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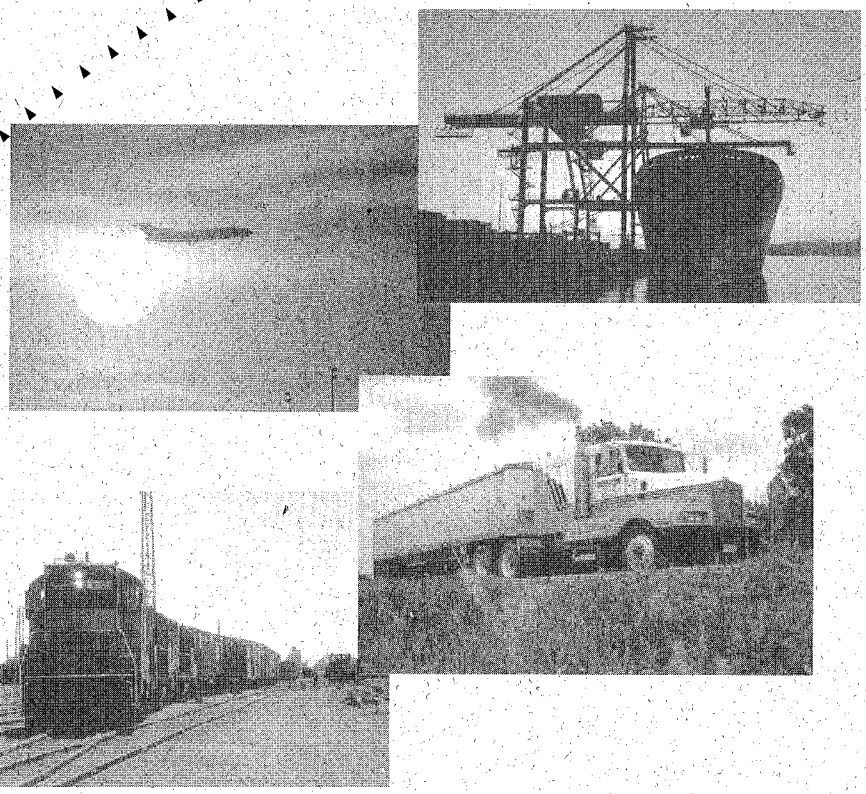

Northwest Minnesota Freight Flow Study

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16. Abstract (Limit: 200 words)

In this project, researchers studied the flow of freight in the 12-county northwestern region of Minnesota for the Minnesota Department of Transportation (Mn/DOT). This project uses data from C.J. Peterson & Associates, as well as data on agricultural commodities, timber, and Canadian border crossings.

This report identifies major commodity flows by origin and destination within and outside of the region and assigns these to a regional highway network using the QRSII model. It presents annual flows by major commodity classification on each highway link, both in weight value shipped, which permits an identification of significant freight corridors within the region. Mn/DOT plans to use this information in targeting investment and maintenance of the region's transportation infrastructure. The study also serves as a prototype for examining freight flows in other regions of the state.

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NORTHWEST MINNESOTA FREIGHT FLOW STUDY

Freight Flow Estimation And Identification of Significant Corridors

Prepared by

Dr. David Braslau
Regional Econometrics, Inc.
Adjunct Associate, Humphrey Institute

and

Dr. Jerry Fruin
University of Minnesota
Department of Applied Economics

with assistance from the
Northwest Minnesota Regional Development Commission
Headwaters Regional Development Commission

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The Office of Freight, Railroads and Waterways also provided data and information on heavy commercial vehicle counts, vehicle weights, and the highway, railway and airport system.

Roger Hille of Mn/DOT District 2 in which the study area is located provided extensive data on agricultural product movements, the regional transportation system, and input and review during the course of the study. Mn/DOT District 2 also provided data on movement of agricultural products and U.S./Canada border crossings.

The Minnesota Timber Producers Association provided data on timber movements in Minnesota.

Information of grain movements and review comments were provided by Ayman Smadi of the Upper Great Plains Transportation Institute in Grand Forks, North Dakota.

Rail waybill data were analyzed by D. Walter Halbach, Department of Applied Economics, University of Minnesota. .

QRS II highway network modeling was performed by David Adams for Regional Econometrics, Inc.

Extensive data from the survey of manufacturers and assistance with data interpretation was provided by Catherine Petersen of C.J. Petersen & Associates.

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EXECUTIVE SUMMARY

INTRODUCTION AND STUDY REGION

This study examines the flow of freight in the northwestern region of Minnesota to assist in the identification of major commodity flows and those corridors along which these commodities flow. This information can be used by the Minnesota Department of Transportation in targeting investment and maintenance of the transportation infrastructure in the region. This study has been structured as a possible prototype for examining freight flows in other regions of the state.

The study region consists of twelve counties in Minnesota Department of Transportation (Mn/DOT) District 2 and falling under the jurisdiction of the Headwaters and Northwest Regional Development Commissions. The demographic and economic structure of the region is described in an overview prepared by the Regional Development Commission and supplemented with the economic database established as part of the IMPLAN input-output model for the study region. Counties of the region are listed in **TABLE E.1**. The study region is depicted in **FIGURE E.1**.

TABLE E.1

COUNTIES INCLUDED IN THE STUDY REGION

Beltrami
Clearwater
Hubbard
Kittson
Lake of the Woods
Mahnomen
Marshall
Norman
Pennington
Polk
Red Lake
Roseau

A range of data sources have been used to compile and evaluate freight flows and corridors through which freight flows. The results of an extensive survey of manufacturing industries in the region comprise a major component of the data used in the study. The survey addressed a range of objectives including data for market analysis of products and industries as well as actual movement of commodities.

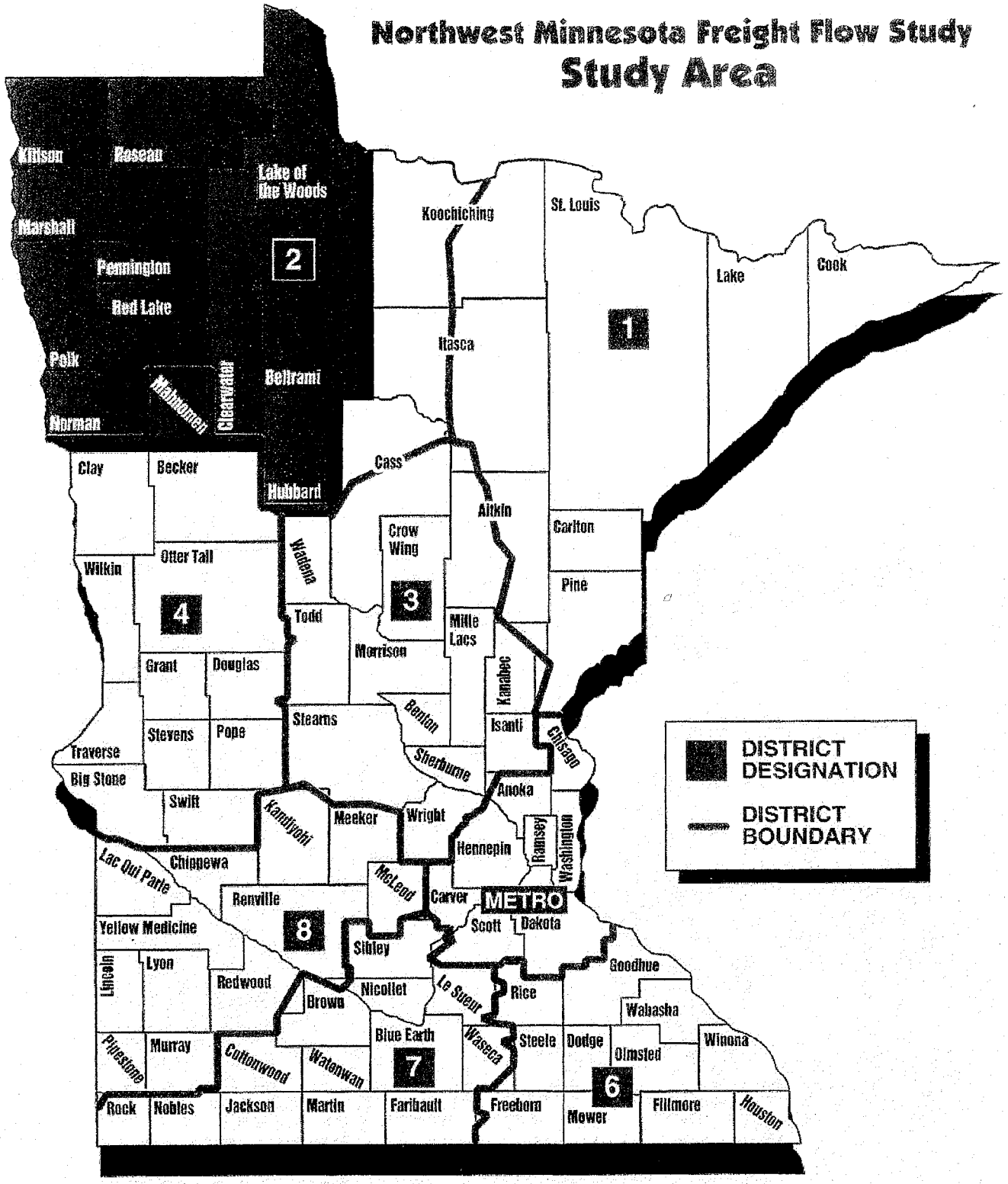

FIGURE E-1

STUDY AREA

Because of its importance in the movement of commodities, the major thrust of this study addresses the regional highway system although commodity movements by rail have also been examined. Commodity flow information is normally provided in terms shipments, tons, or ton-miles. While data have been collected and assigned to the regional highway network in terms of weight, a preliminary evaluation of the value of goods shipped has also been made using two sources of data. The first is the 1992 Commodity Flow Survey by the U.S. Department of Commerce. The second is the Transsearch data base from Reebie Associates, a private firm specializing in the collection and analysis of commodity flow data. The objective of this part of the study is to identify the value of commodities flowing along major corridors that can be then related to the economic importance of each of these highway links. This will provide transportation planners an improved basis for establishing benefit-cost analysis procedures for making investment decisions in the transportation system.

DATA SOURCES

The major data sources used in the study include:

- Reebie (Transearch) data for the year 1995 at the 2-digit industry classification. These show flows in tons by transportation mode within the study region (Minnesota portion of BEA 150) and between the study region and all 183 BEA regions (and states) in the United States.
- Rail Waybill data for 1993 at the 2-digit industry classification. Data were extracted to show flows in carloads between the study region and other states.
- Information on he location of sugar beet piles and routes taken to processing plants within the study region for 1996. This represents a complete accounting of sugar beet flows within the region and in the adjacent growing region in North Dakota.
- Truck crossings from Canada into Minnesota for 1996 and 1997 from the U.S. Customs and Immigration Service. These monthly data identify the major Canadian border crossing points for inbound commodities and also demonstrated the variability in cross-border traffic by month and by year.
- Data from a 1992 MnDOT survey of grain terminals covered approximately 50% of the grain terminals in the study region. These data were combined with other data sources previously compiled to estimate total grain shipment origins within the study region.
- Data on grain production in North Dakota and flows of grain through the region to Duluth and Minneapolis-St. Paul by truck and rail were provided by the Upper Great Plains Transportation Institute based on the 1996 and 1997 time period.
- Data from the Minnesota Timber Producers Association identified major timber production areas within the study region and the primary routes taken these logs to processing facilities in Minnesota with annual estimates during the 1995-2000 production period.
- An extensive survey of manufacturers within the region provided information for 1995 that was used to assign freight flows to the regional highway network. Detailed interviews were held with 22 firms and 94 responses were received from a mail-out

survey. The number of trucks estimated from the survey represent loaded trucks only.

REGULATORY AND WEIGHT ISSUES

The Northwest Minnesota Freight Flow Study Area shares borders with the state of North Dakota and the provinces of Manitoba and Ontario. Minnesota generally has lower size and weight limits than North Dakota, Manitoba and Ontario.

Beyond the single and tandem axle weights, which are within 10% for all four jurisdictions, weight limits vary considerably with Minnesota having the lowest limits overall. North Dakota allows the longest combinations and the Provinces generally allow the heaviest gross vehicle weights.

This situation presents some barriers at the borders and presents some issues for highway freight transportation in the region. A short summary of size and weight limits by province/state provides some context for these truck size and weight issues.

COMMODITY VALUE ESTIMATION

Two data sources have been used to estimate commodity value (as dollars per pound or ton). Reebie Associates (Transsearch) data were first developed from the 1977 Commodity Flow Survey by the US Department of Commerce and have been adjusted upwards using a variety of data sources. The US Department of Commerce 1993 Commodity Flow Survey collected data from firms within Minnesota so that these data are generally representative of products and commodities shipped to and from Minnesota. Estimates were developed for truck shipments in dollars per ton at the 2-digit industry classification. Values for sugar beets and grain were based local information on these two major agricultural commodities.

MANUFACTURERS SURVEY

A survey population was identified using the Directory of Minnesota Manufacturers 1995 database, which lists 292 manufacturing firms with the study area. Three additional firms were recommended for the survey by District 2 MnDOT representatives. Twenty-seven shippers were identified that had more than 50 employees at facilities within the study area. Interviews were held with 22 of these firms. A subsequent and revised survey was mailed to 255 firms of which 94 responded.

Survey responses were compiled by industry (SIC) type, origin, and destination and then adjusted to total regional employment using the IMPLAN data base.

TRAFFIC COUNT AND VEHICLE CLASSIFICATION PROGRAM

As part of this study, a special traffic count/vehicle classification program, developed jointly the MnDOT Central Office and District 2, augmented the ongoing Traffic Monitoring System coverage counts in the area. The Office of Management Data

Services carried out the count program and the Office of Freight Railroads and Waterways compiled a brief report including analysis and observations. The results of this special effort will

- give the district a much more comprehensive picture of traffic make-up and truck movements on the regions highways. Information which is valuable for planning, design, maintenance, and safety considerations.
- help with freight corridor identification and provide data useful in verifying estimated freight flows in a given corridor.
- provide improved detail on relating commodity flows to vehicle types and vehicle flows.

THROUGH FREIGHT FLOWS

Information on through freight flows was limited to grain shipments originating in North Dakota and truck crossings from Canada for which commodity and final truck destinations could not be identified.

The Upper Great Plains Transportation Institute compiled grain data from 1996 and 1997 reports. All destinations from North Dakota elevators are covered by the data although only those with destinations to Duluth-Superior and Minneapolis-St. Paul were tabulated. Elevator-specific shipments may not be released because of confidentiality agreements between the North Dakota Public Service Commission and the UGPTI.

The annual number of reported truck crossings from Canada at customs points within Northwestern Minnesota totaled over 35,000 in 1996 and 57,000 in 1997. The total number of trucks inbound into the region from Canada based upon survey responses is just under 2,000, suggesting that a large number of the trucks entering the region from Canada are passing through the region. These through movements probably range from 30,000 to 50,000, with approximately one-half passing through Warroad, one-quarter passing through Baudette and one-quarter passing through Roseau.

REGIONAL TRANSPORTATION SYSTEM

The regional highway network is assumed to include those roadways (links) which carry regional flows as opposed to local roadways such as farm roads and street networks within communities. The regional highway system assumed in this study includes all federal and state highways, and those county highways identified by county engineers that carry a significant number of 5-axle trucks.

The regional railway system includes both main and branch lines. The regional airport system includes those airports designated by the Minnesota Department of Transportation as part of the State Aviation Systems Plan.

FREIGHT FLOWS BY WEIGHT AND TRUCKLOAD

Freight flows on the highway network were developed through the use of a computer-based highway network model. The first step in the process was to estimate flows on highway links in terms of tonnage by commodity type. Using average tonnage per truck, these were converted into numbers of trucks. Survey data indicated that approximately 70% of tonnage shipped within the region takes place on trucks with five axles or more, with average tonnage on the order of 20 tons per truck. Origin and destination data were assigned to the network using the shortest travel time. Average speeds were assumed for each type of link, with highest speeds on interstate highways and lowest speeds on minor county roads. Where known freight flows and routings were available, these were assigned directly to the highway network. The freight flows estimated in this study refer to loaded trucks only. The highway network used in the computer model included all federal and state highways, and county roads identified by the MnDOT as major truck routes. All communities for which origins or destinations were identified in the survey were included as centroids on the network and others were included as connecting nodes along with other major roadway junctions. In all 367 links, 133 centroids, 16 external nodes and 250 nodes without delay were included in the highway network model Separate assignments were made to the highway network for the following major classes of commodities:

- Sugar beet
- Grain
- Timber
- Canada truck origins
- Manufacturing commodities (in and out)
- All commodities
-

The density of trucks moving on each link is shown on separate exhibits for each of these major commodity classifications. The number of trucks on each link are shown for all commodities combined in keeping with the confidentiality of data collected during the study. In terms of total truck density, the most significant routes include highways 2, 32, and 71 along their entire length within the region. Portions of highways 11, 59, 75, 89, 200 and 220 also indicate regionally significant truck volumes. The information provided in this report gives comparative information by highway segment which can be used in transportation planning and prioritization of routes, segments, and projects. The expanded use of QRS-II assignments could prove of value for system planning and route analysis.

A comparison of estimated truck flows (70% of which are estimated to be 5-axle or greater) has been made with the MnDOT heavy commercial truck counts. A comparison between total loaded truck flows and MnDOT counts show a reasonably good comparison in terms of the most heavily traveled roadways.

Freight flows on the rail system were limited to carload flows into and out of the region by state of origin or destination. These data indicated major movements of grain and

coal through the state by rail. Major destination states for agricultural commodities are Missouri, Illinois, and Louisiana. Major destination states for processed food from the region are Washington, Illinois, and Maryland.

Flows by mode as derived from Transsearch data were also evaluated by major direction and for several distance categories. This provides some insights as to major corridors entering and leaving the region.

SIGNIFICANT CORRIDORS BASED UPON FREIGHT FLOWS BY VALUE

Significant freight corridors have been identified by the value of commodity shipped along each corridor. The value shipped is derived from truck movements converted to value using data developed in this study. The average tonnage carried by a truck in each of the major commodity classes has been multiplied by the value per ton for truckload shipments. The individual links have been ranked according to total value. The results of this analysis (**FIGURE E.2**) demonstrates the importance of the interstate, federal and state highway system including some major links on the county system. The assignment of commodities in this study was based upon average travel speed on links between origin and destination. The study substantiates the flow of highest value on routes that require the minimum travel time. New information provided by this study, however, includes the knowledge of commodity type, weight and value as well as the origins and destinations of these commodities. This type of information can be used in conjunction with benefit/cost studies on identifying and targeting highway maintenance and investment funds in the future.

Movement of freight is critical to the overall economy of the region since it facilitates the effective interaction between suppliers, producers and markets. The long distances to and from major markets contribute further to the important of the transportation system. Significant corridors in terms of freight flows by value are identified in the report. Therefore, improvements to these corridors within the region should yield economic benefits. These corridors generally mirror the information provided through the freight volume analysis with the general exception that agricultural commodities yield appreciably lower value than manufactured goods.

The study incorporates market research regarding commodities shipped as well as computer methods to model flows and flow values. Increased and updated use of this information along with current tools will result in better overall system planning.

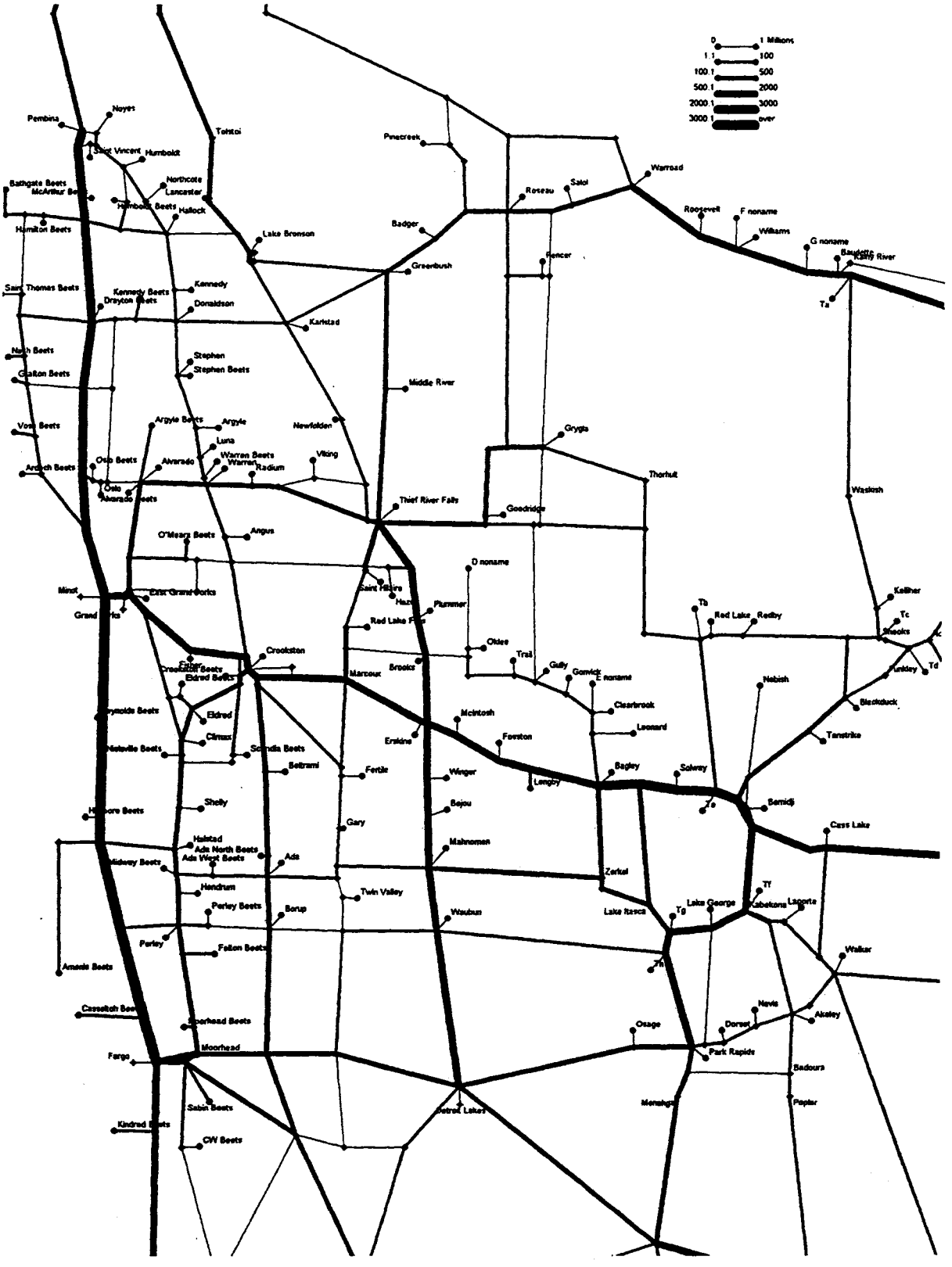

FIGURE E-2

SIGNIFICANT FREIGHT CORRIDORS BY TOTAL VALUE SHIPPED
(Million $)

1.0 INTRODUCTION AND STUDY OBJECTIVES

The flow of freight in the northwestern region of Minnesota has been examined to assist in the identification of major commodity flows and those corridors along which these commodities flow. This information can be used by the Minnesota Department of Transportation in targeting investment and maintenance of the transportation infrastructure in the region. This study has been structured as a possible prototype for examining freight flows in other regions of the state.

The study region consists of twelve counties which fall within the Minnesota Department of Transportation District 2 and under the jurisdiction of the Headwaters and Northwest Regional Development Commissions. The demographic and economic structure of the region is described in an overview prepared by the Regional Development Commission and supplemented with the economic database established as part of the IMPLAN[1] input-output model for the study region.

A range of data sources have been used to compile and evaluate freight flows and corridors through which freight flows. The results of an extensive survey[2] of manufacturing industries in the region comprise a major component of the data used in the study. The survey addressed a range of objectives including data for market analysis of products and industries as well as actual movement of commodities.

Because of its importance in the movement of commodities, the major thrust of this study addresses the regional highway system although commodity movements by rail have also been examined. Air cargo flows are being investigated under a separate study being undertaken by the Minnesota Department of Transportation Office of Aeronautics.

Commodity flow information is normally provided in terms shipments, tons, or ton-miles. While data have been collected and assigned to the regional highway network in terms of weight, a preliminary evaluation of the value of goods shipped has also been made using two sources of data. The first is the 1993 Commodity Flow Survey by the U.S. Department of Commerce. The second is the 1993 Transsearch data base from Reebie Associates, a private firm specializing in the collection and analysis of commodity flow data. The objective of this part of the study is to identify the value of commodities flowing along major corridors that can be then related to the economic importance of each of these highway links. This will provide transportation planners an improved basis for establishing benefit-cost analysis procedures for making investment decisions in the transportation system. It should be acknowledged that freight flows are only one component of the comprehensive transportation system which carries both passengers and freight.

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[1] The IMpact Analysis for PLANning (IMPLAN)model is a microcomputer-based economic input-output model for analyzing regional economies.

[2] See Chapter 7.0 of this report.

The overall objective of the study is to identify significant freight corridors within the region. While extensive data already exist on highway flows of commercial and heavy commercial vehicles by route, the origin and destination of these vehicles and the commodities which they carry is not well understood. Movement of freight is critical to the overall economy of the region since it contributes to the complex interaction of suppliers and sales outlets of regional producers of goods and services. Improvements in the transportation system can contribute to increased efficiency of these movements and hence increased productivity within the region. It is hoped that by identifying significant freight corridors within the region that limited public funding can be targeted in the most optimal manner to enhance the economic productivity of the region.

The structure of this study is briefly outlined below to provide the reader with an overview of how the data were collected, compiled and analyzed to achieve the objectives of the study.

Chapter 2.0 describes the study region in terms of demographics and employment. This information was compiled by the Northwest Regional Development Commission and extracted from the IMPLAN input-output model data files. The objective of this chapter is to provide the reader with an understanding of the major commodities produced and shipped in the region and how the production of these commodities varies within the region.

Chapter 3.0 describes the compilation of existing data on freight flows within the region. Major sources of data were the Minnesota Department of Transportation, Reebie Associates, the Rail Waybill data base, the U.S. Department of Agriculture and the Upper Great Plains Transportation Institute. The data sources and usefulness of the data are described in this chapter.

Chapter 4.0 describes developments affecting freight, including major new facilities, institutional factors affecting commodity flows such as the North American Free Trade Agreement (NAFTA) and truck length and weight regulations.

Chapter 5.0 discusses the methodology used to establish relationships between commodity weight and value. This relies upon data extracted from the 1993 Commodity Flow Survey and detailed commodity value data obtained from Reebie Associates.

Chapter 6.0 describes the extensive survey of manufacturers within the region performed by C. Petersen & Associates, and how the data were extracted for use in the study. Detailed responses from the survey were catalogued into origins and destinations by industry (or commodity) type and adjusted to the entire employment base of the region using control totals for employment by industry from the IMPLAN database.

Chapter 7.0 describes the collection of vehicle flow data by the Minnesota Department of Transportation. Detailed five-axle truck counts were collected by Mn/DOT during 1996

augmented with prior counts from 1994 and 1995 across a wide range of highways within the region. Some of the limitations of these data are also discussed.

Chapter 8.0 describes the flows of freight through the region on the highway system and some limited discussion of rail movements through the region. Highway flows are important in that they require capacity on the highway system (primarily US Highway 2). Railway movements are important in that they can potentially impact traffic capacity at critical rail crossings of highways which are not grade separated.

Chapter 9.0 describes the regional transportation systems including highway, rail and airports. Highway links evaluated in the study include federal, state, and county roads insofar as they carry significant amounts of freight. The railway and airport systems are present primarily for information to the reader since these were not evaluated in any detail in this study.

Chapter 10.0 identifies major generators of freight including sugarbeet piles, timber producing areas, major grain elevator locations, and major manufacturing centers. Some of these generators supply processing and value-added facilities within the region while others produce goods that are sold within and outside of the region.

Chapter 11.0 presents the findings of the study in terms of freight flows by volume and type. Flows by major commodity type are assigned to links on the regional highway system. Inbound and outbound flows from and to other federal Bureau of Economic Analysis Regions throughout the United States are presented. Origins and destinations of major rail shipments to and from the region are also presented.

Chapter 12.0 identifies highway freight corridors based upon the value of freight shipped along the corridor using data discussed in Chapter 11.0. Highway links have been rank ordered by the weight of commodity shipped to identify the most significant corridors in terms of weight. Estimates of value by corridor are also made to provide a preliminary delineation of major corridors by value carried.

2.0 STUDY REGION

2.1 STUDY REGION DESCRIPTION

Definition of the Study Region

The study region consists of twelve counties in northwestern Minnesota. These are listed in **TABLE 2.1.**

TABLE 2.1

COUNTIES INCLUDED IN THE STUDY REGION

Beltrami
Clearwater
Hubbard
Kittson
Lake of the Woods
Mahnomen
Marshall
Norman
Pennington
Polk
Red Lake
Roseau

These twelve counties comprise the Minnesota portion of the Bureau of Economic Analysis (BEA) Region 150, the remainder of which extends to the west into North Dakota. They also make up the area covered by the Headwaters and Northwest Regional Development Commissions.

Location of the study region within Minnesota and with respect to Bureau of Economic Analysis (BEA) economic regions is shown in **FIGURE 2.1.** Location of the region and its counties with respect to Minnesota Department of Transportation Districts Counties is shown in **FIGURE 2.2.**

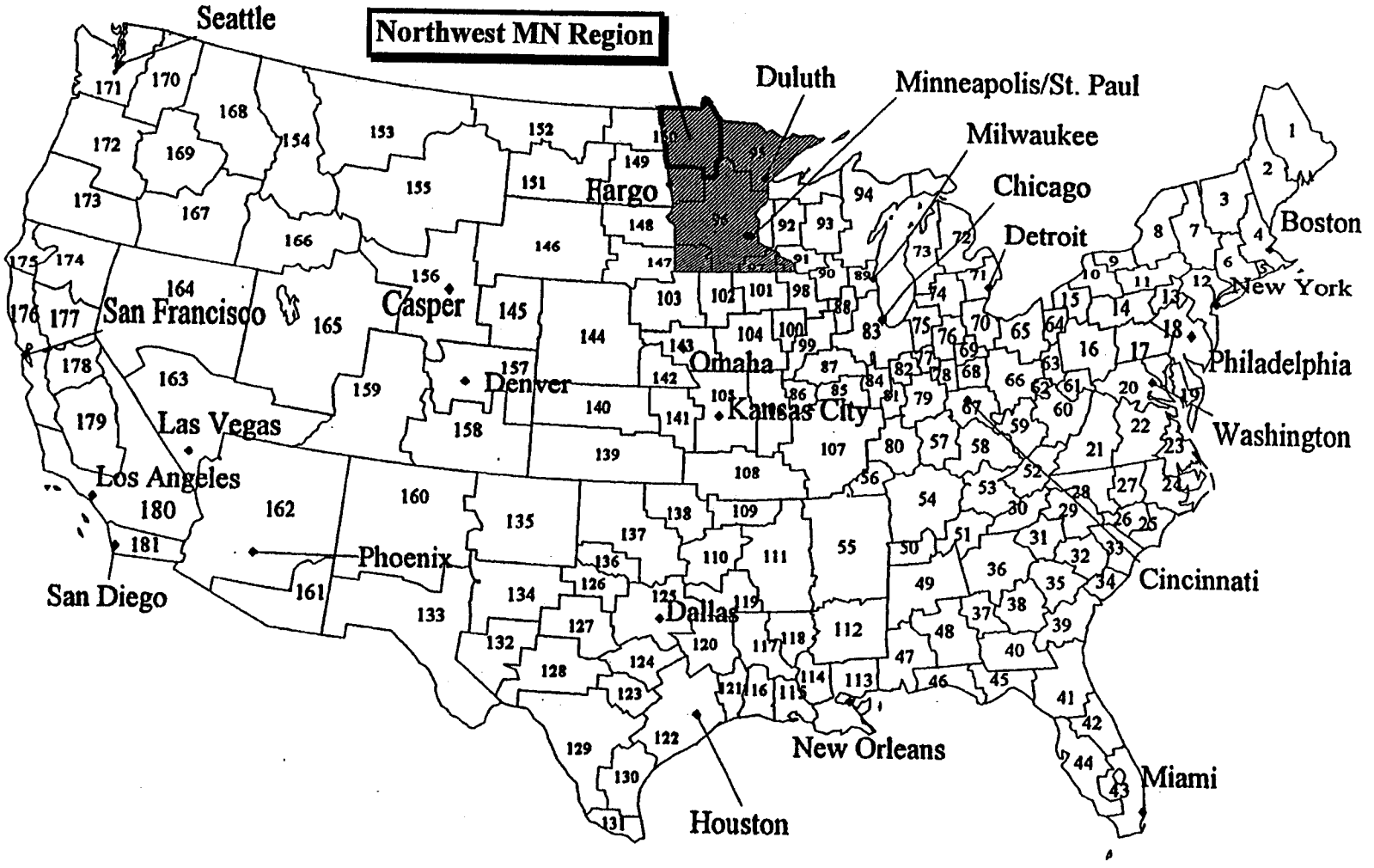


FIGURE 2.1

LOCATION OF THE STUDY REGION

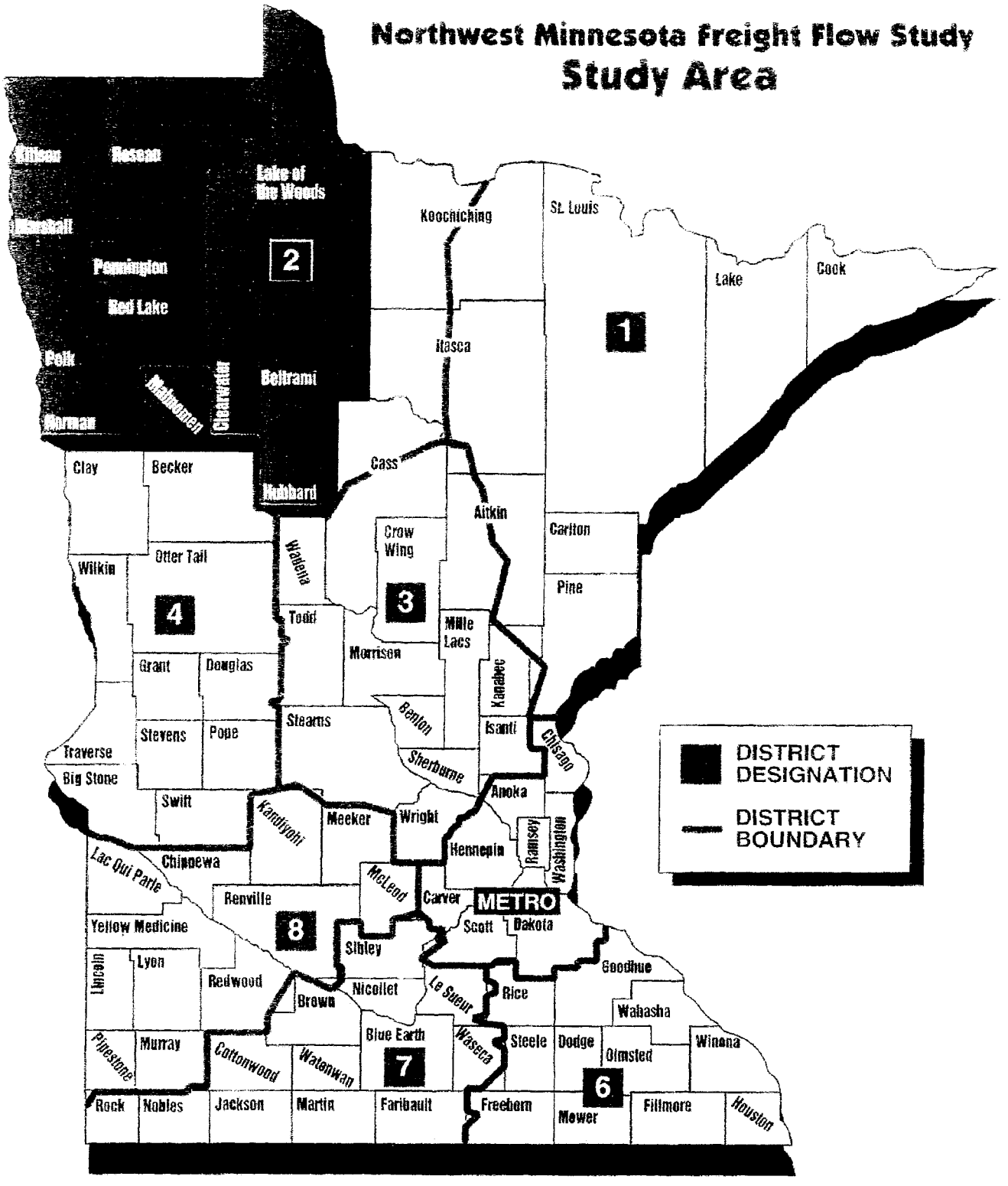


FIGURE 2.2

STUDY AREA

General Regional Profile Of Northwest Minnesota

Minnesota's Department of Transportation District 2, is located in the northwest corner of the state. The study area includes twelve counties within the Northwest (Kittson, Roseau, Marshall, Polk, Pennington, Red Lake, and Norman) and Headwaters Regional Development Commissions (Hubbard, Beltrami, Lake of the Woods, Mahnomen, Clearwater). The district includes portions of Koochiching, Itasca, and Cass Counties but does not include Mahnomen County. The District is comprised of four different general landscape regions which determine the economic and land use activities in the region (see "General Landscape Regions" map in **FIGURE 2.3**).

The **Red River Valley** is a level or gently sloping region with wetlands, meandering waterways and beach ridges from Glacial Lake Agassiz. The dominant land use is cash crop agriculture.

The **Aspen Parklands** is a low, level plain between the Red River Valley and the extensive forested peatlands to the east. Pre-settlement vegetation consisted of aspen savannas, tallgrass, wet prairies and dry prairies. The dominant land use is agriculture with an existing potential for increased forestry activities in the future.

The **Agassiz Basin** is a flat, poorly drained lake plain. The basin's extensive peatlands are dominated by black spruce and tamarack with upland areas of aspen, birch and jack pine. Forestry and recreation along with some agriculture in the fringe areas are the dominant land uses in the Agassiz Basin.

Outstanding and popular characteristics of the **Central Lakes** landscape are the lakes, streams and forests. Primary land uses within this area include forestry, residential/recreation, and agriculture, including the production of both crops and livestock.

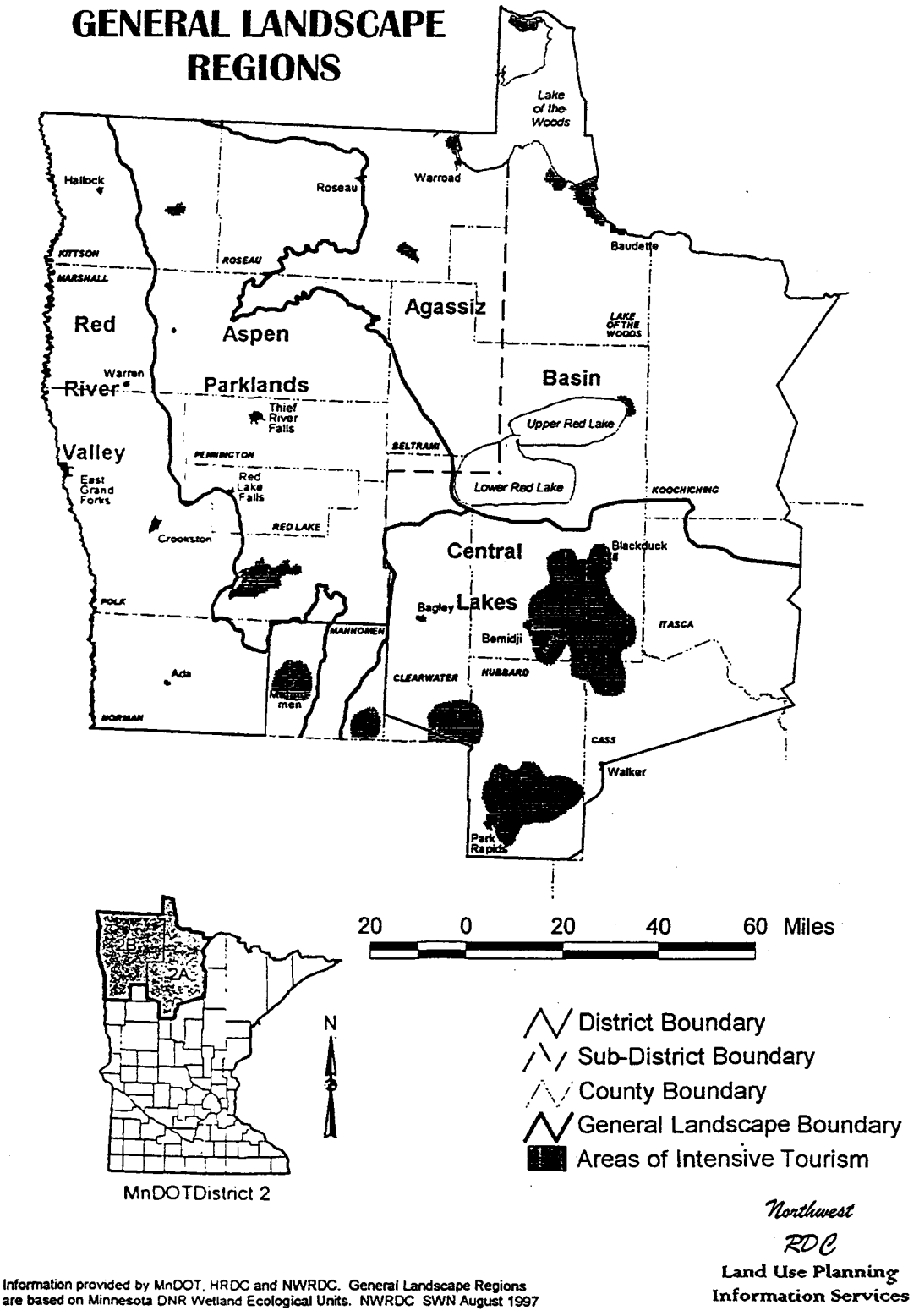


FIGURE 2.3

GENERAL LANDSCAPE REGIONS IN NORTHWESTERN MINNESOTA

General Population Profile of Northwest Minnesota

TABLE 2.2 provides an overview of the county population trends in the region.

TABLE 2.2

NORTHWEST MINNESOTA COUNTIES POPULATION TREND

POPULATION				
Headwaters Region	***1970***	***1980***	***1990***	***1995***
Beltrami	26373	30982	34384	36508
Clearwater	8013	8761	8309	8452
Hubbard	10583	14098	14939	16225
Lake of the Woods	3987	3764	4076	4363
Mahnomen	5638	5535	5044	5127
Subtotal	**54594**	**63140**	**66752**	**70675**
Northwest Region				
Kittson	6853	6672	5767	5572
Marshall	13060	13027	10993	10733
Norman	10008	9379	7975	7885
Pennington	13266	15258	13306	13391
Polk	34435	34844	32498	32904
Red Lake	5388	5471	4525	4481
Roseau	11569	12574	15026	16045
Subtotal	**94579**	**97225**	**90090**	**91011**
TOTAL	**149173**	**160365**	**156842**	**161686**

From Census and State Demographers estimates, 1995.

The largest cities within the region include Bemidji in the east, and Crookston, East Grand Forks and Thief River Falls in the western portion of the region. Populations of the region's cities have remained fairly stable over the last five years with moderate gains in each. This is shown in **TABLE 2.3.**

TABLE 2.3

DISTRICT 2 CITIES' POPULATION TREND

	Bemidji	**Crookston**	**East Grand Forks**	**Thief River Falls**
1990 Pop.	11,245	8,119	8,658	8,010
1995 Pop.	11,422	8,135	8,983	8,053
% change	+ 1.6%	+ 0.2%	+ 3.8%	+ 0.5%

From Census and State Demographer's estimates, 1990, 1995.

General Economic Profile of Northwest Minnesota

The economic base of the Northwest Minnesota includes agriculture, timber and timber related business, manufacturing, retail trade/services, and tourism. The east claims the bulk of the timber related business along with a thriving tourism industry. The west has a stronger agricultural base and is experiencing strong growth in the manufacturing sector. Historically, the region has been as a supplier of raw materials, shipped out of region, for food processing and manufacturing. Secondary processing, or "value added" of products has increased substantially during the last ten years. Other industries, such as tourism, also contribute to the economic vitality of Northwest Minnesota

I. AGRICULTURE

The eastern portion of the district has roughly 650,000 acres of actively farmed land. While modest in scale in comparison to the west, agriculture in the east is well diversified and has some unique products such as wild rice production. Total cash crop sales are nearly equal to livestock and livestock product sales. Agricultural activity is scattered throughout the east with the most intensive activity on the fringe areas of the Agassiz Basin and the western Central Lakes landscape region.

The western portion of the region includes some of the most productive farmland in the world. Over 3.7 million acres of land is intensively farmed with an annual production representing more than two-thirds of the total agricultural income for this region. Most of the production is in the form of sugar beets.

Farm-to-market movements throughout the region are a mixture of local and export. Regional agricultural markets include, among others, Minneapolis/St. Paul, Grand Forks, Fargo/Moorhead, St. Cloud, Winnipeg, and the port of Duluth. Transfer points for the region's cash grains include Duluth, Minneapolis/St. Paul, the Gulf of Mexico and the west coast. Major livestock markets/auction include St. Paul and Fargo. Sugar beets are processed at four plants located near District's western edge or just across the border in North Dakota. The beets are collected at various local piling stations after harvest and hauled to the regional processing plants throughout the winter months. Efficient movement of agricultural products to markets is crucial to the economic integrity of the region.

II. TIMBER

Timber harvesting occurs in the Agassiz Basin and Central Lakes landscape. There is potential for increasing forestry activities in The Aspen Parklands. The following table with figures from 1990 and 1995 reflect this trend. Figures for Norman County could not be separated from Clay County, North Dakota, so were not included. The Clay/Norman harvest for 1995 was 10,900 cords.

TABLE 2.4

FOREST HARVEST BY COUNTY IN CORDS

County	1990 Harvest Volume	1995 Harvest Volume
Beltrami	223,000	238,000
Clearwater	98,700	102,600
Hubbard	91,500	150,800
Lake of the Woods	61,000	59,900
Mahnomen	13,500	22,600
Kittson	4,300	9,900
Marshall	7,000	18,400
Pennington/Red Lake	6,500	12,600
Polk	6,600	16,300
Roseau	32,600	35,300

Minnesota Department of Natural Resources, Forestry Division.

In 1990 there were over 200 logging companies in the region. While some of the timber product is shipped to manufacturing facilities outside of the area, most is processed at a facility within the region. Potlatch, Northwoods Panelboard and Champion Wood Products have major manufacturing facilities in the Bemidji area. The first two facilities produce oriented strand board, while the Champion facility produces a hardwood product similar to plywood.

III. MANUFACTURING

Wood products manufacturing is an important economic activity in the Eastern portion of the region. Over two-thirds of current wood products manufacturers in the East are primary producers. Primary producers perform the initial breakdown of logs into finished or semi-finished products, most of these are shipped to other manufacturers who "add value" to the product. The eastern part of the region has also experienced large increases in manufacturing employment. Two small manufacturing firms, Nortech and RDO Lamb Weston have added employees in Bemidji and Park Rapids. Straight River Engineering, a new manufacturer in Park Rapids, has over 100 employees. A sister company, Product Research and Development, has opened in Bagley and employs over 100 people.

Manufacturing sales in the Western part of the region show an overall increase since 1980 with the bulk of the increase taking place in Roseau County. Sales increases were greater than the state as a whole and represent a significant change in the economic base of the region. Roseau County has had substantial new development, largely attributable to Marvin Windows (commercial/residential windows) and Polaris Industries Incorporated (personal recreational vehicles). Pennington County has also experienced economic growth largely due to Artco Incorporated, another manufacturer of personal recreational vehicles. A number of small manufacturing have been established in the western portion of the region. The firms fabricate parts for the larger manufacturers or supply agricultural products in the area. Most of these companies are located in smaller towns and less populated counties. The impact of employment sector increases in Roseau and Pennington Counties affects a fairly wide area since workers often commute fairly long distances.

Industry and manufacturing in the region have shown great potential for growth and are becoming an increasingly significant force in the region's economy. Recent industrial development across the region indicate area is moving towards a more diversified economy. As with agricultural products, efficient movement of freight is important for obtaining a competitive advantage in the marketplace. Following is a list of major industries in the region:

TABLE 2.5

MAJOR PRIVATE INDUSTRY EMPLOYERS IN NORTHWESTERN MINNESOTA

Employer	#Employees	Location
Marvin Windows	2620	Warroad
Polaris	2130	Roseau
Arctco	1551	Thief River Falls
Shooting Star Casino and Lodge	895	Mahnomen
Digi-Key	635	Thief River Falls
American Crystal Sugar	456	Crookston
American Crystal Sugar	430	East Grand Forks
Lamb-Weston/RDO Frozen	425	Park Rapids
Telnet Systems	345	Bemidji
Potlatch	310	Bemidji
Nortech	290	Bemidji
Anderson Fabrics	275	Blackduck
Northern Pride Inc.	225	Thief River Falls
Solvay Pharmaceuticals	185	Baudette
Dee Inc.	185	Crookston
New Flyer of America Inc.	160	Crookston
Straight River Engineering	145	Park Rapids
Northwoods Panelboard	140	Bemidji
Homark Company Inc.	140	Red Lake Falls
Product Research and Dev.	130	Bagley
Phoenix Industries	115	Crookston
Dahlgren and Company	110	Crookston
Bridgeman	100	Thief River Falls

Information compiled from the HRDC and NWRDC Overall Economic Development Programs. Retail and medical employers excluded.

IV. RETAIL TRADE AND SERVICES

Retail sales represents the gross amount of sales reported including manufacturing, retail, mining, wholesale, finance, services, construction, utilities, and public administration. Total retail sales have shown significant increases over the last five years (see table). Regional centers continue to increase their share of regional sales. For example, in 1990 nearly 60 percent of all sales in the five county Headwaters Region (District 2A and Mahnomen County), occurred in the City of Bemidji (see **TABLE 2.6**)

TABLE 2.6

DISTRICT 2 RETAIL SALES TREND BY COUNTY

Retail Sales ($000's)		
Headwaters RDC	1990	1995
Beltrami	241,838	352,449
Clearwater	27,754	25,114
Hubbard	79,668	107,333
Lake of the Woods	19,670	30,726
Mahnomen	26,949	22,069
Subtotal	395879	537691
Northwest RDC		
Kittson	29,462	29,598
Marshall	49,748	43,183
Norman	30,629	31,913
Pennington	98,237	104,784
Polk	150,469	157,489
Red Lake	21,824	26,180
Roseau	92,323	133,454
Subtotal	472692	526601
TOTAL	868571	1064292

Information compiled from the HRDC and NWRDC Overall Economic Development Programs.

District 2 retailers are facing stiff competition from other regional centers such as Greater Grand Forks, Fargo, St. Cloud and the Minneapolis/St. Paul area. Area consumers often shop out-of-region to find the "best buy" or combine shopping with other activities during a weekend get-a-way.

Canadian shoppers also impact the regions economy. Border traffic counts from Canada have increased over the past few years. Many Canadians are traveling to Minnesota to

shop, particularly on long weekends. The amount of Canadian traffic largely depends on the comparative value of U.S. and Canadian currency.

V. TOURISM

Tourism plays a strong role in the economy of the eastern part of the district. Lake resorts have traditionally been the backbone of the tourism industry. The most intensive tourism areas are located in the Central Lakes area (see general landscape region's map). The lakes and forests of the Central Lakes and the Agassiz Basin also provide a strong attraction for residents of the Twin Cities, North and South Dakota and Iowa. The Headwaters Regional Development Commission reported over 120,000 people visit the Central Lakes counties of Beltrami, Hubbard, and Lake of the Woods during the twelve week summer tourist season. These tourist expenditures account for approximately 75 percent of the more than $28 million in lodging sales in District 2.

The Western portion of the district has recently been investigating the potential for tourism development and is beginning to experience growth in this sector. Pennington, Polk and Roseau Counties account for over 96 percent of the tourism receipts in the western portion of the district. Potential tourism activities in these counties include trail systems, bikepaths, bird and wildlife watching, casinos, golf courses, local campgrounds and shopping facilities.

2.2 IMPLAN DATA FOR REGION AND COUNTIES

The IMPLAN input-output model is a systematic system for examining the structure and interindustry relationships within regions down to the county level. The model was original developed for the United States Forest Service to analyze impacts in federal lands managed by the Forest Service, but was extended by the University of Minnesota to cover all regions of the United States. The model is currently updated and distributed by the Minnesota IMPLAN Group (MIG) in Stillwater, Minnesota.

The IMPLAN model database contains information on 528 different industry types ranging from agricultural crops to the United States Postal Service. These represent combinations of the U.S. Bureau of the Census Standard Industrial Classification (SIC) which has been established to identify the industry groups. The SIC classifies industries into one, two, three and four digit groups, with increasing industry detail. For this study, the IMPLAN industries have been combined into the two-digit (2-digit) classification.

The most recent complete IMPLAN model database which includes county employment within the region is for the year 1993. While more recent County Business Pattern data may be available, the use of the IMPLAN database ensures consistent data across all counties and includes agricultural, self-employed and entrepreneurial employees not included in the County Business Pattern data. Employment distribution provides an overview of the mix and importance of employment by major industry type. The 1-digit industry classification and 1993 employment by county are shown in **TABLE 2.2**.

Beltrami County has the largest employment (19,698) with Polk (16,389) and Roseau (10,707) ranking second and third. While the wholesale and government sectors dominate in Beltrami County, wholesale and professional services dominate in Polk County along with a strong agricultural employment component. The largest employment sector in Roseau County is Non-Durable Manufacturing

TABLE 2.7

INDUSTRY EMPLOYMENT (1-DIGIT) BY COUNTY (1993)

SIC	Description	Beltrami	Clearwater	Hubbard	Kittson	Lake of Woods	Mahnomen	Marshall	Norman	Pennington	Polk	Red Lake	Roseau
0	Agriculture	1,032	884	673	888	312	539	1,901	1,153	773	2,628	524	1,520
1	Mining / Construction	1,498	401	671	134	128	256	316	185	348	837	135	311
2	Non-Durable Manufacturing	998	281	417	11	155	65	86	89	307	889	146	3,377
3	Durable Manufacturing	348	45	124	35	29	13	119	8	1,163	359	29	1,373
4	Transportation	714	158	196	80	88	72	95	169	316	676	108	152
5	Wholesale / Retail Trade	4,516	581	1,446	478	398	501	684	599	1,685	3,198	375	1,323
6	Finance / Insurance / Real Estate	694	97	221	116	55	94	191	210	298	628	74	212
7	Business / Personal Services	1,987	147	815	101	377	1,009	164	117	627	890	60	444
8	Professional Services	3,885	781	1,610	876	417	492	1,105	795	1,845	5,475	505	1,303
9	Government	4,026	647	584	128	267	260	200	578	1,167	809	138	692
	TOTAL	19,698	4,022	6,757	2,847	2,226	3,301	4,861	3,903	8,529	6,389	2,094	10,707

3.0 EXISTING FREIGHT FLOW DATA

3.1 DATA SOURCES

Data were assembled from a variety of sources that provide freight flow information by industry or commodity type, by origin and destination where available, and by major route used where available. Each of these data sources is discussed below.

Reebie (Transearch) data

Reebie Associates is a private firm specializing in the collection and compilation of freight transportation data in the United States. The Reebie data are provided for the year 1995 at the 2-digit industry classification. These show flows in tons by transportation mode within the study region (Minnesota portion of BEA 150) and between the study region and all 183 BEA regions (and states) in the United States.[3] The Reebie database also includes estimates of value by commodity at the detailed 4-digit classification but does not distinguish by mode. These commodity value data were aggregated into the 2-digit classification for purposes of this study. The Reebie data are collected and compiled from a variety of sources including direct electronic data interchange with a number of major trucking firms, rail, water and air cargo data from the U.S. Department of Transportation, and data from other private sources. These represent the best available data on freight flows between major regions of the United States, although the data cannot be easily disaggregated into county level data. While these data do not provide sufficiently detailed information to assist the Minnesota Department of Transportation in the identification of significant freight corridors within the region, they do provide a basis for identifying major inbound and outbound corridors to other regions of the United States.

Rail Waybill data

The 1993 Rail Waybill sample was compiled and analyzed by the Department of Applied Economics of the University of Minnesota. Rail carloads and tons have been provided at the 2-digit industry classification between the study region and origin and destination states within the United States.

Sugar Beets

Detailed information on the location of sugar beet piles within the study region, the general producing area feeding these piles, and the processing plants to which the beets in these piles are shipped were provided by American Crystal Sugar. This represents a

[3] It should be noted that the BEA has redefined the Economic Analysis regions so that the use of these data as a baseline for future analysis may not be possible.

complete accounting of sugar beet flows within the region and in the adjacent growing region in North Dakota. The data identify highway routes taken from the piles to processing plants and the volume (weight) of sugar beets shipped in 1996. Piling site tonnages are provided for 1994, 1995 and 1996. Because the farm to pile trip is generally on farm and local roadway, these movements are not addressed in this study which analyzes flows on the regional system. Since sugar beets are one of the largest volume commodities moved within the region, these data are an essential component in establishing overall regional commodity flows.

Canadian Originations

Truck crossings from Canada into Minnesota for 1996 and 1997 were obtained from the U.S. Customs and Immigration Service. These truck crossings are not classified by vehicle type although it is assumed that most of these are 5-axle trucks for purposes of this study. These monthly data cover major Canadian border crossing points for inbound commodities and also demonstrate the variability in cross-border traffic by month and by year. Unfortunately, these data are not disaggregated into commodity types. Such data could be purchased from Statistics Canada but were beyond the scope of the present study.

Mn/DOT Grain Terminal survey

Data from a 1992 Mn/DOT survey of grain terminals covered approximately 50% of the grain terminals in the study region. These data were combined with other data sources previously compiled by Dr. Jerry Fruin to estimate total grain shipment origins within the study region for 1992. These were also compared with U.S. Department of Agriculture data on regional crop production to ensure reliability of the data.

Upper Great Plains Transportation Institute (UGPTI)

Data on grain production in North Dakota and flows of grain through the region to Duluth and Minneapolis-St. Paul by truck and rail were provided by UGPTI based upon 1996 and 1997 data. These data showed significant flows on US Highway 2 to Duluth-Superior through the region although the overall tonnage shipped to Duluth-Superior by rail was considerably higher.

Minnesota Timber Association

Estimated annual shipments for the period 1995-2000 were provided by the Minnesota Timber Producers Association. The Association identified major timber production areas within the study region and the primary routes to processing or rail transshipment facilities in Minnesota. Shipments on roadways were broken into four major categories by weight. Averages within each of these categories were used when combining these shipments with other commodities on the highway network. The seasonal variation of these shipments was not analyzed in this study.

Manufacturers Survey

The results of this survey constituted a major component of the freight flows assigned to the regional highway network. Detailed interviews were held with 22 firms selected from the Minnesota Directory of Manufacturers because of their importance. An additional 94 responses from a mailed survey provided additional information the shipment of manufactured goods within the region. The survey was performed in 1996 and reflected freight shipments for 1995. Data were extracted from the tabulated survey results using database techniques and combined into a single set of data. Employment represented by survey respondents was estimated and the survey results adjusted to represent total manufacturing employment using total manufacturing employment by county from the IMPLAN data base. The survey also provided an opportunity to establish the average shipment tonnage for each truckload by commodity type. It should be emphasized that the number of trucks estimated from the survey represent loaded trucks only. This also applies to the other commodities discussed above.

3.2 SUMMARY OF AVAILABLE DATA

3.1.1 SUGAR BEETS

Three categories of data were obtained: tonnage from farm to pile, tonnage from pile to plant; and major routes taken from pile to plant (by tonnage). An example of the farm to pile data is shown in **TABLE 3.1**. A map of pile to plant flows is included as **FIGURE 3.1**. The concentrated nature of beet production the region and the cross-border nature of beet production and processing can be seen in **FIGURE 3.1**.

3.1.2 GRAIN

Grain elevator capacity within the region is listed in **TABLE 3.2**. The table lists the community and county in which the elevator is included along with the storage capacity.

Grain shipments by county in North Dakota that flow through the study region are shown in **TABLE 3.3**. Most of these counties are located in close proximity to US Highway 2 which explains the heavy use of this roadway for grain shipments through the region.

TABLE 3.1

EXAMPLE OF FARM TO PILE SHIPMENTS OF SUGAR BEETS

			Cumulative estimate of farm shipments by ring				
Station	**Total Tons**	Route	Mile 1	Mile 2	Mile 3	Mile 4	Mile 5
Humbolt	200,470	Twp & Other	40,094				
		CSAH 16N	40,094	32,075	24,056	16,038	8,019
		CSAH 6E	20,047	16,038	12,028	8,019	4,009
		CSAH 4 E	20,047	16,038	12,028	8,019	4,009
		CSAH 16 S	40,094	32,075	24,056	16,038	8,019
		CSAH 4 W	20,047	16,038	12,028	8,019	4,009
		CSAH 6 W	20,047	16,038	12,028	8,019	4,009
		Total	200,470	128,301	96,226	64,150	32,075
Station	**Total Tons**	Route	Mile 1	Mile 2	Mile 3	Mile 4	Mile 5
Kennedy	155,546	Twp & Other	31,109				
		CSAH 1N	31,109	24,887	18,666	12,444	6,222
		CSAH 7E	31,109	24,887	18,666	12,444	6,222
		CSAH 1S	31,109	24,887	18,666	12,444	0
		CSAH 7W	31,109	24,887	0	0	0
		CSAH 10 W	0	0	18,666	12,444	6,222
		CR 67W	0	0	0	0	6,222
		Total	155,546	99,549	74,662	49,775	24,887
Station	**Total Tons**	Route	Mile 1	Mile 2	Mile 3	Mile 4	Mile 5
DTN yard	150,000	CSAH 7 N	0	0	18,000	12,000	6,000
		TH 11 E	120000	90000	18000	15000	6000
		CSAH 18 S	30,000	24,000	18,000	0	0
		TH 220S				12,000	6,000
		Total	150,000	114,000	54,000	39,000	18,000
Station	**Total Tons**	Route	Mile 1	Mile 2	Mile 3	Mile 4	Mile 5
Stephen	140,078	Twp & Other	28,016				
		TH 75N	28,016	22,412	16,809	0	0
		CSAH 23N	0	0	0	11,206	5,603
		CSAH 5E	28,016	22,412	16,809	0	0
		CSAH 6E	0	0	0	11,206	5,603
		TH 75S	28,016	22,412	16,809	11,206	5,603
		CSAH 6 W	28,016	22,412	16,809	11,206	5,603
		Total	140,078	89,650	67,237	44,825	22,412

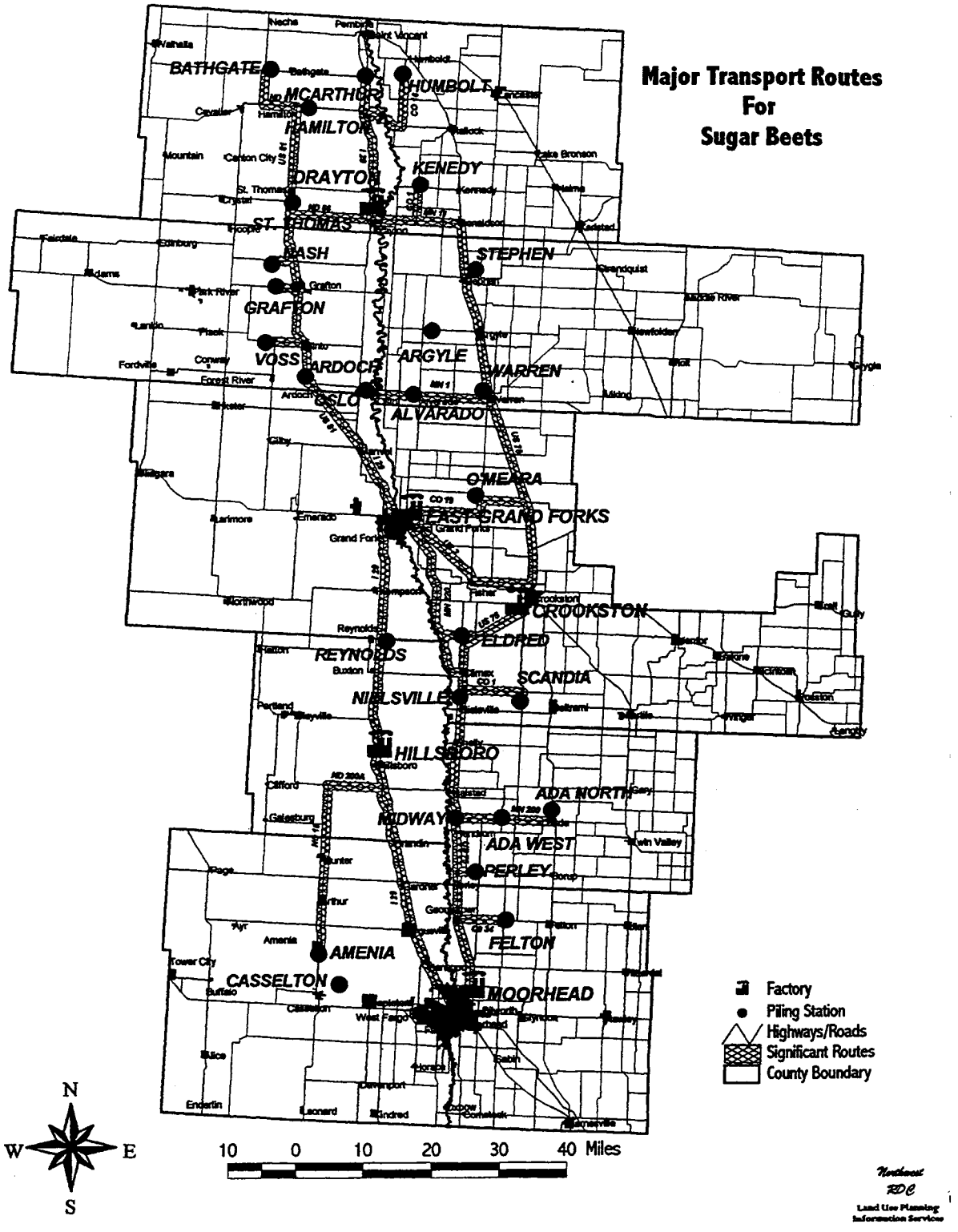


FIGURE 3.1

PORTION OF PILE TO PLANT SHIPMENTS BY ROUTE

TABLE 3.2

GRAIN ELEVATOR CAPACITY WITHIN THE STUDY REGION

	City	County	Capacity (bushels)
38	Clearbrook	Clearwater	77000
1	Ada	Norman	360000
39	Ada	Norman	285000
40	Alvardo	Marshall	350000
41	Angus	Polk	357000
42	Angus	Polk	136000
43	Argyle	Marshall	2065000
2	Argyle	Marshall	240000
3	Badger	Roseau	180000
44	Bagley	Clearwater	151000
45	Baudette	Lake of the Woods	39000
46	Bejou	Mahnomen	66000
47	Beltrami	Polk	580000
48	Blackduck	Beltrami	40000
4	Borup	Norman	30000
5	Brooks	Red Lake	270000
49	Climax	Polk	551000
50	Crookston	Polk	1500000
6	Crookston	Polk	561000
51	Donaldson	Kittson	1148000
52	East Grand Forks	Polk	928000
7	Eldred	Polk	618000
54	Fertile	Polk	641000
9	Fertile	Polk	353000
8	Fertile	Norman	205000
53	Fertile	Polk	110000
10	Fisher	Polk	270000
11	Fisher	Polk	90000
12	Fosston	Polk	393000
13	Gary	Norman	141000
14	Greenbush	Roseau	100000
15	Grygla	Marshall	140000
16	Gully	Polk	170000
17	Hallock	Kittson	400000
55	Hallock	Kittson	107000
18	Halstad	Norman	651000
56	Hazel	Pennington	187000
57	Hendren	Norman	132000
19	Humboldt	Kittson	550000
58	Karlstad	Kittson	286000
59	Kennedy	Kittson	389000
60	Kennedy	Kittson	309000

TABLE 3.2 (continued)

GRAIN ELEVATOR CAPACITY WITHIN THE STUDY REGION

	City	County	Capacity (bushels)
20	Lake Bronson	Kittson	231000
21	Lancaster	Kittson	880000
61	Lancaster	Kittson	168000
62	Luna	Marshall	1380000
63	Mahnomen	Mahnomen	988000
22	Mcintosh	Polk	203000
64	Middle River	Marshall	164000
65	Newfolden	Marshall	561000
66	Northcote	Kittson	223000
23	Oklee	Red Lake	1105000
67	Oslo	Marshall	472000
24	Oslo	Marshall	208000
25	Perley	Norman	330000
26	Plummer	Red Lake	514000
27	Radium	Marshall	395000
28	Red Lake Falls	Red Lake	360000
29	Roseau	Roseau	823000
68	Salol	Roseau	174000
30	Shelly	Norman	320000
31	St. Hilaire	Pennington	350000
32	St. Vincent	Kittson	350000
33	Stephen	Marshall	130000
34	Thief River Falls	Pennington	1100000
69	Thief River Falls	Pennington	255000
70	Twin Valley	Norman	191000
35	Warren	Marshall	400000
36	Warren	Marshall	380000
71	Warrod	Roseau	101000
72	Waubun	Mahnomen	489000
73	Williams	Lake of the Woods	276000
37	Winger	Polk	670000
	TOTAL		30347000

Source: Mn/DOT 1992 survey and Minnesota Farmers Elevator Yearbook

TABLE 3.3

THROUGH SHIPMENTS OF GRAIN BY ORIGIN IN NORTH DAKOTA

County	Tons Shipped	Percent of Total
Cavalier	844,354	30
Benson	371,186	13
Ramsey	327,597	11
Nelson	321,338	11
Rollette	216,452	8
Ward	197,601	7
McKenzie	71,404	2
Kidder	56,601	2
Grand Forks	50,969	2
McLean	47,173	2
Morton	43,652	2
Towner	42,706	1
Hettinger	39,817	1
Cass	36,461	1
Sargent	28,621	1
Walsh	27,576	1
Stutsman	20,265	1
Bottineau	18,207	1
Sioux	17,742	1
Burleigh	13,717	0
Griggs	13,085	0
Barnes	13,016	0
Mountrail	11,852	0
Bowman	9,346	0
Foster	6,706	0
Pembina	6,043	0
Mercer	6,035	0
TOTAL	2,859,522	100

Source: Upper Great Plains Transportation Institute

3.1.3 TIMBER

Major movements of timber from growing to processing area are shown in **FIGURE 3.2.** The depiction of the study area boundary demonstrates the movement of raw timber from the region to processing locations outside of the region. Internal flows of raw timber to the wood processing industry sector are incorporated into the manufacturing survey data discussed in Section 3.1.5.

3.1.4 CANADA TRUCK ORIGINATIONS

Monthly variations of inbound truck shipments from Canada through border crossings in the study region (and Pembina which is on Interstate 29 just west of the region) are depicted in **FIGURE 3.3.** This clearly identifies the major inbound crossing points and shows the large fluctuations that can occur on a month to month basis.

3.1.5 RAIL SHIPMENTS

A sample of agricultural commodity (SIC 1) shipments from the region to state destinations is included as **TABLE 3.4.** This shows the number of cars, total volume in tons and average tonnage per rail car. Similar data are available for other SIC classifications for outbound and inbound shipments by rail.

3.1.6 REEBIE/TRANSEARCH DATA

A table of commodity flows within the study region by mode is included as **TABLE 3.5.** Flows of commodities from the region to other states are included as **TABLE 3.6.** Flows from other states to the region are included as **TABLE 3.7.** The following abbreviations are used in these tables:

RR CL	Railroad Carload
RR IMX	Railroad Intermodal
TL	Truckload (contract)
LTL	Less-than-Truckload (contract)
PVT TK	Private Truck
AIR	Air cargo and mail
WATER	Vessel or barge

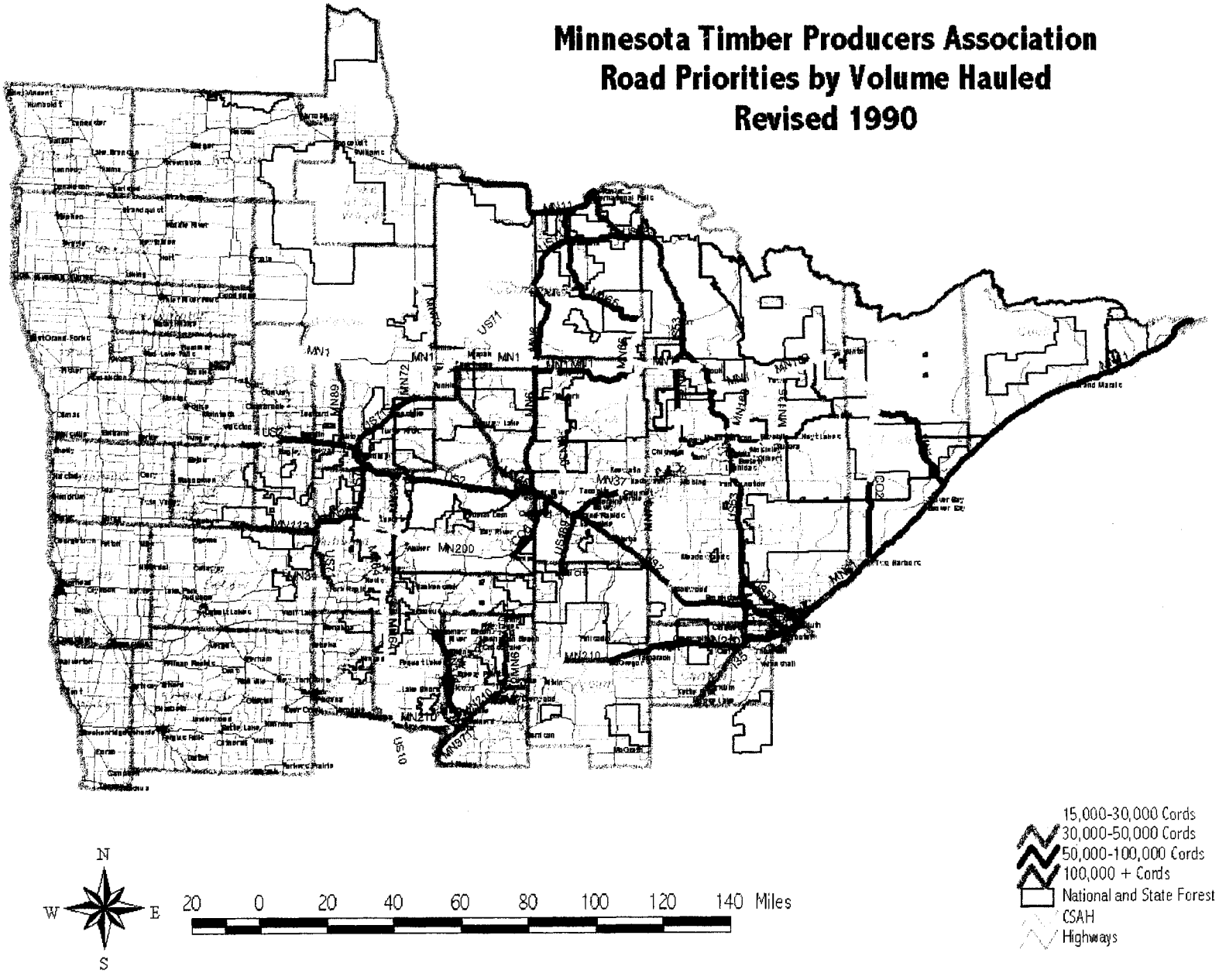


FIGURE 3.2

FLOWS OF TIMBER PRODUCTION TO PROCESSING FACILITIES

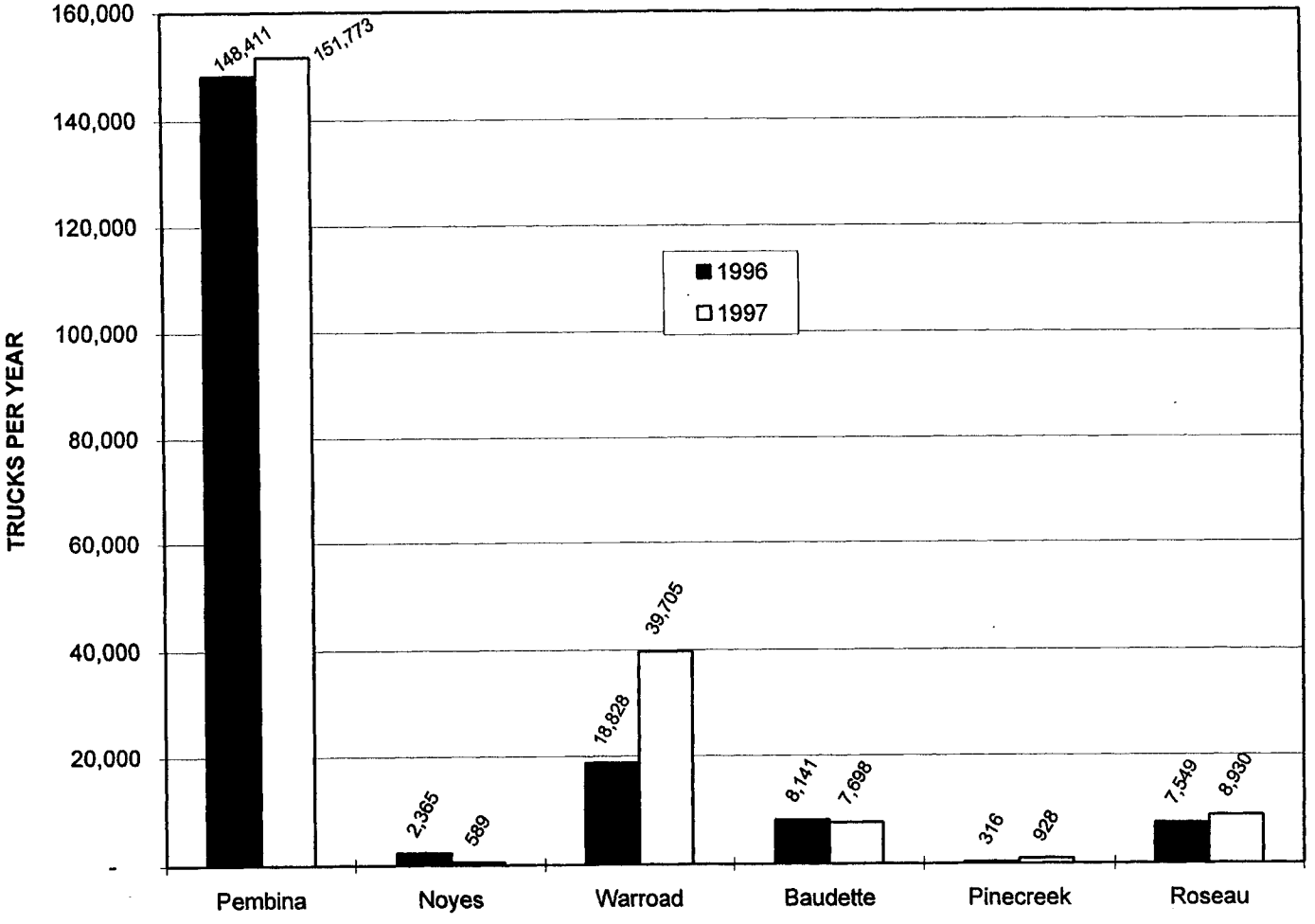


FIGURE 3.3

INBOUND TRUCKS FROM CANADA AT BORDER CROSSINGS

TABLE 3.4

OUTBOUND AGRICULTURAL SHIPMENTS BY RAIL

Termination Point	Number of Cars	Volume in Tons
AZ	84	7,692
CA	228	18,812
CO	40	3,960
FL	340	12,140
IA	40	4,000
IL	1,804	176,036
IN	60	6,000
KS	120	7,800
KY	40	1,880
LA	1,180	117,264
MN	5,896	564,756
MO	3,504	342,532
ND	80	6,000
NJ	100	9,960
NY	72	8,400
OR	36	3,600
PA	112	11,568
TX	748	73,872
WA	672	66,776
WI	2,448	232,728
TOTAL	17,604	1,675,776

Source: 1993 Waybill Data
(based on a 5% sample expanded to 100% with + or = 5% accuracy)

TABLE 3.5

COMMODITY FLOWS WITHIN THE REGION BY MODE

STCC	Commodity	RR CL	RR IMX	TL	LTL	PVT TK	AIR	WATER
11	Coal	351,660	0	0	0	0	0	0
20	Food Products	42,160	0	5,202	1	1,646	0	0
22	Textiles	0	0	541	121	1,069	0	0
24	Wood Products	0	0	1,582	0	5,517	0	0
26	Pulp/paper	0	0	40	0	0	0	0
27	Printed Matter	0	0	0	0	22	0	0
28	Chemicals	0	0	276	9	1,708	0	0
29	Petroleum	0	0	0	1	0	0	0
30	Rubber/plastics	0	0	0	0	74	0	0
32	Stone/concrete	0	0	4,921	1	27,022	0	0
33	Primary metal	0	0	0	0	42	0	0
34	Fabricated metal	0	0	31	11	98	0	0
37	Transport equip	0	0	2,420	0	1,369	0	0
39	Misc manufacturing	0	0	0	1	0	0	0
50	Secondary traffic	0	0	565	21	1,422	0	0

Source: Reebie Associates

STCC = Standard Transportation Commodity Classification
(for most commodities, the STCC and SIC (Standard Industrial Classification) are essentially identical).

The 351,660 tons of coal moved by Rail Carload within the region reflects movements through the study area that are generated within the larger BEA 150 region which also includes part of North Dakota.

TABLE 3.6

STATE DESTINATIONS OF REGIONAL COMMODITY SHIEPMENTS

From Minnesota BEA 150 To All Other States

Dest State	RR CL TONS	RR IMX TONS	TL TONS	LTL TONS	PVT TK TONS	AIR *TONS*	WATER *TONS*	TOTALS
AL	0	0	15078	884	6341	0	0	22303
AZ	70296	0	10021	477	240	0	0	81034
AR	0	0	17025	118	7564	0	0	24707
CA	61416	0	41620	282	2443	0	0	105761
CO	76920	0	9718	588	750	0	0	87976
CT	0	0	1443	118	161	0	0	1722
DE	0	0	79	10	16	0	0	105
DC	0	0	23	1	179	0	0	203
FL	7420	880	25364	166	6742	0	0	40572
GA	2560	0	4963	97	2158	0	0	9778
ID	0	0	2861	570	218	0	0	3649
IL	88120	33440	50247	280	47690	0	0	219777
IN	1680	0	40748	203	7388	0	0	50019
LA	10680	0	35985	126	16242	0	0	63033
KS	7520	0	23817	169	4476	0	0	35982
KY	1376	0	15736	505	692D	0	0	24537
LA	133400	2800	12748	65	3927	0	0	152940
ME	0	0	543	71	0	0	0	614
MD	0	0	6864	143	809	0	0	7816
MA	0	0	2417	95	231	0	0	2743
MI	3920	0	37792	155	10697	0	0	52564
MN	562653	280	340939	4347	813113	0	0	1721332
MS	0	0	7396	58	3385	0	0	10839
MO	245660	520	29213	335	15542	0	0	291270
MT	10320	0	8855	299	383	0	0	19857
NE	11360		15442	34	7902	0	0	34738

From Minnesota BEA 150 to All Other States- by state (SUM)

TABLE 3.6

STATE DESTINATIONS OF REGIONAL COMMODITY SHILPMENTS,

From Minnesota BEA 150 To All Other States

Dest state	RR CL TONS	RR IMX TONS	TL TONS	LTL TONS	PVT TK TONS	AIR TONS	WATER TONS	TOTALS
NV	0	0	3882	262	170	0	0	4314
NH	0	0	161	19	38	0	0	218
NJ	0	920	5340	158	459	0	0	6877
NM	0	0	4185	21	1326	0	0	5532
NY	8000	0	13022	157	4618	0	0	25797
NC	0	0	8856	1160	2520	0	0	12536
ND	297272	0	2074	69	45415	0	0	344&10
OH	0	0	29820	648	8811	0	0	39279
OK	0	0	20107	39	9513	0	0	29659
OR	113991	0	672	34	195	0	0	114892
PA	6120	80	16802	282	2482	0	0	25766
RI	0	0	233	11	104	0	0	348
SC	0	0	940	495	449	0	0	1884
SC	0	0	7347	46	14264	0	0	21657
TN	41880	0	10017	149	3563	0	0	55609
TX	82728	0	34478	665	11934	0	0	129805
UT	9984	0	13829	768	1898	0	0	26479
VT	0	0	25	13	1	0	0	39
VA	0	0	5565	108	7347	0	0	13020
WA	255262	0	2724	60	889	0	0	258935
WV	0	0	4583	10	2088	0	0	6681
WI	4683852	1680	38067	154	37188	0	0	4760941
WY	0	0	3162	11	180	0	0	3353
Report Total	6794390	40600	982828	15535	1120969	0	0	8954322

From Minnesota BEA 150 to All Other States- by state (SUM)

TABLE 3.7

STATE ORIGINS OF REGIONAL COMMODITY SHIEPMENTS

To Minnesota BEA 150 From All States

Orig state	RR CL TONS	RR IMX TONS	TL TONS	LTL TONS	PVT TK TONS	AIR TONS	WATER TONS	TOTALS
AL	21540	0	15408	959	1295	0	0	39202
AZ	0	0	6450	65	92	0	0	6607
AR	0	0	22747	655	6772	0	0	30174
CA	5640	0	5251	541	2021	0	0	13453
CO	68000	0	875	163	110	0	0	69148
CT	0	0	507	130	85	0	0	722
DE	0	0	617	55	60	0	0	732
FL	23880	0	4365	118	717	0	0	29080
GA	0	0	8250	853	506	0	0	9609
ID	0	0	1378	437	459	0	0	2274
IL	9960	0	8267	945	1964	0	0	21136
IN	0	0	10299	960	2053	0	0	13312
IA	28000	0	116939	448	288M	0	0	174275
KS	7308	0	15528	175	3587	0	0	26598
KY	98w	0	1285	740	234	0	0	12139
LA	am	920	3586	171	354	0	0	11258
ME	0	0	1263	40	0	0	0	1303
MD	0	0	824	251	20	0	0	1095
MA	0	0	547	307	439	0	0	1293
MI	0	0	47082	696	6429	0	0	54207
MN	585980	0	615145	10231	1127756	0	0	2339112
MS	0	0	2160	434	217	0	0	2811
MO	0	0	3225	913	1368	0	0	5506
MT	405384	0	3069	225	470	0	0	409148
NE	0	0	3564	80	6949	0	0	10593
NV	0	0	273	12	0	0	0	285
NH	0	0	0	22	8	0	0	30
NJ	0	0	2524	980	232	0	0	3736
NM	0	0	284	9	33	0	0	326

To Minnesota BEA 150 From All States - by state (SUM)

TABLE 3.7

STATE ORIGINS OF REGIONAL COMMODITY SHIEPMENTS

To Minnesota BEA 150 From All States

Orig State	RR CL TONS	RR IMX TONS	TL TONS	LTL TONS	PVT TK TONS	AIR TONS	WATER TONS	TOTALS
NY	0	640	1027	1231	46	0	0	2944
NC	0	720	3168	1507	1726	0	0	7121
ND	92100	0	68208	118	74481	0	0	234907
OH	0	0	15634	1650	2510	0	0	19794
OK	9500	0	2565	267	696	0	0	13028
OR	0	0	3021	76	516	0	0	3613
PA	0	0	5846	1485	535	0	0	7866
RI	0	0	0	57	0	0	0	57
SC	0	0	945	431	267	0	0	1643
SD	0	0	12221	98	26179	0	0	38498
TN	6240	840	640	1472	3156	0	0	12348
TX	0	0	9899	1077	926	0	0	11902
UT	0	0	641	247	71	0	0	959
VT	0	0	14	27	0	0	0	41
VA	0	0	124	339	0	0	0	463
WA	0	0	5158	222	525	0	0	sm
WV	0	0	1037	69	595	0	0	1701
WI	50200	0	91979	632	21449	0	0	164260
WY	2000	0	127	4	0	0	0	2131
Report Total	1331839	3120	1123966	32624	1326796	0	0	3818345

To Minnesota BEA 150 From All States - by state (SUM)

4.0 DEVELOPMENTS AFFECTING FREIGHT

4.1 MAJOR NEW FACILITIES

A review of the regional highway network and railway system identified no new facilities having a major impact on freight flows within, to or from the region. Two major interstate highways are located just outside of the regional boundaries. Interstate 29 immediately west in North Dakota runs north and south and carries a major portion of US and Canada trade. Interstate 94 runs between Fargo/Moorhead and the Twin Cities of Minneapolis-St. Paul and carries much of the freight from the Dakotas into Minnesota. Some of the Interstate 29 traffic also uses Interstate 94 between Winnipeg and the Twin Cities. No major upgrading of either of these facilities is anticipated.

Two additional sugar beet piling sites will be located in Northwestern Minnesota within the next two years due to increases in acreage planted and processing capacity. These piles will be located at a greater distance from processing and will increase ton miles of sugar beets shipped from pile to plant. However, the exact locations of these piles is not currently available.

General continued growth is expected for the economic sectors within the region. However, no specific information on major new facilities or changes related to other commodities or manufacturing facilities has been identified.

4.2 TRADE FLOWS

Canada is Minnesota's largest trading partner in terms of exports. Japan, other Asian countries and the European Union account for the major portion of imports into the United States and Minnesota. A large amount of Canadian crude is imported into the state via pipelines. The North American Free Trade Agreement (NAFTA) has reduced tariffs and encouraged increase trade between the United States and Canada. Direct exports to Canada from Northwestern Minnesota include snowmobiles and wood products although not all of these flow northward on the regional roadway system. A study is currently underway evaluating the impact of NAFTA on the Interstate 35 corridor running from Texas into Minnesota.

4.3 REGULATIONS

The Northwest Minnesota Freight Flow Study Area shares borders with the state of North Dakota and the provinces of Manitoba and Ontario. While there are numerous truck transportation regulatory differences between these neighbors, perhaps the area of difference most often noted is the differences in truck size and weight regulations.

Minnesota generally has lower size and weight limits than North Dakota, Manitoba and Ontario. This fact presents some barriers at the borders and presents some issues for highway freight transportation in the region. **TABLE 4.1,** which summarizes size and weight limits by province/state, provides some context for these truck size and weight issues.

TABLE 4.1a

TRUCK WEIGHT LIMITS BY JURISDICTION

	GVW (lbs)	Single axle	Tandem	Tridem
Minnesota	80,000	20,000	34,000	43,000 (9 ft)
Manitoba	137,800	20,000	37,500	50,700
No. Dakota	105,500	20,000	34,000	48,000 (9ft)
Ontario	137,800+	22,000	37,500	50,700

TABLE 4.1b

TRUCK DIMENSIONS/COMBINATIONS BY JURISDICTION

	Height/Width	Length Semi-trailer length	Twin trailers	Other Long Combinations
Minnesota	13.5'/8.5'	53'	2-28.5'	No
Manitoba	13.5/8.5'	53'	2-32.8'	Yes
No. Dakota	14' /8.5'	53'	2-48'	Yes
Ontario	13.5'/8.5'	48-53'	2-32.8'	Yes

Obviously there are many common or closely ranged limits; width and height for example. In the area of weight, beyond the single and tandem axle weights, which are within 10% for all four jurisdictions, the limits vary considerably with Minnesota having the lowest limits overall. North Dakota allows the longest combinations and the Provinces generally allow the heaviest gross vehicle weights.

5.0 COMMODITY VALUE ESTIMATION

5.1 DATA SOURCES

Two data sources were used to estimate commodity value (as dollars per pound or ton). Reebie Associates (Transsearch) data were first developed from the 1977 Commodity Flow Survey by the US Department of Commerce and have been adjusted to 1995 using a variety of data sources. The US Department of Commerce 1993 Commodity Flow Survey collected data from firms in Minnesota. These data are generally representative of products and commodities shipped to and from Minnesota. Each of these data sources is described briefly below.

5.2 COMMODITY FLOW SURVEY DATA

The Commodity Flow Survey data are reported at the 2-digit industry classification and by mode, providing a means of comparing shipment value by mode. However, because of federal disclosure rules, not all products or commodities are represented by the data.

5.3 TRANSEARCH (REEBIE) DATA

The Reebie data are reported at a detailed 4-digit industry classification although not by mode. By weighting the particular mix of commodities within the larger 2-digit classification using the 4-digit tonnages and values, it is possible to developed a weighted average of value per pound at the 2-digit level that is fairly representative of the Minnesota mix of commodities.

5.4 DATA RECONCILIATION

The two data sources were combined into a single table. Where differences in value occur across modes, the data are derived from the Commodity Flow Survey. Where no differences in value occur across modes, the data are derived from the Transearch database. Because of the importance of grains and sugar beets to the Northwestern Minnesota economy, specific value per pound estimates were estimated based upon Minnesota Department of Transportation staff knowledge of local conditions. A table of dollar value per ton is presented as **TABLE 5.1**.

TABLE 5.1

COMBINED FREIGHT VALUE ESTIMATES (DOLLARS PER TON)

DESCRIPTION	RR CL	RR IMX	TL & LTL	PVT TK	AIR	WATER
00 : ALL COMMODITIES	140	3,520	940	460	580	580
01 : Farm products	120	180	240	300	180	180
Sugar beets ($0.015/lb)				**30**		
Grain ($0.080/lb)				**160**		
09 : Fresh fish or other marine products	3,220	3,220	3,220	3,220	3,220	3,220
10 : Metallic ores	40	40	40	40	40	40
11: Coal	8	8	8	8	8	8
14 : Nonmetallic minerals	20	20	20	20	20	20
20 : Food or kindred products	420	760	960	720	760	760
22 : Textile mill products	3,980	3,980	2,880	4,400	3,980	3,980
23 : Apparel or other finished textile products	17,880	17,880	20,660	17,880	17,880	17,880
24 : Lumber or wood products, excl furniture	900	740	920	280	560	560
25 : Furniture or fixtures	4,300	4,300	4,800	5,360	4,300	4,300
26 : Pulp, paper, or allied products	740	820	760	600	780	780
27: Printed Matter	5,280	5,280	5,280	5,280	5,280	5,280
28 : Chemicals or allied products	1,200	1,200	1,000	1,020	1,200	1,200
29 : Petroleum or coal products	220	220	200	240	220	220
30 : Rubber or miscellaneous plastics products	4,340	4,340	4,100	3,120	21,000	4,340
31 : Leather or leather products	10,620	10,620	5,160	6,580	10,620	10,620
32 : Clay, concrete, glass, or stone products	100	100	160	60	100	100
33 : Primary metal products	1,080	1,080	1,060	1,200	35,000	1,080
34 : Fabricated metal products	4,260	3,840	3,300	3,240	34,000	3,840
35 : Machinery, excluding electrical	10,860	10,860	10,760	4,780	74,780	10,860
36 : Electrical machinery, equipment, or supplies	3,320	13,800	7,860	14,660	128,760	13,800
37 : Transportation equipment	6,920	6,920	6,140	5,980	43,000	6,920
38 : Instruments, photographic goods, optical goods, watches, or clocks	41,280	41,280	41,280	16,060	330,000	41,280
39 : Miscellaneous products or manufacturing	7,740	7,740	6,600	8,900	7,740	7,740
40 : Waste or scrap materials	100	120	140	120	120	120
41 : Miscellaneous freight shipment	12,700	12,700	12,700	12,700	12,700	12,700
50: Secondary traffic	2,920	2,920	2,920	2,920	2,920	2,920
99 : Commodity unknown	0	0	2,920	0	0	0

Sources: 1993 Commodity Flow Survey, 1993 Reebie/Transearch data and assumed rates for sugar beets and grain

6.0 MARKET RESEARCH/SURVEY

6.1 DESCRIPTION OF SURVEY/RESULTS

A survey population was identified using the Minnesota Manufacturers 1995 database, which lists 292 manufacturing firms within the study area. Three additional firms were recommended for the survey by District 2 Mn/DOT representatives. Twenty-seven shippers were identified that had more than 50 employees at facilities within the study area. Interviews were held with 22 of these firms. A subsequent and revised survey was mailed to 255 firms of which 94 responded. Details of the survey and survey results are contained in the report Northwest Minnesota Freight Flow Study: Primary Data Collection Activities (Minnesota DOT, August 1997)

6.2 ADJUSTMENT TO TOTAL MANUFACTURING EMPLOYMENT

Survey responses were compiled by industry (SIC) type, origin, and destination and then adjusted to total regional employment using the IMPLAN data base. An example of origin cities within the study region and destination cities within and outside of the region for shipments of SIC 24 (Wood Products) related commodities is included as **TABLE 6.1.** Detailed data tables have been provided to the Minnesota Department of Transportation but cannot be included here due to agreements on confidentiality in the collection of these data.

TABLE 6.1

SIC 24 (WOOD PRODUCTS) RELATED SHIPMENTS
(origin cities within the region and destinations)

Origin City (in region)	Destination City	Origin City (in region)	Destination City
Bagley	Bagley	Nevis	Nevis
	Bemidji	Park Rapids	Bemidji
	Duluth		Laporte
	Erskine		Park Rapids
	International Falls		Solway
	Minneapolis	Red Lake Falls	Bemidji
	Solway		Solway
Baudette	Baudette	Solway	Fargo
	Solway		Grand Forks
	Tenstrike		Minneapolis
Bemidji	Ada		Sioux Falls
	Akeley	Tenstrike	Fargo
	Bemidji		Minneapolis
	Duluth		Sioux Falls
	Fargo		Thief River Falls
	Lake George	Thief River Falls	Bemidji
	Minneapolis		Thief River Falls
	Sioux Falls	Warroad	Duluth
	Solway		Fargo
	Winnipeg		Fergus Falls
Cass Lake	Tenstrike		Sioux Falls
Lake George	Alexandria		
	Fergus Falls		
	Minneapolis		
	Park Rapids		
	Wahpeton		

6.3 RECOMMENDATIONS FOR SURVEY IMPROVEMENTS

The survey provided comprehensive and detailed information on regional manufacturers, both in terms of inbound shipments (from within and outside of the region) and outbound shipments (to the region and outside of the region). To facilitate the extrapolation of survey results to total regional employment, some improvements in the survey and the survey process may be helpful. These are outlined below.

It is recommended that each survey respondent be identified (for confidential use by Mn/DOT and its contractors) to permit cross-tabulations of the survey results. For example, firm employment could more accurately be used to adjust the survey response to represent total regional employment.

More specific information on employment by firm would also be helpful in adjusting survey responses to total regional employment. For this study, an average value for each of the employment ranges was used which, in some cases, could lead to adjusted results that are distorted towards one or more commodities.

The Directory of Manufacturer's database was compared with the database for the Survey of American Business. Neither of these databases contained all of the manufacturing firms located within the region. The Survey of American Business database included only limited data on manufacturing firms.

Inbound and outbound routes used most heavily were requested from each survey respondent, although most did not provide information that could not otherwise be extracted from the regional highway system structure. It would be helpful if complete routings (from origin to destination), at least for several major routes, were available. Although these were requested in the survey, the respondents were unable to provide this information since they did not know the routes taken by motor carriers. In future studies, it is recommended that motor carriers used by shippers also be surveyed.

In future surveys, the compilation of shipment data should be consistent, using either a monthly or an annual basis. For this study, two separate surveys were performed. The first survey, consisting of interviews with large firms having significant seasonal variation in shipments, requested shipment data on a monthly basis. The second survey, consisting of a mail-out questionnaire to smaller firms, requested shipment data on an annual basis since these firms have lower shipment volumes with smaller seasonal variations in shipments. Therefore, identification of monthly shipments for all firms was not possible.

7.0 VEHICLE DATA COLLECTION

7.1 Mn/DOT VEHICLE CLASSIFICATION COUNTS

Overview of Methodology

As part of a comprehensive study of freight flows in Northwest Minnesota, a special traffic count/vehicle classification program, developed jointly by the Mn/DOT Central Office and District 2, augmented the ongoing Traffic Monitoring System coverage counts in the area. The Office of Management Data Services carried out the count program and the Office of Freight Railroads and Waterways compiled a brief report including analysis and observations. The results of this special effort will be useful in several aspects:

1) It will give the district a much more comprehensive picture of traffic make-up and truck movements on the regions highways. Information which is valuable for planning, design, maintenance, and safety considerations.

2) It will help with freight corridor identification and provide data useful in verifying estimated freight flows in a given corridor.

3) It will provide improved detail on relating commodity flows to vehicle types and vehicle flows.

Data Gathering Process

Locations for data gathering were selected to fill knowledge gaps and supplement regular coverage counts to provide a good representation of commercial vehicle flows in the region. A total of 103 counts were taken during the summer and fall of 1996. These included about 20 counts normally scheduled and about 83 additional counts specifically for this study. In addition, 33- 1994 counts were reviewed and 5 counts conducted in 1995 were also reviewed. Location of heavy vehicle counts is shown in **FIGURE 7.1.**

Of these total counts, 22 were fall counts (September or October) to help determine seasonality of some truck traffic, especially that associated with crop harvest.
Analysis Count results were processed by the Traffic Forecasts & Analysis Section of the Office of Management Data Services. Of the 1996 counts, 39 were 16 hour counts (manual) and the rest were 24 hour counts. The 1994 and 1995 counts were 16 hour counts. Counts were run through a factoring program developed by Traffic Forecasts & Analysis Section to estimate Average Daily Traffic by vehicle class. To provide a view of the Northwest Minnesota region, counts were applied to the highway network to represent estimated Heavy Commercial Average Daily Traffic (HCADT), an indicator of major commercial routes. A review of available data was made to arrive at logical breaks to classify routes on a regional basis, into high, medium and low volume routes. Similarly, five axle semis counts, representing the work-horse of highway freight movements, were also applied to the network to indicate a more succinct view of freight traffic and routes in the region.

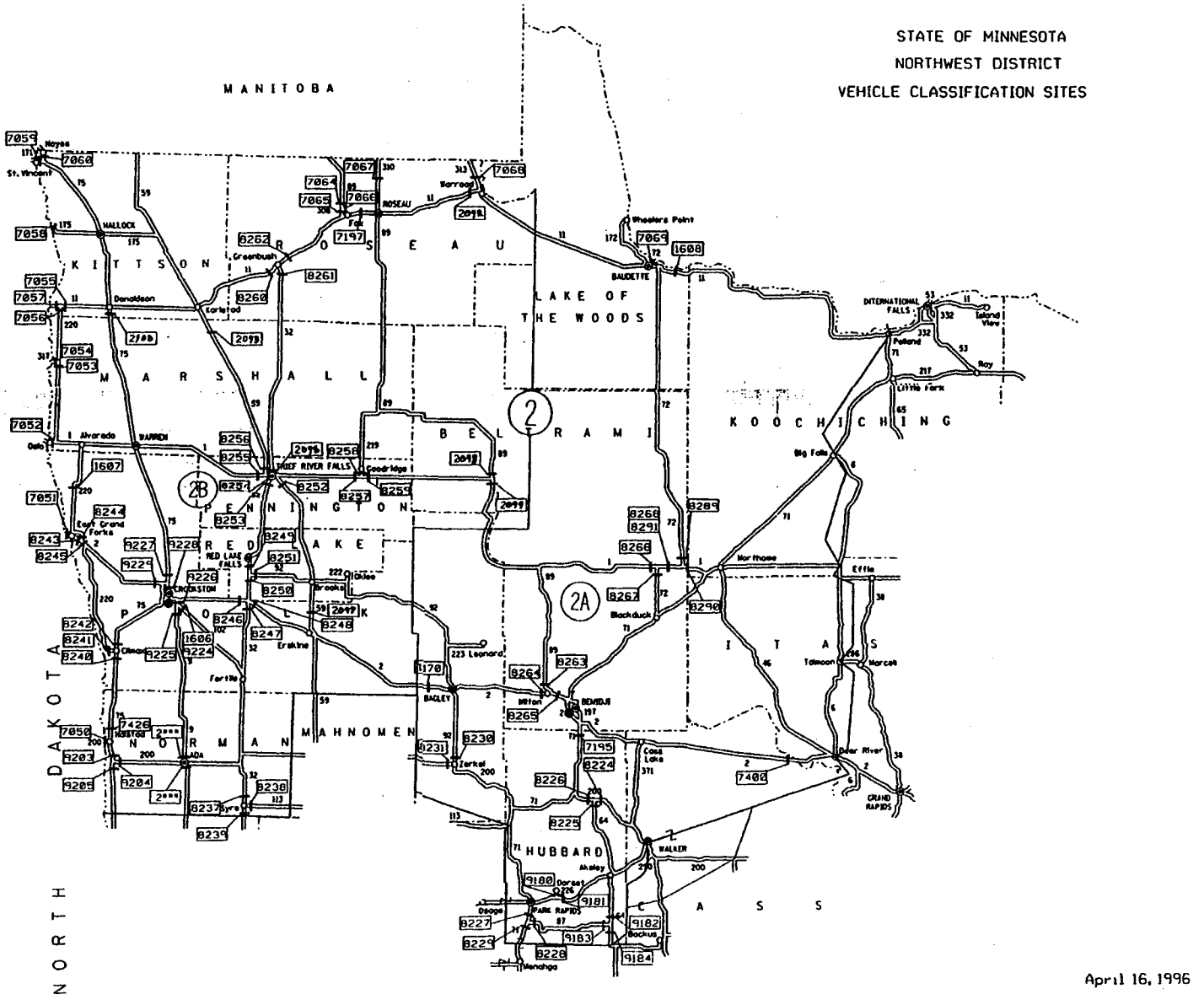


FIGURE 7.1

LOCATION OF Mn/DOT HEAVY VEHICLE COUNTS

7.2 OBSERVATIONS ON THE DATA

Not surprising to anyone familiar with the region, TH 2 is the main freight artery in the region for both total HCADT and a 5 axle semi volume standpoint.

TH 92 is a significant regional 5 axle route. This route may be a means to bypass the scale on TH 2; however, relatively high volumes occur south of TH 2, indicating more than strictly a scale bypass route.

Other important regional 5 axle routes include:

- TH 71 north and south of the Bemidji area and in the Park Rapids area
- TH 59 from Erskine to TRF
- TH 175, east of Hallock

The data/analysis substantiate seasonal peaks in heavy commercial traffic of agricultural goods. However, this peak effect is not uniform in all locations where fall counts were conducted. Some counts actually indicated lower HC volumes. In general, fall peaks were significant, some indicating a 3 to 4 fold increase in HC volumes.

The data provide a good picture of highway freight traffic, but there are some deficiencies. For example, there was no count taken on TH 72, south of Baudette, nor on TH 11 west of Baudette. Also, TH 92 east of the Junction with TH 59 was not counted. Therefore, it was necessary to estimate freight traffic volumes on this route.

8.0 THROUGH FREIGHT FLOWS

Information on through freight flows was limited to grain shipments originating in North Dakota and truck crossings from Canada, although final truck destinations could not be specifically identified. These are discussed below.

8.1 GRAIN FLOWS

The Upper Great Plains Transportation Institute compiled grain data from 1996 and 1997 reports. All destinations from North Dakota elevators are covered by the data although only those with destinations to Duluth-Superior and Minneapolis-St. Paul were tabulated. Elevator-specific shipments may not be released because of confidentiality agreements between the North Dakota Public Service Commission and the UGPTI.

Total grain shipments by truck and by county in North Dakota were presented in **TABLE 3.3**. All of these shipments are assumed to travel on US Highway 2. Grain shipments from North Dakota by truck totaled 3,010,212 tons. Grain shipments from North Dakota to Duluth-Superior by rail totaled 8,996,181 tons.

8.2 CANADA ORIGINATING FLOWS

The annual number of reported truck crossings from Canada at customs points within Northwestern Minnesota totaled over 35,000 in 1996 and 57,000 in 1997. The total number of trucks inbound to the region from Canada, based upon the manufacturing survey responses, is just under 2,000. Even with an upward adjustment of the survey results to reflect total employment in the region, it is clear that a large number of the trucks entering the region from Canada are passing through the region. These through movements probably range from 30,000 to 50,000, with approximately one-half passing through Warroad, one-quarter passing through Baudette and one-quarter passing through Roseau.

9.0 REGIONAL TRANSPORTION SYSTEM

The region transportation system is comprised of three primary components - the highway network, the rail network, and the airport network.

The regional highway network is assumed to include those roadways (links) which primarily carry regional flows as opposed to local roadways such as farm roads and street networks within communities. For this study, the regional highway system is assumed to include all federal and state highways, and those county highways carrying a significant number of 5-axle trucks. The regional highway network is shown in **FIGURE 9.1.**

The regional railway system includes both main and branch lines and is shown in **FIGURE 9.2.**

The regional airport system includes those airports designated by the Minnesota Department of Transportation as part of the State Aviation Systems Plan. The regional airport system is shown in **FIGURE 9.3.** Only two of these airports (Bemidji and Thief River Falls) handle commercial air freight operations, with Bemidji the more important of these two.

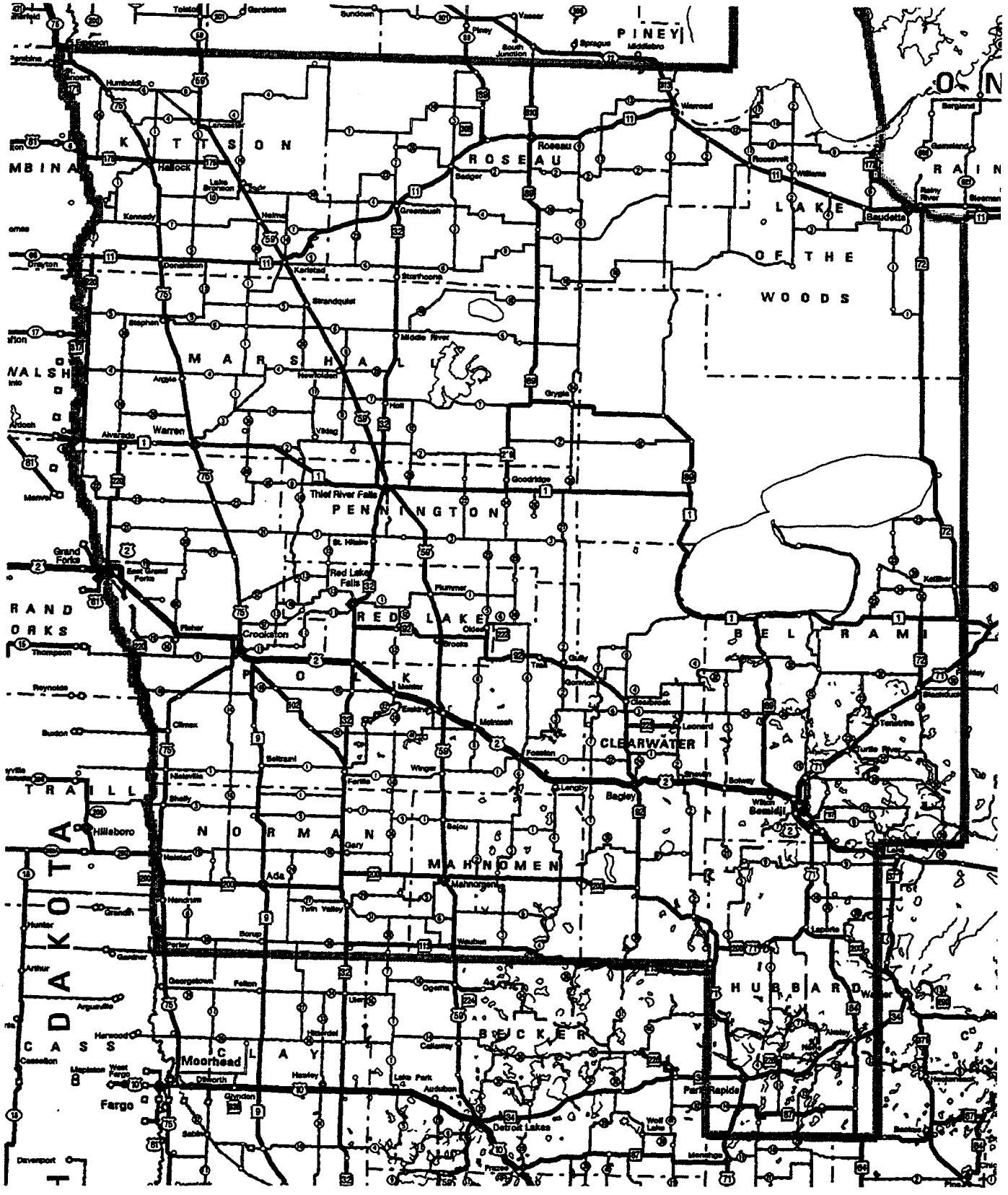


FIGURE 9.1

REGIONAL HIGHWAY SYSTEM

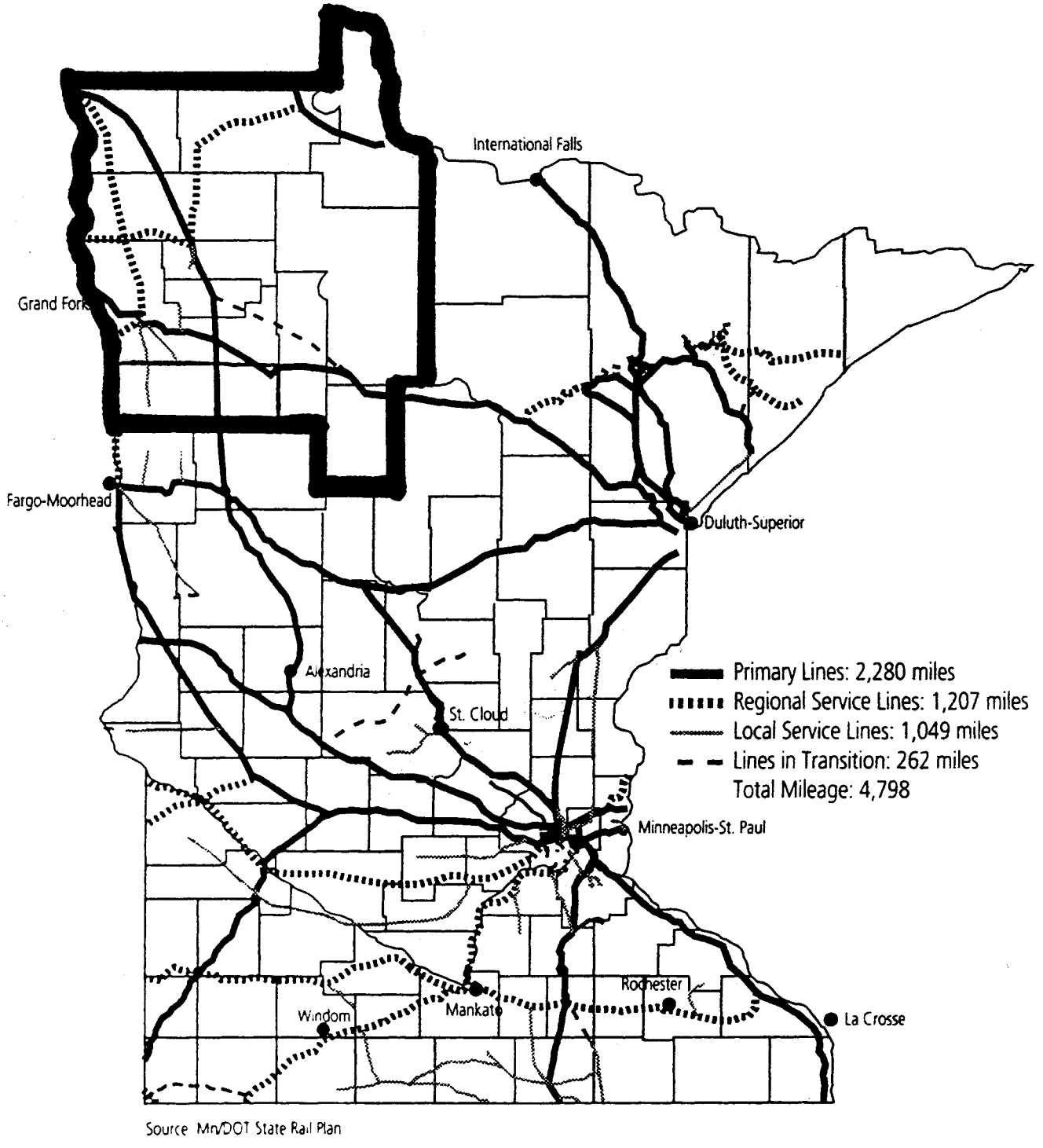


FIGURE 9.2

REGIONAL RAILWAY SYSTEM 1992

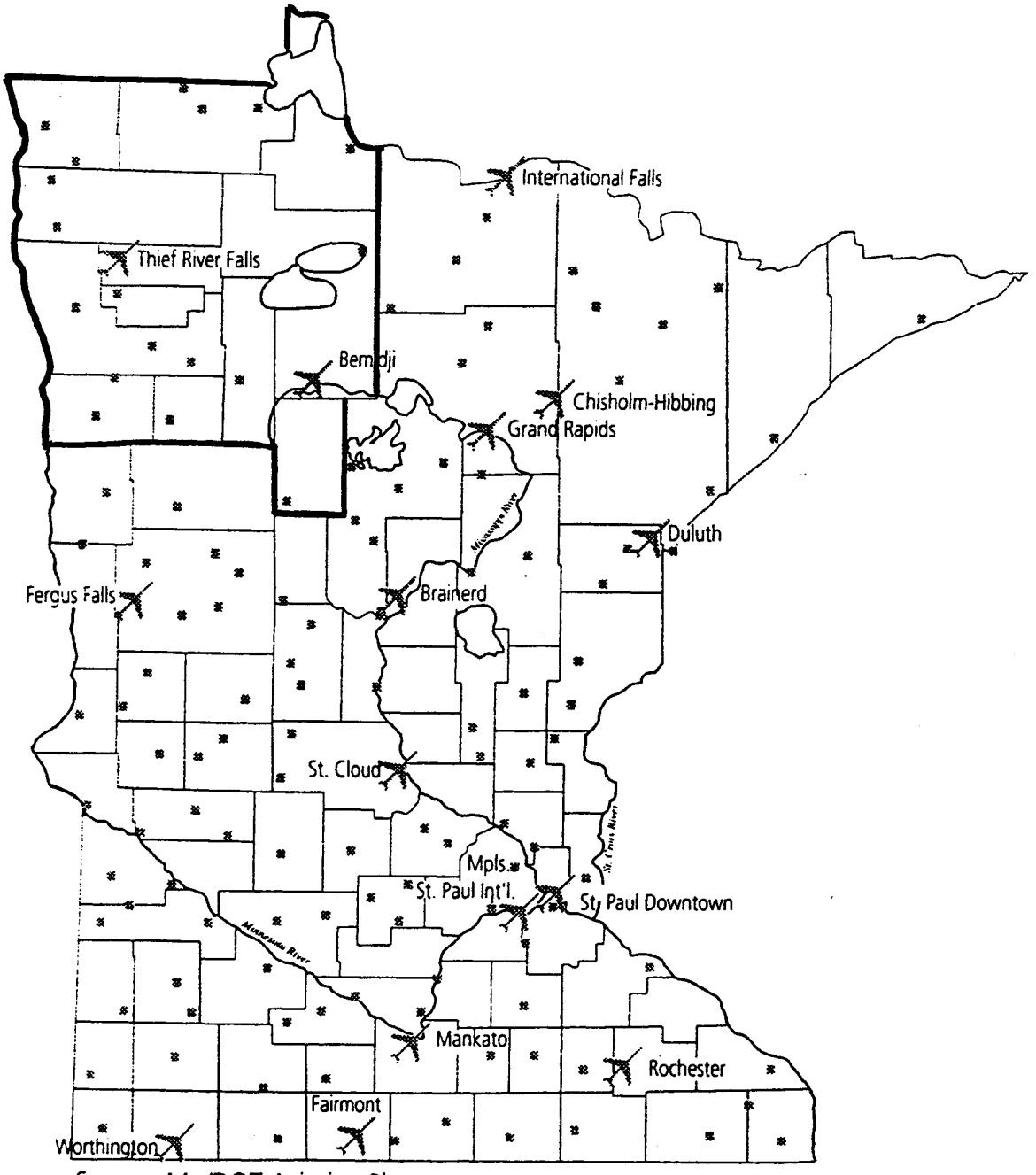


FIGURE 9.3

REGIONAL AIRPORT SYSTEM 1993

10.0 MAJOR FREIGHT GENERATORS

10.1 AGRICULTURAL PRODUCTS

10.1.1 SUGAR BEET PILES

Sugar beet piles distributed throughout the western portion of the region are major generators of truck movements. Piles are strategically located in sugar beet growing areas to minimize travel from the farm to the pile (see **FIGURE 3.1**).

10.1.2 GRAIN ELEVATORS

Grain elevators are a major source of truck and rail movements within the region (see grain elevator locations and capacity listed in **TABLE 3.2**).

10.2 TIMBER

Unlike sugar beets and grain, timber shipments originate over a wide area with shipments traveling directly to a processing or rail transshipment facility. Because of the dispersed nature of these timber cutting areas, a precise mapping of these freight generators is not possible here.

10.3 MANUFACTURING-RELATED COMMODITIES

Major freight generators of manufacturing-related commodities can be identified from the Survey of Manufacturers. Several attempts were made to establish manufacturing employment within each community by SIC classification. However, no satisfactory data source was identified. The Directory of Manufacturers and the Survey of American Business were evaluated as possible data sources. Another possible data source is Dunn and Bradstreet, although a reasonably accurate determination of individual community employment by SIC classification is beyond the scope of this study. Major freight generators by community and SIC classification based upon the survey are listed in **TABLE 10.1**.

TABLE 10.1

MAJOR FREIGHT GENERATORS
(manufacturing-related commodities)

Origin City	Survey Adjusted Truck Tons
Crookston	489,092
East Grand Forks	454,099
Roseau	198,498
Ada	146,087
Bemidji	122,657
Park Rapids	91,578
Bagley	51,684
Thief River Falls	31,294
Solway	19,745
Baudette	17,274
Red Lake Falls	13,556
Grygla	12,923
Warren	12,847
Greenbush	7,494
Cass Lake	5,347
Warroad	4,174
Fosston	3,147
Williams	2,625
Climax	1,564
Clearbrook	1,537
Shelly	1,514
Tenstrike	1,245
Angus	1,243
Beltrami	754
Middle River	684
Gary	454
Blackduck	265
Stephen	250
Hendrum	232
Lake George	217
Erskine	86
Akeley	63
Nevis	57
Lancaster	25
Viking	10

11.0 FREIGHT FLOWS BY VOLUME/TYPE

11.1 HIGHWAY FLOWS

Freight flows on the highway network were developed through the use of a computer-based highway network model. The first step was to estimate flows on highway links in terms of tonnage by commodity type. Using average tonnage per truck, these were converted into numbers of trucks. Survey data suggest approximately 70% of tonnage shipped within the region takes place on trucks with five axles or more, with average tonnage on the order of 20 tons per truck. Where origin and destination data were know, the network model was used to assign trucks to the shortest travel time. Average speeds were assumed for each type of link, with highest speeds on interstate highways and lowest speeds on minor county roads. Where known freight flows and routings were available, these were assigned directly to the highway network. It should be noted that the freight flows estimated in this study refer to loaded trucks only. If all trucks returned empty along identical routes, the actual number of trucks should be doubled. However, since some trucks may return loaded or partially loaded, and routes taken may differ from routes taken by loaded trucks, it is not possible to provide a complete accounting of truck movements on the regional highway network.

11.1.1 IDENTIFICATION OF HIGHWAY NETWORK

The highway network used in the computer model included all federal and state highways, and county roads identified by county engineers as major truck routes. All communities for which origins or destinations were identified in the manufacturers survey or in other data sources were included as centroids on the network. Other communities and roadway junctions were included as connecting nodes. In all, 367 links or centroid connectors, 133 centroids, 16 external nodes, and 250 nodes without delay were included in the highway network model. The regional highway network included in the model is shown in **FIGURE 11.1**.

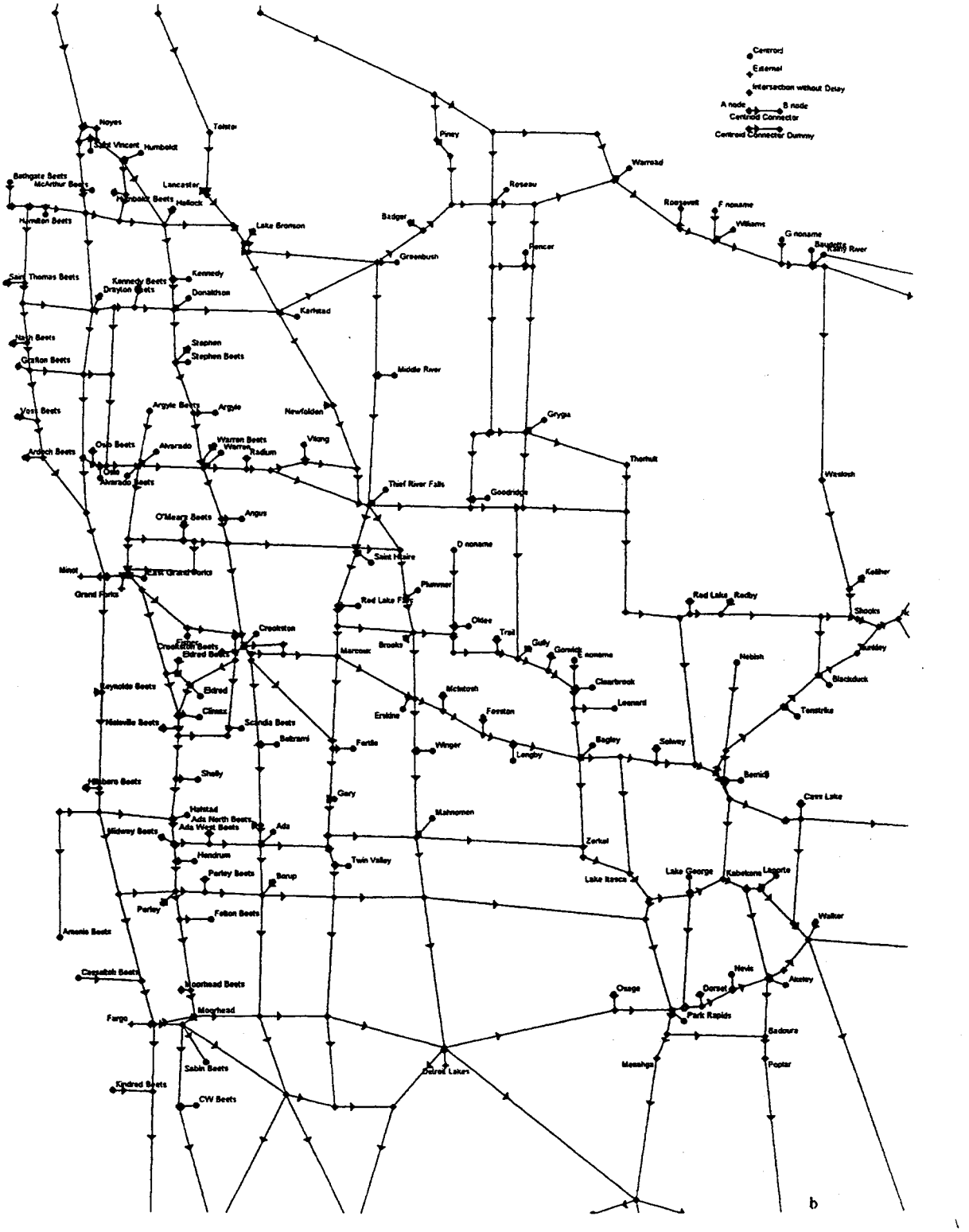


FIGURE 11.1

COMPUTER REPRESENTATION OF REGIONAL HIGHWAY NETWORK

11.1.2 USE OF QRS II MODEL

The transportation analysis software used in this study was the Quick Response System II (QRS II). QRS II is a complete transportation planning software package that includes all steps of transportation planning: Trip Generation, Trip Distribution, Mode Split, and Traffic Assignment. The software package includes the General Network Editor (GNE). GNE is a window-based computer program for analyzing, retrieving and displaying transportation network data. A preliminary investigation was made as to how the model could be used to develop freight trip generation in terms of productions and attractions using economic and employment data; however, the model application in this study was limited to route assignment using an established trip table specifying origins and destinations.

The model was applied in several stages with a review of model outcomes for each stage. Where assigned freight flows deviated from known information, model assumptions were reviewed and modifications made where appropriate. However, no attempt was made to match existing truck counts with the model. A comparison of model output with actual truck counts by Mn/DOT is included in this report in Section 11.1.4.

11.1.3 ASSIGNED FLOWS TO THE HIGHWAY NETWORK (TRUCKS)

Major commodity flow tonnages have been assigned to the regional network. These tonnages have been converted to truck flows using average tons per truck by commodity developed from the manufacturers survey. Truck flows for each of the major commodity types evaluated in this study are presented on the regional network in two forms. The first figure for each commodity shows the truck density by link with heavier lines representing greater numbers of trucks. The second figure for each commodity shows the estimated number of trucks by link. As noted above, these volumes represent loaded trucks only. The lack of assigned trucks on a given link may be due to a number of factors not represented in the model, such as operator route preference, seasonal conditions, and roadway congestion. Data sources for estimating freight flows may not include all shippers, origins, or destinations. Shipments determined from the manufacturers survey were adjusted upward on the basis of county employment as described in Section 6.1. Therefore, shipments or routes not reflected in the survey cannot be reflected in these estimates. Estimation of regional rather than local freight flows is the objective of this study. Therefore, some farm-related flows and wholesale and retail distribution flows are not reflected in these results.

Sugar Beets

The density of sugar beet flows in trucks per year is shown in **FIGURE 11.2.** The concentration of flows in the Red River Valley can be clearly seen. As expected, the flows increase in volume towards the processing plants.

Grain

The density of grain flows in trucks per year is shown in **FIGURE 11.3.** The through flows of grain along US Highway 2 are clearly seen to dominate the grain flows within and through the region. Most of the other flows are towards US Highway 2 and Interstate 94 in the south.

Timber

The density of timber flows in trucks per year is shown in **FIGURE 11.4.** It should be noted that these data represent timber flows related to processing facilities outside of the region. Timber flows inbound to processing locations within the region are reflected in the manufacturing-related commodity flows.

Canada Truck Originations

The density of truck flows originating in Canada in trucks per year is shown in **FIGURE 11.5.** Most of these pass through Pembina and continue on Interstate 29 to the south. Major flows have been assumed to be directed to the south and east.

Manufacturing-Related Commodities

The density of flows related to manufacturing facilities in trucks per year is shown in **FIGURE 11.6.** These flows are distributed more evenly than other commodities throughout the region with increased flows toward the southern portion of the region to major market areas.

Total Flows

The density of total truck flows is shown in **FIGURE 11.7.** The number of trucks by highway link is shown in **FIGURE 11.8.** These show major flows along Interstate 29 (which lies outside of the region) and US Highway 2. All except a limited number of highway links on the network are estimated to carry commodities as can be seen in **FIGURE 11.8.**

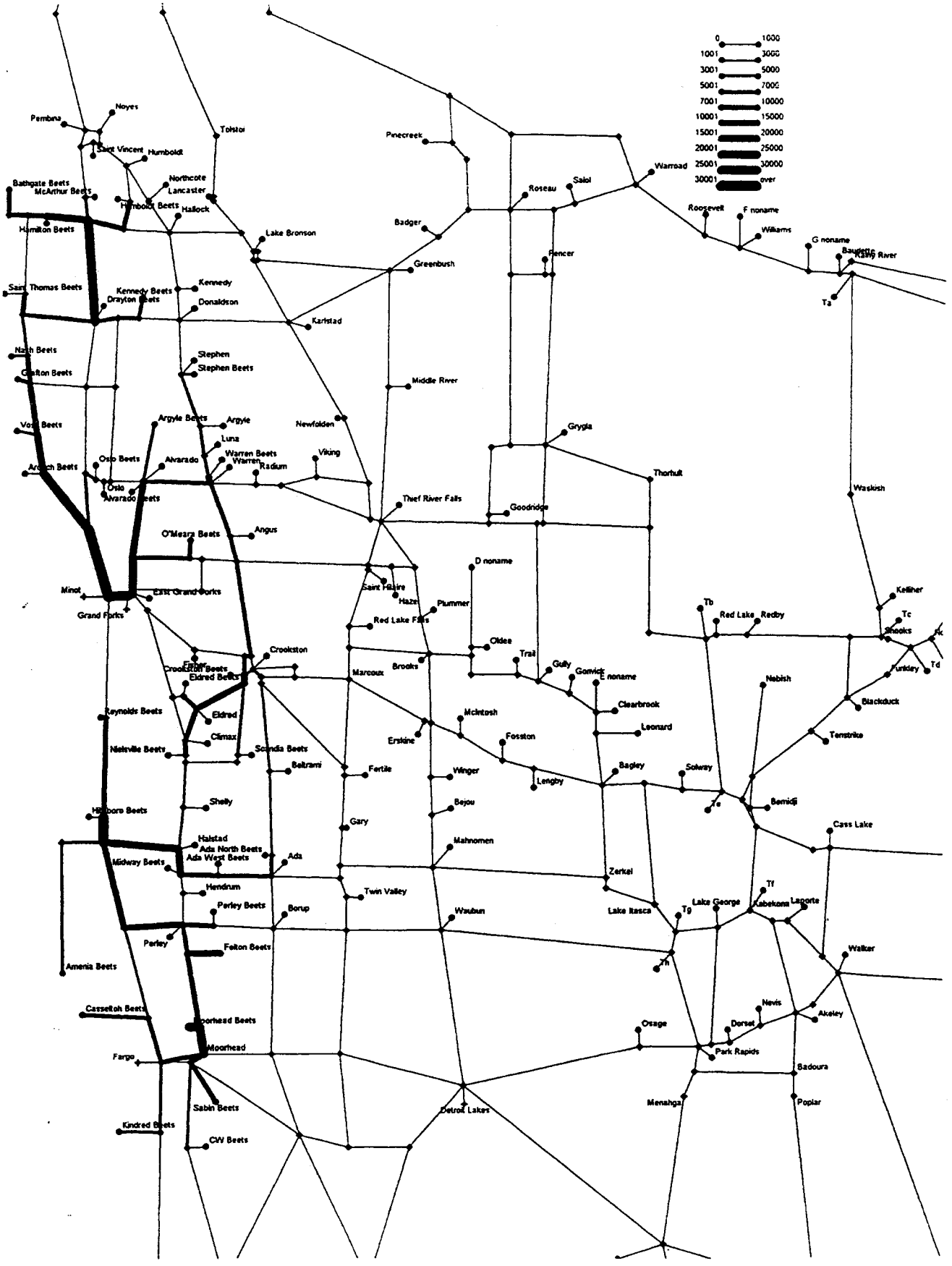


FIGURE 11.2

SUGAR BEET FLOW DENSITY (TRUCKS)

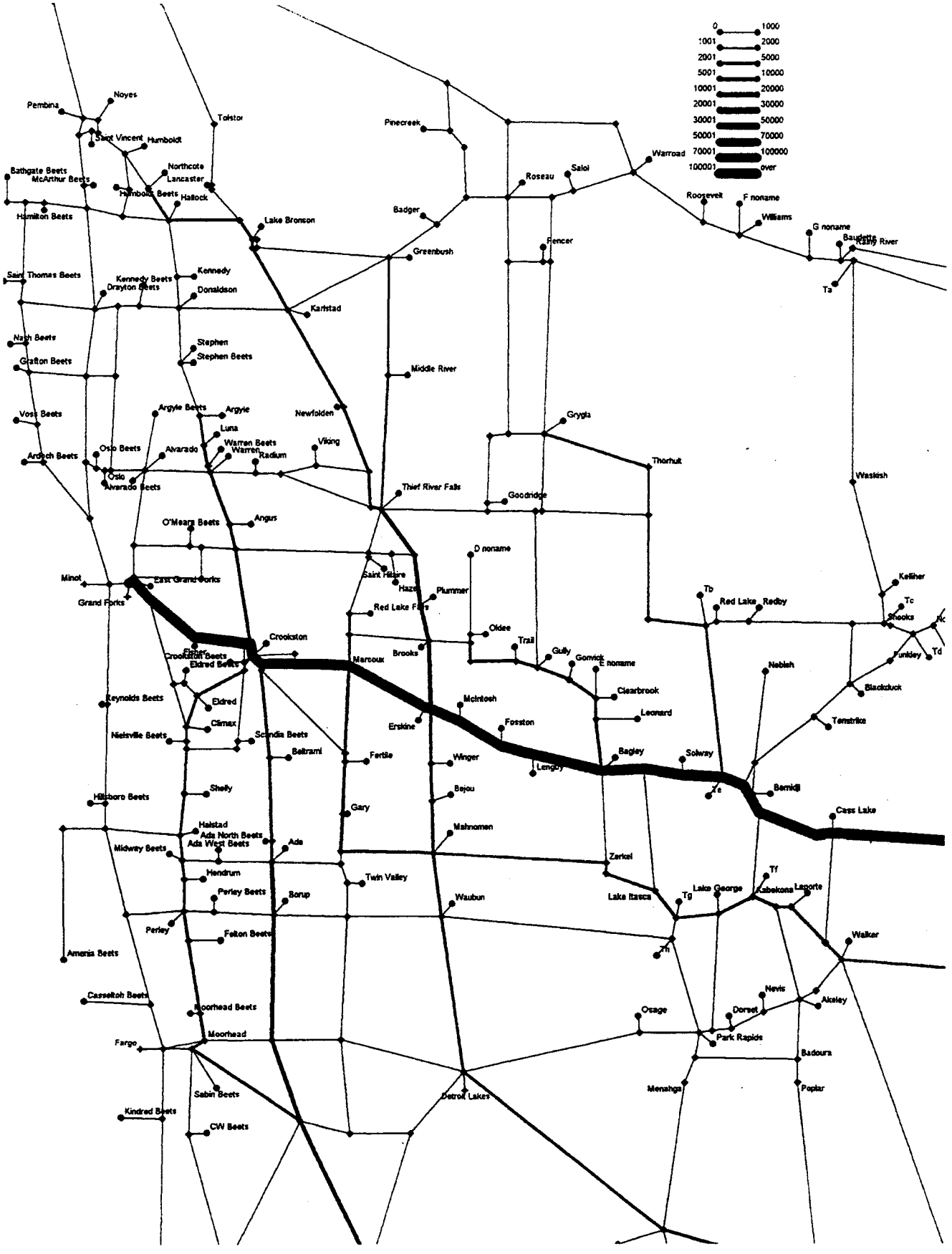


FIGURE 11.3

GRAIN FLOW DENSITY (TRUCKS)

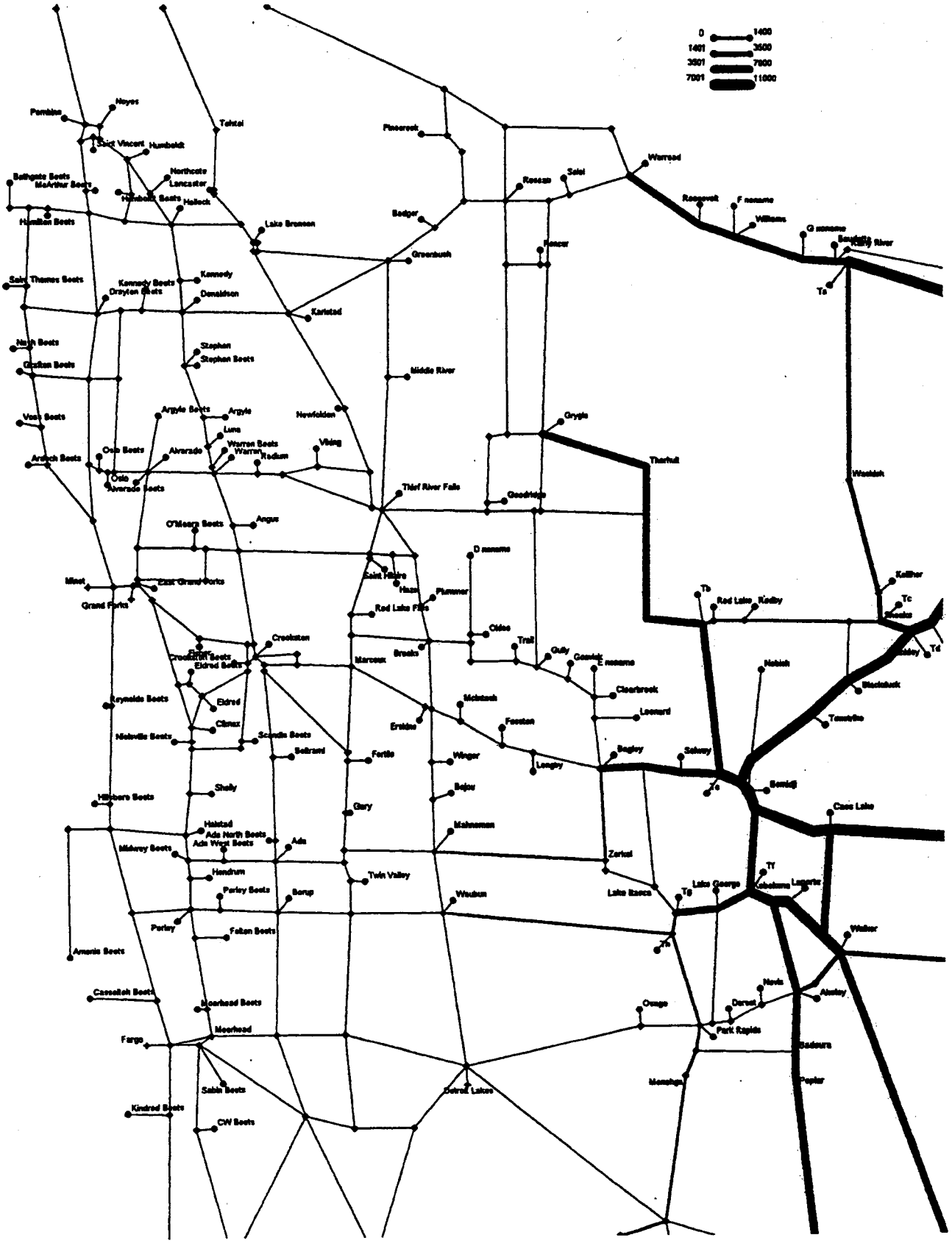


FIGURE 11.4

TIMBER FLOW DENSITY (TRUCKS)

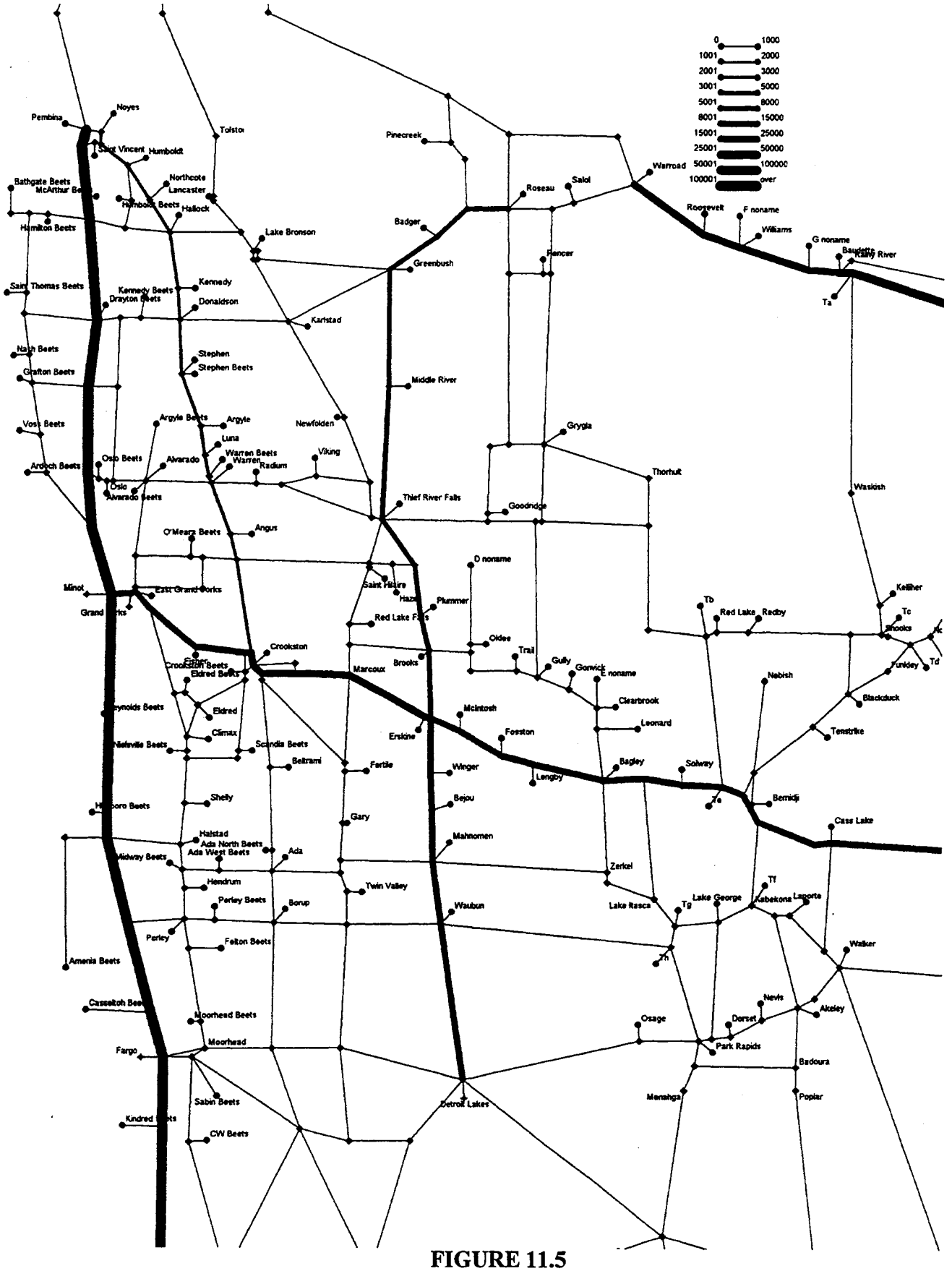


FIGURE 11.5

CANADA ORIGINATION DENSITY (TRUCKS)

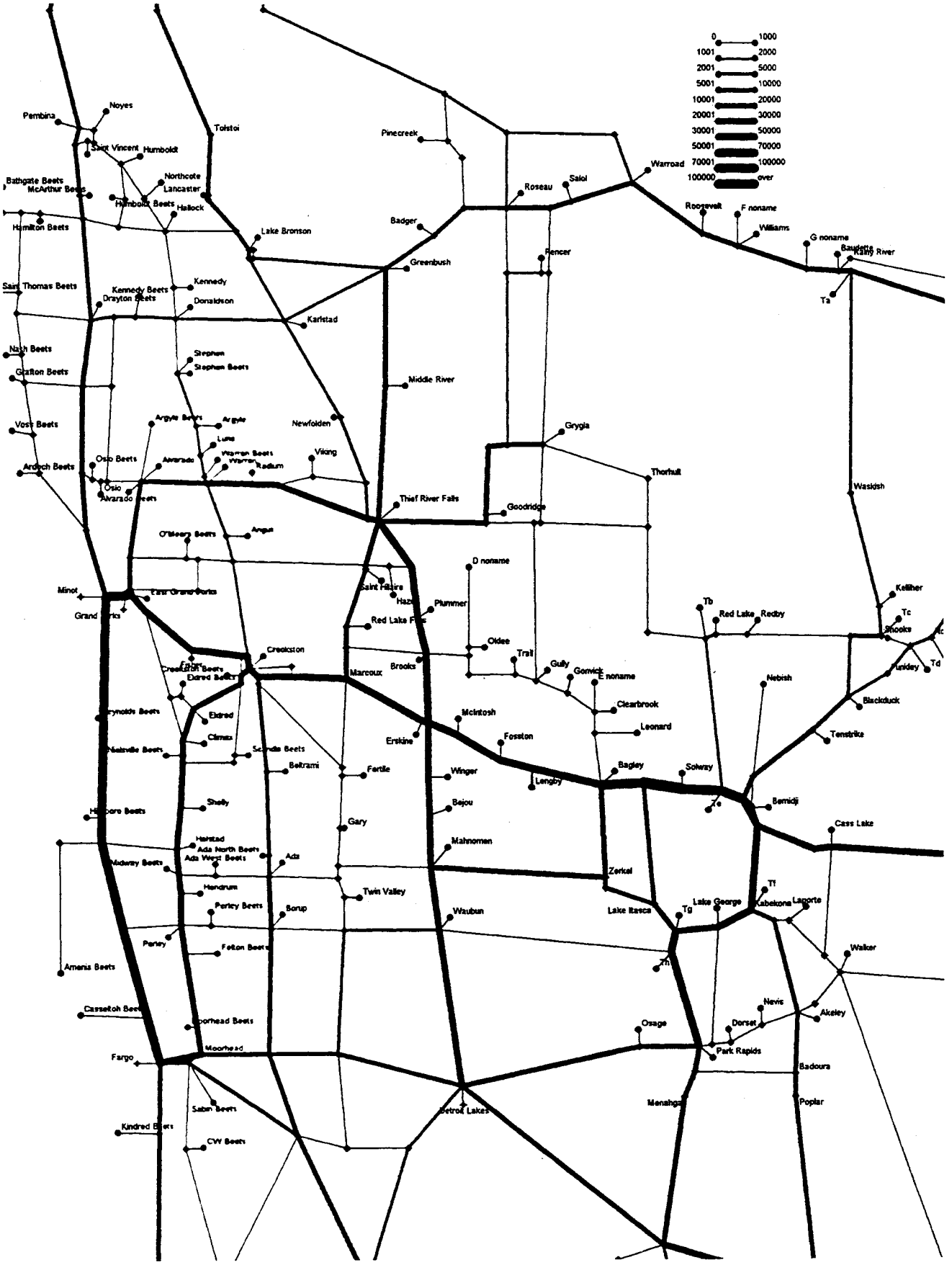


FIGURE 11.6

MANUFACTURED COMMODITY DENSITY (TRUCKS)

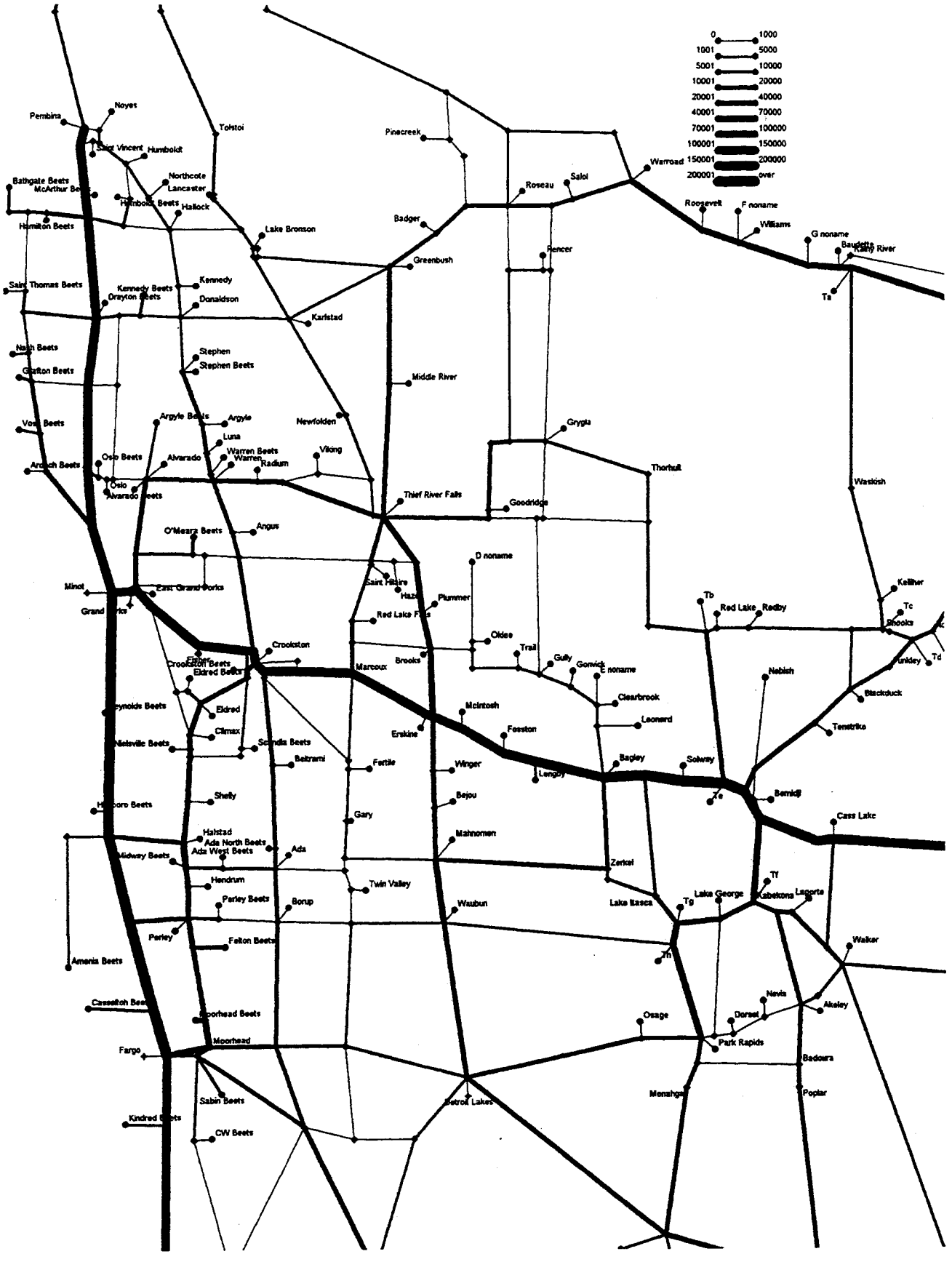


FIGURE 11.7

TOTAL FLOW DENSITY (TRUCKS)

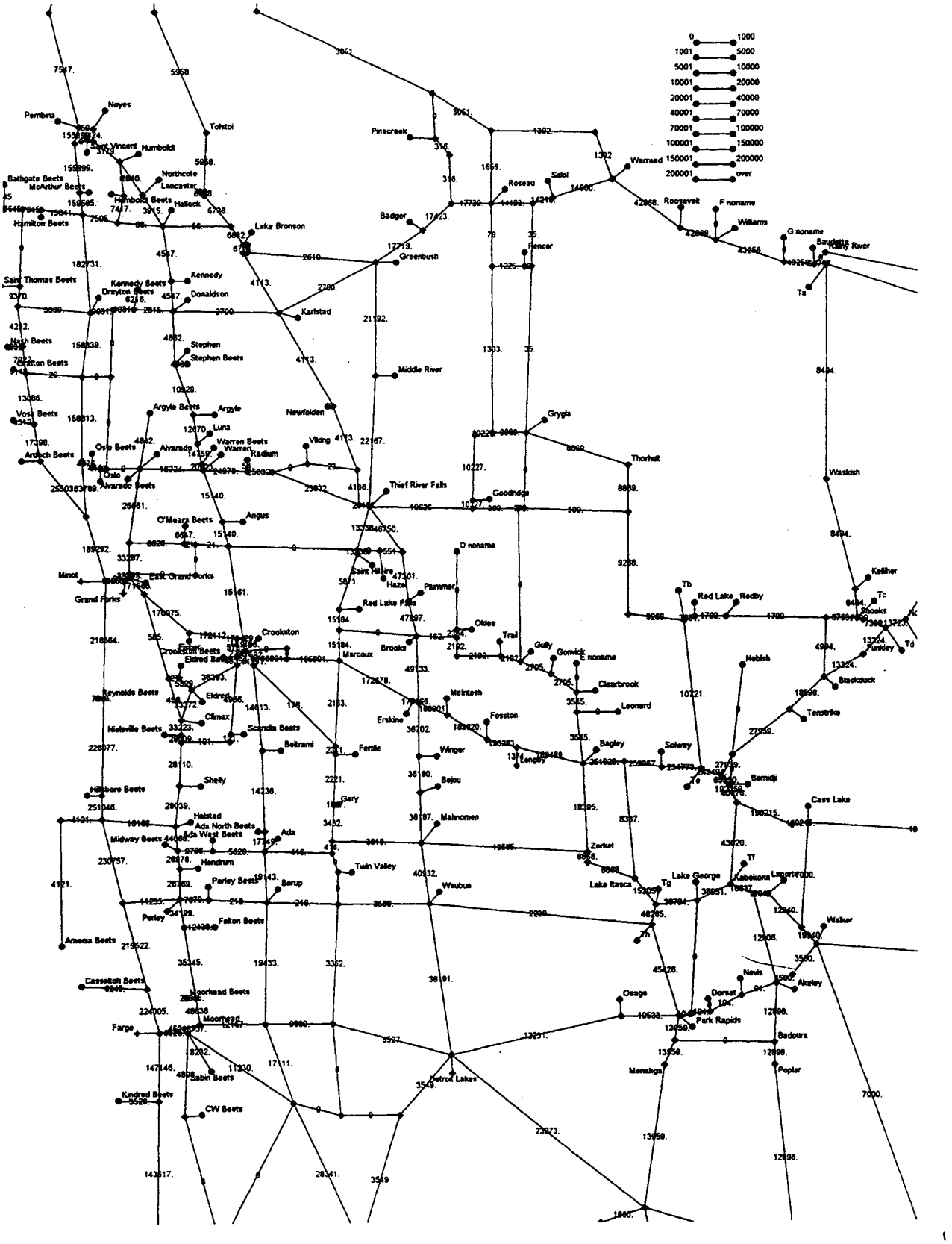


FIGURE 11.8

TOTAL ANNUAL FLOWS (TRUCKS)

Evaluation of Selected Major Links

Total loaded truck flows were estimated on four selected highway links using the loaded-link capability of the QRSII model. These flows, presented in **TABLE 11.1,** are included here to demonstrate the capability of the model in identifying the origins and destinations of (loaded) trucks that are passing a given point. Shown in the table are the A→B (from northwest to southeast) and B→A (southeast to northwest) flows at each of the four points:

- US 2 between MN 220 and Fisher
- US 59 between Thief River Falls and County 3
- MN 11 between MN 72 and US 71
- MN 200 between Mahnomen and MN 92

For example, the largest eastbound volume of loaded trucks on US 2 between MN 220 and Fisher is 109,982 with origin in Grand Forks and destination in Duluth. The largest westbound volume of loaded trucks on this link is 16,356 from Duluth to Grand Forks.

On US 59 between Thief River Falls and County 3, the largest southbound volume of loaded trucks is 7,549 from Roseau to Detroit Lakes. The largest northbound volume on this link is 2,505 from Minneapolis to Greenbush.

On MN 11 between MN 72 and MN 71, the largest eastbound volume of loaded trucks is 20,088 from Warroad to Duluth. The largest westbound volume on the link is 10,092 from Roseau to Duluth.

On MN 200 between Mahnomen and MN 92, the largest eastbound volume of loaded trucks is 6,396 from Mahnomen to Bemidji.

TABLE 11.1

TOTAL TRUCK FLOWS ON SELECTED HIGHWAY LINKS

Highway Link	Origin	Destination	Truck Volume
us2jcts220/<S>Fisher	A ==> B		
	Pembina	Duluth	14800
	St. Thomas Beets	Crookston Beets	355
	Alvarado Beets	Crookston Beets	379
	Oslo	Duluth	300
	Grand Forks	Crookston	2599
		Beltrami	369
		Gary	79
		Ada	138
		Duluth	109982
	Winnipeg	Crookston	1155
		Beltrami	85
		Gary	99
		Ada	8
us2jcts220/<S>Fisher	B ==> A		
	Red Lake Falls	Grand Forks	88
	Crookston	East Grand Forks	10604
		Winnipeg	6017
	Solway	Grand Forks	7542
	Duluth	East Grand Forks	16356
	International Falls	East Grand Forks	2
	Bemidji	Minot	18
us59ThiefRiverFalls/<S>jctc3	A ==> B		
	Lancaster	Duluth	461
		Minneapolis	185
	Badger	Duluth	296
	Lake Bronson	Duluth	41
	Greenbush	Lengby	963
		Detroit Lakes	56
		Duluth	28
		Willmar	236
		Saint Cloud	236
		Minneapolis	1648
	Warroad	Fergus Falls	360
	Roseau	Detroit- Lakes	7549
		Minneapolis	3591
	Middle River	Saint Cloud	38
		Minneapolis	312

TABLE 11.1 (continued page 2 of 3)

TOTAL TRUCK FLOWS ON SELECTED HIGHWAY LINKS

Highway Link	Origin	Destination	Truck Volume
	Radium	Duluth	53
		Minneapolis	1
	Thief River Falls	Bemidji	5937
		Duluth	1985
		Fergus Falls	399
		Willmar	154
		Saint Cloud	143
		Minneapolis	3940
	Winnipeg	Blackduck	104
		Bemidji	870
		Park Rapids	57
us59ThiefRiverFa11s/<S>jctc3	B ==> A		
	Fosston	Thief River Falls	1592
	Tenstrike	Thief River Falls	27
	Bemidji	Thief River Falls	1141
		Winnipeg	2244
	Detroit Lakes	Roseau	1014
		Williams	56
		Thief River Falls	141
	Fergus Falls	Greenbush	1373
	Willmar	Greenbush	124
	Minneapolis	Lancaster	78
		Greenbush	2505
		Roseau	784
		Middle River	190
		Viking,	12
		Thief River Falls	5826
s11jcts72./<S>jctus71	A ==> B		
	Warroad	Duluth	20088
	Salol	Duluth	477
	Roseau	Duluth	2324
	Baudette	Duluth	8354
	Ta (Timber origin a)	International Falls	11000
sll~cts72/<S>~ctus7l	B ==> A		
	Duluth	Warroad	1423
		Roseau	10092
		Baudette	5

TABLE 11.1 (continued page 3 of 3)

TOTAL TRUCK FLOWS ON SELECTED HIGHWAY LINKS

Highway Link	Origin	Destination	Truck Volume
s200lcti29/<S>Halstad	A ==> B		
	Hillsboro Beets	Ada	307
s200jcti29/<S>Halstad	B ==> A		
	Ada West Beets	Hillsboro Beets	3609
	Midway Beets	Hillsboro Beets	6517
	Scandia Beets	Hillsboro Beets	101
	Eldred Beets	Hillsboro Beets	322
	Ada North Beets	Hillsboro Beets	5312
s200Mahnomen/<S>jct,s92Zerkel	A ==> B		
	Gary	Duluth	696
	Ada	Duluth	333
	Mahnomen	Bagley Solway Bemidji	1400 1508 6396
	Detroit Lakes	Clearbrook	168
s200Mahnomen/<S>jcts92Zerke1	B ==> A		
	Solway	Fargo Sioux Falls	502 2514
	Bemidji	Ada	68
sl75Hallock/<S>jctus59	A ==> B		
	Fargo	Lancaster	56

11.1.4 COMPARISON WITH Mn/DOT COUNTS

A comparison of estimated truck movements has been made with the Mn/DOT heavy commercial truck counts discussed in Chapter 7.0. Using data from the manufacturers survey described in Section 6.0, 70% of truck shipments were reported to be over 17 tons. For purposes of this study, it was therefore assumed that 70% of the trucks associated with manufacturing had 5 or more axles. Mn/DOT counting locations where the data were collected were shown in **FIGURE 7.1**.

A comparison between estimated truck flows and Mn/DOT counts by individual highway link is shown in **FIGURE 11.9**. There is reasonable agreement with the heavier traveled links while some significant difference exist on the lesser traveled roadways. However, considering that local trucks and unloaded trucks are not included in the estimation, the estimation of loaded trucks compares favorably with Mn/DOT counts.

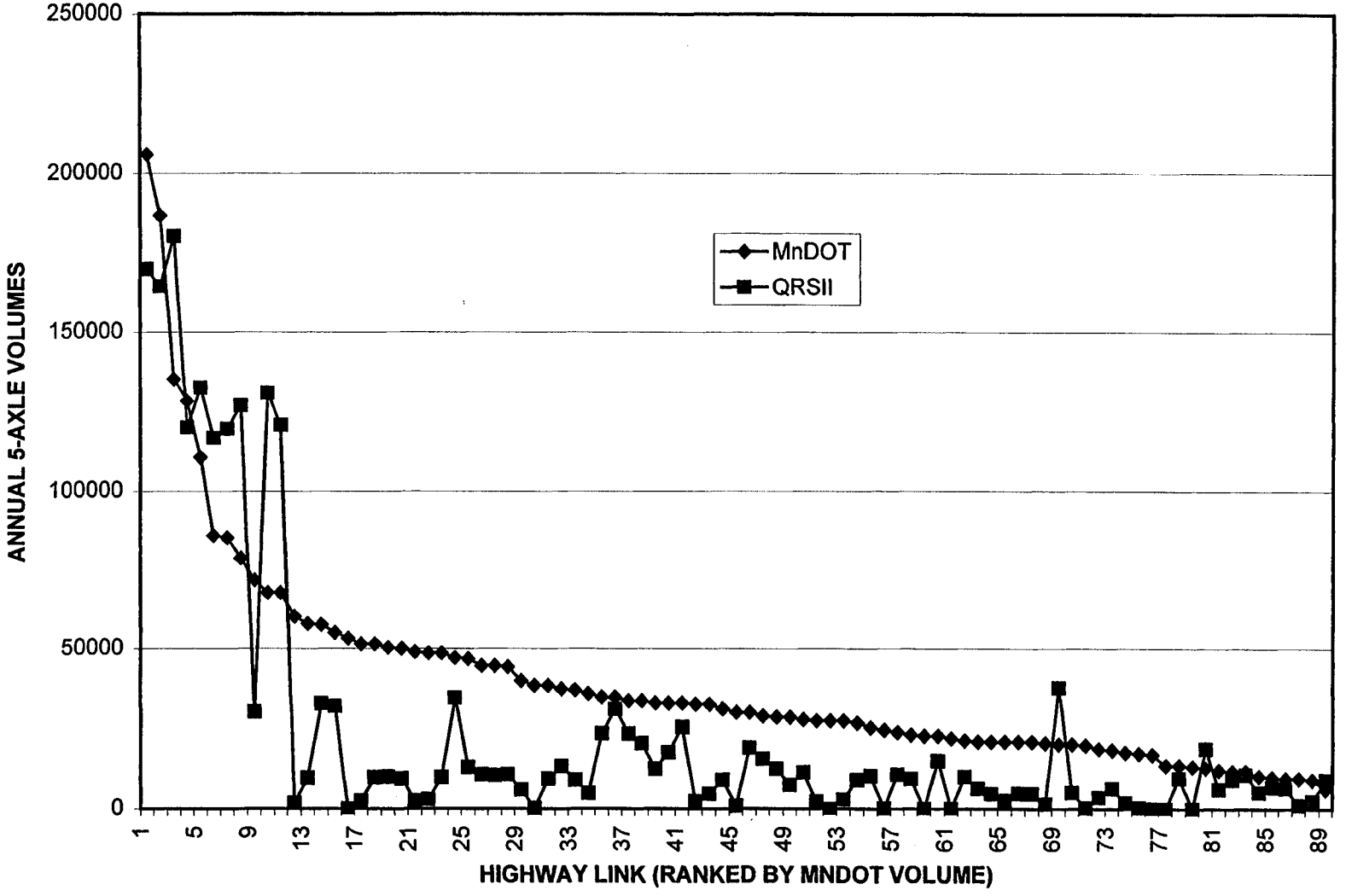


FIGURE 11.9

LINK BY LINK COMPARISON WITH Mn/DOT COUNTS

11.2 RAIL FLOWS

11.2.1 INBOUND FLOWS

TABLE 11.2 presents the largest inbound flows into the region from other states by 2-digit commodity classification.

TABLE 11.2

INBOUND RAIL FLOWS FROM OTHER STATES
(largest shipment within each STCC Commodity group)

STCC	Commodity	Origin State	Tons
1	Agricultural products	North Carolina	2,600
11	Coal	Montana	289,988
14	Non-metallic minerals	Minnesota	102,632
20	Food products	Minnesota	7,260
24	Wood products	Wisconsin	27.560
28	Chemicals/allied products	Florida	35,184
29	Petroleum/coal products	North Dakota	35,040
32	Stone, glass, and clay	Iowa	3,640
33	Primary metal products	Texas	2,840
35	Machinery, ex. metal prod.	Illinois	1,400
42	Empty containers	Illinois	22,400
	Total of all shipments		656,044

11.2.2 OUTBOUND FLOWS

TABLE 11.3 presents the largest outbound flows from the region to other states by 2-digit commodity classification.

TABLE 11.3

OUTBOUND RAIL FLOWS TO OTHER STATES
(largest shipment within each STCC Commodity group)

STCC	Commodity	Destination State	Tons
1	Agricultural products	Minnesota	564,756
14	Non-metallic minerals	North Dakota	314,212
20	Food products	Washington	90,000
24	Wood products	Minnesota	54,108
26	Pulp and paper	Colorado	12,440
28	Chemicals/allied products	Minnesota	11,960
29	Petroleum/coal products	Minnesota	120
32	Stone, glass, and clay	Minnesota	7,960
40	Waste and scrap	Montana	80
	Total of all shipments		2,904,196

11.2.3 THROUGH FLOWS

Through rail flows were not analyzed in detail. A large volume of coal moves through the region from the western coal producing states to the Port of Duluth-Superior for transshipment to Great Lakes destinations. **TABLE 3.5** suggests that at least 350,000 tons of coal flow from North Dakota to Duluth-Superior. Over 13 million short tons of coal were shipped from Montana to the Port of Duluth-Superior in 1995.

In Section 8.1, it was noted that almost 9 million tons of grain move through the region from North Dakota to Duluth-Superior.

11.3 MODAL FLOWS TO/FROM OTHER BEA REGIONS

Estimates of commodity flows into and out of the region were based on Reebie Associates data which includes commodity type, mode uses, and Bureau of Economic Analysis Region (origin or destination)

11.3.1 METHODOLOGY

The United States was divided into five major regions served by major corridors into and out of Northwestern Minnesota. Four major distance categories were evaluated:

- 0-400 miles
- 400-800 miles
- 800-1200 miles
- Greater than 1200 miles

These corridors are shown in **FIGURE 11.10**. The East and Southeast regions would be served by US Highway 2 and routes leading south the Interstate 94. The South region would be served by routes leading to Interstate 94 and then to Interstate 35, as well as routes leading to Interstate 29. The Southwest region would be served by routes leading to Interstates 29 and 94, as well as US Highway 2. The Northwest would be served by US Highway 2 and routes leading to Interstate 94. While this type of information does not clearly identify routes taken into and out of the region, it can supplement the information of external flows developed in this report using other data sources.

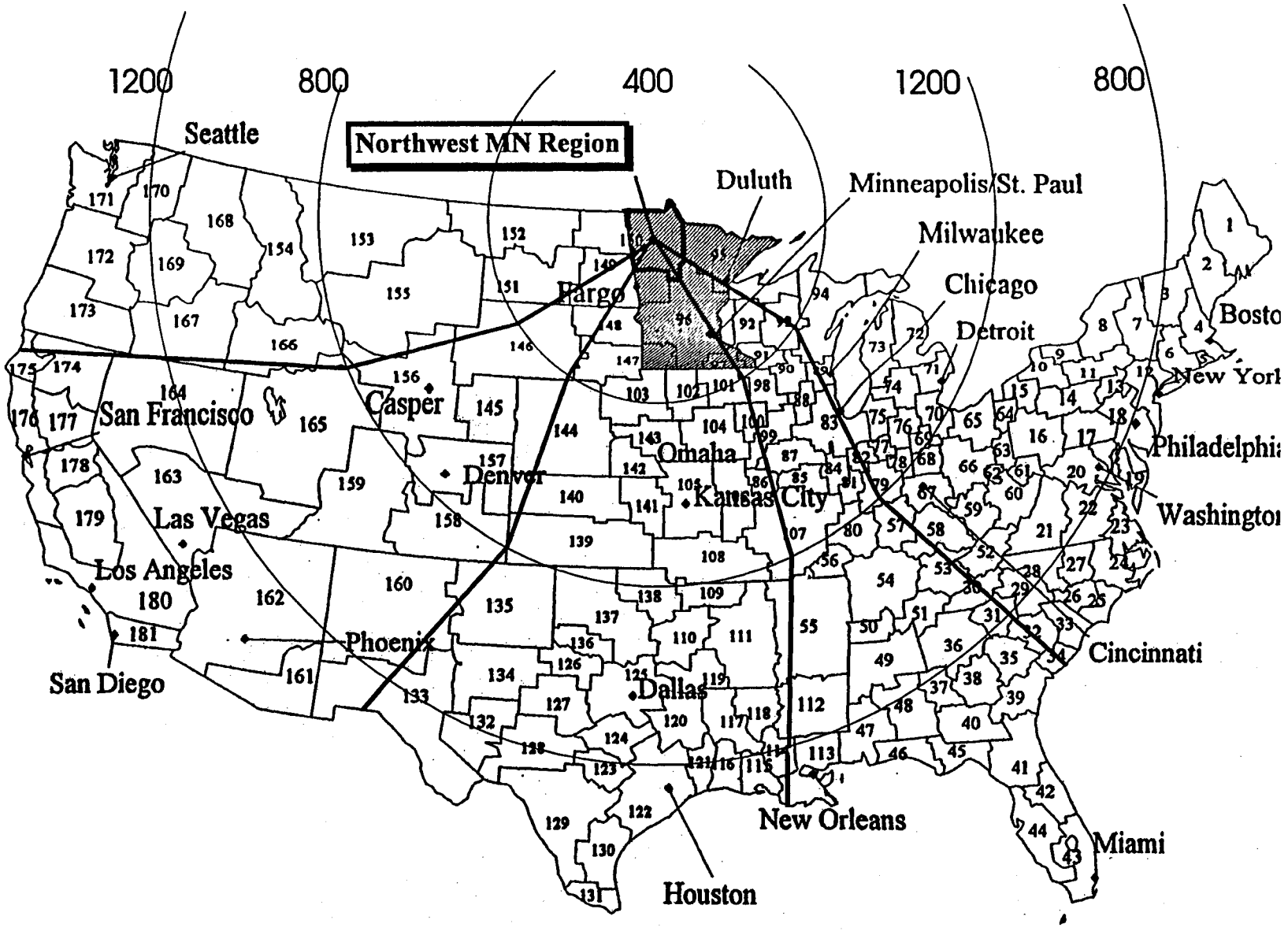


FIGURE 11.10

ASSUMED U.S. REGIONS FOR ORIGINS AND DESTINATIONS

11.3.2 INBOUND FLOWS

An example of inbound flows from the eastern corridor between 0 and 400 miles is included as **TABLE 11.4.** STCC 32 (stone, clay, glass) is the largest inbound commodity and is dominated by private trucks. STCC 24 (wood products) is the next largest commodity with contract and private trucks each carrying a similar amount. Rail carload plays a larger role than trucks for STCC 20 (food products) in this near corridor to the east.

11.3.3 OUTBOUND FLOWS

An example of outbound flow to the eastern corridor between 0 and 400 miles is include as **TABLE 11.5.** This clearly emphasizes the (through) coal shipments (STCC 11) to Duluth-Superior and the movement of (industrial) minerals to the east. Wood product shipments (STCC 24) by rail and glass/stone/clay products (STCC 32) by private and contract truck are also significant.

TABLE 11.4

INBOUND FLOWS FROM THE EAST
(0-400 MILES)

STCC	Rail Carload	Rail Intermodal	Contract Truckload	LTL	Private Truck
1	2400	0	0	0	0
11	7360	0	0	0	0
20	6200	0	4022	9	2208
22	0	0	154	20	264
23	0	0	0	0	24
24	9000	0	18070	5	22821
26	0	0	2797	23	253
27	0	0	52	6	98
28	0	0	0	0	61
29	0	0	0	1	0
30	0	0	23	10	42
32	3920	0	59512	138	276034
33	0	0	302	0	146
34	0	0	77	3	74
35	0	0	0	0	16
36	0	0	569	163	149
37	0	0	62	2	393
39	0	0	10	5	0
50	0	0	1863	70	2170
TOTAL	28880	0	87513	455	304753

Standard Transportation Commodity Codes (STCC)

1	Farm Products (grain, oilseeds)
9	Fresh Fish or Marine Products
10	Metallic Ores
11	Coal
13	Crude Petroleum, Natural Gas, Gasoline
14	Nonmetallic Minerals Exc. Fuels
19	Ordnance
20	Food or Kindred Products
21	Tobacco Products
22	Textile Mill Products
23	Apparel or Other Finished Textile Products
24	Lumber or Wood Products Exc. Furniture
25	Furniture or Fixtures
26	Pulp, Paper or Allied Products
27	Printed Matter
28	Chemicals or Allied Products
29	Petroleum or Coal Products

30	Rubber or Misc. Plastics Products
31	Leather or Leather Products
32	Clay, Concrete, Glass or Stone Products
33	Primary Metal Products
34	Fabricated Metal Products
35	Machinery Exc. Metal Products
36	Electrical Machinery, Equipment or Supplies
37	Transportation Equipment
38	Instruments, Photo, Optical Goods, Clocks
39	Misc. Products of Manufacturing
40	Waste/Scrap Not Identified by Industry
41	Misc. Freight Shipments
42	Containers, Carriers or Devices, Empty
43	Mail, Express or Other Contract Traffic
46	Misc. Mixed Shipments
47	Small Packaged Freight Shipments
48	Waste Hazardous Materials

TABLE 11.5

OUTBOUND FLOWS TO THE EAST
(0-400 MILES)

STCC	Rail Carload	Rail Intermodal	Contract Truckload	LTL	Private Truck
1	153036	0	861	0	386
10	2354	0	0	0	0
11	4252436	0	0	0	0
20	0	1680	1098	4	1910
22	0	0	112	25	221
23	0	0	0	9	0
24	43580	0	8288	4	18609
25	0	0	0	1	0
26	6300	0	124	1	14
27	0	0	8	1	152
28	0	0	136	7	805
29	0	0	1155	2	1413
30	0	0	0	0	98
32	0	0	4838	7	24282
33	0	0	0	0	278
34	0	0	108	38	225
36	0	0	0	1	0
37	840	0	1575	0	1074
38	0	0	0	0	18
39	0	0	9	3	0
40	1440	0	0	0	0
50	0	0	2761	61	8499
TOTAL	4459986	1680	21073	164	57984

12.0 SIGNIFICANT FREIGHT CORRIDORS (BY VALUE)

Significant freight corridors have been identified by the value of commodity shipped along each corridor. The value shipped is derived from truck movements derived above, which have been converted to value using data developed in this study. The average tonnage carried by a truck in each of the major commodity classes has been multiplied by the value per ton for truckload shipments (LTL shipments are not specifically addressed in this study).

The individual links have been ranked according to total value. Several figures are included here to provide some insights into the relative importance of highway links when value is used as a measure.

FIGURE 12.1 shows the top ranking links on the highway network representation shown in **FIGURE 11.1** which includes I-29 running just west of the region. It can be seen in this figure that the major values move on interstate highways and US Highway 2. It should be emphasized that freight shipments on I-29 are much larger since only value identified in this study are included. Most of the goods moving on these segments consist of transshipments from Canada or manufactured goods, with the exception of major grain shipments through the region on US Highway 2.

FIGURE 12.2 shows links with intermediate values, with manufacturing-related shipments dominating these links. Most of these links are US highways with the exception of some state highways including Minnesota 197 and Minnesota 11.

FIGURE 12.3 shows links with lower values (from $50 million to $200 million). Shipments associated with manufacturing dominate all of these links Shipments of grain and beets can be identified but are small relative to the manufacturing-related shipments.

FIGURE 12.4 shows value density on the regional highway network. This is similar to the map of tonnages because of the dominance of manufacturing-related shipments. However, the most significant corridors by value can be clearly identified in the figure. These include interstates, US highways, and Minnesota Trunk Highways with a small number of county roads.

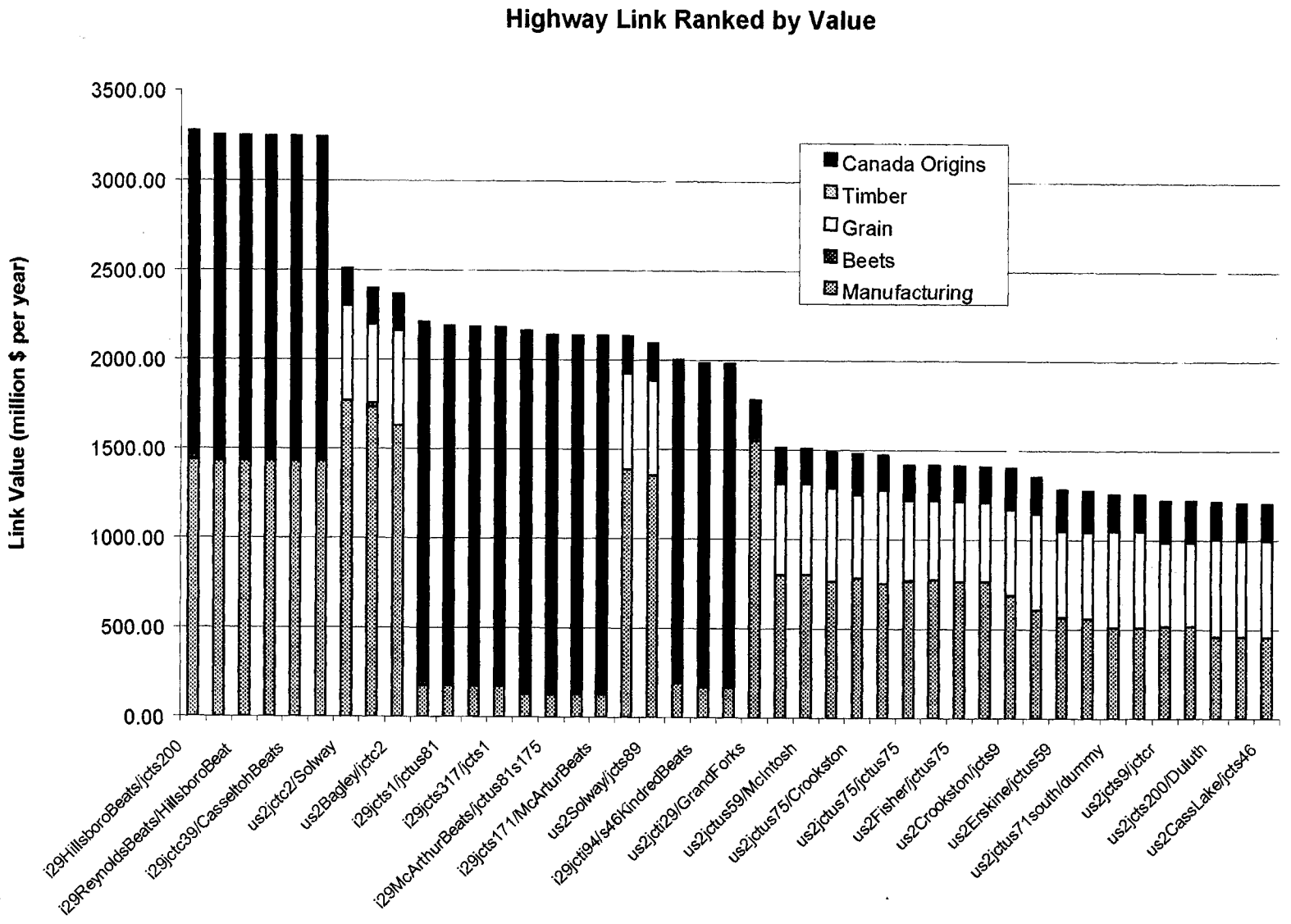
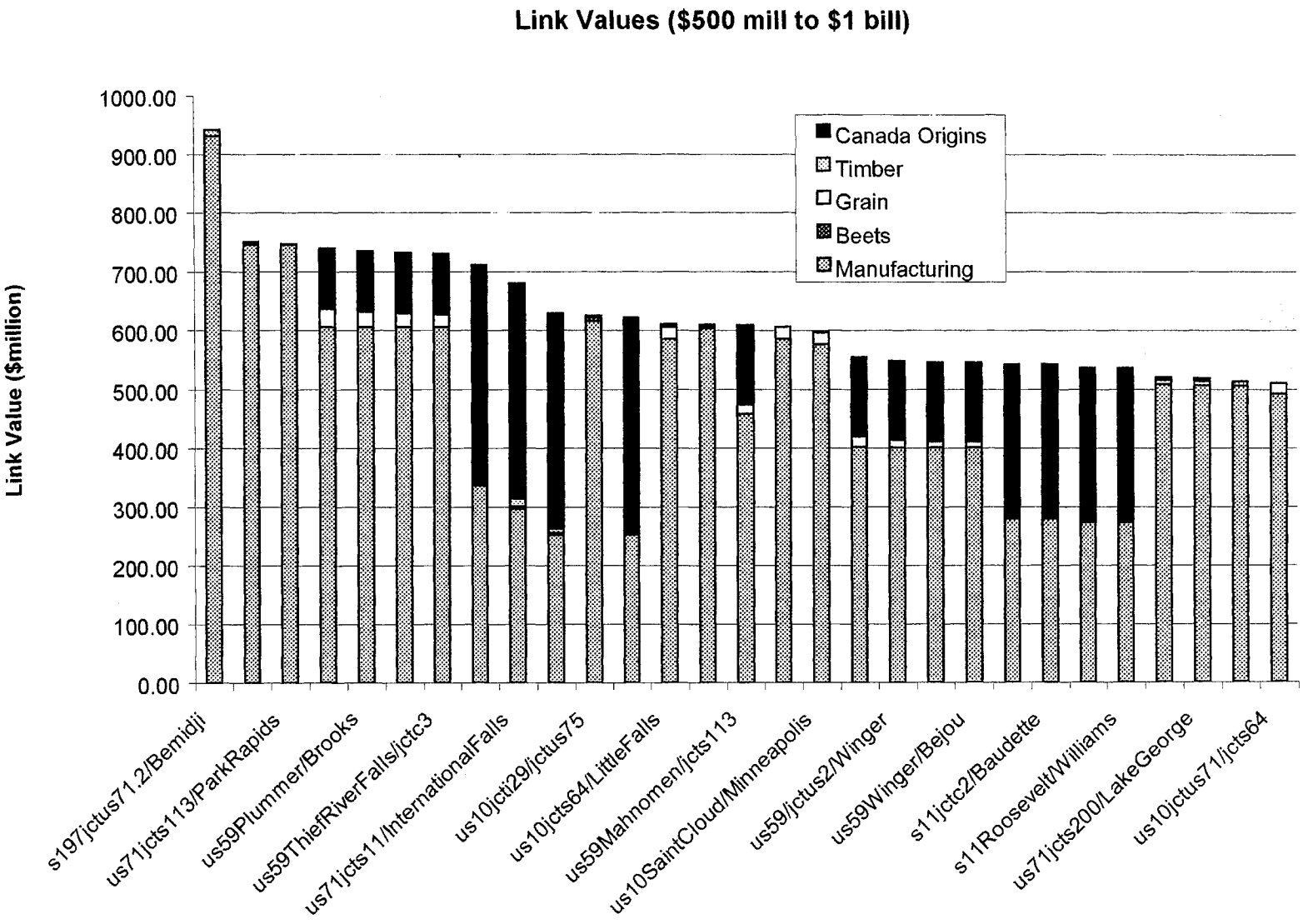


FIGURE 12.1

HIGHWAY LINKS WITH SHIPPED VALUE (GREATER THAN $1 BILLION)



FIRURE 12.2

HIGHWAY LINKS WITH SHIPPED VALUE ($500 MILLION TO $1 BILLION)

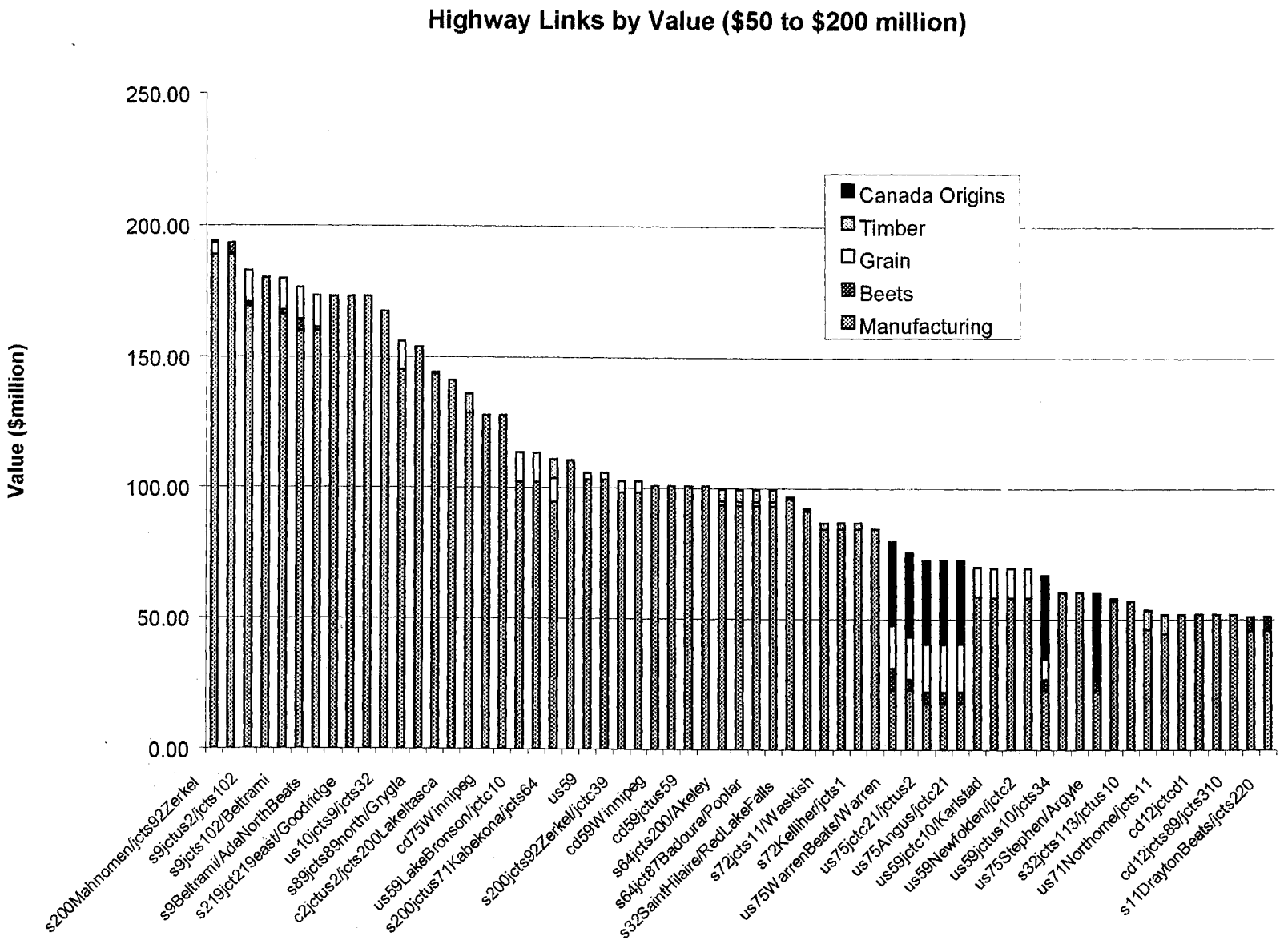


FIGURE 12.3

HIGHWAY LINKS WITH SHIPPED VALUE ($50 TO $200 MILLION)

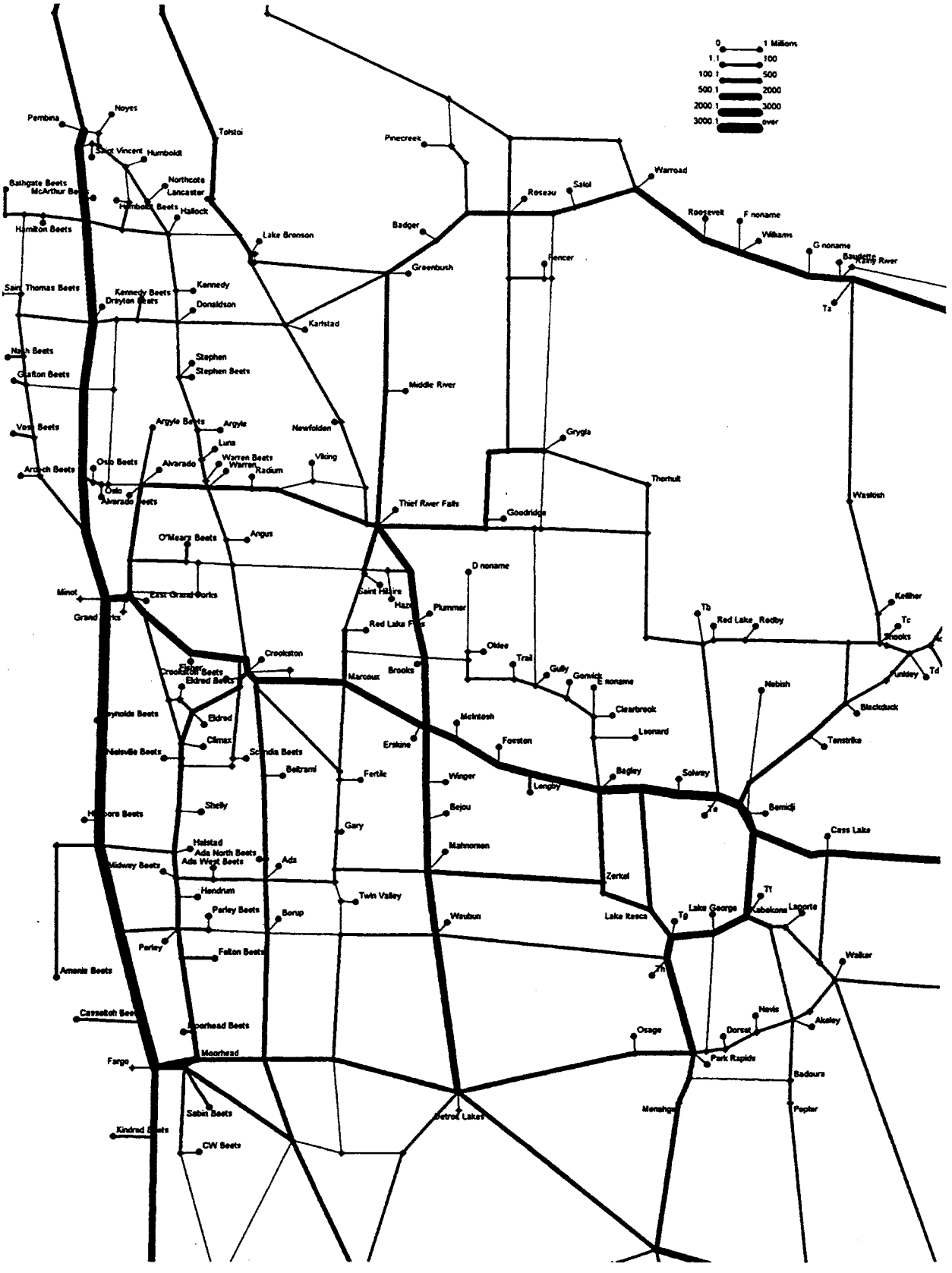


FIGURE 12.4

SIGNIFICANT FREIGHT CORRIDORS BY TOTAL VALUE SHIPPED
(Million $)

These corridors are consistent with the map of significant CSAH freight routes prepared by the Northwest Regional Development Commission as shown in **FIGURE 12.5**. An outcome of this study, however, is the knowledge of commodity type, weight and value as well as the origins and destinations of these commodities. This type of information can be used in conjunction with benefit/cost studies on identifying and targeting highway maintenance and investment funds in the future.

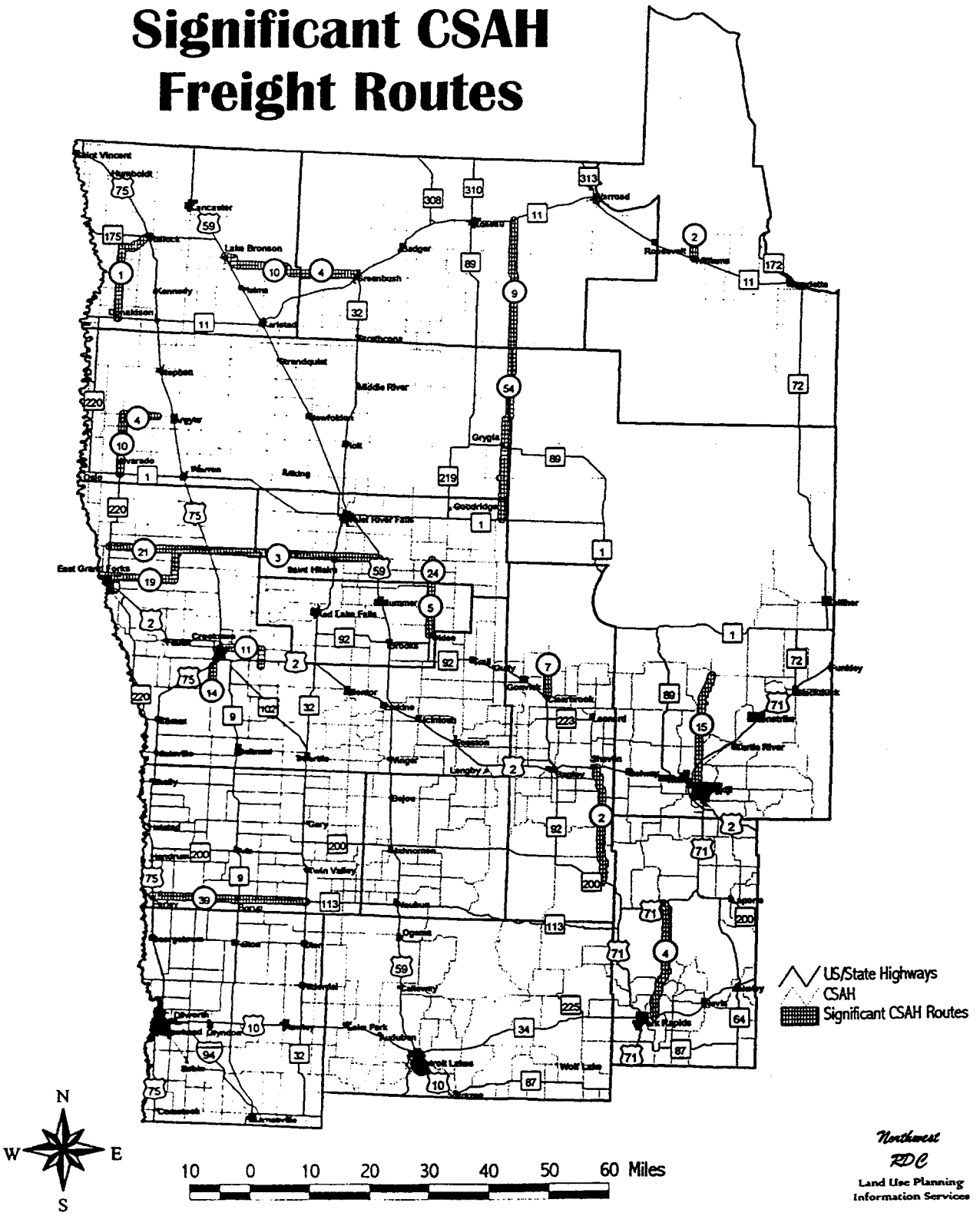


FIGURE 12.5

SIGNIFICANT CSAH FREIGHT ROUTES