,700
PALERMO	110	1,265	0	0	$1,199	$1,636
PEAK	1	1,515	47	8	$2,679	$3,654
PEAK	26	1,515	47	5	$1,935	$2,639
PEAK	52	1,515	47	4	$1,673	$2,282
PEAK	55	1,515	41	1	$1,464	$1,996
PEAK	110	1,515	0	0	$1,425	$1,944
PETERSBURG	1	1,466	23	7	$2,591	$3,535
PETERSBURG	26	1,466	23	5	$1,858	$2,535
PETERSBURG	52	1,466	23	4	$1,620	$2,210
PETERSBURG	55	1,466	17	1	$1,413	$1,928
PETERSBURG	110	1,466	0	0	$1,381	$1,884
PILLSBURY	1	1,486	181	7	$2,743	$3,742
PILLSBURY	26	1,486	181	5	$2,035	$2,775
PILLSBURY	52	1,486	181	4	$1,670	$2,278
PILLSBURY	55	1,486	175	1	$1,471	$2,006
PILLSBURY	110	1,486	0	0	$1,399	$1,908

Table 4 Estimated Costs of BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level						
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Intertrain/ Intratrain Switches	Variable Cost per Car	Fully-Allocated Cost per Car
POWERS LAKE	1	1,283	98	6	$2,392	$3,263
POWERS LAKE	26	1,283	98	5	$1,734	$2,365
POWERS LAKE	52	1,283	98	4	$1,456	$1,986
POWERS LAKE	55	1,283	92	1	$1,267	$1,728
POWERS LAKE	110	1,283	0	0	$1,216	$1,658
RAY	1	1,218	33	6	$2,249	$3,068
RAY	26	1,218	33	5	$1,600	$2,182
RAY	52	1,218	33	4	$1,380	$1,882
RAY	55	1,218	27	1	$1,192	$1,626
RAY	110	1,218	0	0	$1,157	$1,578
REEDER	1	1,314	139	7	$2,468	$3,366
REEDER	26	1,314	139	5	$1,808	$2,466
REEDER	52	1,314	139	4	$1,494	$2,038
REEDER	55	1,314	133	1	$1,305	$1,780
REEDER	110	1,314	0	0	$1,244	$1,696
REYNOLDS	1	1,534	27	8	$2,690	$3,670
REYNOLDS	26	1,534	27	5	$1,935	$2,640
REYNOLDS	52	1,534	27	4	$1,687	$2,302
REYNOLDS	55	1,534	21	1	$1,476	$2,013
REYNOLDS	110	1,528	0	0	$1,437	$1,960
RICHARDTON	1	1,350	32	7	$2,435	$3,321
RICHARDTON	26	1,350	32	5	$1,742	$2,376
RICHARDTON	52	1,350	32	4	$1,509	$2,058
RICHARDTON	55	1,350	26	1	$1,311	$1,788
RICHARDTON	110	1,350	0	0	$1,276	$1,741
ROSS	1	1,250	65	6	$2,320	$3,164
ROSS	26	1,250	65	5	$1,666	$2,273
ROSS	52	1,250	65	4	$1,417	$1,933
ROSS	55	1,250	59	1	$1,229	$1,676
ROSS	110	1,250	0	0	$1,186	$1,617
RUGBY	1	1,366	61	7	$2,480	$3,383
RUGBY	26	1,366	61	5	$1,788	$2,438
RUGBY	52	1,366	61	4	$1,530	$2,087
RUGBY	55	1,366	55	1	$1,333	$1,818
RUGBY	110	1,366	0	0	$1,291	$1,760
SCRANTON	1	1,303	128	7	$2,444	$3,333
SCRANTON	26	1,303	128	5	$1,785	$2,435

Table 4 Estimated Costs of BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level						
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Intertrain/ Intratrain Switches	Variable Cost per Car	Fully-Allocated Cost per Car
SCRANTON	52	1,303	128	4	$1,481	$2,020
SCRANTON	55	1,303	122	1	$1,293	$1,763
SCRANTON	110	1,303	0	0	$1,234	$1,683
SELZ	1	1,377	72	7	$2,504	$3,416
SELZ	26	1,377	72	5	$1,810	$2,469
SELZ	52	1,377	72	4	$1,543	$2,105
SELZ	55	1,377	66	1	$1,345	$1,835
SELZ	110	1,377	0	0	$1,301	$1,774
SPIRITWOOD	1	1,486	18	7	$2,615	$3,568
SPIRITWOOD	26	1,486	18	5	$1,875	$2,558
SPIRITWOOD	52	1,486	18	4	$1,639	$2,235
SPIRITWOOD	55	1,486	12	1	$1,430	$1,951
SPIRITWOOD	110	1,486	0	0	$1,399	$1,908
STANLEY	1	1,257	72	6	$2,335	$3,185
STANLEY	26	1,257	72	5	$1,681	$2,293
STANLEY	52	1,257	72	4	$1,426	$1,945
STANLEY	55	1,257	66	1	$1,237	$1,687
STANLEY	110	1,257	0	0	$1,192	$1,626
STEELE	1	1,475	56	7	$2,630	$3,587
STEELE	26	1,475	56	5	$1,900	$2,592
STEELE	52	1,475	56	4	$1,635	$2,231
STEELE	55	1,475	50	1	$1,430	$1,950
STEELE	110	1,475	0	0	$1,389	$1,895
STERLING	1	1,456	37	7	$2,588	$3,530
STERLING	26	1,456	37	5	$1,861	$2,539
STERLING	52	1,456	37	4	$1,613	$2,201
STERLING	55	1,456	31	1	$1,408	$1,920
STERLING	110	1,456	0	0	$1,372	$1,871
SUTTON	1	1,453	148	7	$2,671	$3,643
SUTTON	26	1,453	148	5	$1,966	$2,682
SUTTON	52	1,453	148	4	$1,632	$2,226
SUTTON	55	1,453	142	1	$1,433	$1,954
SUTTON	110	1,453	0	0	$1,369	$1,868
TAPPEN	1	1,488	69	7	$2,658	$3,626
TAPPEN	26	1,488	69	5	$1,927	$2,628
TAPPEN	52	1,488	69	4	$1,651	$2,252
TAPPEN	55	1,488	63	1	$1,445	$1,971

Table 4 Estimated Costs of BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level						
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Intertrain/ Intratrain Switches	Variable Cost per Car	Fully-Allocated Cost per Car
TAPPEN	110	1,488	0	0	$1,401	$1,911
THOMPSON	1	1,527	20	8	$2,675	$3,649
THOMPSON	26	1,527	20	5	$1,921	$2,621
THOMPSON	52	1,527	20	4	$1,679	$2,291
THOMPSON	55	1,527	14	1	$1,468	$2,002
THOMPSON	110	1,521	0	0	$1,431	$1,952
VALLEY CITY	1	1,510	42	8	$2,668	$3,639
VALLEY CITY	26	1,510	42	5	$1,924	$2,625
VALLEY CITY	52	1,510	42	4	$1,667	$2,274
VALLEY CITY	55	1,510	36	1	$1,458	$1,988
VALLEY CITY	110	1,510	0	0	$1,421	$1,938
WAHPETON	1	1,591	53	8	$2,791	$3,807
WAHPETON	26	1,591	53	5	$2,023	$2,759
WAHPETON	52	1,591	53	4	$1,748	$2,385
WAHPETON	55	1,591	47	1	$1,534	$2,092
WAHPETON	110	1,577	0	0	$1,481	$2,021
WEST FARGO	1	1,563	95	8	$2,784	$3,798
WEST FARGO	26	1,563	95	5	$2,033	$2,773
WEST FARGO	52	1,563	95	4	$1,729	$2,358
WEST FARGO	55	1,563	89	1	$1,519	$2,072
WEST FARGO	110	1,537	0	0	$1,445	$1,971
WHEATLAND	1	1,542	74	8	$2,738	$3,735
WHEATLAND	26	1,542	74	5	$1,990	$2,715
WHEATLAND	52	1,542	74	4	$1,704	$2,325
WHEATLAND	55	1,542	68	1	$1,495	$2,039
WHEATLAND	110	1,528	0	0	$1,437	$1,960
WHITE EARTH	1	1,238	53	6	$2,293	$3,128
WHITE EARTH	26	1,238	53	5	$1,641	$2,239
WHITE EARTH	52	1,238	53	4	$1,403	$1,914
WHITE EARTH	55	1,238	47	1	$1,215	$1,658
WHITE EARTH	110	1,238	0	0	$1,175	$1,602
WILDROSE	1	1,308	123	7	$2,447	$3,337
WILDROSE	26	1,308	123	5	$1,785	$2,435
WILDROSE	52	1,308	123	4	$1,485	$2,026
WILDROSE	55	1,308	117	1	$1,296	$1,768
WILDROSE	110	1,308	0	0	$1,238	$1,689
WILLISTON	1	1,191	6	6	$2,190	$2,988

Table 4 Estimated Costs of BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level						
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Intertrain/ Intratrain Switches	Variable Cost per Car	Fully-Allocated Cost per Car
WILLISTON	26	1,191	6	5	$1,545	$2,107
WILLISTON	52	1,191	6	4	$1,349	$1,839
WILLISTON	55	1,191	0	1	$1,161	$1,584
WILLISTON	110	1,191	0	0	$1,132	$1,545
WILLOW CITY	1	1,387	82	7	$2,526	$3,446
WILLOW CITY	26	1,387	82	5	$1,831	$2,497
WILLOW CITY	52	1,387	82	4	$1,554	$2,120
WILLOW CITY	55	1,387	76	1	$1,357	$1,851
WILLOW CITY	110	1,387	0	0	$1,310	$1,786
WINDSOR	1	1,516	97	8	$2,720	$3,710
WINDSOR	26	1,516	97	5	$1,985	$2,707
WINDSOR	52	1,516	97	4	$1,683	$2,296
WINDSOR	55	1,516	91	1	$1,477	$2,015
WINDSOR	110	1,489	0	0	$1,402	$1,912
YORK	1	1,387	82	7	$2,526	$3,446
YORK	26	1,387	82	5	$1,831	$2,497
YORK	52	1,387	82	4	$1,554	$2,120
YORK	55	1,387	76	1	$1,357	$1,851
YORK	110	1,387	0	0	$1,310	$1,786
ZAHL	1	1,333	148	7	$2,501	$3,412
ZAHL	26	1,333	148	5	$1,837	$2,505
ZAHL	52	1,333	148	4	$1,514	$2,066
ZAHL	55	1,333	142	1	$1,325	$1,807
ZAHL	110	1,333	0	0	$1,261	$1,720

Table 5 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
ALAMO	1	1,322	$4,698	1.9	1.39
ALAMO	26	1,322	$4,473	2.47	1.81
ALAMO	52	1,322	$4,250	2.83	2.08
ALAMO	55	1,322	$4,196	3.2	2.34
ALAMO	110	1,322	$4,088	3.27	2.4
ALTON	1	1,557	$4,797	1.75	1.28
ALTON	26	1,557	$4,574	2.31	1.69
ALTON	52	1,557	$4,349	2.54	1.86
ALTON	55	1,557	$4,295	2.86	2.1
ALTON	110	1,551	$4,187	2.87	2.11
ARVILLA	1	1,535	$4,797	1.78	1.31
ARVILLA	26	1,535	$4,574	2.36	1.73
ARVILLA	52	1,535	$4,349	2.58	1.89
ARVILLA	55	1,535	$4,295	2.91	2.13
ARVILLA	110	1,491	$4,187	2.98	2.19
AYR	1	1,585	$4,797	1.73	1.27
AYR	26	1,585	$4,574	2.28	1.67
AYR	52	1,585	$4,349	2.5	1.83
AYR	55	1,585	$4,295	2.81	2.06
AYR	110	1,505	$4,187	2.96	2.17
BEACH	1	1,261	$4,432	1.91	1.4
BEACH	26	1,261	$4,208	2.53	1.86
BEACH	52	1,261	$3,984	2.8	2.05
BEACH	55	1,261	$3,930	3.18	2.33
BEACH	110	1,261	$3,822	3.2	2.34
BELFIELD	1	1,304	$4,537	1.88	1.38
BELFIELD	26	1,304	$4,314	2.47	1.81
BELFIELD	52	1,304	$4,089	2.77	2.03
BELFIELD	55	1,304	$4,035	3.14	2.3
BELFIELD	110	1,304	$3,927	3.18	2.33
BEREA	1	1,505	$4,797	1.81	1.32
BEREA	26	1,505	$4,574	2.39	1.75
BEREA	52	1,505	$4,349	2.62	1.92
BEREA	55	1,505	$4,295	2.96	2.17
BEREA	110	1,505	$4,187	2.96	2.17
BERTHOLD	1	1,288	$4,797	2	1.46

Table 5 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
BERTHOLD	26	1,288	$4,574	2.62	1.92
BERTHOLD	52	1,288	$4,349	2.97	2.18
BERTHOLD	55	1,288	$4,295	3.37	2.47
BERTHOLD	110	1,288	$4,187	3.43	2.52
BISBEE	1	1,521	$4,797	1.77	1.3
BISBEE	26	1,521	$4,574	2.32	1.7
BISBEE	52	1,521	$4,349	2.58	1.89
BISBEE	55	1,521	$4,295	2.91	2.13
BISBEE	110	1,433	$4,187	3.1	2.27
BISMARCK	1	1,431	$4,797	1.89	1.39
BISMARCK	26	1,431	$4,574	2.53	1.85
BISMARCK	52	1,431	$4,349	2.75	2.01
BISMARCK	55	1,431	$4,295	3.11	2.28
BISMARCK	110	1,431	$4,187	3.1	2.27
BOTTINEAU	1	1,404	$4,797	1.87	1.37
BOTTINEAU	26	1,404	$4,574	2.45	1.8
BOTTINEAU	52	1,404	$4,349	2.76	2.03
BOTTINEAU	55	1,404	$4,295	3.12	2.29
BOTTINEAU	110	1,404	$4,187	3.16	2.32
BOWBELLS	1	1,376	$4,758	1.9	1.39
BOWBELLS	26	1,376	$4,190	2.32	1.7
BOWBELLS	52	1,376	$4,190	2.72	1.99
BOWBELLS	55	1,376	$4,190	3.12	2.29
BOWBELLS	110	1,330	$4,148	3.3	2.42
BOWMAN	1	1,291	$4,511	1.87	1.37
BOWMAN	26	1,291	$4,287	2.44	1.79
BOWMAN	52	1,291	$4,063	2.77	2.03
BOWMAN	55	1,291	$4,009	3.14	2.3
BOWMAN	110	1,291	$3,901	3.19	2.34
BOYLE	1	1,339	$4,511	1.87	1.37
BOYLE	26	1,339	$4,288	2.49	1.83
BOYLE	52	1,339	$4,063	2.72	1.99
BOYLE	55	1,339	$4,009	3.09	2.26
BOYLE	110	1,339	$3,901	3.08	2.26
BREMEN	1	1,402	$4,797	1.87	1.37
BREMEN	26	1,402	$4,574	2.46	1.8
BREMEN	52	1,402	$4,349	2.77	2.03

Table 5 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
BREMEN	55	1,402	$4,295	3.13	2.29
BREMEN	110	1,402	$4,187	3.16	2.32
BUFFALO	1	1,531	$4,797	1.77	1.3
BUFFALO	26	1,531	$4,574	2.32	1.7
BUFFALO	52	1,531	$4,349	2.57	1.88
BUFFALO	55	1,531	$4,295	2.9	2.12
BUFFALO	110	1,531	$4,187	2.91	2.13
BUXTON	1	1,539	$4,797	1.78	1.3
BUXTON	26	1,539	$4,574	2.35	1.72
BUXTON	52	1,539	$4,349	2.57	1.88
BUXTON	55	1,539	$4,295	2.9	2.13
BUXTON	110	1,533	$4,187	2.9	2.13
CANDO	1	1,508	$4,797	1.79	1.31
CANDO	26	1,508	$4,574	2.35	1.72
CANDO	52	1,508	$4,349	2.61	1.91
CANDO	55	1,508	$4,295	2.94	2.15
CANDO	110	1,420	$4,187	3.13	2.29
CASSELTON	1	1,548	$4,797	1.74	1.28
CASSELTON	26	1,548	$4,574	2.28	1.67
CASSELTON	52	1,548	$4,349	2.54	1.86
CASSELTON	55	1,548	$4,295	2.86	2.1
CASSELTON	110	1,522	$4,187	2.92	2.14
CHURCHS FERRY	1	1,493	$4,797	1.81	1.33
CHURCHS FERRY	26	1,493	$4,574	2.39	1.75
CHURCHS FERRY	52	1,493	$4,349	2.63	1.93
CHURCHS FERRY	55	1,493	$4,295	2.97	2.18
CHURCHS FERRY	110	1,405	$4,187	3.16	2.32
CLEVELAND	1	1,512	$4,797	1.77	1.3
CLEVELAND	26	1,512	$4,574	2.31	1.7
CLEVELAND	52	1,512	$4,349	2.59	1.9
CLEVELAND	55	1,512	$4,295	2.92	2.14
CLEVELAND	110	1,493	$4,187	2.98	2.18
DEVILS LAKE	1	1,474	$4,797	1.84	1.35
DEVILS LAKE	26	1,474	$4,574	2.44	1.79
DEVILS LAKE	52	1,474	$4,349	2.67	1.96
DEVILS LAKE	55	1,474	$4,295	3.02	2.21
DEVILS LAKE	110	1,424	$4,187	3.12	2.29

Table 5 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
DICKINSON	1	1,324	$4,478	1.88	1.38
DICKINSON	26	1,324	$4,254	2.52	1.85
DICKINSON	52	1,324	$4,029	2.73	2
DICKINSON	55	1,324	$3,975	3.1	2.27
DICKINSON	110	1,324	$3,867	3.09	2.26
DOYON	1	1,458	$4,797	1.86	1.37
DOYON	26	1,458	$4,574	2.48	1.82
DOYON	52	1,458	$4,349	2.7	1.98
DOYON	55	1,458	$4,295	3.06	2.24
DOYON	110	1,440	$4,187	3.08	2.26
ELDRIDGE	1	1,525	$4,797	1.75	1.28
ELDRIDGE	26	1,525	$4,574	2.28	1.67
ELDRIDGE	52	1,525	$4,349	2.57	1.88
ELDRIDGE	55	1,525	$4,295	2.89	2.12
ELDRIDGE	110	1,480	$4,187	3	2.2
EPPING	1	1,208	$4,652	2.09	1.53
EPPING	26	1,208	$4,427	2.8	2.05
EPPING	52	1,208	$4,203	3.07	2.25
EPPING	55	1,208	$4,149	3.51	2.58
EPPING	110	1,208	$4,041	3.52	2.58
FARGO	1	1,567	$4,797	1.72	1.26
FARGO	26	1,567	$4,574	2.24	1.64
FARGO	52	1,567	$4,349	2.51	1.84
FARGO	55	1,567	$4,295	2.82	2.07
FARGO	110	1,539	$4,187	2.89	2.12
GARDNER	1	1,570	$4,797	1.75	1.28
GARDNER	26	1,570	$4,574	2.31	1.69
GARDNER	52	1,570	$4,349	2.52	1.85
GARDNER	55	1,570	$4,295	2.85	2.09
GARDNER	110	1,560	$4,187	2.86	2.09
GLADSTONE	1	1,336	$4,613	1.92	1.41
GLADSTONE	26	1,336	$4,388	2.56	1.88
GLADSTONE	52	1,336	$4,164	2.79	2.05
GLADSTONE	55	1,336	$4,110	3.17	2.33
GLADSTONE	110	1,336	$4,002	3.17	2.32
GLEN ULLIN	1	1,377	$4,710	1.89	1.38
GLEN ULLIN	26	1,377	$4,486	2.5	1.83

Table 5 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
GLEN ULLIN	52	1,377	$4,262	2.77	2.03
GLEN ULLIN	55	1,377	$4,208	3.14	2.3
GLEN ULLIN	110	1,377	$4,100	3.15	2.31
GLENFIELD	1	1,446	$4,797	1.81	1.32
GLENFIELD	26	1,446	$4,574	2.34	1.72
GLENFIELD	52	1,446	$4,349	2.68	1.96
GLENFIELD	55	1,446	$4,295	3.01	2.21
GLENFIELD	110	1,446	$4,187	3.07	2.25
GRACE CITY	1	1,433	$4,797	1.83	1.34
GRACE CITY	26	1,433	$4,574	2.38	1.74
GRACE CITY	52	1,433	$4,349	2.7	1.98
GRACE CITY	55	1,433	$4,295	3.05	2.23
GRACE CITY	110	1,433	$4,187	3.1	2.27
GRAND FORKS	1	1,513	$4,797	1.81	1.33
GRAND FORKS	26	1,513	$4,574	2.42	1.77
GRAND FORKS	52	1,513	$4,349	2.61	1.92
GRAND FORKS	55	1,513	$4,295	2.96	2.17
GRAND FORKS	110	1,513	$4,187	2.94	2.16
HAMBERG	1	1,396	$4,797	1.88	1.38
HAMBERG	26	1,396	$4,574	2.47	1.81
HAMBERG	52	1,396	$4,349	2.78	2.04
HAMBERG	55	1,396	$4,295	3.14	2.3
HAMBERG	110	1,396	$4,187	3.18	2.33
HAMLET	1	1,304	$4,713	1.93	1.42
HAMLET	26	1,304	$4,490	2.53	1.85
HAMLET	52	1,304	$4,265	2.88	2.11
HAMLET	55	1,304	$4,211	3.26	2.39
HAMLET	110	1,304	$4,103	3.32	2.44
HANNAFORD	1	1,466	$4,797	1.78	1.3
HANNAFORD	26	1,466	$4,574	2.29	1.68
HANNAFORD	52	1,466	$4,349	2.64	1.94
HANNAFORD	55	1,466	$4,295	2.97	2.17
HANNAFORD	110	1,466	$4,187	3.03	2.22
HARWOOD	1	1,558	$4,797	1.76	1.29
HARWOOD	26	1,558	$4,574	2.34	1.72
HARWOOD	52	1,558	$4,349	2.54	1.86
HARWOOD	55	1,558	$4,295	2.87	2.11

Table 5 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
HARWOOD	110	1,548	$4,187	2.88	2.11
HEBRON	1	1,365	$4,681	1.9	1.39
HEBRON	26	1,365	$4,456	2.51	1.84
HEBRON	52	1,365	$4,233	2.77	2.03
HEBRON	55	1,365	$4,179	3.15	2.31
HEBRON	110	1,365	$4,071	3.16	2.31
HETTINGER	1	1,332	$4,606	1.84	1.35
HETTINGER	26	1,332	$4,382	2.38	1.74
HETTINGER	52	1,332	$4,158	2.74	2.01
HETTINGER	55	1,332	$4,104	3.1	2.27
HETTINGER	110	1,332	$3,996	3.17	2.33
HILLSBORO	1	1,553	$4,797	1.76	1.29
HILLSBORO	26	1,553	$4,574	2.32	1.7
HILLSBORO	52	1,553	$4,349	2.54	1.86
HILLSBORO	55	1,553	$4,295	2.87	2.1
HILLSBORO	110	1,547	$4,187	2.88	2.11
JAMESTOWN	1	1,474	$4,797	1.85	1.36
JAMESTOWN	26	1,474	$4,574	2.47	1.81
JAMESTOWN	52	1,474	$4,349	2.68	1.96
JAMESTOWN	55	1,474	$4,295	3.03	2.22
JAMESTOWN	110	1,474	$4,187	3.02	2.21
KELSO	1	1,559	$4,797	1.75	1.28
KELSO	26	1,559	$4,574	2.3	1.69
KELSO	52	1,559	$4,349	2.53	1.86
KELSO	55	1,559	$4,295	2.85	2.09
KELSO	110	1,553	$4,187	2.87	2.1
LAKOTA	1	1,449	$4,797	1.88	1.38
LAKOTA	26	1,449	$4,574	2.51	1.84
LAKOTA	52	1,449	$4,349	2.72	1.99
LAKOTA	55	1,449	$4,295	3.08	2.26
LAKOTA	110	1,449	$4,187	3.07	2.25
LARIMORE	1	1,541	$4,797	1.77	1.3
LARIMORE	26	1,541	$4,574	2.35	1.72
LARIMORE	52	1,541	$4,349	2.56	1.88
LARIMORE	55	1,541	$4,295	2.89	2.12
LARIMORE	110	1,485	$4,187	2.99	2.2
LEEDS	1	1,505	$4,797	1.79	1.31

Table 5 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
LEEDS	26	1,505	$4,574	2.36	1.73
LEEDS	52	1,505	$4,349	2.61	1.91
LEEDS	55	1,505	$4,295	2.95	2.16
LEEDS	110	1,393	$4,187	3.18	2.33
LUVERNE	1	1,479	$4,797	1.76	1.29
LUVERNE	26	1,479	$4,574	2.26	1.66
LUVERNE	52	1,479	$4,349	2.62	1.92
LUVERNE	55	1,479	$4,295	2.94	2.15
LUVERNE	110	1,479	$4,187	3.01	2.2
MEDINA	1	1,503	$4,797	1.78	1.31
MEDINA	26	1,503	$4,574	2.34	1.71
MEDINA	52	1,503	$4,349	2.61	1.91
MEDINA	55	1,503	$4,295	2.94	2.15
MEDINA	110	1,502	$4,187	2.96	2.17
MINOT	1	1,311	$4,797	2.03	1.49
MINOT	26	1,311	$4,574	2.73	2
MINOT	52	1,311	$4,349	2.97	2.18
MINOT	55	1,311	$4,295	3.38	2.48
MINOT	110	1,311	$4,187	3.37	2.47
NEW SALEM	1	1,398	$4,758	1.87	1.37
NEW SALEM	26	1,398	$4,535	2.46	1.81
NEW SALEM	52	1,398	$4,310	2.75	2.02
NEW SALEM	55	1,398	$4,256	3.12	2.28
NEW SALEM	110	1,398	$4,148	3.14	2.3
NIAGARA	1	1,472	$4,797	1.84	1.35
NIAGARA	26	1,472	$4,574	2.45	1.79
NIAGARA	52	1,472	$4,349	2.67	1.96
NIAGARA	55	1,472	$4,295	3.02	2.22
NIAGARA	110	1,472	$4,187	3.02	2.21
NORTH GRAND FORKS	1	1,520	$4,797	1.8	1.32
NORTH GRAND FORKS	26	1,520	$4,574	2.4	1.76
NORTH GRAND FORKS	52	1,520	$4,349	2.6	1.91
NORTH GRAND FORKS	55	1,520	$4,295	2.94	2.16
NORTH GRAND FORKS	110	1,520	$4,187	2.93	2.15
NORTHGATE	1	1,389	$4,758	1.88	1.38
NORTHGATE	26	1,389	$4,190	2.28	1.67
NORTHGATE	52	1,389	$4,190	2.69	1.97

Table 5 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
NORTHGATE	55	1,389	$4,190	3.08	2.26
NORTHGATE	110	1,343	$4,148	3.27	2.39
NORWICH	1	1,320	$4,797	2.02	1.48
NORWICH	26	1,320	$4,574	2.7	1.98
NORWICH	52	1,320	$4,349	2.95	2.16
NORWICH	55	1,320	$4,295	3.36	2.46
NORWICH	110	1,320	$4,187	3.35	2.46
PALERMO	1	1,265	$4,763	2.02	1.48
PALERMO	26	1,265	$4,539	2.67	1.96
PALERMO	52	1,265	$4,315	3.01	2.2
PALERMO	55	1,265	$4,261	3.42	2.51
PALERMO	110	1,265	$4,153	3.46	2.54
PEAK	1	1,515	$4,797	1.79	1.31
PEAK	26	1,515	$4,574	2.36	1.73
PEAK	52	1,515	$4,349	2.6	1.91
PEAK	55	1,515	$4,295	2.93	2.15
PEAK	110	1,515	$4,187	2.94	2.15
PETERSBURG	1	1,466	$4,797	1.85	1.36
PETERSBURG	26	1,466	$4,574	2.46	1.8
PETERSBURG	52	1,466	$4,349	2.68	1.97
PETERSBURG	55	1,466	$4,295	3.04	2.23
PETERSBURG	110	1,466	$4,187	3.03	2.22
PILLSBURY	1	1,486	$4,797	1.75	1.28
PILLSBURY	26	1,486	$4,574	2.25	1.65
PILLSBURY	52	1,486	$4,349	2.6	1.91
PILLSBURY	55	1,486	$4,295	2.92	2.14
PILLSBURY	110	1,486	$4,187	2.99	2.19
POWERS LAKE	1	1,283	$4,704	1.97	1.44
POWERS LAKE	26	1,283	$4,481	2.58	1.89
POWERS LAKE	52	1,283	$4,256	2.92	2.14
POWERS LAKE	55	1,283	$4,202	3.32	2.43
POWERS LAKE	110	1,283	$4,094	3.37	2.47
RAY	1	1,218	$4,671	2.08	1.52
RAY	26	1,218	$4,447	2.78	2.04
RAY	52	1,218	$4,223	3.06	2.24
RAY	55	1,218	$4,169	3.5	2.56
RAY	110	1,218	$4,061	3.51	2.57

Table 5 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
REEDER	1	1,314	$4,566	1.85	1.36
REEDER	26	1,314	$4,342	2.4	1.76
REEDER	52	1,314	$4,118	2.76	2.02
REEDER	55	1,314	$4,064	3.11	2.28
REEDER	110	1,314	$3,956	3.18	2.33
REYNOLDS	1	1,534	$4,797	1.78	1.31
REYNOLDS	26	1,534	$4,574	2.36	1.73
REYNOLDS	52	1,534	$4,349	2.58	1.89
REYNOLDS	55	1,534	$4,295	2.91	2.13
REYNOLDS	110	1,528	$4,187	2.91	2.14
RICHARDTON	1	1,350	$4,645	1.91	1.4
RICHARDTON	26	1,350	$4,420	2.54	1.86
RICHARDTON	52	1,350	$4,197	2.78	2.04
RICHARDTON	55	1,350	$4,143	3.16	2.32
RICHARDTON	110	1,350	$4,035	3.16	2.32
ROSS	1	1,250	$4,734	2.04	1.5
ROSS	26	1,250	$4,509	2.71	1.98
ROSS	52	1,250	$4,285	3.02	2.22
ROSS	55	1,250	$4,231	3.44	2.52
ROSS	110	1,250	$4,123	3.48	2.55
RUGBY	1	1,366	$4,797	1.93	1.42
RUGBY	26	1,366	$4,574	2.56	1.88
RUGBY	52	1,366	$4,349	2.84	2.08
RUGBY	55	1,366	$4,295	3.22	2.36
RUGBY	110	1,366	$4,187	3.24	2.38
SCRANTON	1	1,303	$4,452	1.82	1.34
SCRANTON	26	1,303	$4,229	2.37	1.74
SCRANTON	52	1,303	$4,004	2.7	1.98
SCRANTON	55	1,303	$3,950	3.06	2.24
SCRANTON	110	1,303	$3,842	3.11	2.28
SELZ	1	1,377	$4,797	1.92	1.4
SELZ	26	1,377	$4,574	2.53	1.85
SELZ	52	1,377	$4,349	2.82	2.07
SELZ	55	1,377	$4,295	3.19	2.34
SELZ	110	1,377	$4,187	3.22	2.36
SPIRITWOOD	1	1,486	$4,797	1.83	1.34
SPIRITWOOD	26	1,486	$4,574	2.44	1.79

Table 5 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
SPIRITWOOD	52	1,486	$4,349	2.65	1.95
SPIRITWOOD	55	1,486	$4,295	3	2.2
SPIRITWOOD	110	1,486	$4,187	2.99	2.19
STANLEY	1	1,257	$4,748	2.03	1.49
STANLEY	26	1,257	$4,524	2.69	1.97
STANLEY	52	1,257	$4,299	3.02	2.21
STANLEY	55	1,257	$4,245	3.43	2.52
STANLEY	110	1,257	$4,137	3.47	2.54
STEELE	1	1,475	$4,797	1.82	1.34
STEELE	26	1,475	$4,574	2.41	1.76
STEELE	52	1,475	$4,349	2.66	1.95
STEELE	55	1,475	$4,295	3	2.2
STEELE	110	1,475	$4,187	3.01	2.21
STERLING	1	1,456	$4,797	1.85	1.36
STERLING	26	1,456	$4,574	2.46	1.8
STERLING	52	1,456	$4,349	2.7	1.98
STERLING	55	1,456	$4,295	3.05	2.24
STERLING	110	1,456	$4,187	3.05	2.24
SUTTON	1	1,453	$4,797	1.8	1.32
SUTTON	26	1,453	$4,574	2.33	1.71
SUTTON	52	1,453	$4,349	2.67	1.95
SUTTON	55	1,453	$4,295	3	2.2
SUTTON	110	1,453	$4,187	3.06	2.24
TAPPEN	1	1,488	$4,797	1.8	1.32
TAPPEN	26	1,488	$4,574	2.37	1.74
TAPPEN	52	1,488	$4,349	2.63	1.93
TAPPEN	55	1,488	$4,295	2.97	2.18
TAPPEN	110	1,488	$4,187	2.99	2.19
THOMPSON	1	1,527	$4,797	1.79	1.31
THOMPSON	26	1,527	$4,574	2.38	1.75
THOMPSON	52	1,527	$4,349	2.59	1.9
THOMPSON	55	1,527	$4,295	2.93	2.15
THOMPSON	110	1,521	$4,187	2.93	2.15
VALLEY CITY	1	1,510	$4,797	1.8	1.32
VALLEY CITY	26	1,510	$4,574	2.38	1.74
VALLEY CITY	52	1,510	$4,349	2.61	1.91
VALLEY CITY	55	1,510	$4,295	2.95	2.16

Table 5 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
VALLEY CITY	110	1,510	$4,187	2.95	2.16
WAHPETON	1	1,591	$4,797	1.72	1.26
WAHPETON	26	1,591	$4,574	2.26	1.66
WAHPETON	52	1,591	$4,349	2.49	1.82
WAHPETON	55	1,591	$4,295	2.8	2.05
WAHPETON	110	1,577	$4,187	2.83	2.07
WEST FARGO	1	1,563	$4,797	1.72	1.26
WEST FARGO	26	1,563	$4,574	2.25	1.65
WEST FARGO	52	1,563	$4,349	2.52	1.84
WEST FARGO	55	1,563	$4,295	2.83	2.07
WEST FARGO	110	1,537	$4,187	2.9	2.12
WHEATLAND	1	1,542	$4,797	1.75	1.28
WHEATLAND	26	1,542	$4,574	2.3	1.68
WHEATLAND	52	1,542	$4,349	2.55	1.87
WHEATLAND	55	1,542	$4,295	2.87	2.11
WHEATLAND	110	1,528	$4,187	2.91	2.14
WHITE EARTH	1	1,238	$4,710	2.05	1.51
WHITE EARTH	26	1,238	$4,486	2.73	2
WHITE EARTH	52	1,238	$4,262	3.04	2.23
WHITE EARTH	55	1,238	$4,208	3.46	2.54
WHITE EARTH	110	1,238	$4,100	3.49	2.56
WILDROSE	1	1,308	$4,709	1.92	1.41
WILDROSE	26	1,308	$4,485	2.51	1.84
WILDROSE	52	1,308	$4,261	2.87	2.1
WILDROSE	55	1,308	$4,207	3.25	2.38
WILDROSE	110	1,308	$4,099	3.31	2.43
WILLISTON	1	1,191	$4,618	2.11	1.55
WILLISTON	26	1,191	$4,395	2.85	2.09
WILLISTON	52	1,191	$4,170	3.09	2.27
WILLISTON	55	1,191	$4,116	3.55	2.6
WILLISTON	110	1,191	$4,008	3.54	2.6
WILLOW CITY	1	1,387	$4,797	1.9	1.39
WILLOW CITY	26	1,387	$4,574	2.5	1.83
WILLOW CITY	52	1,387	$4,349	2.8	2.05
WILLOW CITY	55	1,387	$4,295	3.17	2.32
WILLOW CITY	110	1,387	$4,187	3.2	2.34
WINDSOR	1	1,516	$4,797	1.76	1.29

Table 5 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Portland by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
WINDSOR	26	1,516	$4,574	2.3	1.69
WINDSOR	52	1,516	$4,349	2.58	1.89
WINDSOR	55	1,516	$4,295	2.91	2.13
WINDSOR	110	1,489	$4,187	2.99	2.19
YORK	1	1,387	$4,797	1.9	1.39
YORK	26	1,387	$4,574	2.5	1.83
YORK	52	1,387	$4,349	2.8	2.05
YORK	55	1,387	$4,295	3.17	2.32
YORK	110	1,387	$4,187	3.2	2.34
ZAHL	1	1,333	$4,690	1.87	1.37
ZAHL	26	1,333	$4,466	2.43	1.78
ZAHL	52	1,333	$4,242	2.8	2.05
ZAHL	55	1,333	$4,188	3.16	2.32
ZAHL	110	1,333	$4,080	3.24	2.37

REVENUE-COST RATIOS FOR WHEAT SHIPMENTS FROM NORTH DAKOTA TO MINNEAPOLIS

In this section of the report, shipment costs and revenue-cost ratios are presented for wheat movements from North Dakota to Minneapolis. The rates used in this comparison are derived from BNSF Tariff Item 45096. Only three service levels are analyzed: (1) single-car, (2) 26-car, and (3) 52-car. Table 6 presents summary statistics for these service levels.

Because of the shorter trip distances to Minneapolis, fewer adjustments are needed to URCS. Way and through train miles are based on BNSF division points. Intertrain and intratrain switches are assigned by URCS, using a 200-mile distance interval. The origin-destination and train size adjustments developed for 52-car movements to Portland are also implemented for 52-car shipments to Minneapolis. However, no adjustments are made for 26-

car or single-car shipments. According to the waybill sample, over 50 percent of wheat shipments from North Dakota to Minnesota and Wisconsin are single-car shipments or multi-car blocks of less than 25 cars. Given this movement pattern, BNSF's system-average through train characteristics are probably reflective of the mix of car block sizes and commodities that move in eastbound trains.

Table 6
Average Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Minneapolis by Service Level

Service Level	Average Revenue-Variable Cost Ratio	Minimum Revenue-Variable Cost Ratio	Maximum Revenue-Variable Cost Ratio	Standard Deviation of RVC Ratio
1-Car	2.26	1.81	3.30	0.25
26-Car	3.15	2.48	4.86	0.36
52-Car	4.04	3.14	6.64	0.50

Table 7 Estimated Costs of BNSF Wheat Shipments from North Dakota to Minneapolis by Station and Service Level					
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Variable Cost Per Car	Fully Allocated Cost Per Car
ALAMO	1	591	119	$1,433	$1,954
ALAMO	26	591	119	$1,046	$1,426
ALAMO	52	591	119	$756	$1,032
ALTON	1	367	44	$1,058	$1,444
ALTON	26	367	44	$671	$916
ALTON	52	367	44	$493	$673
ARVILLA	1	345	22	$1,010	$1,378
ARVILLA	26	345	22	$623	$850
ARVILLA	52	345	22	$465	$634
AYR	1	280	41	$933	$1,273
AYR	26	280	41	$546	$745
AYR	52	280	41	$396	$540
BEACH	1	606	63	$1,410	$1,923
BEACH	26	606	63	$1,023	$1,395
BEACH	52	606	63	$762	$1,040
BEREA	1	306	67	$990	$1,351
BEREA	26	306	67	$603	$823
BEREA	52	306	67	$430	$587
BERTHOLD	1	495	23	$1,222	$1,667
BERTHOLD	26	495	23	$835	$1,139
BERTHOLD	52	495	23	$631	$861
BISBEE	1	453	72	$1,201	$1,639
BISBEE	26	453	72	$814	$1,111
BISBEE	52	453	72	$594	$810
BOTTINEAU	1	565	93	$1,376	$1,877
BOTTINEAU	26	565	93	$989	$1,349
BOTTINEAU	52	565	93	$723	$986
BOWBELLS	1	537	65	$1,314	$1,793
BOWBELLS	26	537	65	$927	$1,265
BOWBELLS	52	537	65	$686	$936
BOWMAN	1	539	164	$1,395	$1,902
BOWMAN	26	539	164	$1,008	$1,374
BOWMAN	52	539	164	$707	$965
BOYLE	1	528	86	$1,318	$1,798
BOYLE	26	528	86	$931	$1,270
BOYLE	52	528	86	$680	$928
BREMEN	1	381	142	$1,155	$1,575
BREMEN	26	381	142	$768	$1,047

Table 7 Estimated Costs of BNSF Wheat Shipments from North Dakota to Minneapolis by Station and Service Level					
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Variable Cost Per Car	Fully Allocated Cost Per Car
BREMEN	52	381	142	$528	$720
BUFFALO	1	280	41	$933	$1,273
BUFFALO	26	280	41	$546	$745
BUFFALO	52	280	41	$396	$540
BUXTON	1	349	26	$1,019	$1,390
BUXTON	26	349	26	$632	$862
BUXTON	52	349	26	$470	$641
CANDO	1	440	59	$1,173	$1,600
CANDO	26	440	59	$786	$1,072
CANDO	52	440	59	$577	$787
CASSELTON	1	263	24	$896	$1,222
CASSELTON	26	263	24	$509	$694
CASSELTON	52	263	24	$374	$510
CHURCHS FERRY	1	425	44	$1,140	$1,555
CHURCHS FERRY	26	425	44	$753	$1,027
CHURCHS FERRY	52	425	44	$558	$761
CLEVELAND	1	355	19	$1,022	$1,394
CLEVELAND	26	355	19	$635	$866
CLEVELAND	52	355	19	$475	$648
DEVILS LAKE	1	406	25	$1,098	$1,498
DEVILS LAKE	26	406	25	$711	$970
DEVILS LAKE	52	406	25	$533	$727
DICKINSON	1	543	0	$1,272	$1,735
DICKINSON	26	543	0	$885	$1,207
DICKINSON	52	543	0	$680	$928
DOYON	1	390	9	$1,063	$1,450
DOYON	26	390	9	$676	$922
DOYON	52	390	9	$512	$699
EDINBURG	1	387	64	$1,102	$1,503
EDINBURG	26	387	64	$715	$975
EDINBURG	52	387	64	$519	$708
ELDRIDGE	1	342	6	$993	$1,355
ELDRIDGE	26	342	6	$606	$827
ELDRIDGE	52	342	6	$458	$625
EPPING	1	575	103	$1,398	$1,906
EPPING	26	575	103	$1,011	$1,379
EPPING	52	575	103	$736	$1,003
FARGO	1	244	5	$854	$1,165

Table 7 Estimated Costs of BNSF Wheat Shipments from North Dakota to Minneapolis by Station and Service Level					
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Variable Cost Per Car	Fully Allocated Cost Per Car
FARGO	26	244	5	$467	$637
FARGO	52	244	5	$349	$477
GARDNER	1	265	26	$900	$1,228
GARDNER	26	265	26	$513	$700
GARDNER	52	265	26	$377	$514
GLADSTONE	1	531	89	$1,325	$1,807
GLADSTONE	26	531	89	$938	$1,279
GLADSTONE	52	531	89	$684	$933
GLEN ULLIN	1	490	48	$1,235	$1,684
GLEN ULLIN	26	490	48	$848	$1,156
GLEN ULLIN	52	490	48	$631	$860
GLENFIELD	1	337	98	$1,058	$1,443
GLENFIELD	26	337	98	$671	$916
GLENFIELD	52	337	98	$470	$642
GRACE CITY	1	350	111	$1,087	$1,482
GRACE CITY	26	350	111	$700	$954
GRACE CITY	52	350	111	$487	$665
GRAND FORKS	1	323	0	$962	$1,312
GRAND FORKS	26	323	0	$575	$784
GRAND FORKS	52	323	0	$436	$595
HAMBERG	1	387	148	$1,168	$1,593
HAMBERG	26	387	148	$781	$1,065
HAMBERG	52	387	148	$535	$730
HAMLET	1	573	101	$1,393	$1,900
HAMLET	26	573	101	$1,006	$1,373
HAMLET	52	573	101	$733	$1,000
HANNAFORD	1	317	78	$1,014	$1,384
HANNAFORD	26	317	78	$627	$856
HANNAFORD	52	317	78	$444	$606
HARWOOD	1	253	14	$874	$1,192
HARWOOD	26	253	14	$487	$664
HARWOOD	52	253	14	$361	$493
HEBRON	1	502	60	$1,261	$1,720
HEBRON	26	502	60	$874	$1,192
HEBRON	52	502	60	$646	$882
HENSLER	1	484	42	$1,222	$1,666
HENSLER	26	484	42	$835	$1,138
HENSLER	52	484	42	$623	$850

Table 7 Estimated Costs of BNSF Wheat Shipments from North Dakota to Minneapolis by Station and Service Level					
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Variable Cost Per Car	Fully Allocated Cost Per Car
HETTINGER	1	498	123	$1,305	$1,780
HETTINGER	26	498	123	$918	$1,252
HETTINGER	52	498	123	$654	$892
HILLSBORO	1	363	40	$1,050	$1,432
HILLSBORO	26	363	40	$662	$904
HILLSBORO	52	363	40	$488	$666
JAMESTOWN	1	336	0	$980	$1,337
JAMESTOWN	26	336	0	$593	$809
JAMESTOWN	52	336	0	$451	$615
KELSO	1	369	46	$1,063	$1,450
KELSO	26	369	46	$676	$922
KELSO	52	369	46	$496	$677
LAKOTA	1	381	0	$1,044	$1,424
LAKOTA	26	381	0	$657	$896
LAKOTA	52	381	0	$501	$683
LARIMORE	1	351	28	$1,023	$1,396
LARIMORE	26	351	28	$636	$868
LARIMORE	52	351	28	$473	$645
LEEDS	1	437	56	$1,166	$1,591
LEEDS	26	437	56	$779	$1,063
LEEDS	52	437	56	$573	$782
LUVERNE	1	304	65	$986	$1,345
LUVERNE	26	304	65	$599	$817
LUVERNE	52	304	65	$427	$583
MEDINA	1	364	28	$1,042	$1,421
MEDINA	26	364	28	$654	$893
MEDINA	52	364	28	$487	$664
MILTON	1	399	76	$1,128	$1,539
MILTON	26	399	76	$741	$1,011
MILTON	52	399	76	$535	$730
MINOT	1	472	0	$1,172	$1,598
MINOT	26	472	0	$785	$1,071
MINOT	52	472	0	$602	$820
MINTO	1	356	33	$1,034	$1,411
MINTO	26	356	33	$647	$883
MINTO	52	356	33	$479	$653
NEW ROCKFORD	1	368	129	$1,126	$1,536
NEW ROCKFORD	26	368	129	$739	$1,008

Table 7 Estimated Costs of BNSF Wheat Shipments from North Dakota to Minneapolis by Station and Service Level					
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Variable Cost Per Car	Fully Allocated Cost Per Car
NEW ROCKFORD	52	368	129	$511	$697
NEW SALEM	1	469	27	$1,189	$1,622
NEW SALEM	26	469	27	$802	$1,094
NEW SALEM	52	469	27	$603	$823
NIAGARA	1	404	23	$1,094	$1,492
NIAGARA	26	404	23	$707	$964
NIAGARA	52	404	23	$530	$724
NORTHGATE	1	550	78	$1,343	$1,832
NORTHGATE	26	550	78	$956	$1,304
NORTHGATE	52	550	78	$703	$959
NORWICH	1	481	9	$1,192	$1,625
NORWICH	26	481	9	$805	$1,097
NORWICH	52	481	9	$613	$836
PALERMO	1	518	46	$1,273	$1,736
PALERMO	26	518	46	$886	$1,208
PALERMO	52	518	46	$661	$902
PEAK	1	296	57	$968	$1,321
PEAK	26	296	57	$581	$793
PEAK	52	296	57	$417	$569
PETERSBURG	1	398	17	$1,081	$1,474
PETERSBURG	26	398	17	$694	$946
PETERSBURG	52	398	17	$523	$713
PILLSBURY	1	297	58	$971	$1,324
PILLSBURY	26	297	58	$583	$796
PILLSBURY	52	297	58	$418	$571
POWERS LAKE	1	552	80	$1,347	$1,838
POWERS LAKE	26	552	80	$960	$1,310
POWERS LAKE	52	552	80	$706	$962
PROSPER	1	256	17	$881	$1,201
PROSPER	26	256	17	$494	$673
PROSPER	52	256	17	$365	$498
RAY	1	565	93	$1,376	$1,877
RAY	26	565	93	$989	$1,349
RAY	52	565	93	$723	$986
REEDER	1	516	141	$1,344	$1,834
REEDER	26	516	141	$957	$1,306
REEDER	52	516	141	$677	$924
REYNOLDS	1	344	21	$1,008	$1,375

Table 7 Estimated Costs of BNSF Wheat Shipments from North Dakota to Minneapolis by Station and Service Level					
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Variable Cost Per Car	Fully Allocated Cost Per Car
REYNOLDS	26	344	21	$621	$847
REYNOLDS	52	344	21	$463	$632
RHAME	1	552	177	$1,423	$1,941
RICHARDTON	1	517	75	$1,294	$1,765
RICHARDTON	26	517	75	$907	$1,237
RICHARDTON	52	517	75	$666	$908
ROSS	1	533	61	$1,306	$1,781
ROSS	26	533	61	$919	$1,253
ROSS	52	533	61	$681	$929
RUGBY	1	527	55	$1,292	$1,763
RUGBY	26	527	55	$905	$1,235
RUGBY	52	527	55	$673	$918
SCRANTON	1	527	152	$1,368	$1,866
SCRANTON	26	527	152	$981	$1,339
SCRANTON	52	527	152	$692	$943
SELZ	1	406	167	$1,209	$1,650
SELZ	26	406	167	$822	$1,122
SELZ	52	406	167	$560	$764
SPIRITWOOD	1	325	86	$1,032	$1,408
SPIRITWOOD	26	325	86	$645	$880
SPIRITWOOD	52	325	86	$455	$620
STANLEY	1	526	54	$1,290	$1,760
STANLEY	26	526	54	$903	$1,232
STANLEY	52	526	54	$672	$916
STEELE	1	392	56	$1,103	$1,504
STEELE	26	392	56	$716	$976
STEELE	52	392	56	$523	$714
STERLING	1	411	75	$1,145	$1,561
STERLING	26	411	75	$758	$1,033
STERLING	52	411	75	$548	$748
SUTTON	1	330	91	$1,043	$1,423
SUTTON	26	330	91	$656	$895
SUTTON	52	330	91	$461	$629
TAPPEN	1	379	43	$1,074	$1,466
TAPPEN	26	379	43	$687	$938
TAPPEN	52	379	43	$507	$691
THOMPSON	1	337	14	$993	$1,354
THOMPSON	26	337	14	$605	$826

Table 7 Estimated Costs of BNSF Wheat Shipments from North Dakota to Minneapolis by Station and Service Level					
Station	Cars	Loaded Trip Distance	Loaded Way Train Miles	Variable Cost Per Car	Fully Allocated Cost Per Car
THOMPSON	52	337	14	$454	$620
VALLEY CITY	1	301	62	$979	$1,336
VALLEY CITY	26	301	62	$592	$808
VALLEY CITY	52	301	62	$424	$578
WAHPETON	1	286	47	$946	$1,291
WAHPETON	26	286	47	$559	$763
WAHPETON	52	286	47	$404	$551
WEST FARGO	1	248	9	$863	$1,177
WEST FARGO	26	248	9	$476	$649
WEST FARGO	52	248	9	$355	$484
WHEATLAND	1	269	30	$909	$1,240
WHEATLAND	26	269	30	$522	$712
WHEATLAND	52	269	30	$382	$521
WILLISTON	1	592	0	$1,341	$1,829
WILLISTON	26	592	0	$954	$1,301
WILLISTON	52	592	0	$735	$1,002
WILLOW CITY	1	548	76	$1,338	$1,826
WILLOW CITY	26	548	76	$951	$1,298
WILLOW CITY	52	548	76	$700	$955
WINDSOR	1	351	15	$1,013	$1,382
WINDSOR	26	351	15	$626	$854
WINDSOR	52	351	15	$470	$641
YORK	1	548	76	$1,338	$1,826
YORK	26	548	76	$951	$1,298
YORK	52	548	76	$700	$955
ZAHL	1	602	130	$1,457	$1,987
ZAHL	26	602	130	$1,070	$1,459
ZAHL	52	602	130	$771	$1,051

Table 8 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Minneapolis by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
ALAMO	1	591	$3,678	2.57	1.88
ALAMO	26	591	$3,448	3.3	2.42
ALAMO	52	591	$3,308	4.37	3.21
ALTON	1	367	$1,926	1.82	1.33
ALTON	26	367	$1,696	2.53	1.85
ALTON	52	367	$1,557	3.16	2.31
ARVILLA	1	345	$2,113	2.09	1.53
ARVILLA	26	345	$1,883	3.02	2.22
ARVILLA	52	345	$1,744	3.75	2.75
AYR	1	280	$2,033	2.18	1.6
AYR	26	280	$1,803	3.3	2.42
AYR	52	280	$1,664	4.2	3.08
BEACH	1	606	$3,231	2.29	1.68
BEACH	26	606	$3,001	2.93	2.15
BEACH	52	606	$2,862	3.75	2.75
BEREA	1	306	$2,124	2.14	1.57
BEREA	26	306	$1,894	3.14	2.3
BEREA	52	306	$1,755	4.08	2.99
BERTHOLD	1	495	$3,322	2.72	1.99
BERTHOLD	26	495	$3,092	3.7	2.71
BERTHOLD	52	495	$2,953	4.68	3.43
BISBEE	1	453	$2,718	2.26	1.66
BISBEE	26	453	$2,488	3.06	2.24
BISBEE	52	453	$2,349	3.95	2.9
BISMARCK	1	436	$2,583	2.15	1.58
BISMARCK	26	436	$2,353	2.9	2.12
BISMARCK	52	436	$2,214	3.81	2.8
BOTTINEAU	1	565	$2,882	2.09	1.54
BOTTINEAU	26	565	$2,651	2.68	1.97
BOTTINEAU	52	565	$2,512	3.48	2.55
BOWBELLS	1	537	$3,472	2.64	1.94
BOWBELLS	26	537	$3,242	3.5	2.56
BOWBELLS	52	537	$3,103	4.52	3.32
BOWMAN	1	539	$2,972	2.13	1.56
BOWMAN	26	539	$2,742	2.72	2
BOWMAN	52	539	$2,603	3.68	2.7
BOYLE	1	528	$2,876	2.18	1.6

Table 8 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Minneapolis by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
BOYLE	26	528	$2,646	2.84	2.08
BOYLE	52	528	$2,506	3.68	2.7
BREMEN	1	381	$2,814	2.44	1.79
BREMEN	26	381	$2,584	3.37	2.47
BREMEN	52	381	$2,445	4.63	3.4
BUFFALO	1	280	$2,033	2.18	1.6
BUFFALO	26	280	$1,803	3.3	2.42
BUFFALO	52	280	$1,664	4.2	3.08
BUXTON	1	349	$1,926	1.89	1.39
BUXTON	26	349	$1,696	2.68	1.97
BUXTON	52	349	$1,557	3.31	2.43
CANDO	1	440	$2,639	2.25	1.65
CANDO	26	440	$2,409	3.07	2.25
CANDO	52	440	$2,269	3.93	2.88
CASSELTON	1	263	$2,006	2.24	1.64
CASSELTON	26	263	$1,776	3.49	2.56
CASSELTON	52	263	$1,637	4.38	3.21
CHURCHS FERRY	1	425	$2,455	2.15	1.58
CHURCHS FERRY	26	425	$2,225	2.95	2.17
CHURCHS FERRY	52	425	$2,085	3.74	2.74
CLEVELAND	1	355	$2,313	2.26	1.66
CLEVELAND	26	355	$2,083	3.28	2.41
CLEVELAND	52	355	$1,944	4.09	3
DEVILS LAKE	1	406	$2,386	2.17	1.59
DEVILS LAKE	26	406	$2,156	3.03	2.22
DEVILS LAKE	52	406	$2,017	3.78	2.77
DICKINSON	1	543	$2,929	2.3	1.69
DICKINSON	26	543	$2,699	3.05	2.24
DICKINSON	52	543	$2,560	3.76	2.76
DOYON	1	390	$2,334	2.2	1.61
DOYON	26	390	$2,104	3.11	2.28
DOYON	52	390	$1,965	3.84	2.81
EDINBURG	1	387	$2,268	2.06	1.51
EDINBURG	26	387	$2,038	2.85	2.09
EDINBURG	52	387	$1,900	3.66	2.68
ELDRIDGE	1	342	$2,274	2.29	1.68
ELDRIDGE	26	342	$2,044	3.37	2.47

Table 8 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Minneapolis by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
ELDRIDGE	52	342	$1,905	4.16	3.05
EPPING	1	575	$3,612	2.58	1.89
EPPING	26	575	$3,382	3.35	2.45
EPPING	52	575	$3,243	4.41	3.23
FARGO	1	244	$1,846	2.16	1.58
FARGO	26	244	$1,616	3.46	2.54
FARGO	52	244	$1,477	4.23	3.1
GARDNER	1	265	$1,915	2.13	1.56
GARDNER	26	265	$1,685	3.28	2.41
GARDNER	52	265	$1,546	4.1	3.01
GLADSTONE	1	531	$2,939	2.22	1.63
GLADSTONE	26	531	$2,709	2.89	2.12
GLADSTONE	52	531	$2,570	3.76	2.75
GLEN ULLIN	1	490	$2,796	2.26	1.66
GLEN ULLIN	26	490	$2,566	3.03	2.22
GLEN ULLIN	52	490	$2,427	3.85	2.82
GLENFIELD	1	337	$3,494	3.3	2.42
GLENFIELD	26	337	$3,264	4.86	3.57
GLENFIELD	52	337	$3,124	6.64	4.87
GRACE CITY	1	350	$2,481	2.28	1.67
GRACE CITY	26	350	$2,251	3.22	2.36
GRACE CITY	52	350	$2,112	4.33	3.18
GRAND FORKS	1	323	$1,937	2.01	1.48
GRAND FORKS	26	323	$1,707	2.97	2.18
GRAND FORKS	52	323	$1,568	3.6	2.64
HAMBERG	1	387	$2,814	2.41	1.77
HAMBERG	26	387	$2,584	3.31	2.43
HAMBERG	52	387	$2,445	4.57	3.35
HAMLET	1	573	$3,678	2.64	1.94
HAMLET	26	573	$3,448	3.43	2.51
HAMLET	52	573	$3,308	4.51	3.31
HANNAFORD	1	317	$2,279	2.25	1.65
HANNAFORD	26	317	$2,049	3.27	2.39
HANNAFORD	52	317	$1,910	4.3	3.15
HARWOOD	1	253	$1,899	2.17	1.59
HARWOOD	26	253	$1,669	3.43	2.51
HARWOOD	52	253	$1,530	4.24	3.11

Table 8 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Minneapolis by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
HEBRON	1	502	$2,831	2.24	1.65
HEBRON	26	502	$2,601	2.98	2.18
HEBRON	52	502	$2,462	3.81	2.79
HENSLER	1	484	$2,879	2.36	1.73
HENSLER	26	484	$2,649	3.17	2.33
HENSLER	52	484	$2,510	4.03	2.95
HETTINGER	1	498	$2,848	2.18	1.6
HETTINGER	26	498	$2,618	2.85	2.09
HETTINGER	52	498	$2,479	3.79	2.78
HILLSBORO	1	363	$1,926	1.84	1.35
HILLSBORO	26	363	$1,696	2.56	1.88
HILLSBORO	52	363	$1,557	3.19	2.34
JAMESTOWN	1	336	$2,274	2.32	1.7
JAMESTOWN	26	336	$2,044	3.45	2.53
JAMESTOWN	52	336	$1,905	4.23	3.1
KELSO	1	369	$1,926	1.81	1.33
KELSO	26	369	$1,696	2.51	1.84
KELSO	52	369	$1,557	3.14	2.3
LAKOTA	1	381	$2,280	2.18	1.6
LAKOTA	26	381	$2,050	3.12	2.29
LAKOTA	52	381	$1,911	3.82	2.8
LARIMORE	1	351	$2,140	2.09	1.53
LARIMORE	26	351	$1,910	3	2.2
LARIMORE	52	351	$1,771	3.75	2.75
LEEDS	1	437	$2,562	2.2	1.61
LEEDS	26	437	$2,332	2.99	2.19
LEEDS	52	437	$2,192	3.82	2.8
LUVERNE	1	304	$2,257	2.29	1.68
LUVERNE	26	304	$2,027	3.39	2.48
LUVERNE	52	304	$1,887	4.41	3.24
MEDINA	1	364	$2,340	2.25	1.65
MEDINA	26	364	$2,110	3.22	2.36
MEDINA	52	364	$1,971	4.05	2.97
MILTON	1	399	$2,338	2.07	1.52
MILTON	26	399	$2,108	2.84	2.08
MILTON	52	399	$1,969	3.68	2.7
MINOT	1	472	$3,290	2.81	2.06

Table 8 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Minneapolis by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
MINOT	26	472	$3,060	3.9	2.86
MINOT	52	472	$2,921	4.86	3.56
MINTO	1	356	$2,001	1.93	1.42
MINTO	26	356	$1,771	2.74	2.01
MINTO	52	356	$1,632	3.41	2.5
NEW ROCKFORD	1	368	$2,611	2.32	1.7
NEW ROCKFORD	26	368	$2,381	3.22	2.36
NEW ROCKFORD	52	368	$2,242	4.39	3.22
NEW SALEM	1	469	$2,689	2.26	1.66
NEW SALEM	26	469	$2,459	3.07	2.25
NEW SALEM	52	469	$2,320	3.85	2.82
NIAGARA	1	404	$2,183	2	1.46
NIAGARA	26	404	$1,953	2.76	2.03
NIAGARA	52	404	$1,814	3.42	2.51
NORTHGATE	1	550	$3,472	2.59	1.9
NORTHGATE	26	550	$3,242	3.39	2.49
NORTHGATE	52	550	$3,103	4.41	3.24
NORWICH	1	481	$3,133	2.63	1.93
NORWICH	26	481	$2,903	3.61	2.65
NORWICH	52	481	$2,764	4.51	3.3
PALERMO	1	518	$3,473	2.73	2
PALERMO	26	518	$3,243	3.66	2.68
PALERMO	52	518	$3,104	4.69	3.44
PEAK	1	296	$2,119	2.19	1.6
PEAK	26	296	$1,889	3.25	2.38
PEAK	52	296	$1,749	4.19	3.07
PETERSBURG	1	398	$2,244	2.08	1.52
PETERSBURG	26	398	$2,014	2.9	2.13
PETERSBURG	52	398	$1,875	3.59	2.63
PILLSBURY	1	297	$2,194	2.26	1.66
PILLSBURY	26	297	$1,963	3.36	2.47
PILLSBURY	52	297	$1,824	4.36	3.2
POWERS LAKE	1	552	$3,558	2.64	1.94
POWERS LAKE	26	552	$3,328	3.47	2.54
POWERS LAKE	52	552	$3,189	4.52	3.31
PROSPER	1	256	$1,980	2.25	1.65
PROSPER	26	256	$1,749	3.54	2.6

Table 8 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Minneapolis by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
PROSPER	52	256	$1,610	4.41	3.23
RAY	1	565	$3,588	2.61	1.91
RAY	26	565	$3,358	3.4	2.49
RAY	52	565	$3,219	4.46	3.27
REEDER	1	516	$2,892	2.15	1.58
REEDER	26	516	$2,662	2.78	2.04
REEDER	52	516	$2,523	3.73	2.73
REYNOLDS	1	344	$1,926	1.91	1.4
REYNOLDS	26	344	$1,696	2.73	2
REYNOLDS	52	344	$1,557	3.36	2.46
RHAME	1	552	$3,020	2.12	1.56
RICHARDTON	1	517	$2,888	2.23	1.64
RICHARDTON	26	517	$2,658	2.93	2.15
RICHARDTON	52	517	$2,519	3.78	2.77
ROSS	1	533	$3,511	2.69	1.97
ROSS	26	533	$3,281	3.57	2.62
ROSS	52	533	$3,142	4.61	3.38
RUGBY	1	527	$2,668	2.06	1.51
RUGBY	26	527	$2,437	2.69	1.97
RUGBY	52	527	$2,298	3.41	2.5
SCRANTON	1	527	$2,934	2.14	1.57
SCRANTON	26	527	$2,704	2.76	2.02
SCRANTON	52	527	$2,565	3.71	2.72
SELZ	1	406	$2,884	2.38	1.75
SELZ	26	406	$2,654	3.23	2.37
SELZ	52	406	$2,515	4.49	3.29
SPIRITWOOD	1	325	$2,246	2.18	1.6
SPIRITWOOD	26	325	$2,016	3.13	2.29
SPIRITWOOD	52	325	$1,877	4.13	3.03
STANLEY	1	526	$3,492	2.71	1.98
STANLEY	26	526	$3,262	3.61	2.65
STANLEY	52	526	$3,123	4.65	3.41
STEELE	1	392	$2,450	2.22	1.63
STEELE	26	392	$2,220	3.1	2.27
STEELE	52	392	$2,081	3.98	2.91
STERLING	1	411	$2,507	2.19	1.61
STERLING	26	411	$2,277	3.01	2.2

Table 8 Revenue-Cost Ratios for BNSF Wheat Shipments from North Dakota to Minneapolis by Station and Service Level					
Station	Cars	Loaded Trip Distance	Rate Per Car	Revenue-Variable Cost Ratio	Revenue-Fully Allocated Cost Ratio
STERLING	52	411	$2,138	3.9	2.86
SUTTON	1	330	$2,370	2.27	1.67
SUTTON	26	330	$2,140	3.26	2.39
SUTTON	52	330	$2,001	4.34	3.18
TAPPEN	1	379	$2,410	2.24	1.64
TAPPEN	26	379	$2,180	3.17	2.33
TAPPEN	52	379	$2,040	4.03	2.95
THOMPSON	1	337	$1,937	1.95	1.43
THOMPSON	26	337	$1,707	2.82	2.07
THOMPSON	52	337	$1,568	3.45	2.53
VALLEY CITY	1	301	$2,124	2.17	1.59
VALLEY CITY	26	301	$1,894	3.2	2.34
VALLEY CITY	52	301	$1,755	4.14	3.04
WAHPETON	1	286	$1,745	1.84	1.35
WAHPETON	26	286	$1,515	2.71	1.99
WAHPETON	52	286	$1,376	3.41	2.5
WEST FARGO	1	248	$1,846	2.14	1.57
WEST FARGO	26	248	$1,616	3.39	2.49
WEST FARGO	52	248	$1,477	4.17	3.05
WHEATLAND	1	269	$2,028	2.23	1.64
WHEATLAND	26	269	$1,798	3.44	2.52
WHEATLAND	52	269	$1,659	4.34	3.18
WILLISTON	1	592	$3,655	2.73	2
WILLISTON	26	592	$3,425	3.59	2.63
WILLISTON	52	592	$3,286	4.47	3.28
WILLOW CITY	1	548	$2,775	2.07	1.52
WILLOW CITY	26	548	$2,544	2.67	1.96
WILLOW CITY	52	548	$2,405	3.43	2.52
WINDSOR	1	351	$2,303	2.27	1.67
WINDSOR	26	351	$2,073	3.31	2.43
WINDSOR	52	351	$1,933	4.11	3.01
YORK	1	548	$2,592	1.94	1.42
YORK	26	548	$2,361	2.48	1.82
YORK	52	548	$2,222	3.17	2.33
ZAHL	1	602	$3,687	2.53	1.86
ZAHL	26	602	$3,457	3.23	2.37
ZAHL	52	602	$3,318	4.31	3.16

CAVEATS REGARDING REVENUE-COST ESTIMATES

The shipment costs reflected in Tables 4-9 are based on limited public information. Logical train operating assumptions have been drawn from traffic and network data. A strong effort has been made to account for inefficiencies in origin train movements as a result of way train operations over North Dakota's extensive branch-line network. However, several caveats should be considered when evaluating the results of the analysis.

1. Car ownership costs assume efficient car-day cycles based on typical time requirements for activities such as loading, unloading, switching, and running. In general, these car-day estimates reflect average uncongested conditions. Dwell times for cars in specific yards (such as Northtown and Pasco) may exceed the URCS average. Each covered hopper car day adds $13.23 to the estimated shipment cost.

2. The number of intertrain or intratrain switches required for a non-unit train shipment may vary for individual movements. Each intratrain or intertrain switch adds approximately $23 to the variable shipment cost.[18]

3. Shipments from North Dakota to the PNW may be destined for locations other than Portland. The variable costs of movements to Kalama, Longview, Tacoma, or Seattle will be different from the estimated costs to Portland, although the rate is the same for these destinations. Generally, distances from North Dakota stations to Seattle and Tacoma are shorter than distances from North Dakota stations to Portland.[19] In

[18]This unit cost includes both car ownership and locomotive switching expenses.

[19]These distance comparisons are based on the shortest BNSF routes.

comparison, distances from North Dakota stations to Kalama and Longview are farther than distances from North Dakota stations to Portland.

4. Variable and fully allocated costs for branch-line stations do not reflect normal track maintenance costs or reinvestment needs. The URCS gross ton-mile cost assigns system average track maintenance expenses to each movement based on the weight of the car and its contents. The BNSF does not realize significant economies of density on branch lines with light traffic densities – e.g., less than 1 million gross ton-miles per mile. Most of the maintenance and reinvestment needs on these lines are incurred for a minimal level of traffic. For these reasons, the revenue-cost ratios for branch-line stations may present an inflated picture of profitability. A railroad must recover its long-run track maintenance costs in order to justify reinvestment in branch lines. Theoretically, it is possible to compute a high revenue-variable cost ratio for a shipper located on a marginally profitable or unprofitable branch line. This anomaly should be considered when evaluating the revenue-cost ratios and descriptions of profits presented in this statement.

5. Revenue-cost ratios are computed for all stations listed in the BNSF public tariff. The fact that a station is listed in the tariff does not necessarily mean that wheat shipments to Portland or Minneapolis originated from that station. The summary revenue-cost statistics presented in Tables 3 and 6 are unweighted averages for all stations listed in BNSF's tariffs. Because of time lags in the collection of monthly grain movement data from elevators, it is not possible to compute current weighted-average RVC ratios. If the RVC ratios are weighted by actual shipments made during March 2002, or any subsequent month, these weighted values may differ from the simple means shown in

Tables 3 and 6. However, the waybill revenue-cost ratios shown in Tables 1 and 2 **are** weighted by the shipments that occurred in 2000. The revenue-cost ratios derived from the waybill sample are quite similar to the ones computed using current BNSF rates and specific operational parameters. For example, Table 2 shows that the weighted-average RVC ratios computed from the waybill sample are 2.38, 3.00, and 4.16 for wheat movements to Minneapolis in 1-car, 26-car, and 52-car consignments. The comparable RVC ratios computed from current rates are 2.26, 3.15, and 4.04, respectively (Table 6).

6. The current BNSF tariff may reflect rate anomalies as a result of balancing rates between eastern and western markets. Thus, unusual revenue-cost ratios may exist for individual stations such as Glenfield. Moreover, the current rate structure is a "snapshot in time." The results of this study are best interpreted by considering both the current and historical waybill revenue-cost ratios.

PLACING REVENUE-TO-VARIABLE COST RATIOS IN THE CONTEXT OF RATE REASONABLENESS

In order to understand the meaning of the revenue-to-variable cost ratios presented in the previous sections, it is useful to examine simplified rate reasonableness guidelines used by the Surface Transportation Board.[20] These guidelines provide insight into equity considerations and revenue adequacy considerations that should be taken into account when making an assessment of the magnitude of a particular rail rate.

[20]Ex Parte 347(Sub-No. 2), "Rate Guidelines–Non-Coal Proceedings," decided December 27, 1996.

Although a revenue-to-variable cost ratio of 180 percent is often used as a baseline for comparison, rail rates above the 180 percent of variable costs are not necessarily unreasonable. The 180 percent of variable cost figure comes from a Congressional determination that rates exceeding this level can be examined for market dominance. That is, if a rail rate exceeds 180 percent of variable costs, then the shipper can try to establish market dominance by examining the extent of intramodal and intermodal competition. If a rate above 180 percent is shown, and it is shown that intramodal and intermodal competition do not serve to effectively discipline rates, then market dominance is established. Subsequently, the Surface Transportation Board examines other measures in making an assessment of whether or not rates are reasonable.

In its simplified rail rate guidelines, the Surface Transportation Board uses three measures to establish the reasonableness of a rail rate. These measures consider the equity of similarly situated shippers, the revenue adequacy needs of the railroad, and the reasonableness of the carrier's revenue requirements borne by a shipper or group of shippers. The three measures include: the revenue shortfall allocation method (RSAM), the average revenue-to-variable cost percentage for all shipments with revenue-to-variable cost percentages above 180 ($RVC_{>180}$), and the average revenue-to-variable cost ratio on comparable shipments (RVC_{COMP}). The following paragraphs will describe the rationale for each of these measures, show the magnitude of each of these for the BNSF, and compare the revenue-to-variable cost ratios previously shown to the BNSF measures.

As recognized by the Surface Transportation Board, none of these measures can be used alone to make an assessment of whether a rate is reasonable, but in combination they provide a good baseline for examining the level of various rates. RSAM measures the uniform markup

above variable cost that would be needed from every shipper of potentially captive traffic (traffic with revenue-to-variable cost ratios above 180 percent) in order for the carrier to recover all of its costs.[21] The RSAM recognizes the need for differential pricing by the railroad, and the railroad's need for revenue adequacy.

$RVC_{>180}$ measures the average markup for all of the railroad's traffic that moves at rates exceeding variable costs by 180 percent or more. The idea behind the $RVC_{>180}$ measure is that a particular shipper should not be bearing an unreasonable share of the carrier's revenue requirements relative to other potentially captive traffic. Moreover, an interesting comparison between the $RVC_{>180}$ and the RSAM can be made. An $RVC_{>180}$ that exceeds the RSAM suggests that the railroad is meeting its revenue adequacy requirements. Such a finding may be further justification for a rate reduction.

RVC_{COMP} measures the average markup on traffic of similar commodities moving under similar transportation conditions. It is designed to serve as a comparison with traffic that has a similar elasticity of demand. The idea is that a shipper should not be penalized for being on a railroad that has higher revenue needs from its potentially captive traffic. Because of the short time frame for performing this analysis, we are not able to provide revenue-to-variable cost ratios for comparable traffic in this statement.

Table 9 shows the RSAM and the $RVC_{>180}$ for the BNSF in the most recent four years calculated by the STB. In the RSAM column, there are two numbers listed. The difference between the two columns is an efficiency adjustment. The first column, which includes an

[21]The three measure definitions are those specified by the Surface Transportation Board in Ex Parte 347 (Sub-No. 2).

efficiency adjustment, eliminates all movements that have revenues of less than URCS variable costs in calculating the revenue shortfall that must be paid by captive shippers. The rationale for this adjustment is that captive shippers should not be forced to cross-subsidize shipments that are not earning their attributable costs. The second column does not include any such adjustment. The size of the adjustment that should be used is an empirical question. The American Association of Railroads (AAR) argues that the adjustment is too large, with URCS variable costs reflecting some unattributable costs, while many shippers argue that the full adjustment serves as a proxy for railroad inefficiencies. The STB suggests that a number between the adjusted and the unadjusted is appropriate, since there are assets in the railroad industry that would not warrant replacement when they become unusable.

Table 9: BNSF RSAM and for the 4 Years Most Recently Computed by the STB		
Year	**RSAM**	**$RVC_{>180}$**
1996	231-309	262
1997	243-324	262
1998	188-258	266
1999	185-248	263
1996-1999 Average	212-285	263

As Table 9 shows, the RSAM is below average revenue-to-variable cost ratios for North Dakota wheat to many markets, whether an efficiency adjustment is made or not. Moreover, the number of revenue-to-variable cost ratios that exceed the RSAM increases when such an efficiency adjustment is made. Similarly, many North Dakota wheat shipments show revenue-to-variable cost ratios that exceed the average charged by BNSF to potentially captive shippers.

Finally, a comparison between the RSAM and the average revenue-to-variable cost ratio charged to potentially captive shippers by the BNSF shows that in the most recent year, the average revenue-to-variable cost ratio charged to potentially captive shippers exceeds the RSAM with or without the efficiency adjustment. This suggests that BNSF is charging an average rate to its captive shippers that exceeds the average rate necessary for the railroad to cover all of its costs, including a return on investment. This may suggest that the BNSF's rates to some North Dakota shippers exceed reasonable limits.

SUMMARY AND CONCLUSION

In summary, the waybill analysis of revenue-to-variable cost ratios and the analysis of current revenue-to-variable cost ratios for BNSF wheat movements to Portland and Minneapolis paint a similar picture. Both analyses suggest that North Dakota wheat shipments to Portland and Minneapolis are highly profitable for the BNSF. For all service levels in either analysis, the average revenue-to-variable cost ratio to either market is at or above 1.85. Moreover, for all service levels of 26 cars or more to either market, the average revenue-to-variable cost ratios exceed 2.43. For all service levels of 52 cars or more to either market, the average revenue-to-variable cost ratios exceed 2.7.

Revenue-to-variable cost ratios at this level appear high when one considers them in the context of the STB's simplified rate reasonableness guidelines. In 1999, the RSAM – which shows the average markup above variable cost that would be needed from every shipper of potentially captive traffic in order for the carrier to recover all of its costs – for the BNSF was between 1.85 and 2.48. Thus, North Dakota wheat shippers are paying more than one might expect, given the revenue adequacy needs of the BNSF. Moreover, the average rate paid by potentially captive shippers on the BNSF system was 263 percent of variable costs in 1999. The fact that this is higher than the RSAM for the BNSF in the same year suggests that the BNSF is charging a rate to its potentially captive shippers on average that is higher than the rate necessary to achieve revenue adequacy. However, high revenue-cost ratios must be considered within the context of railroad productivity and efficiency gains.

Railroads have become much more productive since deregulation in 1980. Studies by the STB have shown that railroad rates for grain transportation have declined in real terms, while

railroad productivity has grown at one of the highest rates of any industry in the United States. The STB's 2000 rate study shows that revenue per ton for Farm Products shipments in the Western United States dropped by more than 28 percent in constant dollars between 1984-1999, despite an increase in average haul of 17 percent.[22] Specific rate trends could not be developed for North Dakota shipments in time for this statement. However, it is likely that North Dakota wheat rates have also declined in real terms since 1980.

As the cost estimates show, 110-car trains offer a new level of efficiency in long-distance grain transportation. North Dakota elevators that can load 110-car trains within 24 hours will pay much lower freight bills in the future. Moreover, with expedited loading and unloading, and no intermediate yard switching, BNSF can move wheat from eastern North Dakota to the PNW in 4 days. An 8-day car cycle benefits the railroad, shippers, and private car owners. Service and efficiency benefits such as these are important considerations in an evaluation of railroad rates and service levels. Finally, the caveats noted earlier regarding the use of system-average costs should be considered, especially in interpreting the profitability of shipments originated from branch-line stations.

[22]Email communication from William Gelston of Federal Railroad Administration.

TECHNICAL SUPPLEMENT

This section of the report presents a technical description of the Davis Formula and illustrates the calculation of a locomotive adjustment factor for grain trains. The Davis Formula is one method of measuring train and grade resistance and computing locomotive tonnage ratings.

Train resistance is measured in pounds per ton. It reflects many forces such as: (1) rolling resistance, (2) flange resistance, (3) journal (axle) resistance, (4) track resistance, (5) air resistance, and (6) curve resistance. The Davis Formula is an empirically derived equation of the form:

$$R = 1.3 + \frac{29}{w} + bv + \frac{cav^2}{wn}$$

where:

R = train resistance in lb/ton
w = axle weight of a locomotive or car (in tons)
n = number of axles
a = cross-sectional area of a locomotive or car (in square-feet)
b = coefficient that defines speed-dependent resistance
c = streamlining coefficient used to define resistance that varies with the square of speed
v = train speed in mph

The Davis Formula is often adjusted to reflect modern axle types and car dimensions. The results obtained from applying the original formula can be multiplied by a K-factor of .85 to better represent modern equipment and operating characteristics.

Table 10 illustrates the calculation of the train resistance factor for a loaded covered hopper car at a velocity of 20 mph. Table 11 shows the calculation of the train resistance factor for an empty covered hopper car at the same speed, while Table 12 shows the calculation of

locomotive resistance. These resistance factors are used in Table 13 to estimate the tonnage ratings of 4,400-hp and 3,000-hp locomotives in unit train and grain train service, respectively, on a moderate .5 percent grade. The most important aspect of this calculation is the ratio of the number of 3,000-hp units required for a grain train versus the number of 4,400-hp units required for a unit train. This ratio of 1.28 is applied to the system average BNSF unit-train power requirement of 2.784 locomotives to derive the number of units needed for a 100-car grain train (3.55).

Table 10. Calculation of Train Resistance for Loaded 286,000-pound Covered Hopper Car

Factor	Value
Gross car weight	143
w	35.75
n	4
v	20
v2	400
a	125
b	0.045
c	0.0005
cav2	25
wn	143
Unadjusted result	3.19
K-factor	0.85
Adjusted result	2.71

Table 11. Calculation of Train Resistance for Empty Covered Hopper Car	
Factor	**Value**
Gross car weight	32
w	8
n	4
v	20
v2	400
a	125
b	0.045
c	0.0005
cav2	25
wn	32
Unadjusted result	6.61
K-factor	0.85
Adjusted result	5.62

Table 12. Calculation of Train Resistance for 195-Ton 6-Axle Locomotive	
Factor	**Value**
Gross weight	195
w	32.5
n	6
v	20
v2	400
a	120
b	0.03
c	0.0017
cav2	81.6
wn	195
Unadjusted result	3.21

Table 13. Calculation of Power Requirements for a 110-Car Unit Train and a 100-Car Grain Train on Moderate Grades		
Factor	**Unit Train**	**Grain Train**
Normal Car Resistance / Ton	2.71	2.74
Percent Grade	0.5	0.5
Car Grade Resistance / Ton	10	10
Total Car Resistance per Ton	12.71	12.74
Locomotive Resistance / Ton	3.21	3.21
Locomotive Weight	195	195
Locomotive Resistance	626.1	626.1
Locomotive Grade Resistance	1,950	1,950
Total Locomotive Resistance	2,576	2,576
Locomotive Horsepower	4,400	3,000
Minimum Grade Speed	20	20
Tractive Effort	67,760	46,200
Locomotive Drawbar Force	65,184	43,624
Tonnage Rating per Unit	5,129	3,423
Tons in Train	15730	13450
Power Units per Train	3.07	3.93

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