FEASIBILITY OF THE COOPERATIVE SUBTERMINAL: A CASE STUDY OF BISBEE, NORTH DAKOTA

By

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NORTH DAKOTA
DEPARTMENT OF AGRICULTURE

KENT JONES
COMMISSIONER

Dear North Dakotans:

North Dakota's farms and ranches are known the world over for their food producing capabilities. Each year they rank near the top in the production of spring wheat, durum wheat, sunflowers, barley, flax, rye, oats, sugar beets and dry edible beans. North Dakota has achieved this status and reputation through the great record of productivity of its agricultural machine, the backbone of the state's economy.

Although North Dakota is in the heart of food producing country, a geographic wrinkle of fate and the impairment of the Missouri River as a navigable waterway have left the state landlocked and captive. Because of its distance from the major population centers of the United States, and being far from the deepwater ports which serve an expanding export market, the enormous amount of food produced in North Dakota each year must be moved by truck, rail, and barge to where it will ultimately be exported for worldwide consumption.

This lack of proximity to the dinner tables at which the food is consumed makes transportation, especially the railroads, a vital link in the North Dakota food chain.

Through the years, North Dakota agriculture has changed dramatically. Where once over 86,000 farmers worked the land, now there are only 38,000 and they produce many more times the amount of food.

Recent years have seen great changes in North Dakota transportation and marketing procedures. Rail deregulation, rail branchline abandonments, increased fuel costs, etc., have all played a part in forcing North Dakota shippers to look more closely at their transportation and marketing needs for the future.

Against this backdrop, the North Dakota Department of Agriculture decided to play a lead role in helping North Dakota farmers and their elevators to decide how best to participate in these changes. In early 1981, the Department submitted a proposal to the United States Department of Agriculture's Office of Transportation to select and study a site in North Dakota for a potential subterminal elevator. Such a facility would be designed to take advantage of multiple car rates and the resulting savings in transportation costs. In addition,

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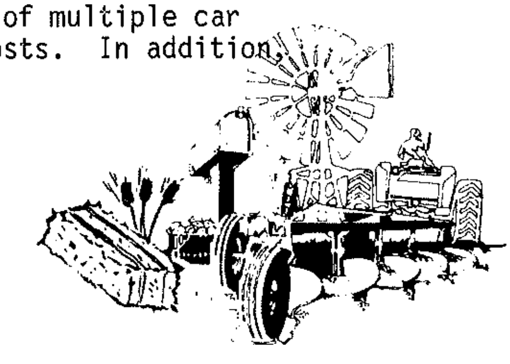

the potential for using a trucking cooperative in gathering the grain from surrounding elevators would be investigated, as well. The methods and results of this study would then be available for use by each elevator manager, elevator board, and farmer throughout the state in taking stock of their particular transportation situation, to assist in making some difficult decisions.

North Dakota agriculture has changed in the last fifty years, and North Dakota's agricultural transportation scene is undergoing a similar transformation. We need to enter into such a revolution with our eyes wide open and with access to as much information as possible to make the decisions and choices necessary for planning the future.

This study, although it assessed some alternatives, does not cover all possibilities or assess other issues such as rate spreads and their resulting economic and social impact, and the impact of a changing merchandising system.

It is my hope, however, that this study, complemented by other available data, can provide some answers and food for thought leading to an improved transportation system for our commodities and an increased access to the new, expanding markets that promise prosperity for our state's farmers and ranchers.

Sincerely,

Kent Jones
Commissioner

KJ:ju

EXECUTIVE SUMMARY

This report set about to examine as a case study the economic feasibility of a cooperatively-owned subterminal for a specific site in North Dakota, as well as the potential of a cooperatively-owned trucking fleet.

Kent Jones, North Dakota Commissioner of Agriculture, felt the study was important because significant changes are occurring in the North Dakota marketing and transportation system.

In 1981, Burlington Northern announced that a number of North Dakota rail lines were being abandoned. Further, during the course of the past year, railroads have announced a number of multiple car and unit train rate reductions that hold the potential of future benefits to those shippers with a large volume subterminal. The U.S. Department of Agriculture, at the same time, initiated a program to look at the feasibility of a cooperative based transportation entity that might serve the needs of rural America as it continued to face a reduction in services. This study is based on that premise.

Recommendations included herein are the result of a case study of the economic feasibility of a subterminal for the Bisbee, North Dakota area. The analytical method used was to calculate and compare the total marketing costs under three different scenarios: the existing system (Chapter IV), the existing system modified by expected rail line abandonment (Chapter V), and a cooperative subterminal system (Chapter V). Four sizes of subterminals were considered, including both 26 car loading facilities and 52 car loading elevators.

Cost analysis of various subterminal elevator configurations revealed that a subterminal is potentially feasible for the Bisbee area. Total per bushel marketing costs (farm gate to terminal market costs) of the subterminal alternative were two to four cents higher than the present system, but included double handling of grain through all of the existing country elevators. These country elevators contributed approximately 13 cents per bushel to the total cost. Eliminating this double handling charge from at least a portion of the existing elevators would lower total marketing costs below costs of the present system.

The appropriate size subterminal to build depended on the volume of grain available. If the total volume identified for the 14 elevators considered was available (11 million bushels), a new 500,000 bushel capacity subterminal should be constructed. If no volume committment can be attained from participating elevators, or if geographical competitive factors limit the volume of available grain, cost analysis supports upgrading one of the existing elevators to 26 car loading capabilities. At the lower volume, construction of the larger subterminal would be financially disastrous due to high fixed costs per bushel.

Further analysis showed that economic feasiblity will be greater if 52 car rates are used 100 percent of the time, and if trucks are not used for long distance movement. It was found that a cooperative trucking fleet, brokerage activities and long-term trucking contracts may be activities complementary to a subterminal.

Specific recommendations include:

1) construct a standard quality subterminal of 500,000 bushel capacity if a large annual volume committment from all area elevators can be realized. Otherwise upgrade one of the existing elevators to a 26 car loading facility.

2) monitor the trade area for potential mergers or other co-operative arrangements.

3) seriously consider the development of a cooperative trucking fleet and make arrangements for the subterminal to serve as a transportation service broker in the local area. Contracts for truck service may also be beneficial to both the elevator and community.

4) do not develop a short line cooperative railroad.

5) maximize the proportion of grain moving under multiple car rates (52 car rate if the larger subterminal is built, 26 car rate if an existing elevator is upgraded).

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CHAPTER I

HISTORICAL BACKGROUND AND INTRODUCTION

> .....you will undoubtedly discover that a history of North Dakota transportation is really a history of the state itself. Whereas states along the eastern seaboard had been settled for 200 years before the whistle of a steamboat or a locomotive was heard, rails stretched across Dakota Territory before there were any towns to serve. The development of agriculture was an immediate necessity if railroads were to survive....
>
> "West of the Red"
> Richard Schneider

The interrelationship between transportation and agriculture has not diminished. The economy of North Dakota is agriculture based and agriculture is directly dependent on transportation. The grain transportation and marketing system is undergoing significant changes -- changes that will require decisions by producers, elevator managers and/or boards of directors, transportation companies and marketers.

Historical Development

The advent of the Northern Pacific land grant in 1871 was the initital impetus for development of agriculture in North Dakota. However, it was not an immediate success. The land grant (almost 23 percent of the total area of the state), while designed to help defray the cost of building a railway, did not stop the Northern Pacific from going bankrupt in the financial panic of 1873. The granted acreage did however, allow for conversion of some of the bonds. The shareholders developed large "bonanza farms" as a means of encouraging settlement and improving the fertility of the soil in North Dakota.

Production from these farms helped to make the Northern Pacific solvent once again. Because of crop disasters and financial problems, the Red River Valley bonanza farms were soon replaced by smaller owner-operator units. Farmers were able to purchase land from the Northern Pacific land grants, and via the Pre-emption Act they could purchase land direct from the Federal Government. Individual producers' land grants were also available from the Homestead Act and Timber Culture Act.

Wheat was and is the mainstay of the agricultural economy in the state. Durum and hard red spring wheat, suited to this semiarid portion of the 'Great American Desert', became a cornerstone for the developing flour mill industry in Minneapolis/St. Paul, which further encouraged settlement of the lands in central and western North Dakota. Wheat was the 'raison d'etre' of North Dakota farming in the late 1800's and early 1900's.

The transportation of early North Dakota products was based on steamboat and Red River Cart. However, the total development of North Dakota agriculture had to wait until the Northern Pacific completed its transcontinental linkup, and built some branchlines into the Missouri plateau. Concurrently, the Great Northern was developing its lines across the northern counties of North Dakota. The Soo Line, owned and financed by the Canadian Pacific, also moved into eastern and central North Dakota, providing competition at various locations for both the Great Northern and the Northern Pacific. Later, the

Milwaukee Road and the Chicago and Northwestern provided service to the western and extreme southern portions of the state.

In 1905 the Soo Line (Minneapolis, St. Paul and Sault Sainte Marie) engaged in a railway war with James J. Hill's Great Northern Railway. The Soo Line built a railroad across the northern counties paralleling the existing Great Northern line about twenty-five miles to the north. The Great Northern responded by platting new towns and building new branchlines into the area north of their main line, resulting in nearly five hundred miles of new track and more than fifty new towns between the Red River Valley and Kramer, North Dakota.

The development of this northern railroad system typifies the pattern of elevator construction throughout the state. Railroads would develop branchlines or put in elevator sidings when competition between railroads forced them into it. This intramodal competition and the distance horses and wagons could travel in a day resulted in elevator construction every six to nine miles. Most of the elevators were small and in many areas too numerous. For example, five elevators were built in Thorne, North Dakota in 1905.

Resultant Marketing System

North Dakota underwent the same trials of drought, depression and population decrease from 1910 to the 1950's as did much of rural America. However, the economy of North Dakota, as well as a few other rural areas, became increasingly dependent on agriculture while the economy of the entire United States became more industrialized and non-agriculture based.

The continuing theme was that of isolation from markets by long distance and market power held by railroads, elevator companies and flour millers. Although the railroads had been brought under economic regulation due to farmer-based protests and litigation, the North Dakota producer was still extremely dependent on railroad service and rates. In many situations the marketing system was rendered impotent by lack of available railcars.

By 1950 North Dakota farmers, aware of the extreme seasonality of production, utilized U.S. Department of Agriculture assistance to build a large on-farm storage system to compete with the private elevator companies. This movement toward on-farm storage was also brought about by the farmers' continuing distrust of big business as well as a noticeable desire for freedom and independence.

The elevator system by this time had undergone some consolidation of private companies, but the biggest change was the strength and number of cooperatively-owned elevators in the state. The cooperative philosophy that spurred development of the Non-Partisan League, the State Mill and Elevator, State Bank of North Dakota, etc., also stimulated the use of cooperatives as a means of obtaining market power. Trading activities, farm supply stores, and even social structures of the rural areas became entwined with and dependent on the cooperative philosophy.

The major markets for grain production continued to be Minneapolis/ St. Paul, whether the grain was domestic or export bound. The domestic markets relied heavily on the milling of wheat for flour while much of the barley moving to the east was bound for malting plants. So, at this time the marketing of wheat was dependent, price and end-use, on the Minneapolis/St. Paul markets.

Early Changes in Structure

North Dakota's grain marketing, transportation and handling system had remained somewhat traditional until the early 1950's. Grain moved from the farm to country elevators by horse and grain wagon in the very early years of settlement and later in small farm trucks. Grain was sold on a cash basis or stored by the producer in commercial storage. Grain was shipped from country elevators to the Minneapolis/St. Paul terminal and later to the Duluth/Superior market almost exclusively by rail until the mid 1950's.

The development of the St. Lawrence Seaway and the advent of over-the-road trucking in the late 50's and early 60's had a significant impact on the North Dakota grain transportation and merchandising system. The development of the Seaway provided an export market for North Dakota grain, which eventually led to Duluth/Superior being the dominant market for North Dakota grain. The advent of exempt (free of Interstate Commerce Commission regulation of entry and rates) trucking of grain to terminal markets had a dramatic effect on both the modal share of grain movement and rail rates. Until trucks provided a form of intermodal competition for the movement of grain, only two rail rates existed for moving grain to Minneapolis/St. Paul and Duluth/Superior--one for flaxseed and one for all other grains. Both rates were at the maximum level allowed by the Interstate Commerce Commission. However, truck competition began in the mid 1950's and accounted for 4.8 percent of the movements to the markets in 1956-57, forcing the railroads to reduce their rates on wheat to Minneapolis/St. Paul and Duluth/Superior. Trucks continued to increase their share of the modal split and in 1963-64 accounted for 21 percent of the movement. The railroads reduced their wheat rates in 1963 to counter this diversion of traffic from rail to truck.

North Dakota's markets for grain consisted primarily of domestic markets which were served by Minneapolis/St. Paul and Duluth/Superior until the mid and late 1960's. The development of export markets for U.S. grain led to new ports and dramatically changed the merchandising of North Dakota wheat. Wheat which was at one time dominated by domestic demand would eventually be influenced by export demand to such an extent that the domestic market would become secondary in importance in terms of total demand for U.S. wheat.

With the development of export markets for wheat, Duluth/Superior became the single largest market for North Dakota grain. Duluth grew to such an extent that it accounted for 50 percent of the hard red spring wheat movement and 65 percent of the durum wheat movement in the 1975-80 time period.

The Pacific Northwest market for hard red spring wheat was also developed as a result of growing export demand. Japanese demand for hard red spring wheat grew, the Pacific Northwest market developed, and the North Dakota railroads implemented a rate structure which encouraged westward movement. The original rate structure, developed in the mid 1960's, was inverse in nature. In other words, as distance from the market increased, the rate decreased. This rate structure was eventually replaced by a flat rate which meant that all stations, regardless of distance, paid the same rate. The Pacific Northwest market grew and now accounts for 20 percent of the North Dakota hard red spring marketings.

New crops have recently developed in the 1970's primarily consisting of sunflowers and, to a lesser extent, corn. These new crops have provided North Dakota producers with production alternatives to wheat and barley, and have resulted in changing transportation and merchandising demands.

Recent Changes

Country elevator facilities, like all other forms of capital, are subject to physical depreciation and eventually heavy maintenance or replacement must be undertaken if the country merchandising business is to remain viable. The average age of elevator facilities in North Dakota is 25 years with over 30 percent of the facilities being over 50 years old. Thus, many of the facilities in North Dakota soon need to be replaced, or a heavy maintenance program implemented. Considerations about future changes and trends become important decision variables when such investment decisions are made. Country merchandising companies in North Dakota must consider recent trends of grain merchandising and transportation and future implications when making new investment decisions. The implication is that, because of recent changes, elevators may choose to become larger operators or to go out of business rather than maintain the 'status quo'.

One of the recent changes in the grain transportation and merchandising system is the competitive relationship between competing producing regions, resulting in a changing rate structure on wheat westbound from North Dakota. The Union Pacific Railroad established rates to the Pacific Northwest from the hard red winter wheat producing region of Nebraska, Kansas, Colorado and Wyoming which were significantly less (30-50 cents per cwt.) than northern rates to the same export location.

The result of such a differential depends on the substitutability of the North Dakota produced hard red spring and southern hard red winter wheat. North Dakotans demanded a similar rate structure because it is thought that there does exist some, if not a great deal, of substitutability between the two wheats. Additionally, truck competition faced by railroads in Montana for westbound hard red winter wheat, and percentage rate increases which change market relationships, led to implementation of a reduced westbound multi-car and unit train wheat rate. Single car rates from North Dakota and Montana were also reduced. This type of rate structure and associated merchandising was totally new to North Dakota and an adjustment process was necessary.

To remain competitive the eastern markets of Minneapolis/St. Paul and Duluth/Superior requested similar rates as a result of the implementation of westbound multi-car and unit train rates. Similar rates have been implemented eastbound as a result of this demand, resulting in transportation and merchandising requirements radically different from those associated with the traditional system. The traditional merchandising and transportation system was typified by the single carload of grain which held approximately 1800 bushels in boxcars and 3300 bushels in covered hopper cars. The 26 car movement represents approximately an 85,000 bushel trade, and the 52-car unit train represents double that or about 170,000 bushels. Problems of accumulation of grain, track requirements, loading capacity, and merchandising ability must be faced if merchandisers are going to successfully utilize these new rate structures.

Rail line abandonment, which is increasing in the state of North Dakota, will also present new problems and challenges to the traditional grain merchandising and transportation system. As branch lines are abandoned producers will have to seek alternative shipping points if abandoned elevators do not remain viable. Currently, railroad abandonment plans call for 1,474 miles of branchline to be abolished in the future.

Increases in energy costs during the past ten years and projected increases in the future have also impacted and will continue to affect the traditional grain marketing systems. First, since transportation is energy-intensive and North Dakota is more geographically disadvantaged than most, the transportation bill will increase faster than the general level of inflation and will also increase relative to most other competing areas. Also, the competitive relationship between truck and rail will shift because of the energy-intensive nature of trucks relative to rails. This will result in trucks becoming less competitive and North Dakota becoming more captive to the rail mode.

Increased user fees on both the inland waterway system and the highway system are currently being proposed. If such fees are implemented total transportation costs will increase having the same effects as cited earlier.

As a result of larger shipments and other changes, grain is being merchandised differently today than it was a short time ago. Traditionally, grain has been traded on a flat basis into the terminal markets. That is, grain is bought from the producer by the country merchandiser and immediately sold into the markets as cash grain either on the "spot" or "to arrive" markets. This is currently being replaced by delayed pricing contracts (DPC) or no price established (NPE) merchandising and forward contracting. The essence of such merchandising is that producers transfer grain to country grain elevators and simultaneoulsy transfer legal ownership to the country merchandiser without pricing the grain for himself. The producer will price the delivered grain at some later date, according to the specifications of the contract and his marketing strategies. This provides logistical flexibility for the merchandisers in that the link between the transportation demand and the producer selling grain is broken, and thus allows the merchandiser to move grain to the terminal markets in a more orderly manner. The probable result of this technique will be to eliminate traditional seasonal peaks which have caused problems for transport companies.

Finally, substantial deregulation of the motor carrier and railroad industries has taken place recently and will surely have some effect on the grain marketing system. While at this time the extent of the impact is still speculative, it is certain to require much keener transportation management than was prevalent prior to deregulation.

Present Situations and Options

The possible competitive results of these dramatic changes in transportation and marketing of grain from North Dakota are rather straightforward. Some elevators in North Dakota will have no rail trackage available to them. They will become totally dependent on trucks to move their grain to terminal elevators, or to country elevators having rail access, or to subterminals in the country. A few elevators may lose access to one railroad while still receiving service from the other. Still other elevators will continue to have access to two rail lines, offering them intramodal as well as intermodal competition. Finally, all of these elevators having access to railroad transportation may be faced with lightweight rail, slow loading capabilities, or not enough trackage to handle multiple car consignments.

Several options for action by cooperatives and private elevators as they make plans for the future are necessary. Concerning elevator investment, the less viable options include no reaction at all and hope for the best, fight abandonment of rail lines, or truck to other elevators and hope to survive. More positive alternatives include construction of double trackage and loading facilities at present elevators so as to qualify for multiple-car rates, construction of a small loading station to be served from existing small country elevators, or construction of a subterminal facility with storage and unit train loading capabilities.

Some modal alternatives for elevators could include leasing or purchasing railroad cars, leasing or purchasing a truck fleet, or operating a short line railroad. Merchandising decisions could include use of single car rates, multiple origin-multiple car rates, extended use of No Price Established (NPE) sales to smooth movement, and finally, cooperative purchase or merger of existing elevator companies. The decision framework faced by elevator managers and owners is, indeed, multi-faceted and complex.

In summary, the complexity of the decisions faced by producers and marketing firms in North Dakota is obviously increasing. These complexities arise from many sources related to the transportation system serving the state. Producers are affected by selective rail line abandonment, lines not capable of carrying large volume, heavyweight hopper cars, and often a shortage of equipment during peak movements. The motor carriers utilized by the grain industry are affected by increasing energy costs, strikes at near port terminals, and differing state regulations. The elevator system has many old facilities that cannot take advantage of new multiple carlot rates. User fees on waterways and highways may further increase the shipping bill for North Dakota producers. As elevator managers and/or boards of directors respond to these changes, information on costs and benefits of alternative options is necessary.

Study Objectives

The overall purpose of this study is to evaluate the feasibility of alternative cooperative arrangements, especially a subterminal elevator, at a selected specific site in Bisbee, North Dakota. While the analysis develops results for Bisbee, the methodology and data sources used will provide guidance to determine feasibility at other North Dakota locations.

Specific objectives are to:

1. describe the study area as to existing elevator/transportation structure and identify the probable future structure.

2. identify the costs of assembly, elevation and distribution of grain

   a. under the existing system.
   b. after contemplated rail line abandonment plans in the study area.
   c. if a subterminal is constructed.

3. evaluate the feasibility of other marketing alternatives such as shipper-owned railroads and truck fleets, etc.

Study Approach

The general approach will be identification of total marketing costs (assembly, elevating and distribution) of alternative market structures. The method of anlaysis is a synthesizing of marketing costs under the various scenarios. Rail or truck costs will be aggregated over mileage and combined with costs of operation of elevators for each of the scenarios to identify the available efficiencies. Alternative complementary arrangements such as cooperative trucking and/or short line railroads will be evaluated as to cost and benefit as well as contribution to the overall feasibility of the cooperative subterminal.

CHAPTER II

SELECTION OF STUDY AREA

Introduction

Great changes have taken place in agricultural transportation in North Dakota in recent years. Rail deregulation, branchline abandonment, unit train rates, subterminal elevators, fast-loading capabilities are all recent additions to the vocabulary of the North Dakota farmer.

Recent announcements by the Burlington Northern Railroad concerning abandonment plans have left many elevator operators, producers and shippers in a quandry as to how to adjust and fill the gap left by potential rail line abandonment. Many of these changes have raised questions and created confusion in the minds of the North Dakota grain shipper. These changes in the grain marketing system and the resultant uncertainty prevalent in the minds of system participants have provided the impetus for this study.

There are obviously a number of potential study sites in North Dakota, so the task was to determine which area could best serve as the site for a "case study" for ascertaining feasibility of a subterminal operation. Criteria used in the decision process were crop production statistics, rail and truck cost figures, rail and road networks, rail abandonment plans, and discussions with elevator managers, board members and patrons. This chapter outlines that process used in narrowing the search and utlimately making the selection of Bisbee as the study area.

Initital Potential Subterminal Study Sites

The initial step in this study was to select an area in North Dakota which seemed to offer the best potential for a subterminal. The extent of branchline abandonment plans in an area was chosen as the criteria to establish a preliminary selection. The following 11 sites constitute the preliminary selection based on a visual observation of the current (July 1, 1981) rail line abandonment map showing all rail lines in Categories 1, 2 and 3:

1. Adrian
2. Bisbee
3. Devils Lake
4. Enderlin
5. Grafton
6. Hannaford
7. McLeod
8. Munich
9. Oakes
10. Russell
11. Williston

Figure 1 is a map of the North Dakota lines subject to rail abandonment; the 11 selected locations are identified by stars. Table 1 is a description of the lines included in the different abandonment categories and the respective mileages in each category.

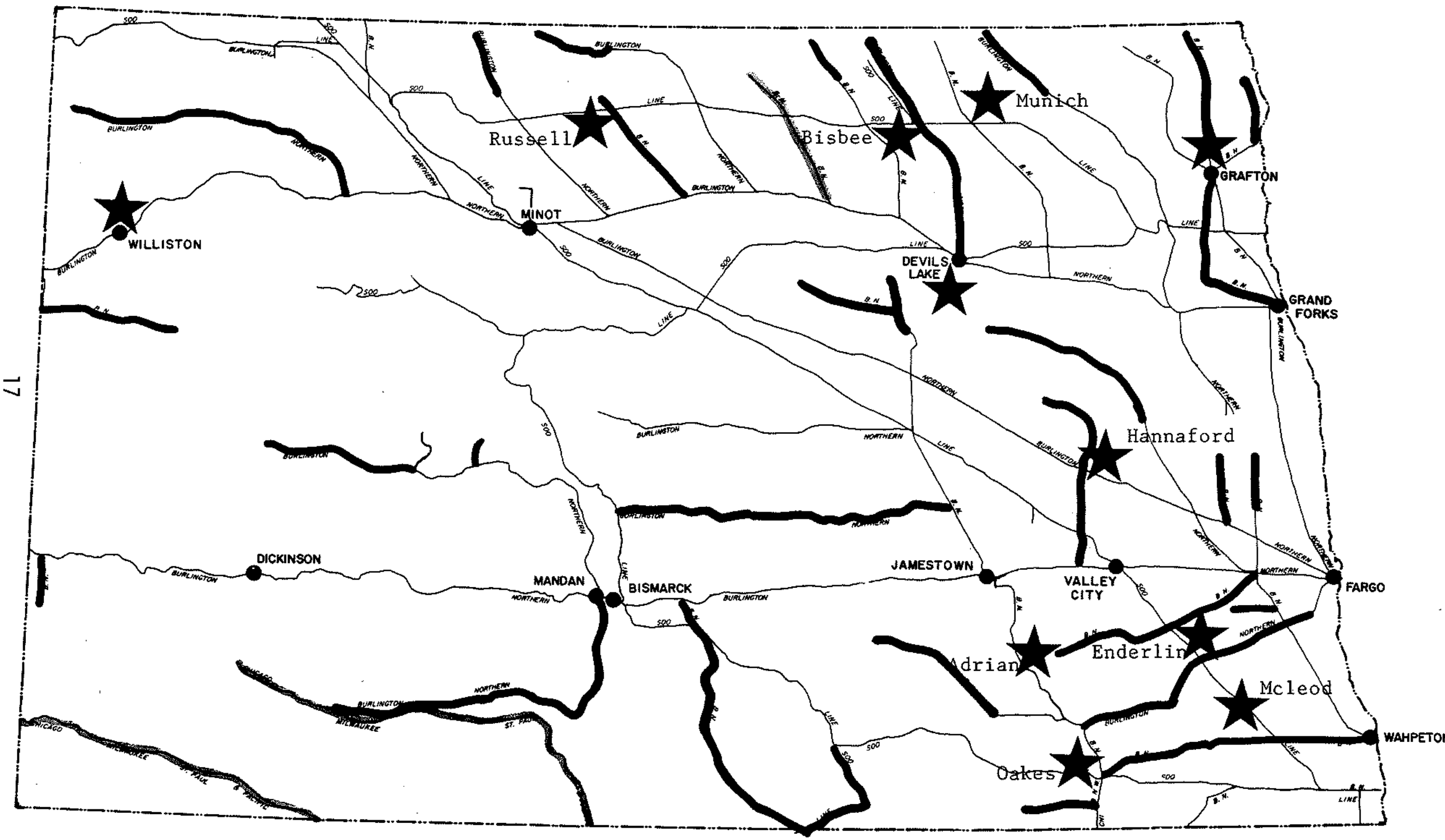
Once the preliminary selections were made, additional criteria were established to select the most feasible site. These additional criteria were:

(1) density of grain production and variety of major grain crops;

(2) extent of service by major highways and main line railroad(s).

NORTH DAKOTA

LINES SUBJECT TO ABANDONMENT



CATEGORY 1 (3 years)
CATEGORY 2 (future)
CATEGORY 3 (pending)

Figure 1

PREPARED BY
INTERMODAL PLANNING
AND RAIL ASSISTANCE DIVISION
10-1-81

TABLE 1. NORTH DAKOTA RAILWAY LINES SUBJECT TO ABANDONMENT, OCTOBER 1, 1981.

Line Description	R.R.	Category	Date Filed	ND Mileage
New England to McLaughlin, SD	MILW	3	05-15-81	123.61
Marmarth to Lemmon, SD	MILW	3	05-15-81	102.73
Wishek to Pollock, SD	SOO	2	05-01-78	35.93
Ellendale to Oakes	BN	1	06-26-81	27.82[a]
Milnor to Oakes	BN	1	06-26-81	32.20
Oakes to Crete	BN	1	05-01-77	-
Crete to Gwinner	BN	1	03-31-80	-
Drayton to Joliette	BN	1	06-26-81	15.50
Hannaford to Binford	BN	1	03-31-80	24.90
Towner to Newburg	BN	1	03-31-80	35.26
Hunter to Blanchard	BN	1	06-26-81	10.42
Rolla to St. John	BN	1	06-26-81	7.24
Devils Lake to Hansboro	BN	1	06-26-81	66.59
Edgeley to Streeter	BN	1	06-26-81	39.83
Tuttle to Wilton	BN	1	06-26-81	37.77
Sanborn to Hannaford	BN	1	06-26-81	26.03
Hazen to Truax	BN	1	06-26-81	6.37
Zap to Killdeer	BN	1	06-26-81	40.86
Beach to Golva	BN	1	06-26-81	12.86
Wahpeton to Milnor	BN	2	06-26-81	40.49
Langdon to Hannah	BN	2	06-26-81	21.00
St. Thomas to Neche	BN	2	03-31-80	25.08
Grand Forks to Grafton	BN	2	03-31-80	44.65
Clifford to Erie	BN	2	06-26-81	17.75
Addison to Chaffee	BN	2	06-26-81	11.79
Casselton to Marion	BN	2	03-31-80	60.18
Sheyenne to Minnewaukan	BN	2	03-31-80	18.66
Oberon to Esmond	BN	2	03-31-80	28.07
McKenzie to Linton	BN	2	03-31-80	44.22
Linton to Eureka, SD	BN	2	06-26-81	37.67
Pingree to Tuttle	BN	2	03-31-80	55.00
Valley City Low Line	BN	2	06-26-81	4.82
Mohall to Sherwood	BN	2	06-26-81	14.58
Lisbon to Independence	BN	2	03-31-80	25.60
Horace to Lisbon	BN	2	06-26-81	46.29
Finley to Warwick	BN	2	06-26-81	50.02
Landa to Antler	BN	2	06-26-81	17.58
Stanley to Grenora	BN	2	06-26-81	87.09
Watford City to Fairview, MT	BN	2	06-26-81	36.58
Mandan to Mott	BN	2	06-26-81	99.10
York to Dunseith	BN	3	08-27-81	41.79
			TOTAL	1,473.93

[a]Includes 7.83 miles of trackage rights on CNW from Oakes to Ludden.

TOTAL ND MILEAGE IN CATEGORY:

Category 1 (3 years)	-	383.65
Category 2 (Future)	-	822.15
Category 3 (Pending)	-	268.13

Prepared by: North Dakota State Highway Department, Intermodal Planning and Rail Assistance Division

Narrowing the Site Selection

The above criteria, crop density and transport network, were reviewed to choose the best prospects of the eleven initially selected. Discussion of these criteria follows.

North Dakota Crop Production

The most predominant crops grown in North Dakota are hard red spring wheat, sunflower, durum wheat, barley, oats and corn. Wheat remains the major crop--sunflower has only recently become the second largest cash crop. Planted acres of hard red spring and durum wheat have generally increased since 1965, while barley and oats planted acreages have trended downward. Acreage of sunflower remained relatively stable until about 1975, after which planted acres increased dramatically (Figure 2).

Farms in North Dakota have generally become larger in the last two decades. In 1981, 41.7 million acres of land was concentrated on 40,000 farms. The average farm size in 1981 was 1043 acres (Table 2). In 1978, when the average farm size was slightly over 1,000 acres, the average harvested cropland area per farm was 464 acres.[1]

North Dakota ranked tenth or higher in acres harvested of ten major crops in 1980 (Table 3), and seventh in total acreage of principal crops harvested. North Dakota ranked first in production of spring wheat, durum wheat and sunflower. In 1981, North Dakota led the nation in production of all wheat.

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[1] 1978 Census of Agriculture Data, taken from North Dakota Agriculture Statistics, 1976-79 Final, Agriculture Statistics No. 49, October, 1981, North Dakota Crop and Livestock Reporting Service.

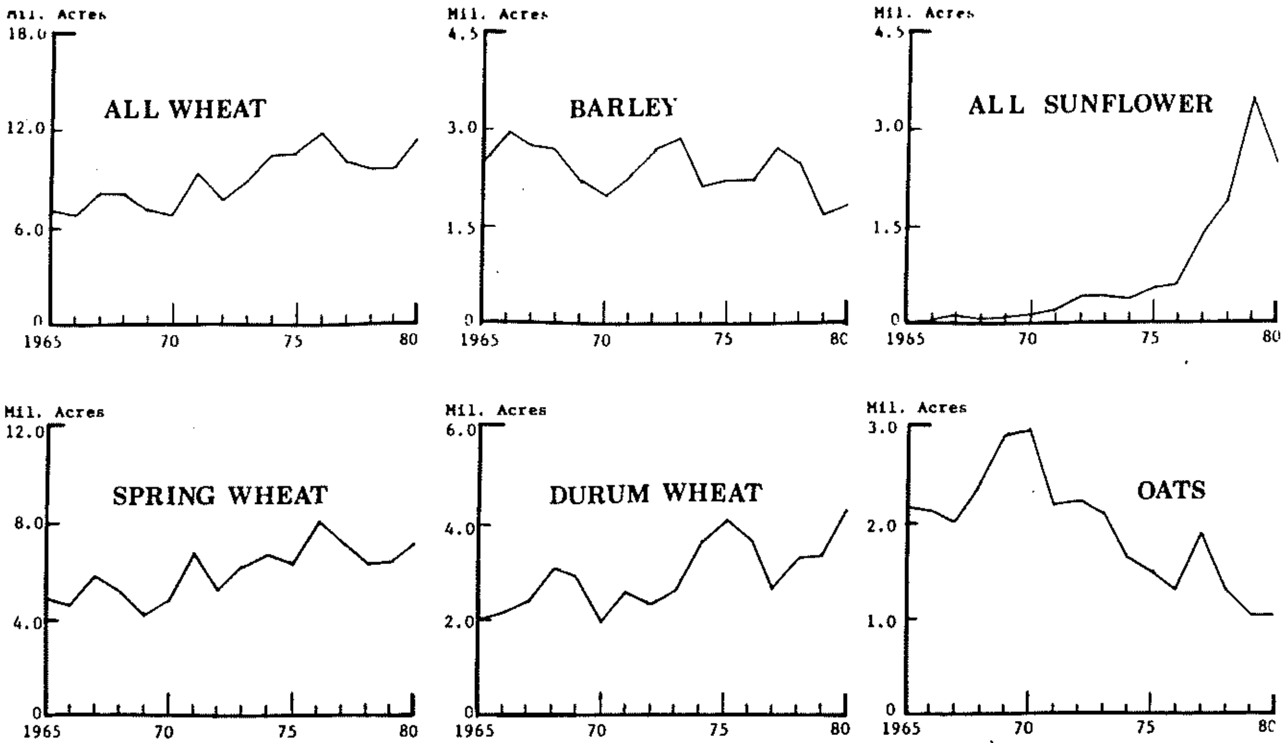


Figure 2. Planted Acres of Major North Dakota Crops, 1965-1980.

Source: "North Dakota Agricultural Statistics, 1981," Ag. Statistics No. 48, North Dakota Crop and Livestock Reporting Service, Fargo, May, 1981.

Location of Crop Production in North Dakota

North Dakota crop production by county and Crop Reporting District (CRD) varies dramatically. (Figure 3 is a map of North Dakota Crop Reporting Districts). Northern and eastern North Dakota is more cropping intensive while western and southern counties are relatively more livestock oriented. Crop Reporting District's 3, 6, and 9 are relatively large producers of hard red spring wheat, barley and sunflower, while CRD's 1, 2 and 3 are major durum growing areas. Corn production is concentrated primarily in CRD's 6 and 9 (Table 4). The rank of North Dakota's counties in crop production is presented in Table 5.

TABLE 2. NUMBER OF FARMS, AVERAGE FARM SIZE, AND ALL LAND IN FARMS, 1966-81.

Year	Number of Farms (units)	Average Farm Size (acres)	All Land in Farms (000 acres)
1966	49,000	857	42,000
1967	48,000	873	41,900
1968	47,000	891	41,900
1969	46,000	911	41,900
1970	45,500	921	41,900
1971	45,000	929	41,800
1972	44,000	950	41,800
1973	43,500	961	41,800
1974	43,000	970	41,700
1975	42,000	1007	42,300
1976	41,500	1012	42,000
1977	41,000	1020	41,800
1978	41,000	1017	41,700
1979	40,500	1030	41,700
1980	40,000	1043	41,700
1981	40,000	1043	41,700

Source: North Dakota Crop and Livestock Reporting Service, Ibid.

Highway and Railroad Network in North Dakota

Figure 4 is a map of the North Dakota highway and railroad network. North Dakota's highway network carries a variety of passenger, grain and other freight traffic. The road system has been required to support an increasing number of over-the-road truck shipments of grain as trucks captured a larger proportional share of the grain traffic in the last decade. Maintenance and road conditions have

TABLE 3. THE TEN LEADING STATES AND NORTH DAKOTA'S RANK IN 1980 CROP PRODUCTION.

Crop	Rank 1	2	3	4	5	6	7	8	9	10	North Dakota's Rank	Percent of Nation
Corn for Grain	Iowa	Ill.	Minn.	Nebr.	Ind.	Ohio	Wisc.	Mich.	S. Dak.	Tex.	25	a
Corn for Silage	Minn.	Iowa	Wisc.	N.Y.	Nebr.	Pa.	S.Dak.	Mich.	Kans.	Calif.	25	1
Winter Wheat	Kans.	Okla.	Wash.	Tex.	Nebr.	Colo.	Mo.	Calif.	Ill.	Ore.	39	a
Durum Wheat	N.Dak.	Ariz.	Calif.	Mont.	S.Dak.	Minn.	--	--	--	--	1	67
Other Spring Wheat	N.Dak.	Minn.	Mont.	Idaho	S.Dak.	Wash.	Oreg.	Colo.	Utah	Nev.	1	28
All Wheat	Kans.	Okla.	N.Dak.	Wash.	Tex.	Mont.	Nebr.	Colo.	Minn.	Idaho	3	8
Oats	Minn.	S.Dak.	Iowa	Wisc.	Mich.	Ohio	Pa.	N.Y.	Neb.	Ill.	11	3
Barley	Idaho	N.Dak.	Calif.	Mont.	Minn.	Wash.	Colo.	S.Dak.	Utah	Oreg.	2	13
Rye	S.Dak.	Ga.	Minn.	N.Dak.	Okla.	S.C.	Mich.	Tex.	Nebr.	Pa.	4	9
Flaxseed	S.Dak.	N.Dak.	Minn.	Tex.	---	---	---	---	---	---	2	38
Potatoes	Idaho	Wash.	Maine	Oreg.	Calif.	Wisc.	N.Dak.	Colo.	Minn.	N.Y.	7	5
Soybeans for Beans	Iowa	Ill.	Ind.	Minn.	Mo.	Ohio	La.	Ark.	Miss.	Nebr.	26	a
Dry Edible Beans	Mich.	Calif.	Idaho	N.Dak.	Nebr.	Colo.	Wash.	Minn.	Wyo.	N.Y.	4	10
Sugarbeets	Calif.	Minn.	Idaho	N.Dak.	Mich.	Nebr.	Colo.	Wyo.	Mont.	Tex.	4	9
Sunflower	N.Dak.	Minn.	S.Dak.	Tex.	---	---	---	---	---	---	1	59
Alfalfa Seed	Calif.	Idaho	Wash.	Okla.	Nev.	Oreg.	Kans.	S.Dak.	Mont.	Utah	12	a
Alfalfa Hay & Mixtures	Wisc.	Iowa	Calif.	Minn.	Nebr.	Idaho	Mich.	S.Dak.	N.Y.	Kans.	21	1
All Other Hay	Tex.	Mo.	N.Y.	Ky.	S.Dak.	Nebr.	Pa.	Ohio	Wisc.	Tenn.	14	3
All Hay	Wisc.	Iowa	Calif.	Minn.	Nebr.	N.Y.	Tex.	S.Dak.	Mo.	Idaho	21	2
Total Acreage of Principal Crops Harvested	Iowa	Ill.	Tex.	Kans.	Minn.	Nebr.	N.Dak.	S.Dak.	Mo.	Ind.	7	5

[a]Less than one-half of one percent.

Source: North Dakota Crop and Livestock Reporting Service, *Ibid*.

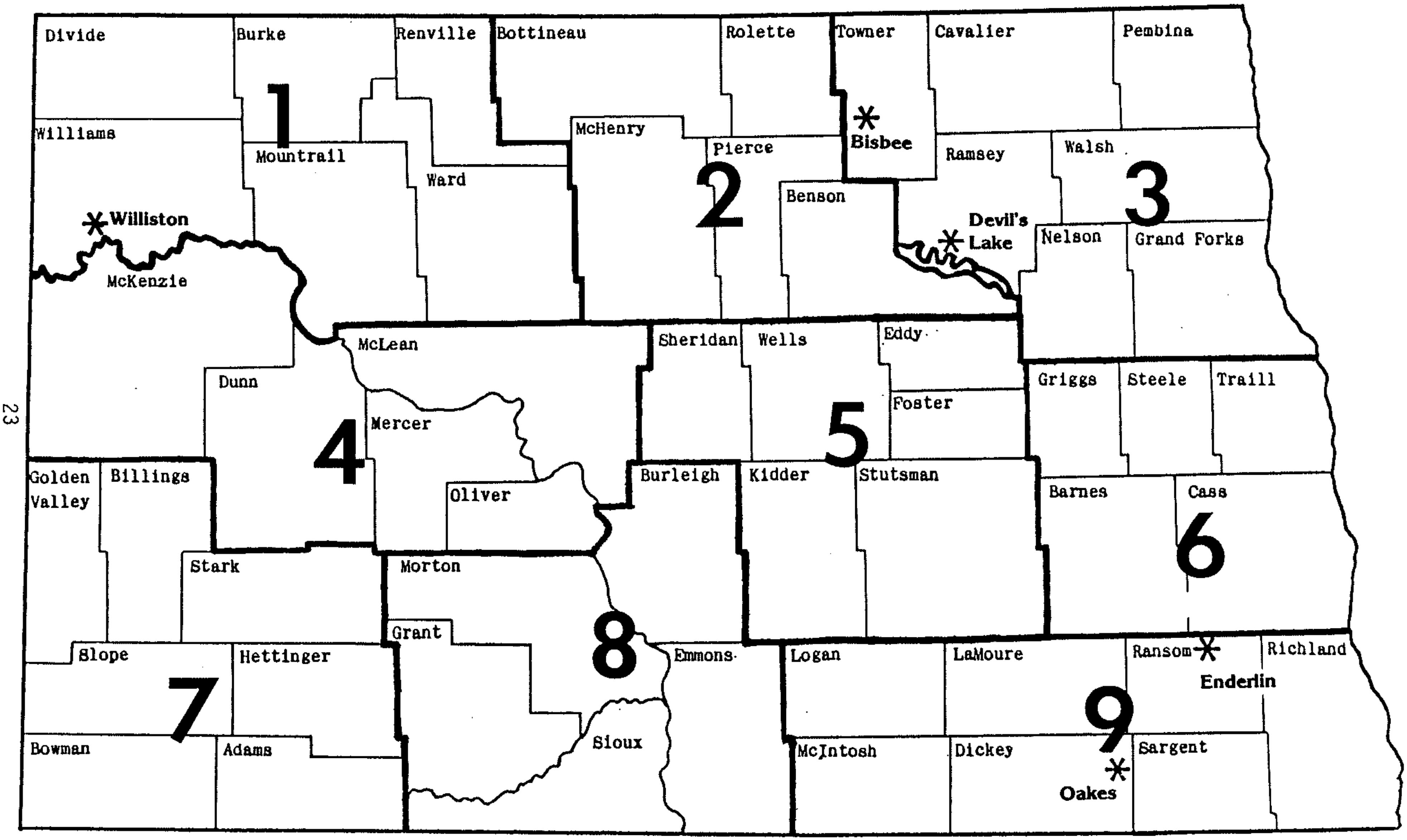
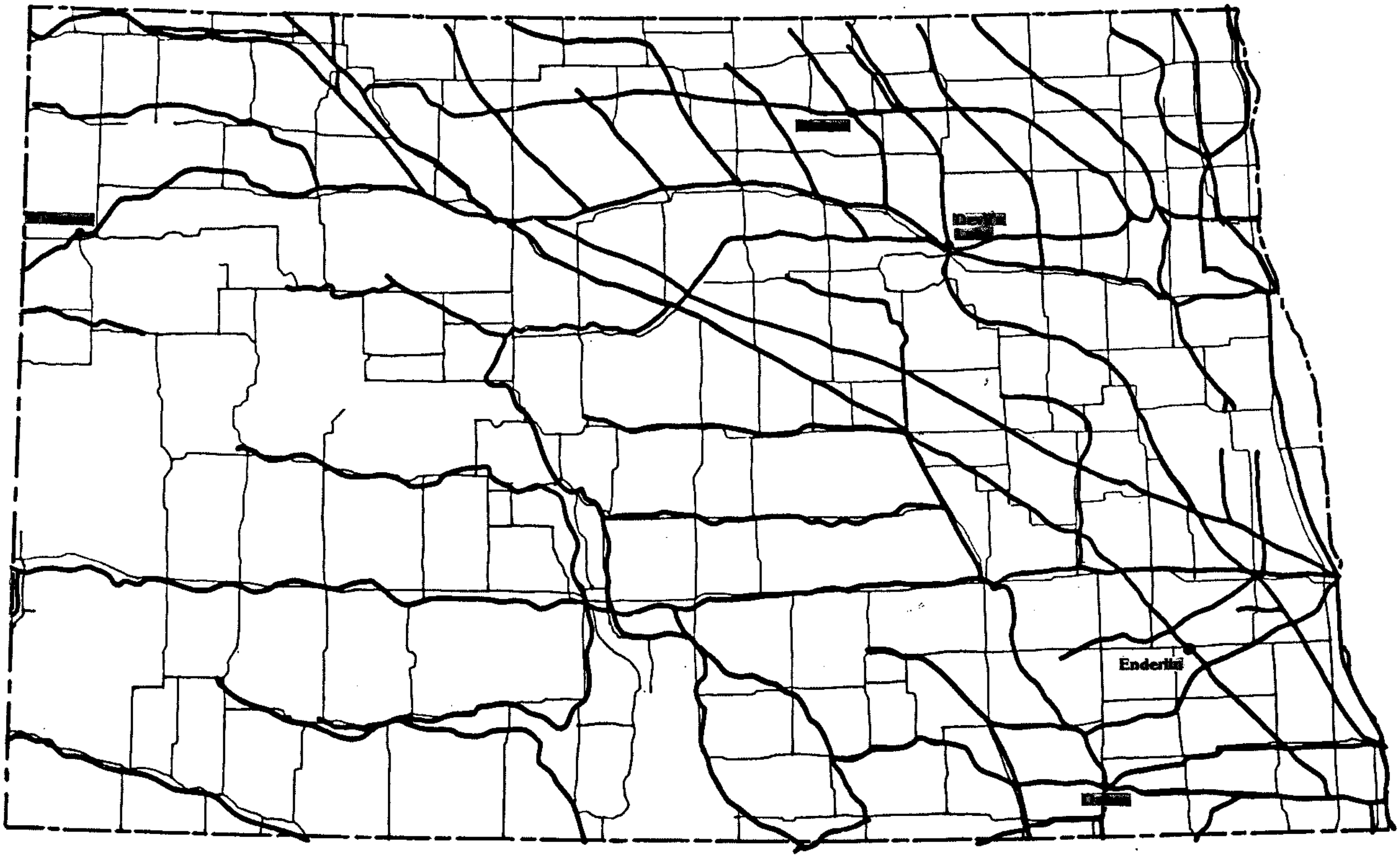


Figure 3. North Dakota Crop Reporting Districts and Five Potential Subterminal Sites.

North Dakota State Highway and Rail Network



STATE HIGHWAYS   RAILROAD LINES

Figure 4. North Dakota State Highway and Rail Network and Five Potential Subterminal Sites.

TABLE 4. PRODUCTION OF MAJOR CROPS BY CROP REPORTING DISTRICT, FIVE YEAR AVERAGE, 1975-79[a]

CRD	HRS	Durum	Barley	Oats	Flax	Corn	Sunflower
	million bushels						million lbs.
1	17.3	23.5	4.1	5.4	0.5	0.1	81
2	9.4	16.9	9.0	5.0	1.0	0.2	178
3	34.6	23.0	34.0	3.7	0.7	0.4	474
4	13.5	6.3	1.5	5.3	0.3	0.1	27
5	19.2	7.8	5.4	5.8	0.8	0.4	382
6	30.3	3.5	24.4	5.0	0.7	2.6	632
7	15.9	2.8	1.7	4.4	0.01	0.1	37
8	11.7	1.1	1.6	6.8	0.4	0.4	25
9	20.4	3.6	8.0	10.9	1.3	13.0	490
State	172.4	88.5	89.7	52.1	5.7	17.1	2326

[a]Corn and sunflower five year averages 1976-80.

Source: North Dakota Crop and Livestock Reporting Service, Ibid.

become topical because of the increased truck traffic and resultant additional road maintenance.

North Dakota's interstate highway system consists of two major arteries. Interstate Highway 94 crosses North Dakota east to west and is approximately 350 miles long. Interstate Highway 29 is approximately 220 miles long and crosses North Dakota north to south along the eastern state border. According to the North Dakota State Highway Department's Highway Statistics (1981),[2] the entire Interstate Highway System consists of 571 miles of concrete and bituminous highways. The state highway system consists of 7,167 miles of primarily

[2] Prepared by the Transportation Services Division of the North Dakota State Highway Department, Bismarck, North Dakota, October, 1981.

TABLE 5. RANK OF NORTH DAKOTA'S COUNTIES IN PRODUCTION OF MAJOR CROPS, 1980.[a]

County	All Wheat	Spring Wheat	Durum Wheat	Sun-flower	Barley
Adams	48	48	37	40	51
Barnes	14	7	23	3	5
Benson	17	38	8	12	17
Billings	53	53	52	51	52
Bottineau	5	28	2	20	10
Bowman	43	46	36	47	40
Burke	20	16	15	37	30
Burleigh	41	34	44	38	46
Cass	1	1	18	1	1
Cavalier	2	4	4	23	2
Dickey	29	17	28	7	20
Divide	11	43	1	32	41
Dunn	47	40	51	53	48
Eddy	32	26	22	17	29
Emmons	45	37	47	42	50
Foster	31	23	26	18	33
Golden Valley	51	52	39	52	37
Grand Forks	16	6	29	6	4
Grant	39	33	48	33	39
Griggs	30	19	30	22	18
Hettinger	36	27	40	29	45
Kidder	46	47	33	39	35
LaMoure	21	11	21	5	21
Logan	38	36	41	35	42
McHenry	22	15	20	26	25
McIntosh	44	39	42	36	43
McKenzie	37	41	27	50	38
McLean	7	18	9	24	34
Mercer	42	35	43	45	49
Morton	40	32	50	41	31
Mountrail	12	42	5	34	28
Nelson	23	31	10	19	19
Oliver	50	45	53	49	32
Pembina	3	2	35	13	11
Pierce	28	30	19	28	24
Ramsey	10	29	7	14	12
Ransom	33	22	34	10	15
Renville	24	20	17	27	23
Richland	6	3	25	4	9
Rolette	27	51	11	30	14
Sargent	25	13	24	9	13
Sheridan	34	24	31	31	27
Sioux	52	50	49	48	53
Slope	49	44	46	46	47
Stark	35	25	45	43	44
Steele	26	12	38	15	6
Stutsman	9	9	14	2	26
Towner	19	49	6	25	8
Traill	15	5	32	11	3
Walsh	8	8	16	21	7
Ward	4	21	3	16	22
Wells	18	10	13	8	16
Williams	13	14	12	44	36

[a]Crop rankings based on preliminary estimates of 1980 production.

Source: North Dakota Crop and Livestock Reporting Service, Ibid.

bituminous and concrete roads. Other county, township and rural roads constitute a total of 85,539 miles, mostly gravel and bituminous surfaced roads.

Each of the five potential sites considered for the subterminal locations are served by "adequate" highways. Williston is situated on U.S. Highways 85 and 2; both are two-lane paved roads easily accessible within a few miles of Williston. Bisbee is located on State Highway 66 within 10 miles of U.S. Highway 281; U.S. Highway 2 is approximately 40 miles from Bisbee. Devils Lake is located directly adjacent to U.S. Highway 2, one of the major highway arteries extending across the northern part of the state. Oakes is situated adjacent to State Highways 1 and 11, and is within 30 miles of U.S. Highway 281. Enderlin is served by State Highway 46 and is within 25 miles of Interstate Highway 94. All potential subterminal sites are served by a road system adequate to serve a large elevator.[3]

North Dakota is served by four railroads--the Burlington Northern (BN); Soo Line; Chicago, Milwaukee, St. Paul and Pacific (Milwaukee Road); and the Chicago and Northwestern (CNW). The BN and Soo Line are both active in transporting North Dakota grain; the Milwaukee Road is in the midst of bankruptcy proceedings (but still serves parts of southwestern ND) and the CNW serves only a portion of one county in southeastern North Dakota.

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[3]This discussion is intended to point out that existing highways are adequate to serve a large elevator--no additional construction would be necessary. Not addressed at this point is the additional road maintenace that may be necessary if truck traffic in the areas increased.

Potential Subterminal Study Sites

Based on branchline abandonment prospects, crop production, and accessibility to major highways and main line railroads, five of the eleven initially selected North Dakota towns were chosen for this study's potential subterminal locations. The five cities selected were Williston, Bisbee, Devils Lake, Oakes and Enderlin (See Figure 1). Each of the grain producing areas surrounding these cities are affected by recent branchline abandonment plans, but all are situated near a main line of one or both major North Dakota railroads. These cities also are all situated in areas of high crop concentration, areas capable of supplying the grain volume needed to support a large elevator facility.

The trade area for a subterminal located in one of the five cities was specified to have a 25 mile radius for Bisbee, Devils Lake, Oakes and Enderlin, and 40 miles for Williston. Williston was hypothesized to serve a larger area due to the lower concentration of grain crops grown in the area and relatively fewer rail lines serving country elevators in western North Dakota.

Grain production within each of the five trade areas was estimated to evaluate the availability of enough grain to support a large facility. Five year average production per square mile in the counties surrounding the five cities was computed and multiplied by the corresponding size of trade area (25 or 40 miles). Total production of four major commodities for each city's trade area is presented in Table 6.

TABLE 6. PRODUCTION OF MAJOR COMMODITIES FOR TRADE AREAS SURROUNDING WILLISTON, BISBEE, DEVILS LAKE, OAKES, AND ENDERLIN, 5 YEAR AVERAGE, 1975-79.

City (trade area radius--miles)	Wheat	Durum	Sunflower	Barley	Corn	Total
			(000 bushels)			
Williston (40)	7,782	4,496	517	754	a	13,549
Bisbee (25)	1,353	8,673	2,212	5,571	a	17,809
Devils Lake (25)	2,369	7,934	4,277	4,311	a	18,891
Oakes (25)	4,721	a	5,901	2,642	3,502	16,766
Enderlin (25)	9,556	a	10,492	6,655	4,077	30,780

[a]Not one of the four major crops for that area. Very little corn for grain is grown in the Williston, Bisbee and Devils Lake areas. Likewise, durum is not a predominant crop in the Oakes and Enderlin areas.

The five cities chosen as potential sites for subterminal location were all affected by abandonment plans as indicated on the July 1, 1981, System Diagram Map. Although Williston is located on a Burlington Northern main line, two branchlines in the area (Stanley-Grenora and Watford City-Fairview, Montana) were listed in Category 2 (being studied for possible abandonment in the future). Bisbee is situated at the intersection of a BN branch line and Soo mainline. However, BN branchlines both east and west of Bisbee are earmarked for possible abandonment. Devils Lake is located on both BN and Soo main lines; a BN branchline (Category 2) extends northward from Devils Lake. Oakes is located on a Soo main line and a BN connecting line; abandonment plans affecting the Oakes area include at least two BN segments. Enderlin is situated on a Soo main line; BN branchlines extending perpendicular to the Soo segment are both under study for possible future abandonment.

Revised abandonment plans were announced by the BN in November, 1981, where some segments were removed from the abandonment list, some were moved to different categories, while others remained unchanged. Both branchlines in the Williston area were returned to normal operating status. Branchlines in the Bisbee area remained unchanged with the revised plans. Lines in the Devils Lake area were, for the most part, unaffected by the changes. Branchlines near Oakes were either unchanged or moved to a less ominous category (e.g., cateogry 1 to category 2). Line segments in the Enderlin area were mostly unaffected by the revisions. A subsequent revised version of the map was issued in June of 1982.

Final Selection of Host Community

To select one of the five sites for the study, open meetings were held in each of the five cities to discuss the project and assess the community attitude towards participation. Representatives from the North Dakota Department of Agriculture, the Upper Great Plains Transportation Institute, Schrader-Lauth and Associates, and North Dakota State Highway Department discussed with elevator managers and board members and community members the concept of a subterminal elevator served by satellite elevators and a trucking cooperative. Statements and positions were presented by the four agencies followed by open discussion with all meeting participants. At the close of each meeting, elevator representatives were asked to complete a one page questionnaire, requesting their attitudes toward subterminal development, their evaluation of the subterminal satellite elevator-trucking cooperative concept, and their willingness to participate in the project. A copy of the survey instrument and results are included in the Appendix, page 146.

Various considerations were taken into account in selecting which of the five cities would be chosen as the host community for the project. Community enthusiasm toward the project was evaluated at each of the meetings to discern the extent of participation expected from area elevators. Due to the data required from the elevators concerning costs and grain shipments, a positive attitude and high degree of participation was required to allow a more site-specific study. Without cooperation from the community and elevators, a more generalized, aggregated study would have resulted. Concentration of production is a key to utilization of a large elevator facility. Therefore, an area with higher crop concentrations was desirable. All five of the study areas selected appeared to have sufficient grain to support a large facility (although a newly constructed elevator may be unable to attract that grain depending on competition from existing facilities, cost structure of the new elevator, etc.). Existing rail service was a key consideration in evaluating the five sites. Although not critical to the existence of a subterminal, being served by more than one railroad would certainly be advantageous to an elevator. A more competitive environment may exist, and the elevator would not be considered as captive to carriers if it could receive service by more than one railroad. Finally, the current abandonment situation in each area was evaluated. If branchline abandonments were pending, an area would be considered more "in need" of a concurrent change in another portion of the marketing system to negate economic disadvantages caused by the abandonment. A subterminal elevator may be considered "essential" to such an area to regain competitive advantages lost when abandonment takes place.

Bisbee was selected as the demonstration project host community after consideration of the aforementioned criteria. Eighty-eight percent of the meeting participants expressed interest in participating, the remaining 12 percent offered no opinion. This represented the most positive attitude toward the project of the five states visited. (Complete results of the one page questionnaire are presented in the Appendix, page 147). Bisbee's crop concentration was judged sufficient to support the volume required by a subterminal. Bisbee is located at an intersection of the BN and Soo Line--both railroads could be utilized by the facility. Two BN branchlines in the area are still listed as candidates for abandonment.[4] For these reasons, Bisbee was selected as the best of five communities to serve as host for the project.

Summary

North Dakota's agricultural sector is diverse in nature and represents a significant portion of the state's economic base. Crop production constitutes about two-thirds of all agricultural income.

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[4]Part of the York to Dunseith branchline was approved for abandonment by the Interstate Commerce Commission on January 29, 1982.

Hard red spring wheat, durum, barley, sunflower and corn are the predominant crops grown in North Dakota.

Five North Dakota cities were selected as potential sites for this project--Williston, Devils Lake, Bisbee, Oakes and Enderlin. Criteria used in the selection process were crop concentration, community attitude toward the project and quality of transportation services in the area. Bisbee was selected as the study site primarily due to the high community enthusiasm toward the project and its present and projected future rail service.

Chapter III is a description of the crop production patterns in the Bisbee area and a discussion of individual elevators to be included in the analysis. Rail and truck service in the study area are also evaluated.

CHAPTER III

CHARACTERISTICS OF STUDY AREA

Introduction

The Bisbee community is located in the northeastern portion of North Dakota in west-central Towner county. Bisbee had a population of 257 in 1980, the second largest community in the county, and is classified as a Class C Farm Trade Center.[5] Grain farming in the Bisbee trade area is concentrated in the production of durum wheat, barley, HRS wheat and sunflower. Bisbee is located within the so-called "durum triangle"; durum is the primary crop grown in the area.

Three counties are included in the Bisbee trade area--Towner, Pierce and Rolette (Figure 5). Small portions of Benson and Cavalier counties are within 25 miles of Bisbee, but geographic locations of rail lines and competing elevators preclude penetrating those areas and drawing grain from them. Characteristics of farms in the three counties are presented in Table 7.

The three counties in Bisbee's trade area all rank high in production of durum, but relatively low in production of other commodities (Table 8). Five year average production of major crops grown in the Bisbee area is presented in Table 9.

Bisbee Area Elevators

A personal interview survey of elevator managers was conducted in November, 1981, to collect data pertaining to their elevator facil-

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[5] Voelker, Stanley; Delmer Helgeson; and Harvey Vreugdenhil; "A Functional Classification of Agricultural Trade Centers in North Dakota," Agricultural Economics Report No. 125, ESCS, USDA and Dept. of Ag. Economics, NDSU, Fargo, March, 1978.

NORTH DAKOTA

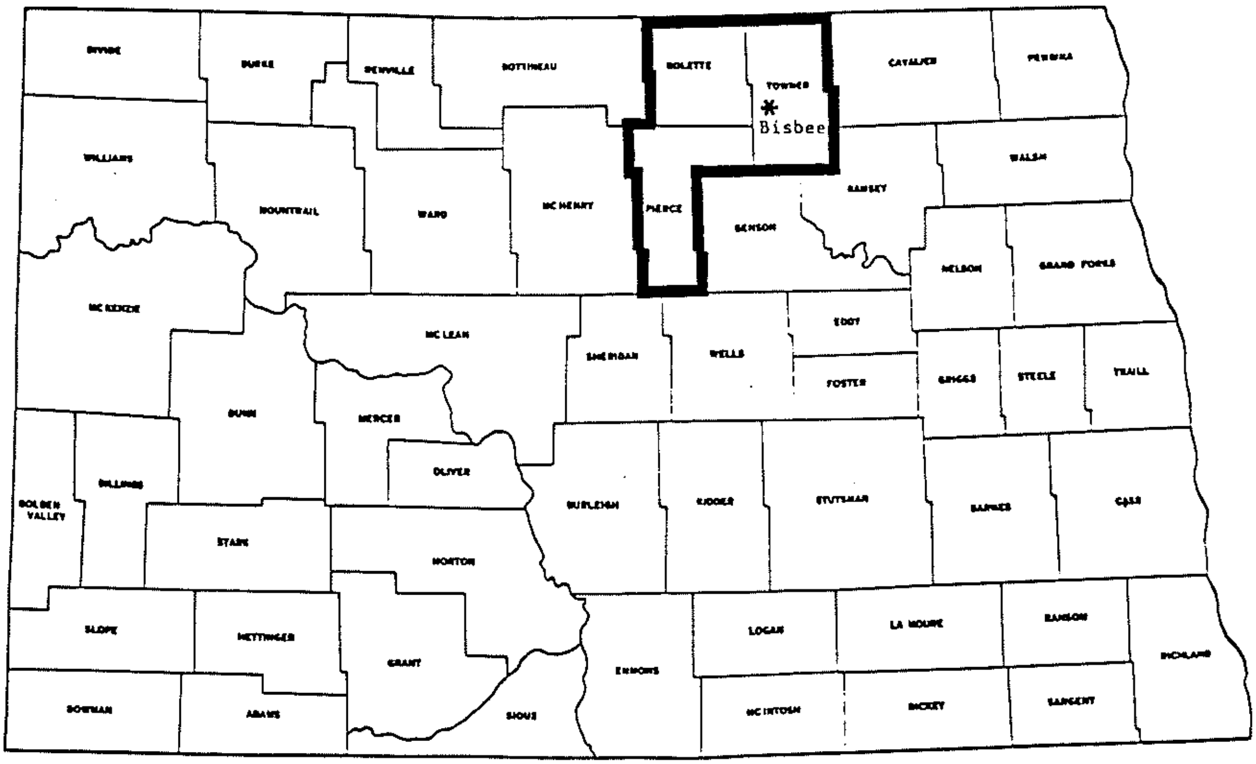

Figure 5. Counties Included in the Bisbee Trade Area.

TABLE 7. NUMBER OF FARMS, AVERAGE FARM SIZE AND PROPORTION OF LAND IN FARMS, ROLETTE, PIERCE AND TOWNER COUNTIES, 1978.

County	Number of Farms (units)	Average Farm Size (acres)	Proportion of Land in Farms (percent)
Rolette	685	877	93.1
Pierce	613	980	90.4
Towner	628	1007	94.8

Source: 1978 Census of Agriculture

TABLE 8. RANK IN COUNTY PRODUCTION OF SELECTED CROPS, 1980.

County	HRS Wheat	Durum	Barley	Oats	Sunflower
Rolette	51	11	14	NA[a]	30
Pierce	30	19	24	NA	28
Towner	49	6	8	NA	25

[a]Not Available.

Source: North Dakota Crop and Livestock Reporting Service, Ibid.

TABLE 9. FIVE YEAR AVERAGE PRODUCTION OF MAJOR CROPS--ROLETTE, PIERCE AND TOWNER COUNTIES, 1975-79[a]

County	HRS Wheat	Durum	Barley	Oats	Sunflower
	----------------	000 bushels	--------------		million lbs.
Rolette	580	2931	1905	559	22.3
Pierce	1528	2194	1143	987	30.4
Towner	789	5847	3735	241	44.9

[a] Sunflower estimates are three year averages, 1978-80.

Source: North Dakota Crop and Livestock Reporting Service, Ibid.

ities and grain marketing patterns. Fourteen elevators were identified and contacted to participate in the survey. One elevator is a branch of a privately-owned company, the remaining 13 are farmer-owned cooperatives. The 14 elevators were owned and operated by nine individual companies. One firm operated elevators at four different locations; two coops operated two stations each. Locations of the 14 elevators are shown in Figure 6.

The average age of the main house at the 14 locations was 32 years, compared to 25 years statewide.[6] Annexes were an average of 33 years old. Average capacity of the main house and annexes were 83,000 bushels and 104,700 bushels, respectively. Total grain handled in the 1980 calendar year averaged 931,000. The firms employed an average of 2.6 persons full time and 0.4 persons part time. Annual operating expenses averaged $117,600. Each elevator manager interviewed was asked to define the distribution of customers within his trade area relative to farmers' distances from the elevator. All

[6]Casavant, Ken, "A Review of the North Dakota Grain Elevator Industry," remarks presented at the North Dakota Grain Handling, Transportation and Merchandising Seminar, Bismarck, North Dakota, February 16, 1982.

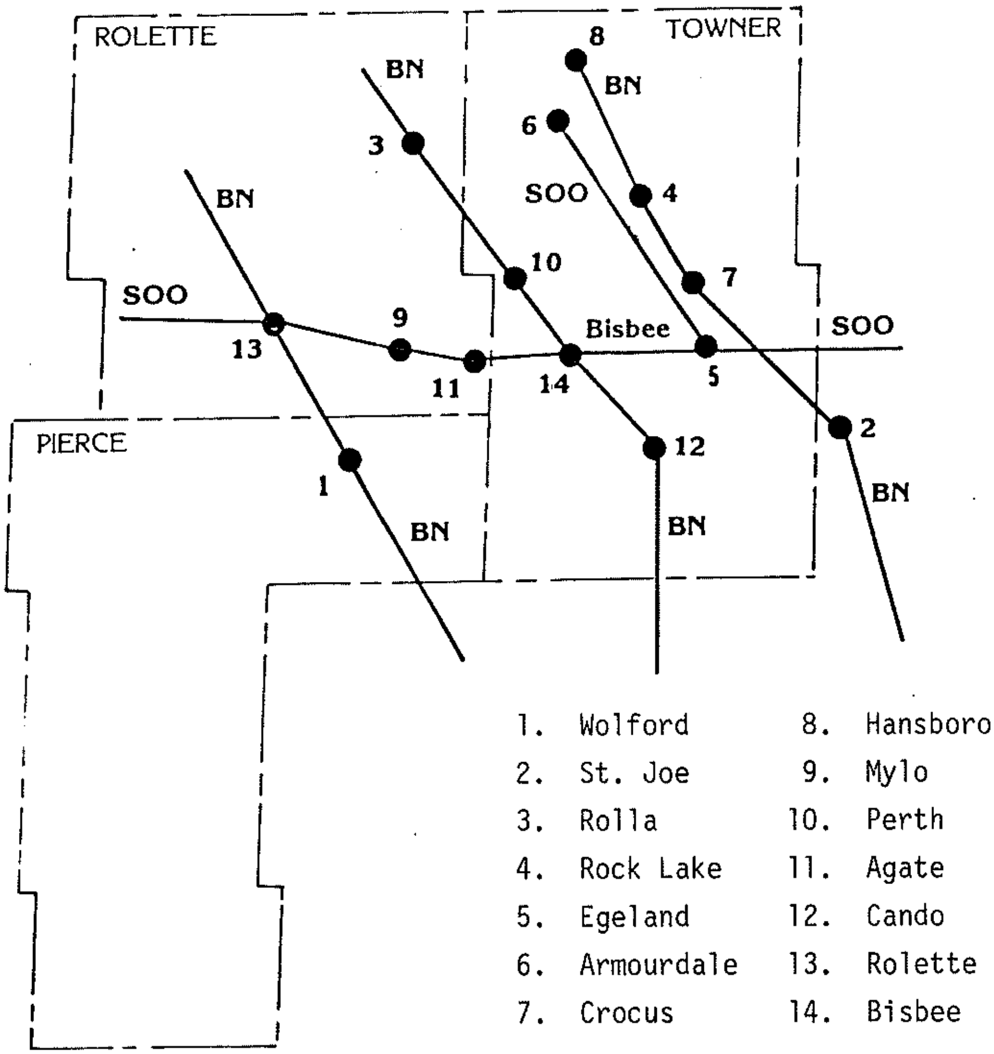

Figure 6. Bisbee Area Elevators Included in the Study and Affected Rail Lines.

managers indicated their trade area did not extend beyond 15 miles (Table 10).

TABLE 10. DISTRIBUTION OF CUSTOMERS WITHIN SPECIFIED DISTANCE FROM ELEVATORS.

Distance from Elevator	Percent of Customers
0 - 5 miles	36.9%
6 - 10 miles	46.5%
11 - 15 miles	16.5%

Managers indicated the average number of grain customers at each elevator was 185, while non-grain customers averaged 22 per elevator. However, two observations should be noted to avoid misinterpretation of these estimates. First, these are number of member-patrons as specified by the elevator managers--they may not all be active members. Second, many farmers may be members of two or more cooperatives. Therefore, a summation of the member-patrons of all the elevators may not be a completely accurate estimate of total area elevator patrons. The percent of incoming grain by type of farm truck also was specified by the elevator managers and is presented in Table 11.

TABLE 11. DISTRIBUTION OF INCOMING GRAIN BY TYPE OF TRUCK, BISBEE AREA ELEVATORS.

Type of Truck	Percent
Single Axle	72.3%
Tandem Axle	27.6%
Semi Tractor-Trailer	0.1%

An analysis of the elevators' annual financial statements revealed a snapshot of the financial conditions of the operations. Financial data were available from 12 of the 14 stations. For coops operating more than one elevator, the data were averaged over all the stations covered by a single statement.

Examining working capital ratios revealed a slightly lower working capital position than generally accepted as a norm. The average current ratio (current assets/current liabilities) of the 12 elevators was 1.5, compared to a general rule of thumb of 2.0. None of the firms' ratios were above 1.6. The "quick" ratio (current assets minus inventories/current liabilities) is a measure of a firm's ability to pay current debts in a short period of time; a standard rule of thumb is one to one. The 12 stations in the Bisbee area had an average quick ratio of .88.

Fixed capital ratio analysis gives a picture of the firm's fixed plant investment and its comparison to total assets and net worth. The net worth to total assets (NW/TA) ratio is a measure of the firm's relative indebtedness. An average NW/TA ratio of 0.57 was found in the 12 statements examined. In other words, the firms owned 57 percent of their total assets--the remaining 43 percent was "owned" by creditors. The average fixed asset to net worth (FA/NW) ratio for the 12 stations was .33. The FA/NW ratio gives insight into what proportion of a firm's net worth is tied up in fixed plant facilities.

The average return on investment (net savings or profit/net worth) of the nine firms was 17 percent. The return on investment (ROI) ratio gives an estimate of the earnings performance of invested capital. The nine firms' ROI ratios ranged from 11 percent to 22 percent.

An analysis of expense relationships gives an indication of the types of costs an elevator may have and how those costs are related to revenues. Wages as a percent of operating expenses averaged 37 percent for the 14 elevators. Operating expenses as a percent of total revenues averaged 73 percent.

The turnover ratio gives an indication of an elevator's utilization of its plant capacity. Presumably, as more bushels of grain are moved through the elevator, fixed costs per bushel decrease. If variable costs per unit do not increase with volume, average total costs would therefore decrease. The average turnover ratio for the 12 elevators was 4.7, ranging from 3.0 to 9.0. The elevators handled an average of 931,000 bushels in the 1980 calendar year. A summary of the financial ratios discussed above is presented in Table 12.

TABLE 12. SELECTED AVERAGE FINANCIAL RATIOS FOR 12 BISBEE AREA ELEVATORS, 1980 CALENDAR YEAR.

Ratio	Value
Current Assets/Current Liabilities	1.5
Current Assets-Inventory/Current Liabilities	0.88
Net Worth/Total Assets	0.57
Fixed Assets/Net Worth	0.33
Net Savings/Net Worth (ROI)	0.17
Operating Expenses/Total Revenue	0.73
Wages/Operating Expenses	0.37
Storage Capacity Turnover	4.7

The overall financial status of the seven cooperative elevators did not appear to be at all questionable. Although working capital was slightly low, net savings in 1980 was at least 11 percent of net worth in all cases. No particular fixed capital or operating ratios appeared out of line.

Elevator managers stated that service revenues (revenues from non-grain activities) comprised approximatley five percent of total net revenues. Services other than grain storage and merchandising provided by area elevators included seed and feed sales, grain cleaning and drying and other miscellaneous services. A summary of services provided and frequency of provision of each particular service is presented in Table 13.

TABLE 13. NONGRAIN-RELATED SERVICES PROVIDED BY BISBEE AREA ELEVATORS.

Type of Service	Number of Elevators Providing Service
Seed Sales	9
Fertilizer Sales	1
Chemical Sales	2
Feed Sales	10
Grain Cleaning	10
Grain Drying	7
Supplies Sales	4
Custom Fertilizer Application	1
Custom Grinding	3

Truck Service

Motor carriers of agricultural products were exempted from rate and route regulation by the Motor Carrier Act of 1935. This allows the motor carrier to set his rate according to what the competitive situation in the market dictates. Although most truckers would contend that they don't have the ability or market power to set their rates, it is a fact that the rates a trucker can charge, and the loads he can get, are affected by competition as well as costs of operation.

The importance of the motor carrier to the grain industry increased throughout North Dakota, including the study area, until the 1979-80 crop year; a slight decrease in modal share has since occurred. The truck modal share had increased from 21 percent in the 1974-75 crop year to 41 percent in 1978-79, then decreased to 38 percent and 37 percent in 1979-80 and 1980-81, respectively (Table 14). Shippers in Crop Reporting District (CRD) 3, in which Bisbee is located, utilize trucks more than other areas, moving 41 percent of volume by truck in 1978-79, up from an average of 26 percent over the previous four years (Table 15). Crop Reporting District 2 is significantly less dependent on trucking, moving 30 percent of all commodities by truck in 1978-79, up from 25 percent over the previous four years (Table 16).

TABLE 14. NORTH DAKOTA GRAIN AND OILSEED SHIPMENTS, BY MODE, 1974-75 TO 1980-81.

Crop Year	Rail (000 bu.)	Truck (000 bu.)	Total (000 bu.)	Truck %
1974-75	229,653	61,929	291,582	21
1975-76	236,491	83,793	320,284	26
1976-77	205,129	100,783	305,912	33
1977-78	235,178	123,426	358,604	34
1978-79	271,069	185,165	456,234	41
1979-80	294,342	181,724	476,066	38
1980-81	251,938	149,147	401,085	37

Source: Griffin, Gene C., "North Dakota Grain and Oilseed Transportation Statistics, 1980-81," Upper Great Plains Transportation Institute Report No. 42, March, 1982.

TABLE 15. SHIPMENTS FROM CROP REPORTING DISTRICT 3, BY COMMODITY AND MODE, 1974-75 TO 1978-79 CROP YEARS.

Commodity	1974-75				1975-76				1976-77				1977-78				1978-79			
	Truck	Rail	Total	% Rail	Truck	Rail	Total	% Rail	Truck	Rail	Total	% Rail	Truck	Rail	Total	% Rail	Truck	Rail	Total	% Rail
										(000 bushels)										
Wheat	4,757	18,136	22,893		8,454	19,244	27,698		7,567	16,597	24,164		8,033	19,298	27,331		20,400	18,356	38,757	
Percent			35	79			35	69			30	69			30	71			37	47
Durum	1,268	16,057	17,326		3,379	15,893	19,272		2,596	15,832	18,427		3,668	22,038	25,707		5,371	17,585	22,902	
Percent			26	93			25	82			23	86			28	86			22	77
Barley	3,478	16,469	19,948		4,350	19,348	23,698		10,169	20,558	30,727		99,637	15,780	25,417		4,157	19,292	23,449	
Percent			31	17			30	82			38	67			27	62			23	82
Oats	1,302	1,851	3,153		924	2,709	3,633		1,439	1,296	2,735		531	954	1,485		525	607	1,131	
Percent			5	59			5	75			3	47			2	64			1	54
Sunflowers	546	245	791		1,023	831	1,853		1,040	1,144	2,184		6,657	3,812	10,469		11,410	3,393	14,803	
Percent			1	31			2	45			3	52			11	36			14	23
Other	606	682	1,288		814	1,224	2,039		580	1,266	1,847		1,015	1,183	2,198		1,028	1,323	2,351	
Percent			2	53			3	60			2	69			2	54			2	56
Total	11,957	53,440	65,402	82	18,944	59,249	78,193	76	23,391	56,693	80,084	71	29,541	63,065	92,607	68	42,837	60,556	103,393	59

Source: Griffin, Gene C. and Ken Casavant, "An Evaluation of North Dakota Grain Movements," UGPTI Report No. 39 and Agricultural Economics Report No. 145, NDSU, Fargo, August, 1981.

TABLE 16. SHIPMENTS FROM CROP REPORTING DISTRICT 2, BY COMMODITY AND MODE, 1974-75 TO 1978-79 CROP YEARS.

Commodity	1974-75				1975-76				1976-77				1977-78				1978-79			
	Truck	Rail	Total	% Rail	Truck	Rail	Total	% Rail	Truck	Rail	Total	% Rail	Truck	Rail	Total	% Rail	Truck	Rail	Total	% Rail
										(000 bushels)										
Wheat	977	5,302	6,279		1,727	6,145	7,872		1,921	4,910	6,831		1,450	5,920	7,370		1,853	8,176	10,029	
Percent			22	84			29	78			23	72			23	80			26	82
Durum	1,568	11,117	12,685		2,365	9,038	11,404		2,223	9,143	11,367		2,864	13,514	16,378		3,773	12,483	16,256	
Percent			45	88			42	79			39	80			50	83			42	77
Barley	766	5,257	6,023		356	4,265	4,621		1,179	6,582	7,761		1,280	3,940	5,220		1,463	5,467	6,930	
Percent			21	87			17	92			26	85			16	75			18	79
Oats	1,739	482	2,221		1,274	532	1,806		1,488	592	2,081		849	124	974		760	423	1,184	
Percent			8	22			7	29			7	28			3	13			3	36
Sunflowers	--	2	2		55	16	71		20	6	26		997	270	1,267		2,521	318	2,839	
Percent			0	100			0	23			0	23			4	21			7	11
Other	798	133	930		1,363	226	1,589		1,030	325	1,355		1,029	314	1,343		1,221	208	1,430	
Percent			3	14			6	14			5	24			4	23			4	15
Total	5,848	22,293	28,140	79	7,140	20,222	27,363	74	7,861	21,558	29,421	73	8,469	24,082	32,552	74	11,591	27,075	38,668	70

Source: Griffin and Casavant, Ibid.

Characteristics

Motor carriers of grain in North Dakota are generally not single truck owner-operators. Almost 50 percent of the truckers operate 2-4 tractors, while 13 percent are larger firms and 37 percent are single truck owners. These firms operate their vehicles about 88,000 miles per year and have a load on their backhaul movement about 30 percent of the time. Since the potential backhaul movement in the Bisbee trade area is quite low it can be expected that truckers in the trade area may have a lower backhaul percentage, even though some partial backhaul into the Grand Forks, Devils Lake, or Fargo areas may be available.

Grain truckers do rely heavily on North Dakota origins for most of their traffic; almost half of the truckers haul grain only from North Dakota and almost 70 percent utilize North Dakota for over 90 percent of their loads. As expected, most loads are delivered to Duluth/Superior and Minneapolis/St. Paul; however, 20 percent of the North Dakota truckers do have some movement to the Pacific Northwest.

The average age of the motor carriers (length of time in business) is about eight years. About three out of every four firms has been in business for over ten years. Firms in the study area could be expected to be slightly younger and smaller in size than the entire industry because of the substantial growth of sunflower volume in recent years.

Costs of Operation

Information concerning cost of local and long distance trucking is useful as questions of subterminal construction or consolidation of elevators arise. The average cost per running mile for trucking in 1980 was about 92 cents. Larger firms had costs of about 90 cents compared to 94 cents for the owner-operator firm. Fixed costs for a typical three tractor-four trailer firm were about $105,000 per year, which included depreciation, interest on investment, license fees, insurance, housing and management. Variable costs, directly related to mileage, were 52 cents per operating mile and included tires, fuel, maintenance, and labor.

The large amount of variable costs indicates that truckers, if they want to stay in business, cannot afford to quote rates below the total costs of operation for long periods of time. This suggests that if elevator managers want to continue to have this transportation option available, they have to be sensitive and knowledgeable about trucking costs and characteristics. (For a complete discussion of the grain trucking industry in North Dakota, see Wilson, Wesley, Gene Griffin and Ken Casavant, "Costs and Characteristics of Operating Interstate Motor Carriers of Grain in North Dakota," to be released as an Upper Great Plains Transportation Institute Report, 1982).

The elevators in the study area rely on truckers to move a significant portion of their grain to markets. Elevator managers were asked, as part of the survey, to comment on the quality and costs of truck service at their elevator. The managers indicated that truck availability was generally not a problem, although most suggested that rail car availability and rail service affected truck service and cost.

Most managers had one to four independent truckers hauling for them, few on a regular basis. Thirteen different trucking firms were identified by elevator managers--three did not reveal names of truckers, only to specify the number of firms serving their elevators. None of the 14 elevators owned or leased any of their own trucks. All trucks identified serving the elevators had gross and net weights of 80,000 pounds and 50,000 pounds, respectively. According to the 1980 Grain Trucking Directory (Upper Great Plains Transportation Institute and North Dakota Grain Dealers Association), 67 grain trucking firms are based in Crop Reporting Districts two and three.

Most managers felt truck rates did not change during peak shipping periods, but some felt rail car shortages did put upward pressure on their trucking costs. One manager indicated that truck rates increased when grain prices were higher. Few truckers were able to find backhauls into the Bisbee area, according to elevator managers. Managers were basically unaware of the frequency of backhauls, as well as who truckers contacted to attain a backhaul. Little information was known concerning the types of commodities backhauled into the area--steel, limestone and lumber were cited as possible commodities.

Rail Service

Five rail segments are involved with the elevators considered in this study. Three Burlington Northern branchlines and one Soo branch line serve the area southeast to northwest, and a Soo main line extends east to west, crossing the BN branchlines (see Figure 6, page 37). The westernmost BN branchline (York-Dunseith) is listed in Category 3 on the System Diagram Map (abandonment pending approval of ICC). The northernmost portion of the second BN branchline (Churches Ferry - St. John) is identified as a Category 1 line (application for abandonment expected within three years). The third BN branchline (Devils Lake to Hansboro) is listed in Category 2 (under study for possible future abandonment). Both Soo Line segments are under normal operating status. The Burlington Northern has stated that the Churches Ferry to St. John line is of sufficient quality to accommodate heavy hopper cars, as is the York to Dunseith line to Wolford. Beyond Wolford, the track cannot support heavy car loadings. The Devils Lake to Hansboro line has heavy rail in place, but the ties and ballast are poor due to an unstable subgrade. During the rainy season, the track sinks into the subgrade, necessitating a complete embargo of the line.

Eight of the 14 elevators are located on BN or Soo branchlines while five are situated on the Soo mainline. Bisbee is located at the intersection of a BN branchline and Soo mainline and receives service from both railroads. All elevators received service twice weekly. The 14 elevators surveyed shipped an average of 274 rail cars each in the 1978-79 crop year, 259 in 1979-80 and 164 in 1980-81. None of the elevators received any commodities by rail. Rail rates for wheat from each of the 14 elevators to Duluth are presented in Table 17.

The time period September, 1977, to January, 1980 was characterized by frequent shortages of rail freight equipment. However, at this writing there is a surplus of freight cars. Railroad personnel (both BN and Soo) have stated recently that rail freight equipment supplies are not likely to take on the variation characteristic of the last decade due to more efficient equipment utilization via multiple car shipments. However, if such shortages were to materialize again, there is no reason to expect that the Bisbee area would be affected differently than the rest of the state.

Since the implementation of multiple car rates, an elevator's ability to load multiple car trains has become a prime consideration in evaluating its long term competitive viability. Many elevators possess neither the storage or load out capacity nor the rail siding necessary to load more than a few cars per day. Only three of the 14 Bisbee area elevators have siding long enough to load 26 or more cars. Load out capacity for elevators for which data were available ranged from 2,000 to 8,000 bushels per hour and averaged 4,000 bushels per hour. Total grain storage capacity averaged 187,700 bushels. Elevator managers indicated they had rail siding capable of holding from six to 42 cars.

Contracts for Rail Service

One of the more potentially significant changes under the Staggers Act of 1980 was the provision that, subject to Commission approval, a carrier and shipper may enter into contracts for rail service. The use of contracts had been held illegal until 1978 but were encouraged in the 1980 Act.

TABLE 17. SINGLE CAR RAIL RATES FOR WHEAT FROM BISBEE AREA ELEVATORS TO DULUTH.

Origin	Rate (cents/cwt.)
Armourdale	107
Bisbee	105
Cando	101
Crocus	104
Agate	105
Rolette	109
Wolford	105
Mylo	107
Rolla	111
Perth	107
Hansboro	111
Rock Lake	105
Egeland	101
St. Joe	101

Some agricultural interests are concerned about anti-competitive results of such contracts while other shippers feel it is an opportunity to participate in a legal instrument that could decrease uncertainty. Thus far, few agricultural contracts have been developed in the nation and no known grain contracts exist in North Dakota. Those few grain contracts filed have been very recent.

There are a number of reasons for this reluctance to participate in contracts:[7]

(1) Rail contracting involves a new legal concept that has not yet been clearly defined.

[7]See Dooley, Frank, Rail Contracts: The Initial Characteristics and Development of Usage, Washington State University, December 1981.

(2) Carriers could be concerned about entering into long-term commitments without substantial protection because of the historical inflationary nature of the economy.

(3) The grain merchandising sector is undergoing significant changes due to the multiple car rate restructuring and elevators and shippers trying to react to these changes have not yet found it useful to utilize contract rates.

(4) Carriers have been reluctant in committing themselves to grain contracts because of the competitive nature of the market on some origin-destination movements. (This reluctance may disappear in the future as the oversupply of rail cars decreases).

(5) The nature of agricultural commodity production and marketing does not lend itself to volume specific rates.

Still there are potential benefits from contracting that suggest its use may increase in North Dakota and in the Bisbee study area.

(1) Contracts could decrease shipper uncertainty associated with transport rates and service availability in the future.

(2) Carriers may enter contracts as a means of maintaining market share and/or generating new traffic in competitive areas.

(3) Contract rates appear to be volume oriented and hence, may be more feasible for a large volume, high capacity subterminal, like that considered for Bisbee, than existing country elevators.

Study Area Rates, Modes and Destinations

The elevators in the study area use both truck and rail to move their grain to market. The truck and rail rates published for each of these elevators are usually quite close (Table 18). This reflects the truckers desire to quote a rate that will allow them to compete with the railroad for grain shipments. The most significant difference in rates was for Mylo where rail rates were 7 cents higher

TABLE 18. RAIL AND TRUCK RATES FOR WHEAT TO MINNEAPOLIS/ST. PAUL AND/OR DULUTH/SUPERIOR

Elevator	Rail Single Car Rate	Truck
	(cents per hundred)	
1. Wolford	105	100
2. St. Joe	101	105
3. Rolla	111	105
4. Rock Lake	105	107
5. Egeland	101	107
6. Armourdale	107	107
7. Crocus	104	107
8. Hansboro	111	105
9. Mylo	107	100
10. Perth	107	105
11. Agate	105	100
12. Cando	101	100
13. Rolette	109	105
14. Bisbee	105	105

than truck rates. Truck rates were slightly lower at eight elevators, higher at four of the firms, and the same at two elevators. This phenomenon emphasizes the extreme competition that exists between the two modes at the single car rail rate level.

The modal shares from each elevator origin also vary (Table 19). The truck modal share varies from a low of zero percent at Armourdale to 60 percent at Wolford and averages 19 percent for all 14 stations. These model shares were used in computing transportation costs to terminal markets.

A final characteristic used to calculate transportation costs to the terminal was the distribution between destinations for each

TABLE 19. MODAL SHARE OF GRAIN SHIPMENTS FROM ELEVATORS IN STUDY AREA, 4 YEAR AVERAGE, 1977-78 TO 1980-81.

Elevator	Rail	Truck
1. Wolford	40	60
2. St. Joe	89	11
3. Rolla	73	27
4. Rock Lake	93	7
5. Egeland	89	11
6. Armourdale	100	0
7. Crocus	100	5
8. Hansboro	75	25
9. Mylo	98	2
10. Perth	70	30
11. Agate	83	17
12. Cando	71	29
13. Rolette	78	22
14. Bisbee	80	20

elevator, (Table 20). This distribution pattern, with the exception of Egeland, shows substantial similarity. Minneapolis/St. Paul received an average of about 30 percent of all grain movements from the 14 elevators, while Duluth received 70 percent. Over the four year period a small percentage (one to eight percent) was shipped to other markets, primarily the Pacific Northwest and other Minnesota destinations. However, due to the lack of specific data concerning these movements, all grain was assumed to move into either the Duluth/Superior or Minneapolis/St. Paul markets.

It does appear that there is some relationship between the quoted rates and the modal splits, but it is not very strong. Wolford,

TABLE 20. GRAIN SHIPMENTS FROM ELEVATORS IN STUDY AREA, PERCENT BY DESTINATION, 4 YEAR AVERAGE 1977-78 TO 1980-81.

Elevators	Minneapolis/St. Paul	Duluth
	---------- Percent ----------	
1. Wolford	40	60
2. St. Joe	33	67
3. Rolla	19	81
4. Rock Lake	16	84
5. Egeland	77	23
6. Armourdale	27	73
7. Crocus	24	76
8. Hansboro	17	83
9. Mylo	31	69
10. Perth	18	82
11. Agate	30	70
12. Cando	18	82
13. Rolette	45	55
14. Bisbee	24	76

for example, has a rail rate five cents higher than the truck rate, but relies on trucks for 60 percent of its movements. Mylo, at the other extreme, has a rail rate seven cents higher than the truck rate, but still moves 98 percent of its grain by rail. Armourdale had identical truck and rail rates but still ships all of its grain by rail.

It is obvious that while rates are important, especially if the difference is large, other factors also influence an elevator manager's modal choice. Possible factors include capacity availability, commodity, destination, backhaul availability, desire to keep truckers as a competitive pressure on the railroads, etc.

Rail Rate and Cost Relationship

The relationship between the rates charged by the railroads and the costs incurred by the railroad in providing that service is very important to planning of a subterminal facility. Since the construction and operation of a subterminal is an extremely costly and complex decision, the possibility exists that, after construction, the railroad might change the rate structure, thus undermining the economic feasibility of the subterminal. It then is useful to examine the relationship that exists between rates and costs from Bisbee to Minneapolis/St. Paul and Duluth/Superior.

The Staggers Act of 1980 allows railroad management much more flexibility in pricing without regulatory or legal ramifications. Rates set by the railroads are subject to Interstate Commerce Commission review, but only under certain conditions. If the ratio of revenue to variable cost is greater than 1.8 (which is rather dubious at the outset due to conflicting costing methods used by different parties), the protestant can appeal to the ICC concerning reasonableness of a rate. The protestant must then prove that market dominance exists and subsequently detail the unjustness and unreasonableness of the rate. If this can be accomplished, rates may be decreased, or potential increases halted. The current flavor of Commission decisions suggests that the three criteria would be difficult to prove in an actual rate case. However, an analysis of current rate/cost relationships may give insight into short-run projected changes in rates.

The costs of single car, 26 car and 52 car movements from Bisbee to the terminal markets were calculated and compared to recent rate quotes (Table 21). Because Minneapolis/St. Paul is slightly further away from Bisbee than Duluth, costs to this terminal are consistently 1½ to 2 cents per hundredweight higher. It is also evident that significant cost savings are realized when shipments increase in size, e.g., full costs drop from 73.7 cents per hundred to 61.6 cents when grain is moved in a 26 car unit instead of a single car. Further cost reductions, about five to six cents, are experienced on a 52 car movement. It is interesting to note that most of the cost savings among the single car, 26 car and 52 car movements are reflected in the multiple car rate reduction.

TABLE 21. RAIL RATES AND COSTS FOR WHEAT[a], BISBEE TO MINNEAPOLIS/ ST. PAUL AND DULUTH, CENTS PER HUNDRED, 1982.

	Duluth			Minneapolis/St. Paul		
	Single Car	26 Cars	52 Cars	Single Car	26 Cars	52 Cars
Variable Cost	56.7	47.4	42.4	58.4	49.0	43.9
Full Cost	73.7	61.6	55.2	75.9	63.7	57.2
Rail Rate	105.0	91.0	86.0	105.0	91.0	86.0
Rate/Variable Cost	1.85	1.91	2.03	1.80	1.86	1.96
Rate/Full Cost	1.43	1.48	1.56	1.38	1.43	1.50

[a]All cost estimates based on 92 ton maximum loaded weight.

Source: Denver Tolliver, UGPTI

All revenue/variable cost ratios for shipments to both destinations are at or over 180 percent. Furthermore, most of the rates are about 40 to 50 percent over fully allocated costs. This suggests that future rate increases reflective of cost recovery adjustments may not be large. However, rate adjustments are generally sought "across the board" rather than for a specific station. Bisbee, therefore may very easily be included in any rate increases sought by the railroads in North Dakota.

A note of caution should be interjected at this point. The future of North Dakota's rate structure is indeed in question. For example, currently the westbound rate structure strongly favors shipment in 52 car lots rather than 26 or single car consignments. But as the grain marketing structure evolves in North Dakota, the situation may change. Large capital investment in 52 car shipping facilities may be ill-advised if the rate structure does not continue to favor the 52 car shipper. Future pricing policies by the railroads may change as large elevators become an integral part of North Dakota's grain marketing channel.

For purposes of this study, current rail rates were used for estimating costs of moving grain from Bisbee to terminal markets. Attempting to project future changes in the rate structure would be purely conjectural in nature and inappropriate for this analysis.

Road System in Study Area

Most elevators in the Bisbee area have ready access to a complete paved highway network. Three of the elevators' shipments would require five miles or less of routing on gravel roads, one elevator has about ten miles of gravel road on its most probable route to Bisbee.

State Highway 66 intersects the BN branchline at Bisbee and runs parallel to the Soo main line from Mylo eastward. Four of the 14 elevators (Rolette, Mylo, Agate, and Egeland) lie direclty adjacent to Highway 66, a two-lane paved highway. These communities' access to a subterminal in Bisbee would be through a direct shipment on Highway 66. U.S. Highway 281 provides access to Bisbee for Cando, Crocus, Rock Lake, Armourdale and Hansboro. Wolford lies adjacent to east-west Highway 17. Shipments from Wolford to Bisbee would either need to be routed over a ten mile segment of unpaved road northward from Highway 17 to Bisbee, or on a more circuitous route through Cando. Perth is not situated on a paved highway; grain shipments to Bisbee would have to be routed over approximately seven miles of gravel road to gain access to a paved road to Bisbee. Shipments from St. Joe would be routed over two miles of gravel and through Cando onto Highway 281. Rolla has direct highway access to Bisbee via Highways 30 south and 66 east.

Grain Storage

The federal government has been involved in farm programs for decades in attempts to stabilize farm prices and grain stocks. The farmer-owned grain reserve presently allows farmers to extend farm storage loans into contracts with the Commodity Credit Corporation (CCC). Farmers are given loans as well as storage payments on stored grains if they leave their grains in storage for the duration of the contract, and if market prices for the commodity do not go above specified levels. If prices go above a "release" price, storage payments to farmers stop. The loan is called for repayment if market prices go above a "call" price. For example, the loan rate for wheat (price used for farmers' grain when computing loan value) was $3.00 per bushel effective August 24, 1980. The release price was $4.20 per bushel and the call price was $5.25 per bushel. If the market price for wheat rose above $4.20 per bushel, farmers no longer received payments for storing their grain but could still continue the loan contract. The loans were called due in full if the price ascended to above $5.25 per bushel. Farmers can remove their grain from the farmer-owned reserve before the price reaches the release level, but only under penalty. Presently, the release price and the call price are identical ($4.65 in 1982), so when the release price is reached, the loans are called for repayment.

According to a 1979 Grain Reserve survey of North Dakota wheat producers, average North Dakota on-farm storage capacity was 28,157 bushels per farm. Crop Reporting Districts 2 and 3 averaged 26,519 and 31,360 bushels per farm, respectively (Table 22). Total storage capacity in the three counties in the study area is presented in Table 23. Off-farm storage facilities in North Dakota (commercial storage) had a total capacity of 154,810,000 bushels in 1981.[8]

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[8]U.S.D.A. - S.R.S, Grain Stocks

TABLE 22. AVERAGE NORTH DAKOTA ON-FARM GRAIN STORAGE CAPACITY PER FARM BY CROP REPORTING DISTRICT.

Crop Reporting District	Capacity (bushels)
1	23,094
2	26,519
3	31,360
4	14,978
5	36,328
6	37,027
7	34,479
8	18,310
9	31,321
State	28,157

Source: 1979 Grain Reserve survey of ND wheat producers by Dennis Ming, UGPTI, unpublished data.

TABLE 23. TOTAL COUNTY ON-FARM GRAIN STORAGE CAPACITY, SELECTED COUNTIES, 1979.

County	Per Farm Storage (bushels)	Number of Farms	Total Available Storage (bushels)
Rolette[a]	26,519	407	10,793,233
Pierce	26,519	408	10,819,752
Towner	31,360	596	18,690,560

[a]Rolette and Pierce counties are located in CRD 2; Towner county is located in CRD 3. Specific data for each county were not available; the assumption was made that CRD data were representative of all counties within that CRD.

Rural Communities in Study Area

The communities within the Bisbee trade area are generally small and have few retail businesses or commercial enterprises. The average population of the 14 cities in 1980 was 323 people, ranging from 1538 to a "community" whose only business and resident was the elevator and its manager. Four of the communities were not listed in the Census Reports and were assumed to have populations less than ten. Only three towns had populations listed above 300, only two greater than 1000 (Table 24).

The potential for backhauling goods by truck into these communities appears to be quite limited. Most of the towns are small and have few established retail or commercial outlets requiring trucked in goods. Cando and Rolla are classified as Class A Farm Trade Centers,[9] the remaining ten communities are classified as hamlets or are unclassified. Also, grocery or retail chains often have their own private carriage and do not utilize common or exempt carrier services. However, some potential may exist for a partial backhaul. For example, a trucker hauling grain to Minneapolis may be more likely to find a backhaul load to Fargo or Grand Forks rather than all the way to Bisbee. A partial backhaul would alleviate somewhat the high cost of empty returns.

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[9] Voelker, Helgeson and Vreugdenhil, op. cit.

TABLE 24. POPULATION OF BISBEE AREA COMMUNITIES, 1980.

City	Population
1. Wolford	76
2. St. Joe	a
3. Rolla	1538
4. Rock Lake	287
5. Egeland	112
6. Armourdale	a
7. Crocus	a
8. Hansboro	43
9. Mylo	31
10. Perth	20
11. Agate	a
12. Cando	1496
13. Rolette	667
14. Bisbee	257

[a]No population data available.

Source: 1980 Census of Population and Housing, U.S. Department of Commerce, Bureau of Census, Issued March, 1981.

Summary

Fourteen country elevators are included in the analysis, each handling an average of about 900,000 bushels of grain in the 1980 calendar year. One of the stations is privately owned, the remaining are farmer-owned cooperatives. Financial conditions of the 14 stations were scrutinized and deemed stable.

Both truck and rail service are utilized in the study area, with rail being the predominant mode for wheat, durum and barley, while sunflower is hauled mostly by truck. Rail service is in the midst of significant change in the study area, caused mainly by proposed branchline abandonment and the implementation of multiple car rail rates.

Chapter IV is an analysis of the existing grain merchandising and transportation system in the Bisbee area. Current grain merchandising techniques are described, and costs of the transportation and merchandising system are presented.

CHAPTER IV

SCENARIO I--CURRENT GRAIN DISTRIBUTION COSTS FOR THE STUDY AREA

Introduction

The country grain marketing system in the Bisbee area and throughout North Dakota is undergoing significant change. The introduction of high capacity farm and over-the-road trucks, multiple car rail rates and new contractual arrangements requires an adjustment by producers and country elevator managers away from the traditional style of grain marketing. The "competitive edge" may quickly change from firm to firm as managers and entrepreneurs grasp new marketing techniques via education about the grain marketing system.

This chapter reviews the existing grain handling and marketing system in North Dakota, paying special attention to the Bisbee study area, by tracing movements of grain from farms to the country elevator and beyond. Marketing alternatives available to farmers and elevator operators are described, as well as operating costs of country grain handling facilities and transportation services.

Grain Procurement and Merchandising in North Dakota

From the time a hopperload of wheat is unloaded from the combine on a farm until it reaches the domestic miller or exporter, the grain goes through a variety of merchandisers and may change hands several times. Many alternatives are available to both farmers and elevator managers concerning timing of grain sales and purchases, contractual agreements and futures market options. This section reviews in brief the marketing channels of grain from North Dakota and some of the marketing options available to participants.

Timing of Grain Movements

The bulk of the grain harvested in the Bisbee area is done so in August and September; sunflower harvest normally follows three to four weeks after the wheat harvest. Farmers usually haul their harvested crops to on-farm storage, or take it to a nearby elevator for sale or commercial storage. The proportion of a farmer's grain sold at different times of the year would depend on his available storage, his need for cash and income tax position, and outstanding contract commitments.

Grain movements out of North Dakota are seasonal in nature, the intensity of the variation depending on the commodity, destination or origin of the grain.[10] The periods immediately after harvest and late spring generally exhibit heavier grain movements than other months (Figure 7). Shipments to Duluth/Superior are more seasonal than movements to other destinations. Shipments of hard red spring wheat and durum generally peak around September and reach a low during early spring. Oats shipments are more variable in nature among months. Western origins in North Dakota generally exhibit less seasonality in their grain shipments than other areas of the state.

Country elevators exist primarily to perform grain merchandising rather than storage. Therefore, these grain movements from country ele-

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[10]Wilson, William W. and John Crabtree, "Seasonal Behavior of Marketing Patterns for Grain from North Dakota", Ag. Econ. Report #143, UGPTI Report #38, March, 1981.

vators to terminal markets very closely approximate movements from farms to country elevators. The extent to which shipments from farm to elevator deviate from elevator to terminal market movements would depend on the extent the storage function of elevators allows them to accumulate or deplete storage stocks at will, with no capacity or logistical constraints. In general, however, average inventory levels of commercial warehouses in the study area and North Dakota would indicate that country elevators are first and foremostly grain merchandisers. A lag between farm to elevator movements and elevator to terminal shipments may occur, however, due to the time required to arrange sale of the grain and procure transportation services.

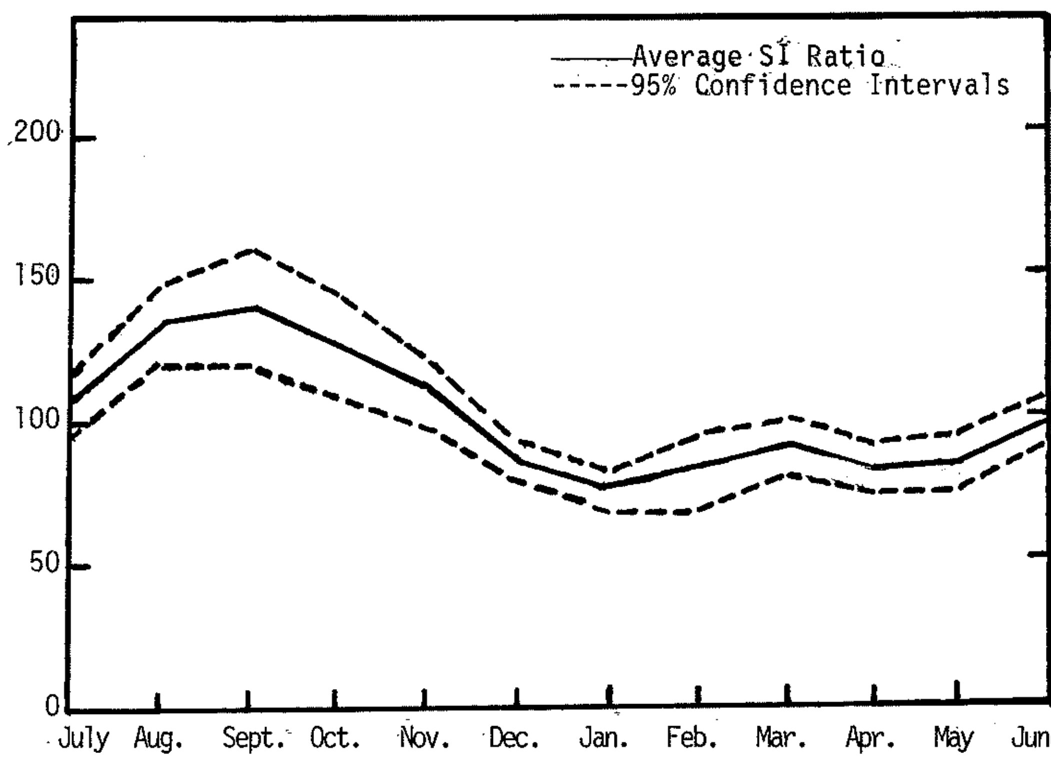

FIGURE 7. MONTHLY SEASONAL-IRREGULAR RATIOS FOR ALL GRAIN MOVEMENTS FROM NORTH DAKOTA

Source: Wilson and Crabtree, Ibid.

Purchases of Grain

Farmers have several selling options available to them when they decide to dispose of their grain. Before he even has the grain in the bin (or even the crop planted), forward contracts are available to lock in a price for his crop. This option guarantees the farmer a price for his grain; many specifications are quoted in such contracts such as grade, quantity, time of delivery, etc.

Traditionally the most common type of sale by farmers and elevator managers in the study area, as throughout North Dakota, is the cash sale. The price quoted the farmer ("board price" at the elevator) is based on the spot market bid prices at major markets less transportation costs and elevator margins. The farmer knows exactly what he will receive for his grain, and the elevator operator knows precisely what his margin is on each bushel he buys and resells.

Another common type of cash sale is the "to arrive" sale where grain is priced for delivery "to arrive" at the terminal market within a specified time period (generally 7, 15 or 30 days). The "to arrive" sale differs in that the grain is priced prior to delivery at the terminal elevator. The risk of price fluctuation on a "to arrive" sale after the grain is priced is on the terminal market buyer rather than on the country elevator.

One type of sales contract farmers may enter into is the delayed payment (DP) contract. The DP contract allows the farmer to sell his grain, yet delay being paid until he feels his income tax and cash flow position will be most benefited. Many farmers will delay payment on grain sold at harvest until after December 31 to adjust their income tax liability.

A contract gaining popularity recently is the "Priced Later" or "No Price Established" (NPE) contract. Under the NPE contract, the farmer "sells" his grain to the elevator, but is allowed to actually price it at some time in the future, depending on the terms of the contract (90 days, six months, or up to one year in some cases). The contracting elevator manager may request that the grain be delivered by the farmer (or arrange for transportation themselves) at his convenience to more effectively utilize elevator capacity and streamline procurement of transportation services. The grain may actually be far along in the marketing system before the farmer prices, or is paid for, his grain. The proportion of grain sold under cash sales, forward contracts and NPE contracts in North Dakota is presented in Figure 8.

Another option presently available to producers is to put their grain into the farmer-owned grain reserve. The farmer is paid for storing his grain and can borrow against the crop. A more complete discussion of this program is presented in Chapter 3.

Country elevators attempt to minimize the price risk they must accept when buying and selling grain. On types of grain sales where the elevator retains ownership of the commodity, the manager will usually hedge an equal amount of grain in the futures or to arrive market, so any adverse price movements in the cash market will be offset by gains in the futures market (basis changes excluded). When the cash grain is sold, he reverses his futures position. However, if the elevator

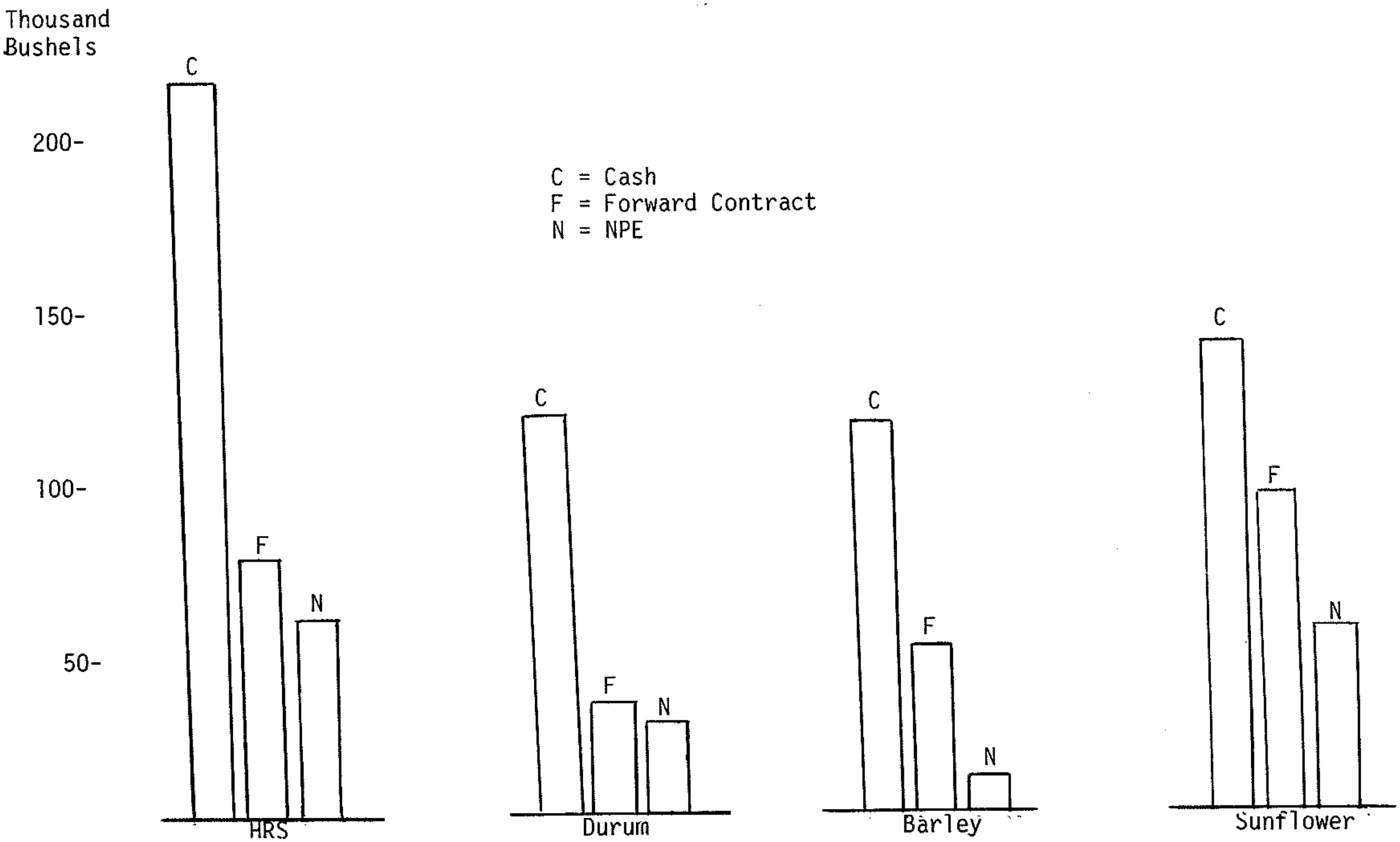

FIGURE 8. TYPES OF PURCHASES BY COMMODITY, NORTH DAKOTA ELEVATORS, 1981.[a]

[a]The elevators included in these survey data actually had 25 percent larger storage capacities than the state average.

Source: Ming, Dennis and William Wilson, op. cit.

operator is willing to take the risk of a price decline, or feels market conditions indicate rising prices, he may not take a position in the futures market. "To arrive" grain sales pose no price risk in transit to the country elevator after the sale is made, therefore the price offered by terminal market buyers for "to arrive" grain is generally less than for other types of sales.

Other Country Elevator Functions

Elevator operations include activities other than grain merchandising, although these activities are a relatively small component of the operations at elevators in North Dakota. Many elevators in North Dakota, and most in the Bisbee trade area, have constructed grain drying systems, particularly since the tremendous increase in sunflower production in the state. Farmers who don't possess drying capabilities and wish to sell high moisture grain can generally hire the elevator to dry the grain before storage. Elevators also perform other quality tests on grain such as dockage and protein tests.

One important peripheral activity by elevators is blending of various lots of grain. Blending is performed to achieve the desired protein level, moisture content, or other combination of grade specifications. Because bid prices for various grades often differ, the elevator manager wishes to blend in such a way to achieve the highest quality batch of grain possible. Elevators equipped with cleaning and drying equipment can often improve the overall quality of grain by conditioning or removing unwanted foreign materials.

Many country elevators often sell farm supplies at their plant, particularly if the elevator is a farmer-owned cooperative. Livestock supplies (including feed), fertilizer and chemicals, and seed are some of the products handled at elevators in the Bisbee area.

Recent Changes in Grain Merchandising

The introduction of unit train shipments has changed the traditional styles of marketing grain for some elevators in North Dakota. Single car consignments of grains have become less attractive due to the rate reductions applied to multiple car movements. The first multiple car rates became effective December 1, 1980, when the Burlington Northern published westbound rates from North Dakota. Both the Burlington Northern and Soo Line have since published eastbound rates for multiple car shipments to Duluth/Superior and Minneapolis/St. Paul. The Burlington Northern published east and westbound rates for all elevators located on their trackage in North Dakota. The Soo Line has adopted the policy of publishing a multiple car rate for individual elevators when a rate is requested from a facility capable of handling multiple car consignments. Thus far, the rates quoted by the two railroads are similar. Specific rates from Bisbee will be discussed in more detail later in this report.

Cost Of Current Merchandising And Transportation System (Scenario I)

It is important to the discussion in Chapter V on "Future Alternatives" to compare future costs with those of the existing system. This section is therefore labeled Scenario I - The Existing System.

Trucking Costs--Farms to Country Elevators

Farmers' grains have traditionally been hauled from the field or on-farm storage to country elevators by single-axle or tandem-axle farm truck. Recently, some producers have either purchased large semi-tractor-trailer rigs for their own use, or hired exempt carriers to haul grain from their farm to elevators or direct to terminal markets. Elevator managers have also arranged for grain to be picked up at the farm and hauled to the elevator or terminal market.

Farm trucks in North Dakota, on the average, are about 20 years old and travel 5,162 miles per year (Table 25). Tandem-axle trucks generally travel more miles and are newer than single-axle trucks. Larger farmers generally have newer trucks which travel more miles than small farms. Costs per mile for the different types of farm truck operations are presented in Table 26.

Costs of shipping grain from the farm to country elevators in the Bisbee area under the existing transportation configuration are estimated in this section. Elevator managers, as part of the personal interview survey, estimated the distribution of their customers within specified mileages of their elevator. A weighted average of the distance traveled by farmers to each elevator was computed and is presented in Table 27. Managers also estimated the proportion of their incoming grain delivered by type of truck (single axle, tandem axle and tractor-trailer rig). A weighted average cost per bushel and per trip was computed using $1.013/mile and 278 bushels/truckload for single axle trucks and $1.266/mile and 543 bushels/truckload for tandem axle trucks (Table 27). The weighted average of the per bushel costs for all 14 elevators was 4.2 cents. Total estimated costs of transporting grain by farm truck to the 14 elevators was $467,980.

TABLE 25. CHARACTERISTICS OF THE NORTH DAKOTA FARM TRUCK INDUSTRY, BY TYPE OF FARM TRUCK OPERATION

Vehicle Type	Miles Traveled Annually	Average Length of Haul (one way)	Average Payload/bu.	Number of Trucks	Year of Trucks
Industry	5,162	11.7	312	1.94	61.6
Single Axle	4,270	11.5	278	1.83	59.9
Tandem Axle	11,979	10.6	543	2.00	70.6

Source: Casavant, Prof. Ken "An Economic Analysis of the Costs and Characteristics of Operating Farm Trucks in North Dakota", to be released as an UGPTI report, 1982.

TABLE 26. ESTIMATED PER-MILE AND PER-BUSHEL COSTS BY TYPE OF FARM TRUCK OPERATION

Vehicle Type	Cost Per Mile	Cost per Bushel-Mile
Single Axle	$1.013	$.0036
Tandem Axle	1.266	.0023

Source: Casavant, Ibid.

Costs of Elevator Operation

Annual operating expenses for the 14 elevators in 1980 were taken from annual statements provided by managers, or were specified in the personal interview. Average total cost (ATC) of each elevator was estimated by dividing total annual costs of operation (including depreciation) by bushels handled in 1980. Using this method, ATC ranged from 10.3

TABLE 27. COSTS OF SHIPPING GRAIN FROM FARMS TO 14 BISBEE AREA ELEVATORS

Elevator Number	One Way Distance Farm-Elevator (miles)	Percent by Truck Type: Single Axle (%)	Percent by Truck Type: Tandem Axle (%)	Round Trip Cost: Total ($)	Round Trip Cost: Per Bushel[a] (cents)	Grain Handled (bu.)	Total Cost ($)
1-Wolford	7.5	85	15	15.76	4.96	424,764	21,068
2-St. Joe	5.5	90	10	11.42	3.75	320,714	12,027
3-Rolla	5.0	b	b	10.83	3.08	1,039,772	32,025
4-Rock Lake	7.5	70	30	16.33	4.57	1,259,938	57,579
5-Egeland	3.75	70	30	8.17	2.29	322,821	7,393
6-Armourdale	3.0	70	30	10.89	3.05	468,309	14,283
7-Crocus	5.0	70	30	10.89	3.05	311,742	9,508
8-Hansboro	7.5	65	35	16.52	4.46	903,653	40,303
9-Mylo	7.0	70	30	15.24	4.26	264,360	11,262
10-Perth	7.5	65	35	16.52	4.46	1,692,322	75,478
11-Agate	10.0	70	30	21.78	6.09	1,035,215	63,045
12-Cando	c	70	30	14.11	3.95	1,461,089	57,713
13-Rolette	7.5	75	25	16.14	4.69	915,924	42,957
14-Bisbee	5.5	70	30	11.98	3.35	696,683	23,339
Total						11,117,306	$467,980

[a]Weighted by percent single axle and tandem axle.

[b]Average used (72.3% and 27.7).

[c]Average used (6.48 miles).

cents per bushel to 30.4 cents per bushel. Average total cost was also estimated using a regression equation developed for all North Dakota elevators[11] (See Appendix, page 150). A summary of costs of operation for the 14 elevators is presented in Table 28.

Average total costs in 1980 exhibited much more variation among elevators than those estimated using the regression equation. These costs should be interpreted carefully due to the organizational structure of many of the elevators. For example, the Rock Lake Farmers Union Elevator Association has four plants under its control, all at separate locations. It would be difficult to apportion expenses out to individual plants in such a case because much of the overhead is incurred by the main office--separate books for many accounting details are not kept for all stations. Total costs of operation at all stations along with total bushels handled were used in computation of average total costs. This single cost estimate was used for all elevators under the firm's control.

Transportation Costs--Country Elevators to Terminal Markets

Grain is transported from the Bisbee area by both rail and trucks. Hard red spring wheat, durum and barley are shipped mostly by rail while sunflower is shipped primarily in trucks.[12] Most of the grain is shipped to either the Duluth/Superior market or the Minneapolis/St. Paul market. Shipments to the Pacific Northwest (PNW) constituted less than one percent

[11]Chase, Craig A., "Cost Structure and Characteristics of North Dakota's Country Grain Elevators", to be released as an Agricultural Economics Report, Department of Agricultural Economics, NDSU, 1982.

[12]Lower multiple car rates may have an effect on truck's competitive advantage on sunflower.

TABLE 28. ACTUAL 1980 AND PREDICTED AVERAGE TOTAL COSTS OF OPERATION, FOURTEEN SELECTED ELEVATORS

Elevator Number	Bushels Handled: Four Year Average 1977-78 to 1980-81	Bushels Handled: 1980	Average Total Cost: Predicted	Average Total Cost: Actual 1980	Total Cost[d]
1	424,764	NA	15.45	17.2	65,626
2	320,714	NA	16.34	30.4	52,405
3	1,039,772	1,315,774	12.63	16.1	131,323
4	1,259,938	2,336,503	12.03	15.8	151,571
5	322,821	a	16.32	15.8	52,684
6	468,309	a	15.15	15.8	70,949
7	311,742	a	16.43	13.8	51,219
8	903,653	c	13.08	10.3	118,198
9	264,360	b	16.95	13.8	44,809
10	1,692,322	2,846,658	11.10	10.3	187,848
11	1,035,215	1,436,296	12.65	14.2	130,955
12	1,461,089	1,503,577	11.56	NA	168,902
13	915,924	NA	13.03	19.1	119,345
14	696,683	802,371	13.90		96,839
					1,442,673

[a]Included in elevator #4 bushels.

[b]Included in elevator #11 bushels.

[c]Included in elevator #10 bushels.

[d]Computed using the four year average bushels handled and predicted average total cost.

of total movements. Shipments to all other destinations[13] accounted for approximately 17 percent of total movements from the 14 elevators (Table 29). Therefore, the two major terminal markets (Duluth/Superior and Minneapolis/St. Paul) were considered in this transportation cost analysis; these two markets were used as proxies for grain shipped to all other markets.[14]

TABLE 29. GRAIN SHIPPED FROM 14 BISBEE AREA ELEVATORS TO SELECTED DESTINATIONS, FOUR CROP YEAR AVERAGE, 1977-78 TO 1980-81[a]

Destination	Grain Shipped (bu.)	Percent of Total
Duluth/Superior	6,747,640	60.7
Minneapolis/St. Paul	2,395,449	21.5
Pacific Northwest	78,897	0.7
Other	1,895,320	17.1
Total	11,117,306	100.0

[a]Includes hard red spring wheat, durum, sunflower and barley.

A weighted per bushel cost from each elevator to both destinations was estimated using four year averages of crop year movements (Table 30). The cost per bushel for each commodity was computed by weighting the freight rate for each mode by their respective modal share. The weighted cost of shipping all commodities to both destinations is presented in Table 31.

[13]Other destinations would include other Minnesota destinations, Sioux City/Omaha/Kansas City, Eastern and Southern destinations, other midwest and southwestern destinations, and all other destinations.

[14]This is an obvious simplification, but limited data are available concerning these other markets, and distances to most of these other markets reasonably approximte distances to Duluth/Superior and Minneapolis/St. Paul.

TABLE 30. WEIGHTED PER BUSHEL TRANSPORTATION COSTS FROM BISBEE AREA ELEVATORS TO DULUTH/SUPERIOR AND MINNEAPOLIS/ST. PAUL, DOLLARS PER BUSHEL

Elevator Number	Destination							
	Duluth				Minneapolis			
	Wheat	Durum	Sunflower	Barley	Wheat	Durum	Sunflower	Barley
1	.62	.62	.28	.48	.63	.63	.28	.66
2	.61	.61	.28	.48	.61	.61	--	.81
3	.65	.66	.30	.52	.66	.66	.30	.83
4	.63	.63	.30	.50	.63	.63	.30	.84
5	.64	.62	.30	.49	.61	.61	--	.82
6	.64	.64	--	.51	.64	.64	--	.84
7	.62	.62	--	.50	.62	.62	--	.81
8	.65	.66	.29	.51	.67	.67	--	.82
9	.64	.64	--	.51	.64	.64	--	.84
10	.63	.64	.29	.50	.64	.64	.29	.84
11	.61	.63	.28	.50	.63	.63	.28	.84
12	.61	.61	.28	.48	.61	.61	.28	.80
13	.64	.65	.30	.51	.65	.65	.29	.84
14	.63	.63	.29	.50	.63	.63	.29	.81

Assumes per bushel weights of: HRS wheat and durum--60 pounds; sunflower--28 pounds; and barley--48 pounds.

TABLE 31. TOTAL TRANSPORTATION COSTS, WEIGHTED BY COMMODITY, CENTS PER BUSHEL

Elevator Number	Destination	
	Duluth	Minneapolis
1	51.6	60.5
2	58.7	76.4
3	61.1	72.1
4	60.1	71.6
5	58.6	70.8
6	62.7	71.8
7	59.9	69.7
8	63.8	76.6
9	63.5	80.0
10	55.4	74.0
11	59.2	77.4
12	54.9	72.6
13	56.3	70.6
14	61.5	75.5

Summary

The intent of this chapter was to briefly describe the current country grain marketing system in the Bisbee area and its costs (Scenario I), so that a comparison of costs can be made with the "future alternatives" discussed in Chapter V.

Total costs of moving grain from farm gate to major terminal markets included farm truck costs, elevator operation costs and transportation costs to terminal market (Table 32). Costs of trucking grain from the farm to country elevator ranged from 2.29 - 6.09 cents per bushel and varied primarily because of difference in size of elevator market area and size of truck used.

Elevator operation costs were estimated using two methods for comparative purposes. Using 1980 annual expenses divided by bushels handled the average cost for the 14 elevators was 16 cents per bushel. Using a previously developed estimating equation for all North Dakota country elevators[15], the average was 14 cents per bushel.

Transportation costs from the country elevators to terminal markets were estimated to find the per bushel "freight bill" from each elevator. Current trucking rates were obtained from the elevator managers and current rail rates were taken from the appropriate tariffs.[16] Only single car rail rates were used for estimating the transportation costs of the traditional marketing system.

A summary of all computed costs, farm truck costs, elevator operation

[15] Chase, op. cit.

[16] Supplement 194 to BN4016 (eastbound non-transit BN rates); Supplement 195 to BN 4016 (eastbound transit BN rates); Supplement 14 to Soo 4087-B (Soo rates eastbound, transit and non-transit).

costs and elevator to terminal market transportation costs are presented in Table 32. The total cost of grain movements from the 14 elevators to Duluth/Superior and Minneapolis/St. Paul was approximately 8.8 million dollars. Grains included in this analysis were hard red spring wheat, durum, sunflower and barley.

TABLE 32. TOTAL MARKETING COSTS FOR GRAIN FROM 14 BISBEE AREA ELEVATORS TO MAJOR TERMINAL MARKETS

Elevator Number	Farm Truck Costs	Elevation Costs	Transportation Costs		Total Cost/ bushel		Total Cost	
			Duluth	Mpls.	Duluth	Mpls.	Duluth	Mpls.
1	4.96	15.45	51.6	60.5	72.01	80.91	184,747	136,046
2	3.75	16.34	58.7	76.4	78.79	96.49	169,302	102,121
3	3.08	12.63	61.1	72.1	76.82	87.81	646,191	174,387
4	4.57	12.03	60.1	71.6	76.70	88.20	816,585	172,246
5	2.29	16.32	58.6	70.8	77.21	89.41	58,075	221,333
6	3.05	15.15	62.7	71.8	80.90	90.00	277,705	112,535
7	3.05	16.43	59.9	69.7	79.38	89.19	188,812	65,876
8	4.46	13.08	63.8	76.6	81.34	94.14	613,016	141,216
9	4.26	16.95	63.5	80.0	84.71	101.21	154,071	83,478
10	4.46	11.10	55.4	74.0	70.96	89.56	985,915	271,301
11	6.09	12.65	59.2	77.4	77.94	96.14	563,179	300,567
12	3.95	11.56	54.9	72.6	70.41	88.11	843,577	231,726
13	4.69	13.03	56.3	70.6	74.02	88.32	370,170	367,260
14	3.35	13.90	61.5	75.5	78.75	92.75	414,222	158,312
							6,285,567	2,538,524
Total							$8,824,091	

The costs computed in this section are an estimate of total marketing costs as the country grain merchandising system existed prior to recent changes. Chapter V contains similar estimates of unit costs assuming specified changes in the grain marketing system occur.

CHAPTER V

SCENARIOS II & III - FUTURE ALTERNATIVES

Introduction

The costs of transportation and merchandising as the marketing system exists today were presented in Chapter IV (Scenario I). Chapter V reviews two different situations that may exist in the future as the grain marketing system in the Bisbee area evolves. Scenario II is an analysis of changes in system costs as proposed branchline abandonments take place. Scenario III is an analysis of the cost of transportation and merchandising grain if a subterminal elevator is constructed in Bisbee.

Scenario II - Pending Abandonment Situation

One railroad line segment is pending abandonment at this writing, the Devils Lake to Hansboro branchline, where four of the 14 elevators included in this study are located (St. Joe, Crocus, Rock Lake and Hansboro). After abandonment, these four elevators are assumed to become noncompetitive due to loss of rail service and go out of business.

Grain that moved through these four elevators is assumed to remain within the trade area, and is allocated among the remaining ten elevators in the following manner:

Grain from Hansboro goes to:	½ to Rolla (16 miles) ½ to Armourdale (5 miles)
Grain from Rock Lake goes to:	3/4 to Perth (15 miles) ¼ to Egeland (17 miles)
Grain from Crocus goes to:	1/3 to Perth (13 miles) 1/3 to Bisbee (15 miles) 1/3 to Egeland (8 miles)

Grain from St. Joe goes to:	2/3 to Cando (15 miles) 1/3 to Egeland (15 miles)

These allocations were based on several criteria including geographic location of elevators, along with statistical indication that certain elevators have a high throughput, and are operating at lower costs which should allow them to penetrate the new market area.

Farm Truck Costs

The elimination of some country elevators would result in increased farm trucking costs for producers as they are forced to seek alternative outlets for their grains. Grain from the four elevators on the Devils Lake to Hansboro line is allocated as outlined above. Farm truck costs incurred for all grain moving to the remaining ten elevators were $578,055, about 24% higher than before abandonment took place (Appendix, page 151).

Elevator Costs

Ten elevators remain under this scenario, but these ten will handle the same number of bushels as the group of 14 handled in the previous analysis. Six of the remaining ten elevators will handle increased volumes due to the reallocation of grain from elevators closing due to abandonment.

As country elevators expand throughput, average total costs of operation are generally expected to decrease.[17] With additional throughput, fixed costs are spread out over more units, causing average total cost to decrease. Therefore, one goal of elevator managers is to move the

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[17]See Chase, Craig A. et. al. "Statistical Cost Analysis of Existing North Dakota Country Elevators," Department of Ag. Econ. Report, NDSU, forthcoming.

maximum number of bushels through their facilities, while still scrutinizing costs and competitive position. However, for facilities with few depreciable assets remaining or little debt to capitalize, fixed costs may not comprise a significant portion of operating costs. Therefore, high throughput may not be as critical for financial survival as much as highly leveraged operations.

The ten elevators remaining in this scenario were assumed to incur the same per bushel costs as in the previous analysis (Table 28). Average total costs remained identical under this Scenario even though six of the ten are merchandising more bushels than previously. Total costs of elevation under Scenario II were $1,436,194, about one-half of one percent lower than before abandonment (Appendix, page 152).

Transportation Costs--Country Elevators to Terminal Markets

Per bushel transportation costs from the remaining country elevators would not change after abandonment. Modal shares, market destination proportion and transportation rates from remaining elevators would remain unchanged. Therefore, the transportation costs shown in Table 30, page 77 (costs for each commodity to each destination) and in Table 31, page 77 (costs for each destination, weighted by commodity) would be identical to Scenario II. Total transportation costs, however, may increase due to grain being shipped from western origins relative to before abandonment.

Total Marketing Costs

Total system costs of moving grain from the Bisbee area under Scenario II are presented in Table 33. The table includes costs of moving grain from farms to the remaining ten elevators, elevator operation costs and transportation costs from country elevators to terminal markets. Total marketing costs under Scenario II were $8,898,508, or less than one percent higher than before abandonment.

Scenario III - Subterminal Construction in Bisbee

In this section, marketing costs and alternatives are analyzed assuming a subterminal facility is constructed in Bisbee. Also, a brief analysis of the cost of upgrading existing elevators is presented. Thirteen of the original 14 country elevators are assumed to be in operation, serving the subterminal in Bisbee as satellite stations for transshipment of grain. It is assumed the original country elevator in Bisbee will go out of business, becoming noncompetitive after construction of the subterminal only a few miles away. Trucking costs from farms to existing country elevators, as well as operating costs of various subterminal configurations, are estimated.

Trucking Costs--Farms to Country Elevators

Farm to country elevator trucking costs would not change with the advent of a subterminal in Bisbee. All country elevators (Bisbee excluded) would be operating normally, except they would be shipping grain to Bisbee rather than individually to terminal markets. Producers formerly shipping to the country elevator in Bisbee would now be trucking to the subterminal in or near Bisbee (Appendix, page 153).

Country Elevator Costs

Country elevator costs would remain unchanged after subterminal con-

TABLE 33. TOTAL MARKETING COSTS FOR GRAIN FROM SELECTED BISBEE AREA ELEVATORS TO MAJOR TERMINAL MARKETS, SCENARIO II

Elevator Number	Farm Truck Costs	Elevator Costs	Transportation Costs Duluth	Transportation Costs Mpls.	Total Cost/bu. Duluth	Total Cost/bu. Mpls.	Total Cost Duluth	Total Cost Mpls.
	------------------------------	cents/bu.	------------------------------				---dollars---	
1	4.96	15.45	51.6	60.5	72.01	80.91	184,747	136,096
2	*	*	*	*	*	*	--	--
3	5.06	12.63	61.1	72.1	78.79	89.79	950,763	255,807
4	*	*	*	*	*	*	*	*
5	6.56	16.32	58.6	70.8	81.48	93.68	161,110	609,758
6	3.02	15.15	62.7	71.8	80.87	89.97	545,436	221,035
7	*	*	*	*	*	*	--	--
8	*	*	*	*	*	*	--	--
9	4.26	16.95	63.5	80.0	84.71	101.21	154,071	83,478
10	6.18	11.10	55.4	74.0	72.68	91.28	1,635,676	447,886
11	6.09	12.65	59.2	77.4	77.94	96.14	563,179	300,567
12	4.70	11.56	54.9	72.6	71.16	88.86	977,324	267,897
13	4.96	13.03	56.3	70.6	74.29	88.59	371,521	368,383
14	4.08	13.90	61.5	75.5	79.48	93.48	480,417	183,357
							6,024,244	2,874,264
							$8,898,508	

struction, except that the country elevator in Bisbee would be replaced by the subterminal. The remaining 13 country points would retain their original volume (Scenario I, Table 28, page 75), resulting in the same per bushel operating costs as before branchline abandonment or the addition of a subterminal (Appendix, page 154).

Trucking Costs--Country Elevators to Bisbee

Under the subterminal--satellite elevator configuration, trucking services would be procured (either cooperatively or for-hire) by the subterminal to haul grain from the surrounding country elevators. Truck costs[18] were used to compute total costs of transshipping grain from the country stations to Bisbee. Total costs of transporting grain from the 13 elevators to Bisbee were $412,830 or approximately four cents per bushel (Appendix, page 155).

Transportation Costs--Bisbee To Terminal Markets

Total transportation costs were estimated initially by assuming all grain moved by rail in 52 car unit trains. A subterminal elevator manager would seek to ship the maximum possible number of bushels on the 52 car rate. However, it is unreasonable to assume that any elevator could ship its entire annual volume under such situations. The costs presented in this section, therefore, would represent the lower limit on total shipping costs from Bisbee to terminal markets (Tables 34 and 35).

Subterminal Facility

The construction and operation of a subterminal facility requires a substantial capital investment as well as recurrent operating expenses during the year. In this section the characteristics, capital needs, and operating costs of a potential subterminal to be built at the Bisbee site are identified. The cost estimates utilized, as modified in this study, were recently developed by Chase and Helgeson in 1982 and reflect 1981 cost conditions (For an in-depth discussion, see Chase and Helgeson, Cost Analysis of Potential North Dakota Subterminal Systems, Department of Agricultural Economics, North Dakota State University, February, 1982.).

[18] Wilson, Wesley, Gene Griffin and Ken Casavant, "Costs and Characteristics of Operating Interstate Motor Carriers of Grain in North Dakota", UGPTI Report, 1982, forthcoming.

TABLE 34. TOTAL TRANSPORTATION COSTS--BISBEE TO MINNEAPOLIS/ST. PAUL AND DULUTH/SUPERIOR, AFTER 52 CAR SUBTERMINAL CONSTRUCTION[a]

Commodity	Number Of Cars Consigned	Rate/Bushel Duluth	Rate/Bushel Mpls.	Bushels Shipped Duluth	Bushels Shipped Mpls.	Total Cost Duluth	Total Cost Mpls.
		------$------				---------$---------	
Wheat, Durum	52	.5160	.5160	6,164,167	1,344,153	3,180,710	693,583
Sunflower	52	.2408	.2408	756,103	34,643	182,070	8,342
Barley (Duluth only)	52	.4128	--	1,089,352	--	449,685	--
Barley (Mpls. only)	15[a]	--	.7200	--	1,728,888	--	1,244,799
						3,812,465	1,946,724
						$5,759,189	

[a]Barley rates to Minneapolis are offered for a maximum consignment of 15 cars--no further rate reductions are available on larger shipments.

TABLE 35. TOTAL TRANSPORTATION COSTS--BISBEE TO MINNEAPOLIS/ST. PAUL AND DULUTH/SUPERIOR, AFTER 26 CAR SUBTERMINAL CONSTRUCTION[a]

Commodity	Number Of Cars Consigned	Rate/Bushel Duluth	Rate/Bushel Mpls.	Bushels Shipped Duluth	Bushels Shipped Mpls.	Total Cost Duluth	Total Cost Mpls.
		------$------				---------$---------	
Wheat, Durum	26	.5460	.5460	3,093,027	675,553	1,688,793	368,852
Sunflower	26	.2548	.2548	379,650	16,749	96,735	4,268
Barley (Duluth only)	26	.4368	--	547,142	--	238,992	--
Barley (Mpls. only)	10	--	.7536	--	870,961	--	656,356
						2,024,520	1,029,476
						$3,053,996	

[a]Before comparing transportation costs from the 52 car and 26 car subterminals, it is important to recognize that the smaller facility is assumed to handle approximately 5.5 million bushels, only half the volume of the larger elevator.

Four sets of cost estimates based on size are included: 300,000; 500,000; 850,000; and 1,100,000 bushel capacity elevators. The 300,000 bushel subterminal is a 26 car loading facility--the remaining three are capable of loading a 52 car train.[19] Construction costs and operating costs are presented and a cost sensitivity to turnover rates is presented. Since it is possible to vary the quality of an elevator facility, an analysis of differing qualities, e.g. a "bare-bones" facility, a plain facility, a standard facility and a deluxe facility is presented for the 500,000 bushel facility. These estimates are also based on work done by Craig Chase, et. al. at North Dakota State University in late 1981.

Size Alternatives

The alternative capacities built into the elevator have a strong effect on capital costs and operating costs associated with different turnovers. The general characteristics of the four elevator capacities are presented, followed by the accompanying relationship between costs and turnover. (Special details and assumptions of the Chase-Helgeson models are presented for the four sizes of the facilities in the Appendix, pages 156 to 166).

300,000 Bushel Capacity

The construction cost of the 300,000 bushel capacity facility would be $2,505,000. Total annualized costs of construction and operation of this size subterminal are approximately $700,000 (Table 36). Fixed costs comprise the greatest portion (75 percent) of total annual costs.

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[19] The 300,000 bushel subterminal has the capability to load a 52 car train, but cost estimates contained allowed for railroad trackage sufficient to load only 26 cars. Doubling the amount of trackage would be the only additional investment required to convert to a small capacity 52 car loading facility.

TABLE 36. SELECTED COSTS ASSOCIATED WITH A 300,000 BUSHEL FACILITY

Cost Category	Dollars
Construction Cost	2,505,000.00
AE Fixed Cost	521,970.36
Annual Variable Cost	86,185.00
Interest on Variable Cost	7,325.00
Interest on Grain Purchased[a]	82,450.00
Total Operating Cost	175,960.00
Total Annual Cost	697,930.36

[a]Assumes a turnover of ten. Interest on grain purchased is computed assuming a 15 day interest charge. All interest charges on operating capital are computed at 17 percent annually. Interest on fixed capital is computed at 14 percent annually. Interest on annual variable costs are computed at 17 percent for six months to adjust for ongoing interest charges on expenses incurred throughout the calendar year.

The 300,000 bushel subterminal is slightly different in design, but still capable of loading a 52 car train with minor modifications. Although designed to load only a 26 car train, adding 3500 feet of additional rail siding would suffice to upgrade the facility to 52 car capabilities. Construction cost of the smaller subterminal is approximately $800,000 less than the 500,000 bushel size; the cost differential is due primarily to the number and size of bins in each elevator, the amount of rail siding built, and the level of sophistication of elevator machinery used.

The effect of turnover ratio on per bushel cost is presented in Table 37. As volume handled increased from 1.5 million bushels (turnover of 5) to 4.5 million bushels (turnover of 15), total per bushel cost decreased from 46.5 to 15.5 cents per bushel. Most of the savings gained from higher throughput are from reduced fixed costs per bushel (34.8 to 11.6 cents).

TABLE 37. RELATIONSHIP OF TURNOVER RATES AND PER UNIT COSTS, 300,000 BUSHEL FACILITY[a]

Cost Item	Turnover Rate 5	10	15
Average Fixed Cost	.348	.174	.116
Average Variable Cost	.057	.029	.019
Average Interest[b]	.060	.030	.020
Total Per Bushel Cost[c]	.465	.233	.155

[a]Per unit costs computed for this facility at different turnover rates were computed in the same manner as the other size subterminals, i.e. total variable and total fixed costs were not allowed to change as throughput was altered. This procedure was used to emphasize economies of utilization from high throughput. In later sections concerning per bushel costs of handling volumes suggested for the Bisbee area, variable costs (including interest) were allowed to change as volume handled changed, resulting in slightly different per bushel costs at selected turnover rates.

[b]Includes interest on variable operating costs and interest on grain purchased.

[c] May not add due to rounding.

Upgrading Existing Facilities

One alternative to building a new elevator is to refurbish or upgrade an existing facility to load unit trains. Many North Dakota elevators have some of the characteristics necessary to utilize multiple car rates, but may lack necessary rail siding, load out capacity or storage capacity. Adding storage, trackage or more sophisticated machinery may upgrade an elevator to unit train capabilities at a cost substantially less than constructing a brand new concrete elevator.

Upgrading costs will vary with each elevator's particular construction and capacity. Six of the fourteen elevators included in this study are upgradable, according to elevator managers. The average estimated cost to upgrade the elevators to 26 car loading facilities was approximately $350,000. The average value of land and buildings less depreciation at these elevators in 1980 was about $560,000. The total annualized cost of operating an elevator upgraded to a 26 car loading facility or a value of $910,000 ($350,000 + $560,000) is approximately $400,000, or 13.5 cents per bushel at a turnover of ten (3,000,000 bushels).[20]

Increasing the throughput of the upgraded facility lowers per bushel operating costs considerably. At a turnover of five (1,500,000 bushels), per bushel costs are 27.1 cents, but decrease to 8.7 cents when a turnover of 15 is realized (4,500,000 bushels). Table 38 is a summary of costs associated with an upgraded existing elevator. Table 39 is a summary of the relationship between unit costs and turnover rates.

TABLE 38. SELECTED COSTS ASSOCIATED WITH AN UPGRADED EXISTING ELEVATOR

Cost Category	Dollars
Construction Cost[a]	910,531
AE Fixed Cost	231,065
Annual Variable Cost	86,185
Interest on Variable Cost	7,326
Interest on Grain Purchased[b]	81,813
Total Operating Cost	175,324
Total Annual Cost	406,389

[a]Includes value of existing elevator plus cost of upgrading.

[b]Assumes a turnover of ten. Interest charges computed as for the new 300,000 bushel facility.

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[20]The assumption is made here that these upgraded elevators have storage capacities of 300,000 bushels.

TABLE 39. RELATIONSHIP OF TURNOVER RATES AND PER UNIT COSTS, UPGRADED EXISTING ELEVATOR

Cost Item	Turnover Rate 5	10	15
Average Fixed Cost	.1540	.0770	.0513
Average Variable Cost	.0575	.0287	.0192
Average Interest[a]	.0594	.0297	.0169
Total Per Bushel Cost[b]	.2709	.1354	.0874

[a]Includes interest on variable operating costs and interest on grain purchased.

[b] May not add due to rounding.

500,000 Bushel Capacity

The construction cost of a 500,000 bushel capacity facility would be $3,390,000. The annual total cost of operating this subterminal is slightly less than $1,000,000 (Table 40).

TABLE 40. SELECTED COSTS ASSOCIATED WITH 500,000 AND 1,100,000 BUSHEL FACILITIES

Cost Category	500,000	1,100,000
	-------------dollars-------------	
Construction Cost	$3,390,000.00	$5,380,000.00
AE Fixed Costs	690,038.82	1,073,289.56
Annual Variable Costs	126,098.00	205,680.00
Interest on Variable Cost	10,718.00	17,483.00
Interest on Grain Purchased[a]	137,417.00	302,317.00
Total Operating Cost	274,233.00	525,480.00
Total Annual Cost	964,271.82	1,598,769.56

[a]Assumes a turnover of 10. Interest charges are computed in the same manner as the 300,000 bushel facility.

Sources: Chase, et. al.

The annual fixed costs are about $690,000 comprised of depreciable and non-depreciable fixed costs. Of this amount, salaries to the manager and assistant manager were about $55,000. The annual variable costs are expected to be about $126,000 with about $95,000 of that amount being employee expense. Interest on operating capital, both interest on variable cost and interest on grain purchased, would be about $148,000 annually, resulting in total annual operating costs of $274,233.00. Total annual costs of operation (both fixed and variable) would be approximately $960,000.

The importance of volume and high capacity utilization is evident when examining the impact of turnover on per unit operating costs (Table 41).

TABLE 41. RELATIONSHIP OF TURNOVER RATES AND PER UNIT COSTS, 500,000 BUSHEL FACILITY

Cost Item	Turnover Rate 5	10	12
Average Fixed Cost	.276	.138	.092
Average Variable Cost	.050	.025	.017
Average Interest[a]	.059	.030	.020
Total Per Bushel Cost	.385	.193	.129

[a]Including interest on variable operating costs and interest on grain purchased.

Source: Chase, et. al.

The per bushel operating cost for a turnover of 5 (2.5 million bushels) would be 38.5 cents, comprised mainly of 27.6 cents fixed cost. Doubling that turnover to 10 (5 million bushels) decreased per bushel operating costs to 19.3 cents, or a drop of over 19 cents. Significant reductions occur in fixed costs where about 14 cents were saved, but variable costs also dropped by 50% as the annual variable costs, e.g., labor and electric power are spread out over more and more bushels. If the subterminal of this size can achieve a turnover of 15 (7.5 million bushels) costs per bushel decrease even further to 12.9 cents. Significant reductions occur in both variable cost and average interest on operating capital and grain purchased.[21]

850,000 Bushel Capacity

The 850,000 bushel capacity subterminal would have construction costs of $4,587,000, about 40% more than the 500,000 bushel capacity elevator (Table 42). Total fixed costs each year would be about $900,000 with $163,500 in annual variable costs. The addition of interest on variable operating costs and grain purchased makes total annual cost of slightly over 1.3 million dollars. This is $365,000 or about 37% more than the 500,000 bushel facility.

TABLE 42. SELECTED COSTS ASSOCIATED WITH 850,000 BUSHEL FACILITY

Cost Category	Dollars
Construction Cost	$4,587,000.00
Annual Fixed Costs	918,622.79
Annual Variable Costs	163,500.00
Interest on Variable Costs	13,898.00
Interest on Grain Purchased	233,608.00
Total Operating Cost	411,006.00
Total Annual Cost	$1,329,628.79

[a]Assumes a turnover of 10. Interest charges are computed in the same manner as the 300,000 bushel facility.

Source: Chase et. al.

[21]Again, this assumes no change in total variable or total fixed costs as output varies from a turnover ratio of ten (5,000,000 bushels).

The relationship between turnover rates and per unit costs for the 850,000 bushel facility are indicated in Table 43. The per bushel cost or handling expense drops to 10.4 cents if a turnover of 15 (13 million bushels) is achieved, and is 31.3 cents if only a turnover of 5 (4.2 million bushels) is attained. The most significant economies are evident in average fixed cost which drops from 21.6 cents to 7.2 cents per bushel as the volume is tripled.[22]

TABLE 43. RELATIONSHIP OF TURNOVER RATES AND PER UNIT COSTS, 850,000 BUSHEL FACILITY

Cost Item	Turnover Rate 5	10	15
Average Fixed Cost	.216	.108	.072
Average Variable Cost	.038	.019	.013
Average Interest[a]	.058	.029	.019
Total Per Bushel Cost[b]	.313	.156	.104

[a]Includes interest on variable operating costs and interest on grain purchased.

[b]May not add due to rounding.

Source: Chase, et. al.

1,100,000 Bushel Facility

The construction costs for a subterminal with this amount of storage capacity are substantial--$5.4 million dollars (Table 44). However, compared to the 500,000 bushel facility, this subterminal would have more than doubled its capacity for only a 63% increase in capital construction costs. The total operating cost per year would be about $525,000 more

[22]Assumes no change in Total Variable or Total Fixed Costs as output varies from a turnover of ten (8.5 million bushels).

than the smaller facility considered (500,000 bushels), an increase of 90 percent. The total annual cost would be $1.6 million, about a 65% increase in costs for a 110% increase in capacity available to the manager of a subterminal facility.

TABLE 44. SELECTED COSTS ASSOCIATED WITH 1,100,000 BUSHEL FACILITY

Cost Category	Dollars
Construction Costs	$5,380,000.00
Annual Fixed Costs	1,073,289.56
Annual Variable Costs	205,680.00
Interest on Variable Cost	17,483.00
Interest on Grain Purchased	302,317.00
Total Operating Cost	525,480.00
Total Annual Cost	$1,598,769.56

[a]Assumes a turnover of 10. Interest charges computed in the same manner as the other facilities.

Source: Chase et. al.

The same potential economies of capacity utilization are available in this elevator size as in the previous two models (Table 45). As turnover is increased from 5 (5.5 million bushels) to 15 (16.5 million bushels), the average fixed cost drops from 19.5 cents to 6.5 cents. Total per bushel cost of operation drops from 29 cents to 9.7 cents per bushel as turnover is tripled.[23]

The per bushel operating costs for the four subterminal models are summarized in Table 46. The savings from increased capacity and turnover

[23]Assumes no change in Total Variable or Total Fixed Costs as output varies from a turnover ratio of ten (11 million bushels).

of that capacity are evident, but as will be discussed later, the impact on costs of constructing a large facility and not achieving a high turnover is startling and should serve as a caution to the management of a potential cooperative subterminal.

TABLE 45. RELATIONSHIP OF TURNOVER RATES AND PER UNIT COSTS, 1,100,000 BUSHEL FACILITY

Cost Item	Turnover Rate 5	10	15
Average Fixed Cost	.195	.098	.065
Average Variable Cost	.037	.019	.012
Average Interest[a]	.058	.029	.019
Total Per Bushel Cost[b]	.290	.145	.097

[a]Includes interest on variable operating costs and interest on grain purchased.

[b]May not add due to rounding.

Source: Chase et. al.

TABLE 46. PER BUSHEL OPERATING COSTS, THREE TURNOVER RATES, FOUR SIZES OF SUBTERMINALS, DOLLARS PER BUSHEL

Storage Capacity (bushels)	Turnover Rate 5	10	15
300,000	.465	.233	.155
500,000	.385	.193	.129
850,000	.313	.156	.104
1,100,000	.290	.145	.097

Quality Alternatives in Potential Subterminal

The construction and operating costs for a subterminal are as discussed above, affected by the size of facility built. The construction costs are also affected by the design and quality of the subterminal facility. The services offered and flexibility of a subterminal can vary from a "hole in the ground" to a modern computerized facility with premium conveyor systems, weighing mechanisms, dust control, etc. This section will briefly survey the effect of differing qualities, using the 500,000 bushel subterminal as an example. This example is preceeded by a short review of a "bare bones" facility that can provide at least minimum ability to access multiple car rates.

Bare Bones Multiple Car Loading Facility

Continental Grain Co. has constructed a ramp-pit-conveyor system at Hankinson, North Dakota for loading unit grain trains. This form of multiple car loading operation would be considered the lowest initial outlay type of facility that could potentially be built to load unit trains. The facility consists of a gravel truck ramp leading onto a steel unloading pit. The pit is emptied into rail cars by a gravel conveyor belt at a rate of approximately 10,000 bushels per hour. This type of "subterminal" has no storage, no office (at the loading site) and no elevation legs. The only components of the operation are the conveyor, steel pit, and truck ramp.

A Hankinson-type operation requires sophisticated logistical coordination of incoming grain to effectively utilize the unloading facility and load the train within allotted times. Maximum coordination of incoming trucks must be attained to avoid queuing problems at the country elevators and the unload facility when grain is trucked in from area elevators or farms. The number of truckloads required to load a 52 car train necessitates organized delivery of the grain; a 52 car train of jumbo hopper cars holds approximately 171,600 bushels or about 200 semi truckloads.

The most obvious advantage of a Hankinson-type subterminal operation is the low initial investment costs. According to industry personnel (Continental and G.T.A.), the operation can be constructed for $70,000 to $150,000. The traditional concrete subterminal elevator with upright storage and leg facilities would cost many times that amount. Also, the Hankinson-type operation would likely require little time from ground-breaking to start of loading operations.

Labor requirements would be different than traditional country elevators. Current Hankinson-type operations utilize local part-time labor for loading, while supervisory grain marketing personnel located in regional offices arrange purchase and sale of the grain, as well as other organizational tasks. Total labor requirements may be less than traditional elevators because only the grain merchandising function is performed--none of the other peripheral elevator activities (such as storage) are performed.

The operation must still locate next to the required rail siding, but according to a Continental Grain representative, the conveyor is mobile, and 50 per cent of original investment costs are recoverable.

With the development of subterminals and evolution of multiple car rate structures, many country elevators are concerned with losing their competitive edge due to the economies of transporting grain in unit trains from subterminals. A low cost Hankinson-type operation would not likely buy from farmers, but from other elevators, due to uniform quality considerations. Therefore, country elevators' autonomy may be preserved.

One obvious drawback of the operation is the lack of on-site office space and storage capability. The operation must rely completely on the organized inflow of trucks coming from existing area elevators. This requires sophisticated logistical organization of a trucking fleet to avoid waiting lines at the elevators and train loading site, and to get the required quantity of grain to the loading site within the allotted time period.

Exposure to inclement weather may be a problem for this type of loading facility. The ramp and approach may be affected by rain or snow. However, the actual loading procedure would not likely be restricted due to weather any more than an existing country elevator.

Other problems affect the long term feasibility of such an arrangement. It is not possible to blend grain at the loading site and the advantages of such merchandising flexibility may be lost. This lack of opportunity to combine price and merchandising alternatives and resulting lack of long term planning, may affect the competitive position of the subterminal.

Plain Facility

It might be possible to reduce the construction cost of the 500,000 bushel facility by almost $700,000 by eliminating some options from the standard design of this size facility. Savings could be achieved by reducing office space ($30,000), reducing contingencies 50% by contracting ($100,000), eliminating the drier and dust control ($225,000), reducing the driveway and scale facilities ($190,000), etc. Such a facility could not offer the same services as the standard facility.

Deluxe Facility

A deluxe system could also be designed, one that offers services and conveniences to the producer but one that is costly to construct. It could easily cost $1,000,000 more than the standard facility to provide these additional services. Additional expenses include increased office building space ($30,000); increase of contingencies to $250,000 ($50,000); increased dust control ($25,000); increased drier capacity and feeding ($30,000); etc. Increases or decreases may also occur due to changes in the amount of land around the facility. The alternative construction costs for a subterminal are summarized in Table 47.

It is evident that the management of a cooperative subterminal must do an in-depth study of their service demands by their patrons relative to the size and quality of subterminal facility to be constructed. The large deluxe facility is 150% more costly to construct than the plain small facility, an investment difference critically affecting total cost per bushel.

TABLE 47. ALTERNATIVE CAPITAL INVESTMENT ESTIMATES

Facility Capacity (bushels)	Plain	Standard	Deluxe
500,000	$2,635,000	$3,390,000	$4,035,000
850,000	3,900,000	4,587,000	5,500,000
1,100,000	4,600,000	5,380,000	6,500,000

The standard facility does offer most of the service of the deluxe design, and at a significantly lower cost. The Hankinson-type of bare bones operation is designed only for a short term competitive advantage and seems to offer little long run advantage.

Probable Operating Costs for a Bisbee Subterminal

Subterminal operating costs estimated by Chase and Helgeson were computed using a turnover of ten as a base case. All costs were specified at a level if turnover was equal to ten. As throughput was changed (turnover rates of 5 and 15 were also analyzed), neither total fixed costs nor total variable costs were allowed to vary with the change in throughput. In fact, variable costs, (if they are in fact true variable costs) should change as output is altered. It is questionable, however, how many of the "variable costs" actually do vary in proportion to output. Therefore, for purposes of this study, an arbitrary judgement was made on each variable cost account as to its variability with output (grain handled). As output was changed, variable costs (including interest) were adjusted to take into account changes in costs incurred as throughput was expanded or contracted from the base case (turnover = 10).

The country elevators in the Bisbee trade area have a historical average annual volume of around 11,117,000 bushels. The volume to be handled by a cooperative subterminal might be higher or lower than this average, depending on truck movements, trade area increases, and other elevator competitive reactions.

Estimating a realistic or maximum achievable turnover ratio for any elevator is difficult and very speculative in nature. The amount of grain available for merchandising by any elevator in North Dakota is highly variable and dependent upon many factors. Seasonality of production and farm marketings in North Dakota means that elevators must be built to handle peak marketings (generally in fall), but due to seasonality of marketings, much elevator merchandising capacity is underutilized for a good portion of the year. An elevator's ability to achieve high turnovers will depend on concentration of production, the extent to which other elevators are competing for that production, the willingness of farmers to sell their crops, and other factors. For purposes of this study, turnover ratios of 25 or greater were assumed unattainable due to logistical restrictions and marketing factors such as limited production and competition among elevators.

Per bushel operating costs for the four sizes subterminal were extrapolated from costs estimated by Chase and Helgeson. Additional variable costs (including interest) attributable to the additional bushels handled over the base case (turnover = 10) were estimated and are presented for the four sizes of elevators in the Appendix, pages 167 to 171.

The proportion of total costs which actually varied as throughput was increased was small, about three-fourths of a cent, or less than five percent of total costs at a turnover of ten. Therefore, as volume handled was increased, cost per bushel decreased dramatically. Tables 48 and 49 are summaries of turnover ratios and per bushel operating costs for different capacity subterminals and various levels of throughput.

Per bushel operating costs for two types of 26 car subterminals are presented in Table 48. Unit costs for a hypothetical upgraded elevator handling four volumes of grain are shown, as well as per bushel costs incurred by a new concrete 26 car facility. At a turnover of ten, the upgraded facility offers an almost 10 cent per bushel operating cost advantage. If five million bushels can be handled at the elevator (turnover of 16.7) the upgraded elevator's cost advantage is reduced to about six cents.

Unit costs of the three sizes of 52 car loading facilities are presented in Table 49. The 500,000 bushel subterminal has approximately a three to nine cent per bushel cost advantage over the other size facilities over the relevant range of throughputs. The larger volume (16,000,000 bushels) was deemed unattainable by the 500,000 bushel elevator, but realistically achievable by the two larger units. The volume identified for the Bisbee trade area is approximately 11,000,000 bushels; all three of the 52 car facilities would appear to have no logistical problems in handling that amount of grain.

TABLE 48. PER BUSHEL OPERATING COSTS, DIFFERENT TRADE VOLUMES, NEW AND UPGRADED 26 CAR LOADING FACILITIES

Facility Capacity (bushels)	Trade Volume (bushels) 2,000,000 Turnover	2,000,000 Dollars Per Bushel	3,000,000 Turnover	3,000,000 Dollars Per Bushel	5,000,000 Turnover	5,000,000 Dollars Per Bushel	8,000,000 Turnover	8,000,000 Dollars Per Bushel
300,000 (upgraded)	6.7	0.1848	10	0.1355	16.7	0.0960	26.7[a]	0.0738
300,000 (new)	6.7	0.3306	10	0.2326	16.7	0.1544	26.7[a]	0.1104

[a]Unattainable for this size elevator.

TABLE 49. PER BUSHEL OPERATING COSTS, DIFFERENT TRADE VOLUMES, NEW 52 CAR LOADING SUBTERMINAL ELEVATORS

Facility Capacity (bushels)	Trade Volume (bushels) 5,000,000		8,000,000		11,000,000		16,000,000	
	Turn-over	Dollars Per Bushel	Turn-over	Dollars Per Bushel	Turn-over	Dollars Per Bushel	Turn-over	Dollars Per Bushel
500,000	10	.1929	16	.1340	22	.1072	32[a]	.0849
850,000	5.9	.2423	9.4	.1641	12.9	.1286	18.8	.0990
1,100,000	4.5	.2800	7.3	.1874	10	.1453	14.5	.1103

[a]Unattainable for this size elevator.

The analysis indicates once again that volume and trade area to be handled by the cooperative subterminal are extremely important. If an annual volume of 11 million bushels is projected, the 500,000 bushel facility would offer an operating cost of about 10.7 cents per bushel. If that volume was not met, and only 8 million bushels were handled the per bushel costs would increase to 13.4 cents, an increase of 2.7 cents. Consider the impact of the same misprojection if the largest facility had been built. The per bushel cost increase would be 4.2 cents, indicating that the penalty for misprojecting annual volume increases substantially as size of the facility increases.

Choosing the most economically favorable facility when deciding on the needs for the Bisbee area is not as easy as to simply choose the elevator with the lowest per bushel operating cost. One critical parameter in the decision process is the volume of grain available for merchandising by the subterminal, or the amount of grain an effective elevator manager can attract through competitive pricing and merchandising policies. Any elevator may become financially stripped without a certain volume of grain handled. From Tables 48 and 49 it is clear that at lower volume throughputs, the smaller facilities have a distinct operational cost advantage. But, at higher volumes handled, the smaller elevators would encounter logistical barricades and inefficiencies. If such a situation occurred and patrons were forced to sell grain elsewhere, the cooperative's reputation as a reliable outlet for grain may be permanently damaged.

On the other hand, overconstruction and an overestimation of available grain volume would cause extremely high per bushel costs (Table 49) and a subsequent further decrease in volume as farmers shipped to competing elevators offering higher prices for grains. As stated previously, the penalty for over construction and misprojecting volume handled is substantial. However, if the cooperative strongly feels that a high volume is available or can receive contractual committments from elevators, the larger subterminal may be a viable choice.

Sensitivity Analysis

North Dakota country elevators traditionally have used trucks to ship at least a portion of their grain to terminal markets. Total 1980-81 crop year shipments by truck from North Dakota were 149.1 million bushels or 37% of all movements.[24] Modal shares vary by commodity and origin, and differ due to, at lease in part, availability of rail freight equipment and competitiveness of freight rates between the two modes to various destinations. In this section an analysis is made on several transportation variables and the potential impact they would have on a subterminal.

[24]UGPTI Report #42, March, 1982.

Option I - Continue Current Modal Share

Country elevator managers examine availability and price of transportation alternatives when choosing the mode by which their grain will be shipped. However, both modes (rail and truck) may still be utilized regardless of the level of price compeititon between the two. In order to maintain a desired level of service, the manager may specify a minimum portion of his grain to be shipped by each mode simply to keep that transportation alternative available. Utilization of the serving railroad's rail line may indicate an interest by elevator management in keeping that rail service intact. On the other hand, the same manager may use trucks at times during the year to maintain that truck service for particular commodities or peak shipping seasons.

The ability of trucks to maintain their modal share will depend largely on the rate levels imposed by railroads serving North Dakota elevators. Trucks must maintain a voluminous share of the grain traffic from the state in order to utilize invested capital. At this writing, truck rates from most Bisbee area elevators to Minneapolis/St. Paul and Duluth/Superior approximate the railroads' three car rates. However, the existing Bisbee elevator truck rates are higher than the average, actually equalling the single car rail rate (Table 50).

Truck rates were specified by elevator managers. The single car rail rate from Bisbee and the current truck rate are both \$.63 per bushel. Savings by shipping rail on the three, 26 and 52 car rates were 2.4¢, 8.4¢ and 11.4¢ per bushel, respectively. Truck rates would not be expected to decrease substantially to meet multiple rail car shipment rates because the operating cost per bushel is already above the present truck rate.

TABLE 50. RAIL RATES, TRUCK RATES AND TRUCK COSTS FOR WHEAT SHIPPED FROM BISBEE, NORTH DAKOTA, TO MAJOR TERMINAL MARKETS[a]

Rail			Truck			
Number of Cars Consigned	Rate/cwt.	Rate/bu.	Destination	Rate/cwt.	Rate/bu.	Cost[b] $/bu
1	1.05	.63	Mpls.	1.05	.63	1.007
3	1.01	.606	Duluth	1.05	.63	.908
26	.91	.546				
52	.86	.516				

[a]Rail rates are identical to both Mpls./St. Paul and Duluth/Superior. Also, truck rates to both markets are equal from the Bisbee area.

[b]Assumes 456 highway miles to Minneapolis, 411 miles to Duluth, per mile cost of $.92, and <u>no</u> backhaul.

If trucks do, in fact, maintain a portion of the traffic, total transportation costs could be expected to be more (four percent or $256,000) than under exclusively 52 car rail movement (Table 51). Trucking firms cannot be expected to continue to absorb losses currently suggested by the above revenue/cost estimates and remain in business. Therefore, higher shipping costs to country elevators (and producers) will be incurred if truck service is to be maintained.

TABLE 51. TOTAL TRANSPORTATION COSTS--52 CAR RAIL SHIPMENT AND CURRENT MODAL SHARE CONDITIONS

Proportion of Total Movement by Rail	Total Bushels Handled	Total Shipping Cost
100% (rail)	11,117,306	$5,759,189
78% (rail)	8,671,499	4,474,493
22% (truck)	2,445,807	1,540,858
		$6,015,351

Option II - Backhaul Potential

Attaining a backhaul for a portion or all of the return trip reduces substantially the costs that must be borne by the fronthaul of a truck shipment. Backhauls into the Bisbee area would be expected to be minimal, but a partial backhaul into Fargo, Grand Forks or Devils Lake could be expected at least occasionally. Given the existing rail and truck rates the frequency of backhaul would have to increase to about 85% to make trucks competitive with the 26 car rail rate, and almost 100% to compete with the 52 car rate (Table 52).

TABLE 52. EFFECTS OF BACKHAUL FREQUENCIES ON TRUCK-RAIL RATE COMPETITIVENESS, MINNEAPOLIS SHIPMENT

Backhaul Frequency	Reduction Factor Applied to Base Truck Rate	Truck Cost Per Bushel	26-Car Rail Rate/bu.	52-Car Rail Rate/bu.
0%	1.00	1.007	.546	.516
25%	1.25	.8056	.546	.516
50%	1.50	.6713	.546	.516
75%	1.75	.5754	.546	.516
80%	1.80	.5594	.546	.516
90%	1.90	.5300	.546	.516
100%	2.00	.5035	.546	.516

Option III - No Satellite Elevators

One marketing option considered by North Dakota elevators when multiple car shipments are proposed is operation of a subterminal--satellite elevator system. This option would involve moving grain from farms to the subterminal via the existing country elevators. This alternative would most likely incur lower farm truck costs, but double handling of grain (country elevator and subterminal) may negate those savings.

Subterminal development may force some existing country elevators to revert to private (producer) ownership if those elevators cannot remain competitive. In this case, the subterminal would operate independently, relying on trucks (farm or tractor-trailer rigs) to deliver grain. This alternative would require an expanded truck fleet to haul the grain to Bisbee. Producers may find it more economical to hire tractor-trailer rigs to truck their grain to Bisbee than to haul long distances to Bisbee with their farm trucks. If the subterminal was in charge of trucking the grain, they would be required to go directly to farms to load the grain. In the event of cooperative truck fleet ownership, either situation would require a large total capacity truck fleet to handle the additional bushels, particularly during peak shipping periods.

The demise of the existing country elevators as satellite stations might also require a larger storage capacity subterminal. The subterminal could no longer depend on grain trucked from satellite stations to aid in loading of a newly arrived unit train. Capital costs, and per bushel fixed costs, would rise with the larger facility size required.

One major concern of policy makers and the elevator trade in North Dakota is the impact of subterminal development on smaller, existing country elevators. If the satellite elevators do not operate, and the subterminal functions alone, local employment may drop due to the decreased need for country elevator managers and employees. The impact on local economies, therefore, may be a concern when choosing a subterminal-satellite configuration.

Option IV - Some Single Cars Used

It is doubtful that any subterminal elevator could ship 100% of its annual volume via large unit trains. Specialized commodities may not be available in sufficient volume to be procurred in 26 or 52 car lots. Also, seasonality of production and grain movements in North Dakota suggest that an elevator may not be able to collect the required amount of grain in a short time period to load a large train. It is clear, however, that total transportation costs would rise as the frequency of single car consignments from a subterminal increase (Appendix, page 172). These single car shipments would lower the competitive viability of the subterminal. The very impetus of subterminal development is to access multiple car rates. Without rate savings from substantial multiple car movements, subterminal capital costs would render the facility ineffective in merchandising grain. Limited grain movements in single car consignments may not markedly hurt the subterminal's competitive position (and may be necessary in some instances), but a manager would seek to minimize the proportion of his total movements by single cars.

Total Marketing Costs

A summation of transportation and elevator costs yields a total "marketing bill" of grain from the Bisbee area. The costs included farm trucking costs to country elevators, country elevator operating costs, costs of trucking from country stations to the subterminal in Bisbee, subterminal operating costs, and costs of rail shipment from Bisbee to terminal markets. Total marketing costs under this scenario were approximately 9.1 million dollars (Table 53).

TABLE 53. TOTAL MARKETING COSTS FROM BISBEE AREA ELEVATORS TO MAJOR TERMINAL MARKETS, AFTER SUBTERMINAL CONSTRUCTION

Elevator Number	Farm Truck Costs	Country Elevator Costs	Country Elevator to Subterminal Shipping Costs	Subterminal Operating Costs	Subterminal to Terminal Shipping Costs
1	$21,068	$65,626	$22,980	$1,191,755 (See Table 49 page 105, Subterminal discussion)	$5,759,189 (See Table 34 page 87)
2	12,027	52,405	17,703		
3	32,025	131,323	59,683		
4	57,579	151,571	51,531	.	.
5	7,393	52,684	9,620	.	.
6	14,283	70,949	24,820	.	.
7	9,508	51,219	10,662	.	.
8	40,303	118,198	57,924	.	.
9	11,262	44,809	6,424	.	.
10	75,478	187,848	33,677	.	.
11	63,045	130,955	12,526	.	.
12	57,713	168,902	59,759	.	.
13	42,957	119,345	45,521	.	.
14	23,339	a		.	.
	467,980	1,345,834	412,830	1,191,775[b]	5,759,189

TOTAL MARKETING COSTS = $9,177,608

[a]Elevator not operating after subterminal construction.

[b]Computed as follows: 11,117,300 bushels x $.1072 bushel = $1,191,775. See Table 49, page 105, subterminal cost discussion for a complete explanation of subterminal elevator costs.

As was the case under previous analyses, transportation costs to terminal markets comprised the greatest portion of total marketing costs. Farm truck costs and trucking costs from existing country elevators to Bisbee each represented five percent of total costs, while country elevator and subterminal costs comprised 15 and 10 percent, respectively. Transportation charges from Bisbee to terminal markets, however, represented 65 percent of total costs.

Impacts on Roads in Study Area

The abandonment of branchlines in the study area forces more grain to move on the highways as it moves to different loading points or long distances to the terminal elevator. The development of a subterminal at Bisbee or other similar central locations tends to significantly increase the traffic on roads leading to those locations. This increased volume of heavily laden trucks will cause increased damage to those roads, roads that were probably not constructed to handle high traffic density. The costs of reconstructing and maintaining these roads are real costs that can be attributed to the development of a subterminal. However, they are public costs and not costs that will enter into the decision making process of the country elevator or subterminal.

Cooperative board members may feel they are taxpayers who deserve to have roads available to their firm. Also, the producers, patrons, and rural communities benefiting from a subterminal also feel they have paid appropriate taxes and deserve roads capable of providing the service needed by the rural community. In any case, identification of the impact on roads will allow continued planning by the North Dakota State Highway Department and projections of new financing needs of the Highway Department.

Highway structural strength is measured by use of a "structural number", which indicates the type and thickness of surfacing on a particular roadbed. For example, a road with a structural number between 2.00 and 3.00 has a four inch asphalt mat supported by a six to eight inch aggregate (gravel) base. A structural number between 3.00 and 4.00 indicates that a road has a six inch asphalt mat and a six to eight inch aggregate base. Most roads in the Bisbee area have structural numbers between 1.00 and 2.00 (two inches of asphalt, six to eight inches of aggregate). The required structural number is dependent upon the type and intensity of traffic and the type of subgrade. Impacted roads in the Bisbee area, structural numbers, and average daily traffic on roads and costs estimates are presented in the Appendix, page 173.

The construction cost estimates prorate the required construction costs over the old and new traffic. Only those roads receiving high enough traffic density to require reconstruction are included in construction costs. The total capital construction cost allocated to the Bisbee truck traffic is $414,000 if reconstruction is done in 1983. This construction cost may allow some marginal decreases in maintenance but this savings would probably be overbalanced by the increased maintenance on the road segments that do not require total reconstruction.

The gravel roads would also incur increased annual maintenance costs of about $1,000 per mile. There are 25 miles of gravel road that are projected to receive increased damage so an annual cost of $25,000 can be attributed to the operation of a subterminal.

The implications of this brief analysis are quite straight-forward. There is definitely a physical and financial impact on the highways in the area, caused by the development of a subterminal. Although these are public costs and not costs privately borne by the subterminal, there should be a strong relationship between the private firm (the cooperative subterminal) and the public funding agency (ND Highway Department) in planning of the project. If roads are not rebuilt as needed, movements to the subterminal or trucking costs may increase, thus affecting the economic feasibility and viability of the cooperative subterminal. Alternatively the Highway Department requires political and social support so adequate planning and funding levels can be maintained or developed.

Summary

This chapter outlined the costs and characteristics of two possible marketing situations, one based on the existing system with planned abandonment taken into account and the second based on the construction of a cooperatively operated subterminal.

In the marketing situation described as Scenario II - Pending Abandonment, the costs of transportation and marketing caused by the abandonment of rail line from Devils Lake to Hansboro and closure of four elevators, appear to change by less than one percent ($8.89 million compared to $8.82 million in Scenario I). The costs of farm truck assembling of grain would increase by nearly 20% in Scenario II. Increased trucking costs would be counterbalanced by a slight decrease (less than 1%) in elevator costs of operation since the same volume of grain would be moved through elevators that had lower per bushel costs. The total cost difference in Scenario II from current cost (Scenario I) is minimal.

Construction of a cooperative subterminal (Scenario III) requires a significant capital investment and higher operating costs. The assumption is made that all elevators would continue in operation and all grain would be moved through the subterminal on 52 car rail rates (500,000 bushel, 850,000 bushel and 1,100,000 bushel capacity facilities) or on 26 car rates (300,000 bushel capacity subterminals). Farm to country elevator and related handling costs were not expected to change under this market structure. Truck movements from the country elevator to the subterminal would be a new marketing expense ($412,830), as is the operating cost of the subterminal.

Four alternative sizes of the subterminal were analyzed, ranging from 300,000 to 1,100,000 bushels. The capital construction costs of each of these facilities ranged from $2,505,000 to $5,380,000. Also analyzed was the cost of upgrading existing elevators in the area to load 26 car trains. Significant savings were available when large volumes were moved and high turnovers achieved. Grain volume identified for the Bisbee trade area was approximtely 11 million bushels. Estimated per bushel operating costs and required turnover to handle the specified volume ranged from 10.7 cents and a turnover of 22 for the 500,000 bushel facility, to 14.5 cents and a turnover of 10 for the 1,100,000 bushel facility. Costs of constructing a 26 car subterminal were also estimated to examine effects of a lower available trade volume. Per bushel operating costs for the 26 car facilities ranged from 9.6 to 15.4 cents at an annual volume of 5.5 million bushels.

Differing qualities of construction were also examined. Depending on the quality and specifications of the facility, construction costs varied drastically. For example, the 500,000 bushel facility construction cost ranges from $2.6 to $4.0 million. It appeared the standard facility did offer the most of the desired service and at the most reasonable costs. The bare bones Hankinson-type facility was designed to achieve short term competitive advantages and offered little long run advantages.

Several observations can be made by examining marketing alternatives and their sensitivity to costs:

1. If managers maintain the historical share of truck and rail movements (22 and 78 percent, respectively), shipping costs would increase $256,000, a four percent increase.

2. Truck backhauls must reach near 100% to be price competitive with the 52 car rail rate.

3. Continued use of existing country elevators as satellites causes double handling costs.

4. If some of the existing elevators were not retained as satellites, a larger subterminal would have to be built and more trucking capacity developed.

5. A decrease from 80% to 60% movement under the 52 car rail rate would increase costs by nearly $30,000.

6. Public road maintenance and construction costs related to construction of the subterminal would be significant.

The total marketing cost of the 52 car subterminal alternative (Scenario III) was approximately $9.2 million (Table 54), a $350,000 increase from Scenario I. However, by avoiding double handling through only one average size satellite elevator handling 800,000 bushels, a savings of over $100,000 would be realized.

Also, for the 26 car subterminal at the lower volume (5.5 million bushels), per bushel marketing costs were slightly higher than under Scenario I. Once again avoiding double handling at the satellite stations would lower total costs considerably.

Chapter VI outlines some additional potential cost savings options that could provide further advantages to a subterminal operation.

TABLE 54. ALTERNATIVE MARKETING COSTS[a]

Cost Item	Present (Scenario I)	Abandonment (Scenario 2)	Marketing Configuration: Subterminal Constructed (Scenario 3)				
			26 Car Elevators		52 Car Elevators		
			upgraded 300,000 bu	new 300,000 bu	500,000 bu	850,000 bu	1,100,000 bu
Farm Truck	467,980	578,055	247,604	247,604	467,980	467,980	467,980
Country Elevators	1,442,673	1,436,194	613,650	613,650	1,345,834	1,345,834	1,345,834
Country Elevator to Terminal	6,913,438	6,884,260	NA	NA	NA	NA	NA
Country Elevator to Sub-Terminal	NA	NA	124,440	124,440	412,830	412,830	412,830
Sub-terminal	NA	NA	535,976	862,028	1,191,775	1,429,685	1,615,344
Subter-minal to Terminal	NA	NA	3,053,996	3,053,996	5,759,189	5,759,189	5,759,189
Total Mar-keting Costs	8,824,091	8,898,509	4,575,666	4,901,718	9,177,608	9,415,518	9,601,177
Total Cost Per Bushel	.79373	.80042	.81956	.87796	.82552	.84692	.86362

[a]Costs for the new and upgraded 300,000 bushel facilities are based on the following assumptions: all rail shipments in 26 car trains; rail rates do not change; a turnover of approximately 18 is achieved (5.5 million bushels); and all grain is moved through the subterminal.

Subterminal costs for the 52 car elevators are based on the following assumptions: all rail shipment in 52 car trains; rail rates do not change; 11 million bushels are handled; and all grain is moved through the subterminals.

CHAPTER VI

OPTIONS COMPLEMENTARY TO A COOPERATIVE SUBTERMINAL

Introduction

The basic function of the proposed subterminal at Bisbee is to achieve reduced costs as a result of multiple car rates and volume economies. But, other options and activities exist, options that could improve and support the economic feasibility of a new subterminal as well as improve the quality of services available to producers and consumers in the area. These options and advantages should be evaluated by the management of a cooperative relative to the needs of its patrons.

Some potential options, and their associated advantages and disadvantages, will be evaluated in this chapter. These options are: (1) Cooperatively owned and operated truck fleet, (2) Long term trucking contracts with existing owner-operators, (3) Local brokerage service for trucking, (4) New grain merchandising alternatives, and (5) Cooperative ownership and operation of a short line railroad.

Cooperative Trucking Fleet

The subterminal board of directors and management can consider developing a cooperatively owned trucking fleet as a means of affecting the economic viability of the new subterminal at Bisbee. The general objective is to decrease costs of assembly and distribution by providing a competitive alternative to other motor vehicles for assembly and to the railroads in delivering the grain to the market. The impact of abandonment, new farm storage, and construction of a new subterminal will place new transportation demands in the Bisbee area. Options available to the cooperative management to handle these needs include: (1) the continued use of owner-operator trucking firms in the area on a trip basis; (2) institution of longer-term contracts with these owner-operators; or (3) development of a cooperatively owned and operated trucking fleet.

Potential benefits of such an arrangement to the subterminal do exist. The most obvious is to use the trucking fleet as a continuing competitive deterrent to rate increases by the railroad. It would give the subterminal manager more flexibility and control in assembling grain for multiple car shipments. A known transportation capacity at a known transportation cost will also be on hand at the manager's discretion. Additionally and quite importantly, by running some trucks of their own and monitoring and analyzing their own cost experiences, they can evaluate the rate/cost relationships of the owner-operator firms hired on a trip basis and the associated rate reasonableness. Finally, as will be discussed in this section, the cooperatively owned and operated fleet might be able to operate more efficiently than existing truck firms.

This section will examine selected characteristics of trucking firms in North Dakota and then evaluate potential economies available to the subterminal manager. Particular attention will be paid to cost savings arising from annual vehicular mileage, backhaul, and labor/financing efficiencies.

Selected Characteristics

Most trucking firms in North Dakota are medium-size firms (2-4 tractors) with one-third being owner-operator firms and about one in nine trucking firms are large firms with five or more tractors. These firms average about 88,000 miles per year per vehicle with about 65 percent of these miles being loaded. The average trade area of these trucking firms is quite small, a radius of 310 miles and the average length of haul is about 475 miles, reflecting the common destinations of Duluth and Minneapolis/St. Paul.

The operating costs for North Dakota truckers appear to be about 90 to 94 cents per mile in the time period of this study. There appear to be significant differences in costs of operation by firm size. The larger firms had a four cent per mile cost advantage over the owner-operator and about a two cent advantage over the medium-size firm.

The internal cost advantage of larger sized trucking firms is also increased by the existence of external marketing advantages as well. The ability to get loads in both directions of a movement has a strong impact on costs per loaded mile. Larger firms were able to have 59 percent of their return trip miles loaded in 1980, compared to about 24 percent for the owner-operator firm. The trade area served by the larger firm also is larger, over 700 miles compared to 275 for the owner-operator firms. These activities also result in the larger firm being able to utilize their vehicles over slightly more miles (3,000) than owner-operators.

This market and cost advantage of a larger trucking firm has direct implications for the cooperative trucking fleet in a Bisbee subterminal elevator. It suggests that the new fleet may have both a cost and market advantage over the existing owner-operators, advantages that would strengthen the viability of a subterminal facility.

Potential Economies Available to a Subterminal Trucking Fleet

The cooperatively owned truck fleet, operating under a centrally controlled administrative framework, has potential economies available to it, economies not as readily available to other firms. Some of these areas of potential cost savings are annual mileage, backhaul, fixed costs of the subterminal, economies of large scale purchase, labor efficiency and financing.

Annual Mileage

The cooperatively owned trucking fleet could improve on the annual mileage experienced by other owner operators because the abandonment of rail lines will have increased the potential movement by truck to country elevators in the area and there will be movement from the country elevators to the subterminal itself. Since the manager of the subterminal will be directing these movements, much of this traffic can be held "captive" to the cooperative trucks.

The potential impact of greater annual vehicle mileage can be identified by looking at Table 55. The variable costs per mile in this example are 52 cents, consisting of tires, fuel, maintenance, and labor. The fixed costs of operating the three tractor-four trailer firm are $104,610 per year, consisting of depreciation, interest, license fees, insurance, housing costs, and management. Total per mile trucking costs decrease as annual mileage increases, going from $1.22 per running mile when the firm travels 50,000 per truck per year to $.75 per mile if the vehicle is able to achieve 150,000 miles per year, a savings of 39 percent. In fact, even a 10% increase in annual mileage by the cooperative, from the industry average (88,000 per vehicle) would decrease cost about 3 cents per mile or a cost advantage to the cooperative trucking firm of $30.00 for every 1,000 mile trip.

TABLE 55. ANNUAL MILEAGE AND TOTAL TRUCKING COSTS.

Number of Miles		Total Cost per Mile
Firm	Vehicle	
150,000	50,000	$\frac{150,000 (\$.52) + 104,610}{150,000} = \$1.22$
225,000	75,000	$\frac{225,000 (\$.52) + 104,610}{225,000} = \$\ .99$
300,000	100,000	$\frac{300,000 (\$.52) + 104,610}{300,000} = \$\ .87$
450,000	150,000	$\frac{450,000 (\$.52) + 104,610}{450,000} + \$\ .75$

Backhaul

The cooperatively owned truck fleet may, just as other larger trucking firms in North Dakota, find new sources of backhaul movements into the trade area. Even though product movement into the Bisbee area is not heavy, backhaul possibilities from Minneapolis/ St. Paul to Grand Forks, Minot or Fargo are more readily available. The impact of increased loaded backhaul mileage on costs per loaded mile is startling (Table 56).

TABLE 56. BACKHAUL FREQUENCY AND EFFECTIVE COST OF OPERATION.

Backhaul Frequency	Reduction Factor Applied to Base Rate	Per Mile Total Cost
0	1.00	$ .92
25%	1.25	.74
50%	1.50	.61
75%	1.75	.53
100%	2.00	.46

The effective cost per mile is 46 cents if all miles are loaded, relative to a one-way empty haul of 92 cents. Even if only a 25% backhaul frequency is achieved, the costs are effectively dropped to 74 cents per mile. Obviously, the firms experiencing a 60% load factor on return mileage have a substantial advantage, about 20 cents per mile, over the smaller owner-operator who only loads 25 precent of his backhaul.

The manager of the trucking fleet could work to become the focal point for miscellaneous steel, fertilizer, equipment and other commodities moving in the Bisbee trade area. As indicated earlier in this study many services, feed, chemicals, etc., are offered in the area. This, combined with the increased flexibility brought about by the Motor Carrier Act of 1980, will increase the possibilities of backhaul for the grain trucker. And, as loaded backhaul mileage increases, the costs that must be borne by the front haul are reduced substantially.

Cost Efficiencies of the Subterminal and Cooperative Truck Fleet Relationship

Some efficiencies may also arise because the cooperative trucking fleet is administratively combined with the subterminal operation. The manager of the subterminal could, depending on the size of the truck fleet, serve as manager of both entities. Mechanics could be used on both truck and subterminal operations. Housing for the trucks and truck repair could be developed concurrently with the needs of the subterminal facility. Also, since the firm is large and is purchasing materials for both operations, discounts may be received and costs decreased. Further, the labor force in the elevator could also be used as truck operators, particularly in times of seasonal demand. Finally, the cooperative elevator, through the use of retained earnings, may have a financial advantage over other trucking firms due to lower or internally specified interest rates.

Implications

Without a doubt there are definite benefits to the subterminal, and producers in the Bisbee trade area, of operating a cooperatively owned truck fleet in conjunction with the subterminal. Rate increases by the railroad may be minimized by the availability of this competitive alternative. The subterminal manager will have more flexibility, control and knowledge of appropriate rates to be paid to other truckers as a result of the truck fleet.

Further, there are potential economies available that might lower the per mile trucking costs experienced by the cooperative trucking fleet. Increased backhaul loads, increased annual mileage, and increased efficiencies from the fleet-subterminal administrative relationship are all possible sources of savings.

Yet, there are perils as well! If annual mileage of the vehicles is not high, tremendously high fixed costs per mile or loaded mile occur. So, the manager must evaluate the market relative to potential mileage and backhaul possibilities and, only then, decide on usage of a cooperatively owned trucking fleet. One possible option is to purchase a small "core" of trucks and using owner-operators as needed for seasonal demands. This could shrink the fixed costs and still give the Bisbee subterminal manager a feeling for what the costs of trucking really are.

Trucking Contracts With Existing Owner-Operators

The subterminal could use long-term contracts with existing owner-operators or other trucking firms to have the available capacity to handle the new country elevator to terminal movements. The contracts could be very general or could be very specific, depending on the needs and desires of the participating parties. The terms of the contract could include: (1) length of the contract; (2) volume guaranteed between the elevator and carrier, probably a minimum specified by month, if possible, and for the term of the contract; (3) rate to be paid, by destination and season; it could be indexed to cost increases or decreases over time; (4) exclusivity or not; just who is the carrier going to haul for: and (5) sharing of backhaul revenues; if the subterminal operation serves as a broker, what share is acceptable.

The potential benefits to the subterminal of contracting with owner-operators deal principally with decreasing uncertainty. The rate to be paid is essentially known and merchandising decisions can be based on that knowledge. A given and known amount of capacity will always be available in a timely fashion. The truckers hauling the grain are known driver/firm managers and can be trusted to provide a reasonable service. The backhaul percentage might be increased by the subterminal manager's contacts; if the contract so specifies, the resulting lower costs of operation from either backhaul or increased annual mileage might be shared by the subterminal.

Potential costs or dangers also exist. Since the day-to-day or even month-to-month market movements are difficult to predict, the needed or appropriate capacity is also difficult to ascertain. As a result, some unused services may have been purchased but not used. The carrier may not be available on the day desired by the subterminal manager unless the contract calls for exclusivity.

Further, the savings from the economies available from a centrally controlled traffic manager, discussed earlier, might be achieved but could be absorbed by the trucking firm. This last benefit, together with the prior information about the relative cost. of operation, make contracting for services a possible but risky option for the subterminal management.

Brokerage Activities

Another option a subterminal operation has is to perform the role of broker in bringing supply and demand for transportation services together. Such a function has the possibility of providing needed services to the community while improving the quality and quantity of service available to the subterminal. The subterminal management may be in a good position to serve as broker for transport of all commodities into and out of the area. They would have frequent contact with all rural communities in the trade area and, over time if performance warranted, local businessess would consider the subterminal as the focal point of the local transportation industry.

Benefits from providing such a function are quite diverse in nature. Providing the motor carriers with potential backhaul or increased traffic annually will effectively lower per mile operating costs for the carriers. This well might relax upward pressure on rates since the minimum possible rates are based on costs of operation. Secondly, backhaul brokerage might generate carrier loyalty so, even in times of peak demand, the carriers will still work for the subterminal operation. Finally, this brokerage activity will provide a service to the business community in the trade area. This function may help reduce rural businesses' transportation bills or simply serve as an aid in finding desired service. In sum, the brokerage activity will aid both subterminal, the rural business community, and customers of both.

Grain Merchandising Advantages of a Subterminal

Subterminal elevator operation has certain advantages inherent to its existence. This section reviews potential marketing alternatives or advantages available to a subterminal that the traditional country merchandiser may not be able to exploit.

Access to Multiple Car Rates

The most obvious of a subterminal elevator's advantages is the ability to load multiple car trains and access the rate associated with them. These large elevators are generally equipped with high load out capacities which enable them to load a 26 or 52 car train within the allotted time constraints. Specifications in grain tariffs state the time period in which a train must be loaded before demurrage charges are imposed (generally 24 hours beginning with the first 7:00 a.m. after the cars are delivered to the elevator).

Subterminal elevators are normally constructed with at least sufficient storage capacity to load a 52 car train. Fifty-two jumbo hopper cars hold approximately 171,000 bushels of grain. Many elevators in North Dakota do not possess sufficient storage to load a 52 car train, particularly a train loaded with only one commodity.

Some tariffs allow for mixing of two commodities within the same 26 or 52 car train.

Rail siding is another crucial factor associated with an elevator's ability to load out unit trains. Few elevators possess rail siding long enough to load 26 or 52 cars.

Origin vs. Destination Grading

Grain shipped from North Dakota traditionally has been graded by licensed inspectors when it reaches its destination at a terminal market. Destination grading involves a delay at the terminal market until the grain is graded, and increases carrying costs to the country elevator because of the extended time until payment. Industry personnel have suggested that grain grading at the point of origin may shorten considerably the time from shipment to payment.[25] Also, some discrepancy has been reported between the official destination grade and the quality of grain elevator managers felt they had actually shipped.

Subterminal development may lead to a push for official origin grading in North Dakota. If a few larger elevators replace many smaller facilities, origin grading may become feasible as the absolute number of grading stations decreases. Official graders would be performing the actual grain inspections at fewer stations, thereby possibly lowering total costs to elevators.

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[25]Wilson, William W. and Dennis R. Ming, "Grain Merchandising in North Dakota", Upper Great Plains Transportation Institute Report, NDSU, forthcoming.

Blending Opportunities

Blending of various lots of grains by country elevators is performed to achieve more uniform (and potentially overall higher) quality batches of grain than the original separate lots and to maximize returns to producers by only reaching the minimum requirements in each grade (see Chapter IV). Grain delivered to the country elevators by farmers is generally highly variable with respect to moisture content, percent dockage, protein level, etc. A high volume elevator with fast handling capabilities can take advantage of opportunities in blending of grains.

Operating Cost Advantages

One potential advantage of newer, larger facilities is lower costs of operation due to reduced variable costs and high volume throughput. Although a new subterminal will be a high fixed cost operation, high throughput will spread out those fixed costs over many units. Assuming variable costs do not increase, average total cost will decrease as throughput rises. And as developed in Chapter V, some per bushel variable costs also decrease as output increases. Also, maintenance and repair costs would be lower with new machinery. It should be noted that the costs of operating a new subterminal facility will depend highly on the amount of grain that a manager can move through his elevator. Without a high turnover ratio and high throughput, the most efficient of grain merchandising operations may be a financial disaster.[26]

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[26] Chase, Craig, et. al., "Cost Analysis of Potential North Dakota Subterminal Systems," *Agricultural Economics Report*, NDSU, forthcoming.

Another advantage in grain or service merchandising is the ability to buy large scale or wholesale the supplies needed by firms in the area, whether farmers or country elevators. Fertilizer, chemicals and farm supplies can be distributed from the subterminal with any savings from volume being shared by the subterminal and patron.

Use of NPE Contracts

A subterminal operation in Bisbee may not need to be of the larger design if management can effectively coordinate grain coming from farms and/or satellite stations. One merchandising technique which may aid in the assembly of grain is the "Priced Later" or "No Price Established" (NPE) contract. By allowing farmers to price their grain within some future time period, but allowing for prior delivery of the grain, the elevator can more effectively utilize storage space. Effective coordination of a trucking fleet would allow grain pick-up at the farm when the elevator manager has scheduled loading of a unit train. Therefore, the subterminal would not require storage space to hold the entire 170,000 bushels needed to load the train. Rather, the manager may choose to have two-thirds of the required grain on hand, and pick up the remainder from producers during the train loading process. Performing the same operation for all commodities on every train loaded effectively reduces needed storage capacity by one-third.

No Price Established contracts also may provide more efficient utilization of the cooperative's truck fleet. If producers' stored grains are left in farm storage until slack shipping seasons, trucks may be put to use picking up grain at farms, rather than at satellite stations or delivering grains to terminal markets.

This merchandising technique may decrease the frequency of single (or less than 52) car shipments from the subterminal. Allowing the manager to procure grain from farms "at will" would enable him to "smooth out" the irregular flows of grain characteristic of North Dakota elevators. It should be noted that NPE contract use is not exclusive to subterminal operations; this merchandising technique is available to all country elevators. However, its use may be more complementary to the subterminal operation (vis-a-vis the trucking coop) than to the traditional country grain merchandiser.

Cooperatively Owned Short Line Railroad in the Bisbee Area

One transportation alternative to branchline abandonment in the Bisbee area is to organize the affected line(s) as a short line railroad. The organization would operate independent of the area's two existing railroads, the Soo Line and Burlington Northern. Presumably, elevators affected by branchline abandonment would purchase and operate the line cooperatively to sustain their rail service rather than resort to complete truck service.

Four of the 14 elevators included in this study are located on a line cited for possible abandonment. The Devils Lake to Hansboro branchline is listed in Category 2 (under study for possible future abandonment). The York to Dunseith line has one of the 14 located on it, but a recent Interstate Commerce Commission decision approved abandonment of only the portion of the line void of grain elevators. Therefore, it would only be in the interest of the elevators on the Devils Lake to Hansboro line to cooperate in forming a short line railroad, if they considered such an organization as a viable alternative to loss of rail service by the Burlington Northern.

A short line railroad operated by the cooperative elevators presumably would pick up empty freight cars at Bisbee, deliver them to the four elevators for loading, and return them to Bisbee for reblocking into the large train. One other operational alternative would be for the short line to load grain at the country elevator stations and unload at Bisbee for reloading into the larger train. This alternative, however, would require rail unload capabilities at Bisbee, essentially making it an inland terminal. Both of these operations would require that the short line railroad travel over approximately 13 miles of Soo mainline track to and from Bisbee. This movement would require a previous agreement with the Soo Line Railroad.

Advantages of the Short Line Railroad Alternative

The most obvious advantage of short line formation near Bisbee is the preservation of rail service to elevators impacted by branchline abandonment. Rail service to the four elevators would be sustained, and possibly more effectively than prior to abandonment. Due to the cooperative ownership, shippers may receive more timely and potentially more inexpensive service. Non-union labor and reduced equipment and overhead costs may actually lower the cost of providing service to the elevators. Also, area roads may receive less damage if grain is moved by rail rather than by farm trucks or semi-tractor rigs.

Disadvantages of the Short Line Railroad Alternative

A short line railroad operation in North Dakota would be an extremely high fixed cost-low volume operation. The volume of grain available in the Bisbee area for the short-line to ship would not be sufficient to achieve any economies of size. A five year average of grain handled by the four elevators was approximately 2.8 million bushels. At 3300 bushels per hopper car, only 850 cars would be shipped annually by the short line railroad.

Also, all of this grain would not necessarily be shipped by rail. A four year weighted average of shipments from these four elevators indicated that trucks have carried 13 percent of all movements. Even with cooperative formation of a short line railroad, some of the grain may still be expected to move by truck.

In a previous study of short line railroad development in North Dakota,[27] low grain volume and high fixed start up costs prohibited formation of the operation. In that study, a branchline shorter in length than the Devils Lake to Hansboro line was analyzed.[28] On that

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[27]See Zink, Dan, "Analysis of Short Line Railroad Development in North Dakota," UGPTI Report, forthcoming.

[28]It should be noted that the four impacted elevators represent only about one-half of the line segment. Therefore, the entire line may not necessarily need to be purchased.

line, maximum grain volume by rail dictated approximatley 1000 rail cars shipped annually, compared to 850 cars on the Devils Lake to Hansboro line.

Trackage rights may not be attainable from the Soo Line Railroad, to operate between Egeland and Bisbee. These privileges may be particularly difficult to get when the Soo Line will likely be hauling some of the grain regardless of the operation of a short line railroad.

Costs of purchasing and performing necessary rehabilitation may preclude even the initial stages of the operation. Net liquidation value of the Devils Lake to Hansboro branchline is approximately two million dollars.[29] Rehabilitation costs would vary with the expected level of traffic and present condition of the roadway. Some rail on the northern portion of the line would require replacing for regular movement of large hopper cars. The subgrade structure on this line would need reconstruction due to the unstable nature of the roadbed during rainy portions of the year. A conservative estimate of rehabilitation costs necessary to continue current traffic levels would be approximately $20,000 per mile, or a total of 1.3 million dollars. These two estimates ($2 million + $1.3 million) approximate the initial outlay necessary for startup of a short line railroad on the Devils Lake to Hansboro branch line.

Most short line railroads in North Dakota would be primarily dependent on grain traffic for their revenues. An operation

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[29]Based on NLV of $31,300/mile. For a more complete discussion of NLV calculation and unit costs of rehabilitation, see Zink, Ibid.

in the Bisbee area would have few other commodities to haul. Grain shipments are seasonal, resulting in seasonal revenues to the operation.

Feasibility of a Cooperatively Owned Short Line Railroad Serving the Bisbee Area

Affected elevators must choose among different alternatives when faced with branchline abandonment. The short line railroad alternative would not be cost-effective compared to simply trucking grain to the desired elevator, either by farm truck or semi-tractor rigs. Enormous fixed start-up costs and low volume of grain movements would prevent successful operation of the short line in the Bisbee area. If the short line was instituted, high costs of operation could force producers and elevators to divert grain from the short line to trucks, further compounding the operation's problem of low volume and low fixed plant utilization.

The short line railroad, if in operation, may either deliver loaded cars to Bisbee for reblocking into a larger train, or unload grain at Bisbee for reloading. Either situation has drawbacks. The mainline carrier (Soo Line or BN in this case) may object to switching operations on their train carried out by the short line if a few cars are to be taken out and loaded at an elevator other than Bisbee. Also, maximum loading times would prevent transfer of empty cars from Bisbee for loading at other elevators and their return. The second situation (unloading cars at Bisbee and reloading into a large train) would require rail unloading capabilities at Bisbee--a prohibitively expensive endeavor. The subterminal at Bisbee would also seek to avoid any double handling of grains, so little economic rationale for such an operation would seem to exist.

Summary

The options discussed in this chapter do offer potential advantages to a subterminal and the rural community but some of them have disadvantages that appear to outweigh the advantages. A cooperative trucking fleet owned and operated by the subterminal appears to be an economically justified activity. The trucking fleet can serve as a competitive deterrent to rate increases by the railroad, can achieve lower costs per mile due to increased annual mileage, backhaul increases, and spreading out of some of the cooperative subterminal's fixed costs.

Trucking contracts with existing owner-operators also appear potentially profitable. Uncertainty of rates and capacity are minimized under this option. Additionally, the owner-operators are experienced and can provide reliable service. However, for these long term contracts to be a positive option for the subterminal, savings from the economies generated by the cooperative subterminal must be divided between the subterminal and the owner-operator.

The subterminal can also serve as a broker in bringing supply and demand for transportation services together. The brokerage activity can decrease costs of operation for rural transportation and provide a service to the business community in the trade area.

Grain merchandising by a subterminal has advantages not always available to a smaller country elevator. The elevator can achieve multiple car rates, can offer the possibility of origin grading, can achieve savings by blending appropriately, can achieve some operating cost economies, and can buy supplies wholesale or at volume discounts. Also, use of No Price Established contracts would more fully utilize the cooperative's truck fleet and "smooth out" seasonal variations in grain movements.

The subterminal could own and operate a short line railroad, but there is little potential for such an operation to be economically feasible. The low volume in the area, combined with high purchase price, rehabilitation of line, and operating costs are strong deterrents to further consideration of a short line railroad as an option complementary to a cooperative subterminal.

The options discussed in this chapter generally support the feasibility of the subterminal elevator in Bisbee. The cooperative trucking fleet, if fully utilized would complement operations at the elevator, as would any brokerage or contracting activities entered into by the elevator management.

CHAPTER VII

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Summary

The grain transportation and marketing system of North Dakota is undergoing significant changes, changes that will require decisions by producers, elevator managers and/or boards of directors, transportation companies and marketers. Some of these changes, e.g., abandonment, multiple car rates, user fees, etc., necessitate reaction by elevators in order to remain viable. This study examined the feasibility of alternative cooperative arrangements, especially a subterminal elevator. Specific objectives were to:

1. describe a study area as to existing elevator/transportation structure and identify the probable future structure;
2. identify the costs of assembly, elevation, and distribution for grain under three situations:
    a. the existing system,
    b. after contemplated rail line abandonment plans in the study area,
    c. if a cooperative subterminal is constructed;

and 3. evaluate the feasibility of other marketing alternatives such as shipper owned railroads and truck fleets.

The study area, Bisbee, was chosen based on several criteria. Community enthusiasm and interest appeared high at early meetings and was necessary to do a site-specific study. An area of high crop concentration was desired so the large volume necessary for a subterminal facility would be available. Existing rail service and/or rail line abandonment considerations were the final criteria. The characteristics in the

Bisbee trade area indicated that a study could be accomplished and the findings applied to other areas of North Dakota.

The general study approach was an indentification of total marketing costs (assembly, elevating and distribution) of alternative marketing costs under the various scenarios. Rail or truck costs were aggregated over mileage and combined with costs of operation of elevators for each of the scenarios to identify the available efficiencies.

The identified total marketing costs of each scenario are summarized in Table 54, page 118. The costs borne by the agricultural producers in the Bisbee study area range from $8,824,091 to $9,177,608 under the three scenarios, a difference of about $350,000 or about 3.2 cents per bushel. The per bushel costs were about 79-82 cents in each of the options which were considered viable.

The abandonment of rail lines in the area has the projected impact of slightly increasing the costs of operation by $74,418 or less than one percent. This occurs because farmers who formerly trucked grain to elevators on the Devils Lake to Hansboro branchline had to haul to more distant elevators. Some savings were noticed as grain was now moved through elevators which are slightly more efficient and which experienced slightly lower transportation rates to the terminals than the four eliminated elevators. However, it is doubtful that such savings would be realized because of probable capital investment requirements, congestion and logistical inefficiencies, and loss of volume to other modes or areas.

Comparison of the present or existing situation to the 500,000 bushel subterminal alternative indicates a project increase of $350,000 in total costs, or about three cents per bushel. See Table 57 for a comparison of costs among all marketing configurations. The costs incurred by the country elevators would decrease because Bisbee would not be in operation except as a subterminal. The costs of transportation from the study area to terminal markets would decrease substantially, from $6.9 million to $5.8 million. However, these savings are offset by the additional costs of operating a subterminal and the country elevator to a subterminal transportation expenses.

Construction of a larger sized subterminal has an undesirable impact on total marketing costs. Per bushel costs increase from 82.6 cents to 86.4 cents as the size of the facility is increased from 500,000 bushels to 1,100,000 bushels storage capacity. The increased subterminal costs arise because no increase in trade volume is assumed.

Subterminal elevator costs computed herein are based on several critical assumptions (see footnotes to Table 54). If the projected volume is not achieved, or if 52 car rates are not accessible, or if the relative spreads between single and multiple car rail rates change, the subterminal's competitive viability compared to the existing system in the Bisbee area may be lost.

Conclusions and Recommendations

General conclusions of the study can be identified. The cooperative subterminal is a potentially feasible and reasonable alternative for the Bisbee study area. The basic reason this analysis did not identify complete feasibility was because all country elevators were assumed to remain active and not lose any volume to the subterminal. The result is a tremendous double handling cost of about 23 cents per bushel. Eliminating this double handling could decrease the costs of elevating by 12.2 cents per bushel or a total savings of $1,345,834. In fact, it is not necessary to eliminate all of the elevators to generate economic feasibility; if four average size elevators handling 800,000 bushels each were eliminated, $400,000 of savings would be realized; this savings would generate economic feasibility. Such an occurrence may be expected since several of the 14 elevators are quite old and may be phased out over the near or immediate future because of age or competitive factors.

Some recommendations include the following:

1) construct a subterminal. It looks potentially feasible and the flexibility and merchandising opportunities discussed in this study appear to increase the probability of feasibility.

2) investigate the market area and competition closely so the correct size of elevator can be determined. It does appear the 500,000 bushel facility is appropriate if the trade volume identified can be achieved (11 million bushels). Otherwise, upgrade one of the existing elevators to a 26 car subterminal.

3) build the standard quality of subterminal. The benefit/cost ratio of options appears highest for this quality.

4) continually monitor the trade area and investigate potential cooperative mergers or other arrangements.

5) the operation of a cooperative trucking fleet should be undertaken since it looks economically feasible under rigorous management.

6) include brokerage activities and long term trucking contracts because they do offer benefits to the subterminal and rural community.

7) do not investigate further the possibility of a cooperatively owned and opearated short line railroad.

If the available trade area is reduced and the elevators on the outskirts of the area do not commit their volume to the cooperative, construction of the 52 car loading subterminal would lead to financial disaster due to low throughput. It is important to recognize the high fixed cost nature of elevator operations--high throughput is imperative to reduce fixed costs per bushel. If only this lower volume was attainable, the 300,000 bushel 26 car facility is the more feasible alternative. If only one-half the original volume (11 million bushels) was available, the 26 car upgraded subterminal will be strongly favored due to the lower associated construction (upgrading) costs of the existing elevators.

APPENDIX

QUESTIONNAIRE

REGIONAL SUBTERMINAL AND TRUCKING COOP PLAN

1. Do you feel that the development of subterminals, large country elevators, will occur in North Dakota in the next five years?

_____ yes

_____ no

_____ not sure

2. Why do you think such development will or will not take place?

____

____

____

____

____

____

3. How do you rate the concept of a subterminal with satillite elevators and a trucking coop presented to you today in light of the present situation.

_____ excellent

_____ good

_____ fair

_____ poor

4. Would your elevator willingly participate in the planning of such a project?

_____ yes

_____ no

QUESTIONNAIRE RESULTS

SITE SELECTION SURVEY

	Oakes N=29 (%)*	Devils Lake N=50 (%)*	Rolla N=17 (%)*	Williston N=32 (%)*	Enderlin N=17 (%)*
1. Do you feel subterminals will develop in North Dakota in five years?					
yes	76	50	82	73	71
no	10	12		9	6
not sure	10	30	18	18	24
no answer	3	--	--	--	--
2. See Attached Sheets					
3. How do you rate the subterminal, satellite elevator, trucking coop concept presented?					
excellant	7	8	24	9	6
good	24	24	65	31	59
fair	28	34	--	50	24
poor	41	28	12	9	12
no answer	--	6	--	--	--
4. Would your elevator participate in planning such a project?					
yes	55	54	88	81	65
no	34	28	--	9	6
undecided	7	10	6	--	12
no answer	3	8	6	9	18

*Totals may not add to 100% due to rounding.

2. Why do you think such a development will or will not take place?

Oakes

Push for subterminals by railroad	7
Push for subterminals by large grain firms	3
Branch line abandonment	5
Multiple car rates make subterminals more competitive	3
Grain volume increasing	1
Farm size increasing	1
Economic necessity	1
Cooperative to save small elevators	1

Devils Lake

Branch line abandonment	10
Push for subterminals by railroad	5
Construction costs prohibitive	2
Multiple car rates	2
High trucking costs	1
Present poor rail service	1
Lack of organization among present elevators	1
Price competition from subterminals	1
Subterminal not profitable	1
Financing not available	1
Inflation	1
Large grain firms will initiate subterminal wave	1
Present system cannot load 26 or 52 car units	1

Rolla

Branch line abandonment	6
Unit trains (multiple car rates)	4
No west coast market for durum	1
No durum futures market	1
Increasing farm size	1
Railroad push for subterminals	1

Rolla - continued

Large grain firms push for subterminals	1
Increase in transportation costs	1

Williston

Railroad push for subterminal	12
Branch line abandonment	6
Streamline movement of grain	2
Trucks abuse highways	1
Unit trains	1
Survival of local coop	2
Pressure from large food processors	1

Enderlin

Branch line abondonment	5
Economic necessity	4
Railroad push for subterminals	1
Subterminals would eliminate competition	2
Unit trains (rate structure)	2

REGRESSION EQUATION DEVELOPED FOR ALL NORTH DAKOTA ELEVATORS

Actual cost data from North Dakota elevators were used to develop an equation of the form:

$$Y = a \times b \ln X$$

where: Y = predicted ATC,

a = the intercept or constant term

b = the slope parameter, and

X = the independent variable, $\frac{\text{bushels handled}}{10{,}000}$

For example, elevator three handled an average of 1,039,772 bushels over crop years 1977-78 to 1980-81. Therefore, the estimated per bushel cost is computed as follows:

$$\text{ATC} = 20.01 - 3.15 \text{ bu. } \ln \ (10.39772) = 12.63 \text{ cents per bushel.}$$

COSTS OF SHIPPING GRAIN FROM FARMS TO BISBEE AREA ELEVATORS, AFTER ABANDONMENT

Elevator Number	One Way Distance Farm Elevator[a] (miles)	Percent by Truck Type: Single Axle	Percent by Truck Type: Tandem Axle	Round Trip Cost: Total $/bu.	Round Trip Cost: Per Bushel[b] cents/bu.	Grain Handled (bu.)	Total Cost ($)
1	7.5	85	15	15.76	4.96	424,764	21,068
2	*	*	*	*	*	*	*
3	8.3	70	30	18.08	5.06	1,491,599	75,475
4	*	*	*	*	*	*	*
5	10.6	73	27	22.92	6.56	848,625	55,670
6	5.0	68	32	10.94	3.02	920,136	27,788
7	*	*	*	*	*	*	*
8	*	*	*	*	*	*	*
9	7.0	70	30	15.24	4.26	264,360	11,262
10	10.3	67	33	22.59	6.18	2,741,190	169,406
11	10.0	70	30	21.78	6.09	1,035,215	63,045
12	7.6	73	27	16.44	4.70	1,674,898	78,720
13	7.5	75	25	16.14	4.69	915,924	42,957
14	6.7	70	30	4.08	3.29	800,597	32,664
							$578,055

[a]Mileages to some elevators and percent by truck type changed due to grain being shipped from producers formerly patronizing an elevator on an abandoned branchline.

[b]Weighted by percent single axle and tandem axle.

ELEVATOR COSTS AND BUSHELS HANDLED AFTER REALLOCATION OF MARKET AREAS, AFTER ABANDONMENT

Elevator Number	Bushels Handled Before Abandonment	Bushels Handled After Abandonment	Predicted Average Total Cost cents/bu.	Total Cost ($)
1	424,764	424,764	15.45	65,626
2	320,714	a	--	--
3	1,039,772	1,491,599	12.63	188,389
4	1,259,938	a	--	--
5	322,821	848,625	16.32	138,496
6	468,309	920,136	15.15	139,401
7	311,742	a	--	--
8	903,653	a	--	--
9	264,360	264,360	16.95	44,809
10	1,692,322	2,741,190	11.10	304,272
11	1,035,215	1,035,215	12.65	130,955
12	1,461,089	1,674,898	11.56	193,618
13	915,924	915,924	13.03	119,345
14	696,683	800,597	13.90	111,283
	11,117,306	11,117,308		$1,436,194

[a]Elevator not operating after abandonment.

COSTS OF SHIPPING GRAIN FROM FARMS TO 14 BISBEE AREA ELEVATORS, AFTER SUBTERMINAL CONSTRUCTION

Elevator Number	One Way Distance Farm-Elevator (miles)	Percent by Truck Type: Single Axle (%)	Percent by Truck Type: Tandem Axle (%)	Round Trip Cost: Total ($)	Round Trip Cost: Per Bushel (cents)	Grain Handled (bu.)	Total Cost (%)
1	7.5	85	15	15.76	4.96	424,764	21,068
2	5.5	90	10	11.42	3.75	320,714	12,027
3	5.0	b	b	10.83	3.08	1,039,772	32,025
4	7.5	70	30	16.33	4.57	1,259,938	57,579
5	3.75	70	30	8.17	2.29	322,821	7,393
6	5.0	70	30	10.89	3.05	468,309	14,283
7	5.0	70	30	10.89	3.05	311,742	9,508
8	7.5	65	35	16.52	4.46	903,653	40,303
9	7.0	70	30	15.24	4.26	264,360	11,262
10	7.5	65	35	16.52	4.46	1,692,322	75,478
11	10.0	70	30	21.78	6.09	1,035,215	63,045
12	c	70	30	14.11	3.95	1,461,089	57,713
13	7.5	75	25	16.14	4.69	915,924	42,957
14	5.5	70	30	11.98	3.35	696,683	23,339
Total						11,117,306	$467,980

[a]Weighted by percent single axle and tandem axle.
[b]Average Used (72.3% and 27.7%)
[c]Average Used (6.48 miles)

PREDICTED AVERAGE TOTAL COSTS OF OPERATION, THIRTEEN SELECTED ELEVATORS

Elevator Number	Bushels Handled Four Year Average	Bushels Handled 1980	Average Total Cost Predicted	Average Total Cost Actual 1980	Total Cost
			---------- cents/bushel	--------	($)
1	424,764	NA	15.45	17.2	65,626
2	320,714	NA	16.34	30.4	52,405
3	1,039,772	1,315,774	12.63	16.1	131,323
4	1,259,938	2,336,503	12.03	15.8	151,571
5	322,821	a	16.32	15.8	52,684
6	468,309	a	15.15	15.8	70,949
7	311,742	a	16.43	15.8	51,219
8	903,653	c	13.08	13.8	118,198
9	264,360	b	16.95	10.3	44,809
10	1,692,322	2,846,658	11.10	13.8	187,848
11	1,035,215	1,436,296	12.65	10.3	130,955
12	1,461,089	1,503,577	11.56	14.2	168,902
13	915,924	NA	13.03	NA	119,345
14	d				
	10,420,023				1,345,834

[a]Included in elevator #4 bushels.
[b]Included in elevator #11 bushels.
[c]Included in elevator #10 bushels.
[d]Elevator not operating after subterminal construction.

COSTS OF TRUCKING GRAIN FROM AREA ELEVATORS TO BISBEE, AFTER SUBTERMINAL CONSTRUCTION

Elevator Number	Miles to Bisbee	Cost Per Mile (dollars)	Total Cost/trip ($)	Total Cost/bu. (cents)	Bushels Handled	Total Cost ($)
1	24.5	.92	45.08	5.41	424,764	22,980
2	25.0	.92	46.00	5.52	320,714	17,703
3	26.0	.92	47.84	5.74	1,039,772	59,683
4	18.5	.92	34.04	4.09	1,259,938	51,531
5	13.5	.92	24.84	2.98	322,821	9,620
6	24.0	.92	44.16	5.30	468,309	24,820
7	15.5	.92	28.52	3.42	311,742	10,662
8	29.0	.92	53.36	6.41	903,653	57,924
9	11.0	.92	20.24	2.43	264,360	6,424
10	9.0	.92	16.56	1.99	1,692,322	33,677
11	5.5	.92	10.12	1.21	1,035,215	12,526
12	18.5	.92	34.04	4.09	1,461,089	59,759
13	22.5	.92	41.40	4.97	915,924	45,521
14	a	--	--	--	--	--
					10,420,623	412,830

[a]Elevator not operating after subterminal construction.

300,000 BUSHEL CAPACITY SUBTERMINAL

Depreciable Fixed Costs

Item Name	Cost	No.	Life	Repairs	Salvage Value	Annual Equivalent Cost
Land (in acres)	$ 2,000.00	5	40	$ 0.00	$10,000.00	$ 1,400.00
Elevator Structure	735,000.00	1	40	3,500.00	0.00	106,975.56
Driveway Structure	420,000.00	1	40	2,000.00	0.00	61,128.93
Elevator Machinery	450,000.00	1	10	2,200.00	0.00	88,431.31
Dust Control	90,000.00	1	10	450.00	0.00	17,686.27
Drier System	120,000.00	1	10	600.00	0.00	23,581.70
Electrical	120,000.00	1	10	600.00	0.00	23,581.70
Aeration and Temp.	40,000.00	1	10	200.00	0.00	7,860.56
Railroad Trackage (in feet)	60.00	3,500	40	3,360.00	0.00	32,916.46
Railcar Mover	80,000.00	1	10	2,400.00	0.00	17,737.13
Office Building	60,000.00	1	40	290.00	0.00	8,732.70
Office Furniture	20,000.00	1	10	100.00	0.00	3,930.28
Contingencies	150,000.00	1	10	0.00	0.00	28,757.12
Total Depreciable Fixed Cost	422,719.72					

Nondepreciable Fixed Costs

Item Name	Cost	Annual Equivalent Cost
Insurance	$13,695.00	$15,612.30
Bonds	3,060.00	3,488.40
Taxes	22,250.00	25,364.98
Manager Salary	27,500.00	31,349.98
Asst. Manager Salary	18,500.00	21,089.98
Director Fees	900.00	1,026.00
Dues	250.00	285.00
Annual Meeting	850.00	969.00
Warehouse License	30.00	65.00
Total Nondepreciable Fixed Cost	$99,250.64	
Total Fixed Cost	$521,970.36	

300,000 BUSHEL CAPACITY SUBTERMINAL

Variable Cost

Item Name	No.	Cost	
Bookkeeper	1/2	$ 5,200.00	
Secretary	1	9,360.00	
Laborers	2	29,120.00	
Employee Benefits		10,760.00	
Payroll Taxes		5,960.00	
Unemployment Compensation		990.00	
Workmen's Compensation		1,420.00	
Office Supplies		2,750.00	
Elevator Supplies		3,500.00	
Power		7,500.00	
Telephone		1,750.00	
Subscriptions		300.00	
Advertising		1,750.00	
Special Meeting		350.00	
Travel and Convention		2,500.00	
Legal Fees		500.00	
Rodent Control		350.00	
Tax and Div. Work		325.00	
Data Processing		500.00	
Residence Expense		300.00	
Protein Tests		1,000.00	
Total Variable Cost		$86,185.00	
Interest on Variable Cost		7,325.00	
Interest on Grain Purchased[a] (28 days)		82,450.00	(153,907.00)
Total Operating Cost		$175,960.00	
Total Annual Cost (Variable and Fixed)		$697,930.36	($769,387.36)

[a]Assumes a turnover of 10.

CONSTRUCTION - 500,000 BUSHEL CAPACITY SUBTERMINAL

Elevator Structure - 14 Bin Network

(a)	6-storage bins 30' x 135', 72,596 ea.	435,576 bu.
(b)	6-working bins ranging 3,230-10,820	36,020
(c)	1-shipping bin	8,280
(d)	1-interface bin	16,510
		496,386 bu.*

*Includes 5 percent compaction.
Cost was calculated at $2.35/bu. for 500,000 bu.

Driveway Structure

(a) 2-fully enclosed driveways w/electrically operated doors.
(b) 1-70' hydraulic truck dumper for semi-trucks supported by a 60-ton scale dumping into a 1,000 bushel receiving pit.
(c) 1-100' deck with a twin lift for tandem trucks supported by a 60-ton scale dumping into a 1,000 bushel receiving pit.
(d) driveway structure and equipment are attached to an 800 square-foot testing office.

Machinery

(a) 2-7,500 BPH receiving legs of which one is capable of feeding an 8,000 BPH cleaner prior to storage.
(b) grain is distributed by a double (14 duct roto-flo) and single (revolving valve) distribution system (14" lined).
(c) bins are connected by manual gates for blending purposes.
(d) movement is accomplished by a 7,500 BPH conveyor system.
(e) shipping may be accomplished by the use of any one of these 10,000 BPH truck loadouts (14" lined) or a 40,000 BPH rail loadout (26" lined). An in-line sampler is included in the rail loadout.
(f) includes a 300# three-station manlift.

Dust Control

(a) provides for the collection of dust at both receiving pits, bucket elevator boots and heads, each distributor, and loadout spout. Specifics not disclosed by blueprints or estimates.

Drier System

(a) 1,200 BPH gravity fed returned by conveyor.

Aeration and Temperature

(a) 25 HP aeration fans in each of the six major bins.
(b) 3-cable temperature system in each of the above six.

Railroad Trackage

(a) $60/ft. would like room for 100 plus cars at 65 ft./car resulting in a need for 6,500 ft. Would use 7,000 ft. as an optimum.

Office Building

(a) 2,000 sq. ft. at $30/sq. ft.

500,000 BUSHEL CAPACITY SUBTERMINAL

Construction Cost - $3,330,000

Depreciable Fixed Costs

Item Name	Cost	No.	Life	Repairs	Salvage Value	Annual Equivalent Cost
Land (in acres)	2,000.00	10	40	0.0	20,000.00	2,800.00
Elevator Structure	1,175,000.00	1	40	5,600.00	0.0	171,015.38
Driveway Structure	420,000.00	1	40	2,000.00	0.0	61,128.93
Elevator Machinery	550,000.00	1	10	2,600.00	0.0	108,082.69
Dust Control	125,000.00	1	10	600.00	0.0	24,564.27
Dryer System	120,000.00	1	10	600.00	0.0	23,581.70
Electrical	150,000.00	1	10	700.00	0.0	29,477.11
Aeration and Temp.	50,000.00	1	10	250.00	0.0	9,825.70
Railroad Trackage (in feet)	60.00	7,000	40	6,700.00	0.0	65,832.83
Railcar Mover	80,000.00	1	10	2,400.00	0.0	17,737.13
Office Building	60,000.00	1	40	300.00	0.0	8,732.70
Office Furniture	20,000.00	1	10	100.00	0.0	3,930.28
Contingencies	200,000.00	1	10	0.0	0.0	38,342.84
Total Depreciable Fixed Cost	$565,051.56					

Nondepreciable Fixed Costs

Item Name	Cost	Annual Equivalent Cost
Insurance	18,488.00	21,076.32
Bonds	5,100.00	5,814.00
Taxes	30,300.00	35,225.98
Manager Salary	30,000.00	34,199.98
Asst. Manager Salary	22,500.00	25,649.98
Director Fees	1,200.00	1,368.00
Dues	300.00	342.00
Annual Meeting	1,100.00	1,254.00
Warehouse License	50.00	57.00
Total Nondepreciable Fixed Cost	$124,987.26	
Total Fixed Cost	$690,038.82	

500,000 BUSHEL CAPACITY SUBTERMINAL

Variable Cost

Item Name	No.	Cost	
Bookkeeper	1	10,400.00	
Secretary	1	9,368.00	
Laborers	3	43,680.00	
Employee Benefits		17,390.00	
Payroll Taxes		7,710.00	
Unemployment Compensation		1,230.00	
Workmens Compensation		1,650.00	
Office Supplies		4,000.00	
Elevator Supplies		4,500.00	
Power		11,000.00	
Telephone		2,500.00	
Subscriptions		600.00	
Advertising		3,000.00	
Special Meeting		500.00	
Travel and Convention		4,000.00	
Legal Fees		750.00	
Rodent Control		520.00	
Tax and Div. Work		500.00	
Data Processing		800.00	
Residence Expense		500.00	
Protein Tests		1,500.00	
Total Variable Cost		126,090.00	
Interest on Variable Cost		10,718.00	
Interest on Grain Purchased[a] (28 days)		137,417.00	(256,511.00)
Total Operating Cost		274,225.00	
Total Annual Cost (Variable and Fixed)		$964,263.82	($1,083,357.82)

[a]Assumes a turnover of ten.

CONSTRUCTION - 850,000 BUSHEL CAPACITY SUBTERMINAL

Elevator Structure - 17 Bin Network

(a)	8-storage bins 36' X 120' 85,190 ea.	681,520 bu.
(b)	6-working bins, range 11,510 to 25,690	109,110
(c)	2-interface bins 23,810 ea.	47,620
(d)	1-shipping bin	14,310
		852,560 bu.*

*Includes 5 percent compaction.
Cost was calculated at $2.25/bu. for 850,000 bu.

Driveway Structure

(a) same as 500,000 bu. subterminal.

Machinery

(a) 2-10,000 BPH receiving legs of which one is capable of feeding a 10,000 BPH drag scalper and 11,000 BPH cleaner.
(b) grain is distributed by a double (14 duct roto-flow) and two single (revolving valve) distribution systems (14" lined).
(c) bins are connected by manual gates for blending purposes.
(d) movement is accomplished by a 10,000 BPH conveyor system.
(e) shipping may be accomplished by the use of any of three 10,000 BPH truck loadouts (14" unlined) or a 40,000 BPH rail loadout (26" lined). An in-line sampler is included in the rail loadout.
(f) includes a 500# four-station manlift.

Dust Control

(a) same type of system as 500,000 bu. subterminal.

Drier System

(a) 1,500 BPH gravity fed returned by conveyor.

Aeration and Temperature

(a) 8-25 H.P. aeration fans.
(b) 16-overspace fans.
(c) three cable temperature system in the eight storage bins and two interface bins.

Railroad Trackage

(a) 7,000 ft. at $60/ft.

Office Building

(a) 3,000 sq. ft. at $35/sq. ft.

850,000 BUSHEL CAPACITY SUBTERMINAL

Construction Cost - $4,597,000.00

Depreciable Fixed Cost

Item Name	Cost	No.	Life	Repairs	Salvage Value	Annual Equivalent Cost
Land (in acres)	2,000.00	20	40	0.0	40,000.00	5,599.99
Elevator Structure	1,912,000.00	1	40	9,200.00	0.0	278,282.31
Driveway Structure	420,000.00	1	40	2,100.00	0.0	62,584.93
Elevator Machinery	750,000.00	1	10	3,600.00	0.0	147,385.56
Dust Control	150,000.00	1	10	720.00	0.0	29,477.11
Dryer System	150,000.00	1	10	720.00	0.0	29,477.11
Electrical	180,000.00	1	10	850.00	0.0	35,372.55
Aeration and Temp.	100,000.00	1	10	480.00	0.0	19,651.41
Railroad Trackage (in feet)	60.00	7,000	40	6,700.00	0.0	65,832.83
Railcar Mover	80,000.00	1	10	2,400.00	0.0	17,737.13
Office Building	105,000.00	1	40	500.00	0.0	15,282.23
Office Furniture	30,000.00	1	10	150.00	0.0	5,895.42
Contingencies	250,000.00	1	10	0.0	0.0	47,928.54
Total Depreciable Fixed Cost	$760,507.12					

850,000 Bushel Capacity Subterminal

Nondepreciable Fixed Cost

Item Name	Cost	Annual Equivalent Cost
Insurance	27,058.00	30,846.12
Bonds	5,810.00	6,623.39
Taxes	42,270.00	48,187.80
Manager Salary	35,000.00	39,899.98
Asst. Manager Salary	25,000.00	28,499.98
Director Fees	1,600.00	1,824.00
Dues	400.00	456.00
Annual Meeting	1,500.00	1,710.00
Warehouse License	60.00	68.40
Total Nondepreciable Fixed Cost	158,343.67	
Total Fixed Cost	$918,850.79	

850,000 BUSHEL CAPACITY SUBTERMINAL

Variable Cost

Item Name	No.	Cost	
Bookeeper	1	10,400.00	
Secretary	1	9,360.00	
Secretary/Clerk	1/2	4,680.00	
Laborers	4	58,240.00	
Employee Benefits		21,400.00	
Payroll Taxes		9,490.00	
Unemployment Compensation		1,510.00	
Workmens Compensation		2,120.00	
Office Supplies		5,250.00	
Elevator Supplies		6,000.00	
Power		15,000.00	
Telephone		3,250.00	
Subscriptions		850.00	
Advertising		3,500.00	
Special Meeting		750.00	
Travel and Convention		5,000.00	
Legal Fees		1,000.00	
Rodent Control		700.00	
Tax and Div. Work		750.00	
Data Processing		1,250.00	
Residence Expense		750.00	
Protein Tests		2,250.00	
Total Variable Cost		163,500.00	
Interest on Variable Cost		13,898.00	
Interest on Grain Purchased[a] (28 days)		233,608.00	(436,069.00)
Total Operating Cost		411,006.00	
Total Annual Cost (Variable and Fixed)		$1,329,856.79	($1,532,317.79)

[a]Assumes a turnover of ten.

CONSTRUCTION - 1,100,000 BUSHEL CAPACITY SUBTERMINAL

Elevator Structure - 21 Bin Network

(a)	10-storage bins 32' X 140' 90,800 ea.	908,000 bu.
(b)	3-interface bins 21,975 ea.	65,925
(c)	6-working bins ranging 4,415-21,315	85,260
(d)	1-rail shipping bin	12,730
(e)	1-truck shipping bin	4,945
		1,076,860 bu.*

*Includes 7 percent compaction for storage bins and 5 percent for all others. Cost was calculated at $2.15/bu. for 1,100,000 bu.

Driveway Structure

(a) same as 500,000 bu. subterminal.

Machinery

(a) 2-15,000 BPH receiving legs, 2-15,000 BPH drag scalpers and 2-16,000 BPH cleaners.
(b) grain is distributed by a double (16 duct roto-flow) and two single (revolving valve) distributor systems (16" lined).
(c) bins are connected by manual gates for blending purposes.
(d) movement is accomplished by a 15,000 BPH conveyor system.
(e) shipping may be accomplished by the use of any of six 15,000 BPH truck loadout (16" lined) or a 40,000 BPH rail loadout (26" lined). An in-line sampler is included in the rail loadout.
(f) includes a 300# three-station manlift.

Dust Control

(a) same type of system as 500,000 bu. subterminal.

Drier System

(a) 1,500 BPH gravity fed returned by conveyor.

Aeration and Temperature

(a) 10-25 H.P. aeration fans.
(b) 20-overspace fans.
(c) three cable temperature system in the 10 storage bins and three interface bins.

Railroad Trackage

(a) 7,000 ft. at $60/ft.

Office Building

(a) 3,000 sq. ft. at $35/sq. ft.

1,100,000 BUSHEL CAPACITY SUBTERMINAL

Construction Cost - $5,390,000.00

Depreciable Fixed Cost

Item Name	Cost	No.	Life	Repairs	Salvage Value	Annual Equivalent Cost
Land (in acres)	2,000.00	20	40	0.0	40,000.00	5,599.99
Elevator Structure	2,365,000.00	1	40	11,400.00	0.0	344,214.00
Driveway Structure	420,000.00	1	40	2,100.00	0.0	62,584.93
Elevator Machinery	1,000,000.00	1	10	4,800.00	0.0	196,514.13
Dust Control	175,000.00	1	10	840.00	0.0	34,389.96
Dryer System	150,000.00	1	10	720.00	0.0	29,477.11
Electrical	190,000.00	1	10	900.00	0.0	37,337.69
Aeration and Temp.	130,000.00	1	10	600.00	0.0	22,875.33
Railroad Trackage (in feet)	60.00	7,000	40	6,700.00	0.0	65,832.83
Railcar Mover	80,000.00	1	10	2,400.00	0.0	17,737.13
Office Building	105,000.00	1	40	500.00	0.0	15,282.23
Office Furniture	30,000.00	1	10	150.00	0.0	5,895.42
Contingencies	275,000.00	1	10	0.0	0.0	52,721.39
Total Depreciable Fixed Cost	$890,462.14					

1,100,000 Bushel Capacity Subterminal

Nondepreciable Fixed Cost

Item Name	Cost	Annual Equivalent Cost
Insurance	33,045.00	37,671.30
Bonds	6,320.00	7,204.79
Taxes	49,950.00	56,942.97
Manager Salary	40,000.00	45,599.98
Asst. Manager Salary	27,500.00	31,349.98
Director Fees	1,600.00	1,824.00
Dues	400.00	456.00
Annual Meeting	1,500.00	1,710.00
Warehouse License	60.00	68.40
Total Nondepreciable Fixed Cost	$182,827.42	
Total Fixed Cost	$1,073,289.56	

1,100,000 BUSHEL CAPACITY SUBTERMINAL

Variable Cost

Item Name	No.	Cost
Bookkeeper	1	$ 10,400.00
Secretary	1	9,360.00
Secretary/Clerk	1	9,360.00
Elevator Supervisor	1	18,720.00
Laborers	4	58,240.00
Employee Benefits		26,040.00
Payroll Taxes		11,540.00
Unemployment Compensation		1,760.00
Workmens Compensation		2,360.00
Office Supplies		6,500.00
Elevator Supplies		7,500.00
Power		18,000.00
Telephone		4,500.00
Subscriptions		1,000.00
Advertising		4,000.00
Special Meeting		1,000.00
Travel and Convention		6,500.00
Legal Fees		1,300.00
Rodent Control		850.00
Tax and Div. Work		1,000.00
Data Processing		1,750.00
Residence Expense		1,000.00
Protein Tests		3,000.00
Total Variable Cost		205,680.00
Interest on Variable Cost		17,483.00
Interest on Grain Purchased[a] (28 days)		302,317.00 (564,324.00)
Total Operating Cost		525,480.00
Total Annual Cost (Variable and Fixed)		$1,598,769.56 ($1,860,776.56)

[a]Assumes a turnover of ten.

PER BUSHEL OPERATING COSTS FOR DIFFERENT LEVELS OF OUTPUT, 300,000 BUSHEL UPGRADED SUBTERMINAL ELEVATOR

	Volume Handled (bushels)			
	2,000,000	3,000,000 (base case)	5,000,000	8,000,000
Costs Incurred from Handling Base Case Volume				
Total Fixed Cost	$231,065	$231,065	$231,065	$231,065
Total Variable Cost	86,185	86,185	86,185	86,185
Interest on Variable Cost	7,326	7,326	7,326	7,326
Interest on Grain Purchased	81,813	81,813	81,813	81,813
Total	406,389	406,389	406,389	406,389
Additional (Reduced) Costs Attributable to Increased Volume				
Fixed Cost	0	--	0	0
Variable Cost[a]	(8,800)	--	17,600	44,000
Interest on Variable Cost[b]	(748)	--	1,496	3,740
Interest on Grain Purchased[c]	(27,271)	--	54,542	136,354
Total	(36,819)	0	73,638	184,094
Total Cost	$369,570	$406,389	$480,027	$590,483
Average Total Cost	0.1848	0.1355	0.0960	0.0738[d]

[a]Variable costs attributable to increased output were computed assuming an additional unit cost of $.0088 per bushel.

[b]Interest computed on the additional variable cost only.

[c]Interest computed on the additional grain handled only.

[d]Throughput of eight million bushels (turnover = 26.7) would be unattainable for most North Dakota elevators, but was included to emphasize economies of utilization form high throughput.

PER BUSHEL OPERATING COSTS FOR DIFFERENT LEVELS OF OUTPUT, NEWLY CONSTRUCTED 300,000 BUSHEL CAPACITY SUBTERMINAL

	Volume Handled (bushels)				
	2,000,000	3,000,000 (base case)	5,000,000	8,000,000	11,000,000
Costs Incurred From Handling Base Case Volume					
Total Fixed Cost	$521,970	$521,970	$521,970	$521,970	$521,970
Total Variable Cost	86,185	86,185	86,185	86,185	86,185
Interest on Variable Cost	7,325	7,325	7,325	7,325	7,325
Interest on Grain Purchased	82,450	82,450	82,450	82,450	82,450
Total	697,930	697,930	697,930	697,930	697,930
Additional Costs Attributable to Increased Volume					
Fixed Cost	--	0	0	0	0
Variable Cost[a]	(8,800)	--	17,600	44,000	70,400
Interest on Variable Cost[b]	(748)	--	1,496	3,740	5,984
Interest on Grain Purchased[c]	(27,271)	--	54,967	137,417	219,867
Total	(36,819)	--	74,063	185,157	296,251
Total Cost	$661,111	$697,930	$771,993	$883,087	$994,181
Average Total Cost	0.3306	.2326	.1544	.1104[d]	.0904[d]

[a]Variable costs attributable to increased output were computed assuming an additional unit cost of $.0088 per bushel.

[b]Interest computed on the additional variable cost only.

[c]Interest computed on the additional grain handled only.

[d]Throughputs of eight million and 11 million bushels (turnover = 26.7 and 36.7, respectively) would be unattainable for most North Dakota elevators, but were included to emphasize economies of utilization from high throughput.

PER BUSHEL OPERATING COSTS FOR DIFFERENT LEVELS OF OUTPUT, 500,000 BUSHEL CAPACITY SUBTERMINAL

	Volume Handled (bushels)			
	5,000,000 (base case)	8,000,000	11,000,000	16,000,000
Costs Incurred From				
Handling Base Case Volume				
Total Fixed Cost	$ 690,039	$690,039	$690,039	$690,039
Total Variable Cost	126,090	126,090	126,090	126,090
Interest on Variable Cost	10,718	10,718	10,718	10,718
Interest on Grain Purchased	137,417	137,417	137,417	137,417
Total	964,264	964,264	964,264	964,264
Additional Costs Attributable to Increased Volume				
Fixed Cost	--	--	--	--
Variable Cost[a]	--	23,100	46,200	84,700
Interest on Variable Cost[b]	--	1,964	3,927	7,200
Interest on Grain Purchased[c]	--	82,450	164,900	302,317
Total	--	107,514	215,027	394,217
Total Cost	$964,264	$1,071,778	$1,179,291	$1,358,481
Average Total Cost	.1929	.1340	.1072	.0849[d]

[a]Variable costs attributable to increased output were computed assuming an additional unit cost of $.0077 per bushel.

[b]Interest computed on the additional variable cost only.

[c]Interest computed on the additional grain handled only.

[d]A throughput of 16 million bushels (turnover = 32) would be unattainable for most North Dakota elevators, but was included to emphasize economies of utilization from high throughput.

PER BUSHEL OPERATING COSTS FOR DIFFERENT LEVELS OF OUTPUT, 850,000 BUSHEL CAPACITY SUBTERMINAL

Costs Incurred From Handling Base Case Volume	Volume Handled (bushels) 5,000,000	8,000,000	8,500,000 (base case)	11,000,000	16,000,000
Total Fixed Cost	$918,851	$918,851	$918,851	$918,851	$918,851
Total Variable Cost	163,500	163,500	163,500	163,500	163,500
Interest on Variable cost	13,898	13,898	13,898	13,898	13,898
Interest on Grain Purchased	233,608	233,608	233,608	233,608	233,608
Total	1,329,857	1,329,857	1,329,857	1,329,857	1,329,857
Additional Costs Attributable to Increased Volume					
Fixed Cost	0	0	--	0	0
Variable Cost[a]	(20,650)	(2,950)	--	14,750	44,250
Interest on Variable Cost[b]	(1,755)	(251)	--	1,254	3,761
Interest on Grain Purchased[c]	(96,192)	(13,742)	--	68,708	206,125
Total	(118,597)	(16,943)	--	84,712	254,136
Total Cost	$1,211,260	$1,312,914	$1,329,857	$1,414,569	$1,583,993
Average Total Cost	.2423	.1641	.1565	.1286	.0990

[a]Variable costs attributable to increased output were computed assuming an additional unit cost of $.0049 per bushel.

[b]Interest computed on the additional variable cost only.

[c]Interest computed on the additional grain handled only.

PER BUSHEL OPERATING COSTS FOR DIFFERENT LEVELS OF OUTPUT, 1,100,000 BUSHEL CAPACITY SUBTERMINAL

Costs Incurred From Handling Base Case Volume	Volume Handled (bushels) 5,000,000	8,000,000	11,000,000 (base case)	16,000,000
Total Fixed Cost	$ 1,073,290	$1,073,290	$1,073,290	$1,073,290
Total Variable Cost	205,680	205,680	205,680	205,680
Interest on Variable Cost	17,483	17,483	17,483	17,483
Interest on Grain Purchased	302,317	302,317	302,317	302,317
Total	1,598,770	1,598,770	1,598,770	1,598,770
Additional Costs Attributable To Increased Volume				
Fixed Cost	0	0	--	0
Variable Cost[a]	(31,200)	(15,600)	--	26,000
Interest on Variable Cost[b]	(2,652)	(1,326)	--	2,210
Interest on Grain Purchased[c]	(164,900)	(82,450)	--	137,417
Total	(198,752)	(99,376)	--	165,627
Total Cost	$1,400,018	$1,499,394	$1,598,770	$1,764,397
Average Total Cost	.2800	.1874	.1453	.1103

[a]Variable costs attributable to increased output were computed assuming an additional unit cost of $.0052 per bushel.

[b]Interest computed on the additional variable cost only.

[c]Interest computed on the additional grain handled only.

TRANSPORTATION COSTS UNDER VARIOUS CAR CONSIGNMENT SIZES.

Proportion of Type of Consignment Commodity	Number of Cars Consigned	Rate/bushel		Bushels Shipped		Total Cost	
		Duluth	Mpls.	Duluth	Mpls.	Duluth	Mpls.
80% wheat, durum	(52)	.5160	.5160	4,931,334	1,075,322	2,544,568	554,866
20% wheat, durum	(26)	.5460	.5460	1,232,833	268,831	673,127	146,782
80% seeds	(52)	.2408	.2408	604,882	27,714	145,656	6,674
20% seeds	(26)	.2548	.2548	151,221	6,929	38,531	1,766
80% barley-M	(15)	.7200	--	--	1,383,110	--	995,839
20% barley-M	(10)	.7536	--	--	345,778	--	260,578
80% barley-D	(52)	--	.3888	871,482	--	338,832	--
20% barley-D	(26)	--	.4368	271,870	--	95,166	--
						3,835,880	1,966,505
						$5,802,385	
60% wheat, durum	(52)	.5160	.5160	3,698,500	806,492	1,908,426	416,150
20% wheat, durum	(26)	.5460	.5460	1,232,833	268,831	673,127	146,782
20% wheat, durum	(1)	.6300	.6300	1,232,833	268,831	776,685	169,364
60% seeds	(52)	.2408	.2408	453,662	20,786	109,242	5,005
20% seeds	(26)	.2548	.2548	151,221	6,929	38,531	1,766
20% seeds	(1)	.2940	.2940	151,221	6,929	44,459	2,037
60% barley-M	(15)	.7200	--	653,611	--	--	470,600
20% barley-M	(10)	.7536	--	217,870	--	--	164,187
20% barley-M	(1)	.8064	--	217,870	--	--	175,690
60% barley-D	(52)	--	.3888	--	1,037,333	403,315	--
20% barley-D	(26)	--	.4368	--	345,777	151,035	--
20% barley-D	(1)	--	.5040	--	345,777	174,272	--
						$4,279,092	1,551,581
						$5,830,673	

ROAD IMPACTS AND FINANCE NEEDS

Road	Section	Structural Number	Average Daily Traffic (ADT)	Change in ADT Trucks	Prorated Construction Cost	Prorated Maintenance Cost
1	17# Wolford to FAS 4805	1.05, 1.35	250	40		
2	(gravel) FAS 4805 to Bisbee	--	40	5		$10,000
3	(gravel) St. Joe to #17	--	45	10		2,000
4	#17 St. Joe turn to Cando	1.24	550	90		
5	#281 Cando to Junction #66	2.37	900	150	$120,500	
6	#66 Egeland to Junction #281	1.36	400	70	38,100	
7	(gravel) Crocus to #281	--	25	5		4,000
8	#69 Hansboro to $281	1.76	280	45		
9	#281 Junction #69 to Junction #5	2.57	525	90		
10	#281 Junction #66 to Crocus Turn	1.77	410	70 }	33,600	
11	#281 Crocus Turn to Junction #5	1.77	510	90 }		
12	#30 Junction #281 to Junction #66	2.0	450	65		
13	#66 Rolette to Junction #30	2.04	450	60		
14	#66 Agate Turn to Bisbee	2.04	435	60		
15	#66 Junction #30 to Agate Turn	2.04	340	50	$161,900	
16	#281 E. Junction #66 to W. Junction #66	1.77	750	130	8,000	
17	#61 Bisbee to Junction #281	1.36	540	75	51,900	
18	(gravel) Perth to Bisbee	--	110	20		9,000
				Total	$414,000	$25,000

Source: Kerry Olson, North Dakota Highway Department, 1982.

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