5.0 Grain Car Consolidation Facility Impact Analysis

5.1 INTRODUCTION

From the time large grain consolidation facilities made their appearance in the State, Montana rail planning documents noted that the emergence of these facilities represented a significant technological shift in transportation. "Shuttle elevators" are very large grain elevators designed for movement of trainloads of grain directly from elevator to port. They generally have sufficient track and equipment capacity to fill 110-car trainloads within 15 hours; and have greater grain storage capacity. They are significantly larger and more efficient than prior grain elevator systems. The increasing prominence of shuttle elevators in Montana is part of a national trend toward consolidation of grain loading facilities.

This section begins with a description of Montana's wheat industry as it relates to transportation. Truck-to-rail gain transfer facilities are then described, and the section concludes with a discussion of overall impacts of shuttle facilities.

5.2 GRAIN PRODUCTION AND SHIPPING TRENDS

As shown in Table 5.1, wheat far exceeds all other international export categories from Pacific Northwest ports in terms of value, with $410.4 million in 2006 (31.6 percent of total exports). The 2006 export volumes were more than 24 percent higher than the previous year. For the purposes of this study, the term "wheat" refers to all classes produced in Montana, of which there are five major classifications: Hard Red Winter, Hard Red Spring, Hard White, Durum, and Soft White.

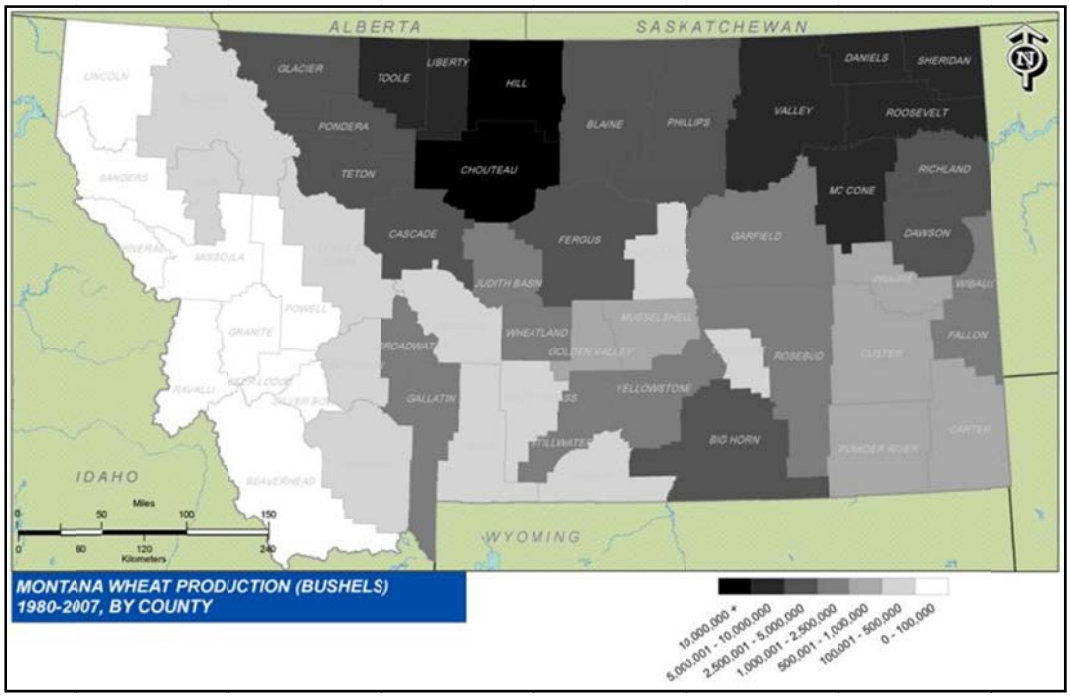
Figure 5.1 shows where wheat is produced in the State, showing total wheat production by county over the 27-year period from 1980 to 2007. This aggregate view normalizes annual totals which may vary according to weather patterns (most Montana wheat production is non-irrigated). The production patterns in the northern half of the State coincide roughly with the high-capacity BNSF Hi-line route. The location of grain consolidation facilities will generally follow this production geography.

Table 5.1 Montana International Exports by Product
2006

Exports	Dollar Value	Percent of Export Value	Percent Change 2005-2006
Total Montana Exports	$1.297 billion	–	24.5%
Wheat	*$410.400 million*	*31.64%*	*24.1%*
Inorganic Chemicals	$192.500 million	14.84%	96.7%
Industrial Machinery	$185.900 million	14.33%	15.2%
Ores, Slag, and Ash	$73.300 million	5.65%	-35.6%
Paper and Paperboard	$39.600 million	3.05%	12.7%
Wood and Wood Products	$32.600 million	2.51%	-0.6%
Live Animals	$2.900 million	.22%	95.4%

Source: Montana CEIC/Montana Agricultural Statistics Services and WISER Origin of Movement 2006. Available at: www.exportmontana.com.

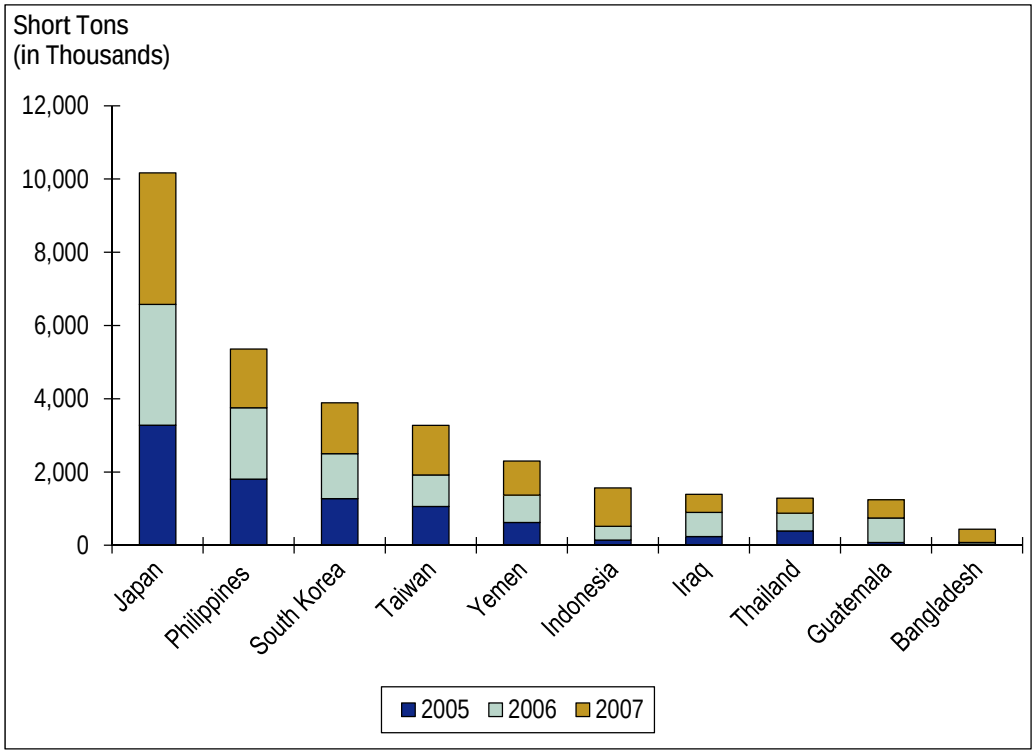
Figure 5.1 Wheat Production by County
1980 to 2007



Montana Grain Flows

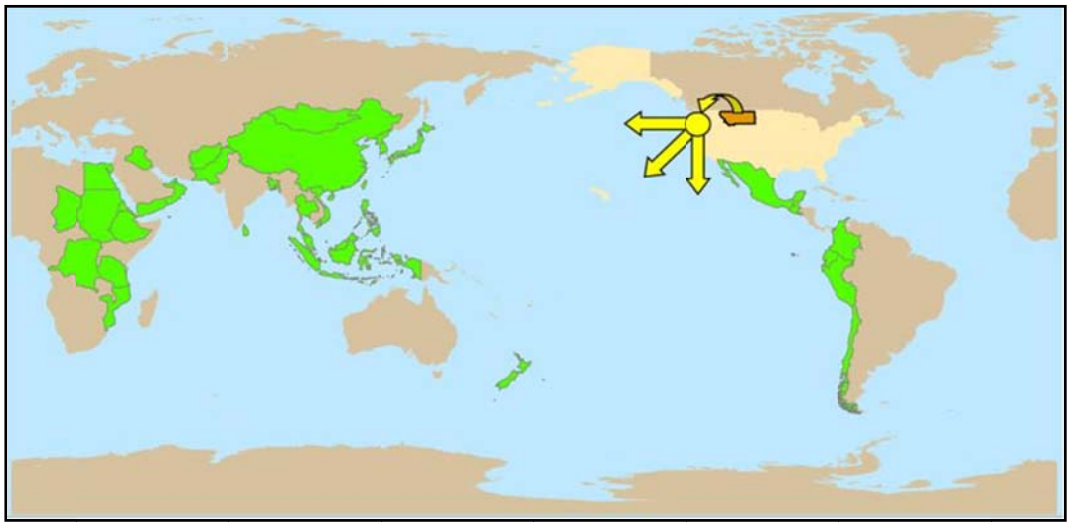
The vast majority of Montana wheat is shipped by rail to Pacific Northwest (PNW) Port terminals in the Portland area. At the terminal, typically Montana wheat is mixed with wheat from other parts of the country to achieve specified protein levels for the purchaser of the grain. Where the wheat is finally shipped from the port varies depending on a number of factors, such as the changing food consumption patterns of Asian populations with increasing disposable income (more pastries than noodles) and whether the grain is bound for mills and value added manufacture or just for milling. Recently, the Pacific Rim countries have been prominent buyers of Montana wheat. Figure 5.2 shows the top 10 destination countries for wheat shipped from Portland seaports in 2005-2007. Japan is the largest, importing more than 10 million short tons. The Philippines, South Korea, and Taiwan are the next leading wheat importers.

Figure 5.2 Wheat Exports from Pacific Northwest Ports
2005 to 2007



The map in Figure 5.3 shows global wheat exports from PNW ports in the 2005 to 2007 period. The map shows that wheat from this region flows to Asia, Africa, Central, and South America.

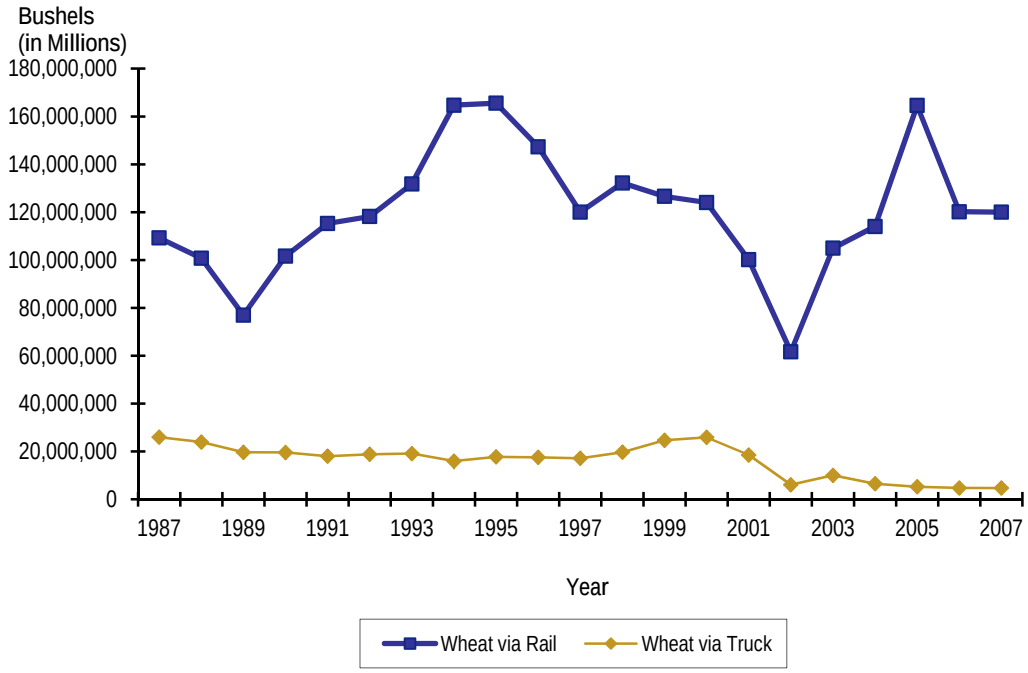
Figure 5.3 PNW Wheat Distribution
2005 to 2007



Source: U.S. Department of Commerce, Bureau of the Census.

Transportation mode options for wheat shippers depend on a variety of factors, including production, weather, market prices, rail car supply, and rail transport rates. Since wheat production is dependent on precipitation, wheat production and shipments fluctuate. Figure 5.4 depicts grain shipments by rail and truck from 1987 to 2007. Rail shipments of wheat varied: in the 1989 to 1995 period, wheat shipments by rail doubled; then declined by a similar amount between 1995 and 2002; then again doubled between 2002 and 2006. These volumes correspond generally to statewide crop production. This variability poses operational challenges to carriers that allocate rail cars to producers and shippers. Grain growers and railroads communicate carefully about crop production estimates and transport needs.

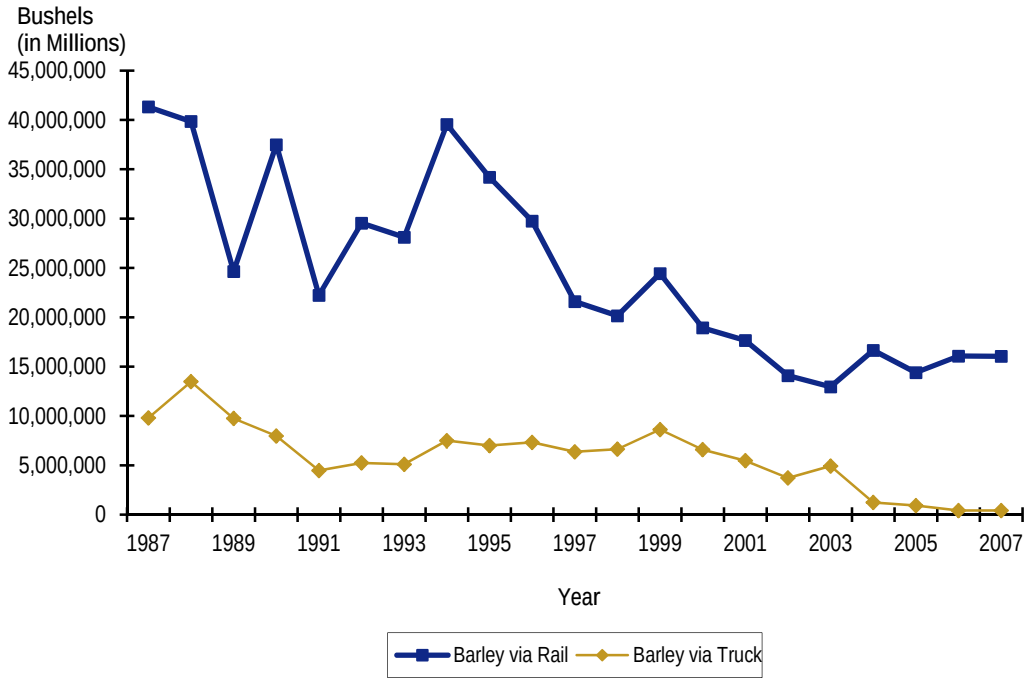
Figure 5.4 Montana Wheat Shipments by Mode
1987 to 2007



Source: Montana Wheat and Barley Committee. Available at: http://wbc.agr.mt.gov/Buyers_Processors/industry_book.html.

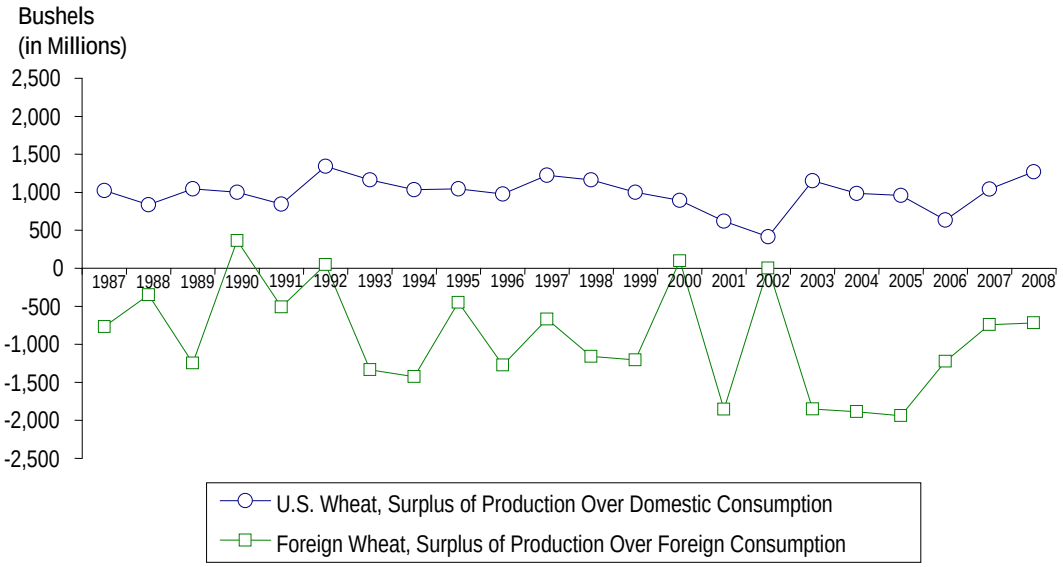
By volume, Montana's barley crop is much smaller than wheat. Barley shipments by both rail and truck (Figure 5.5) declined over the 1987 to 2007 period. The 20-year trend in barley shipping by rail declined, and shipments by truck tapered off to nearly nothing after 2004, as cattle feed markets for barley substituted other grain stocks.

Figure 5.5 Montana Barley Shipments by Mod
1987 to 2007



The U.S. has historically been a major global supplier of wheat. Figure 5.6 identifies wheat supply and demand for the United States and the world. This has a couple of key implications: 1) for the past 20 years, U.S. supply has consistently exceeded domestic demand, creating a basis for U.S. wheat exports, and 2) the world supply is less consistent at meeting demand, with several recognizable downturns over this 20-year period. Given these trends, it is expected that foreign markets will continue to demand American wheat.

Figure 5.6 Wheat Excess Supply Over Demand, U.S. and Foreign
1987 to 2007



Source: Montana Wheat and Barley Committee/MASS. Available at: http://wbc.agr.mt.gov/Buyers_Processors/Production_reports/usallwheat_supplydemand_bu.pdf.

5.3 110-CAR GRAIN SHUTTLE FACILITY ROLE IN DISTRIBUTION

Grain shuttle facilities – large grain elevators designed to load 100- to 110-car trainloads quickly – are playing an increasingly important role in the distribution of Montana grain. Their emergence and increasing prominence represents a technological shift that affects Montana farmers, grain elevator operations, short-line and larger railroad operators, and the State's roadway system. Other factors also affecting the movement of grain from producers to consumers include: farm to elevator truck movements, fluctuations in grain prices, rail car availability, elevator capacity, port congestion, and ship availability.

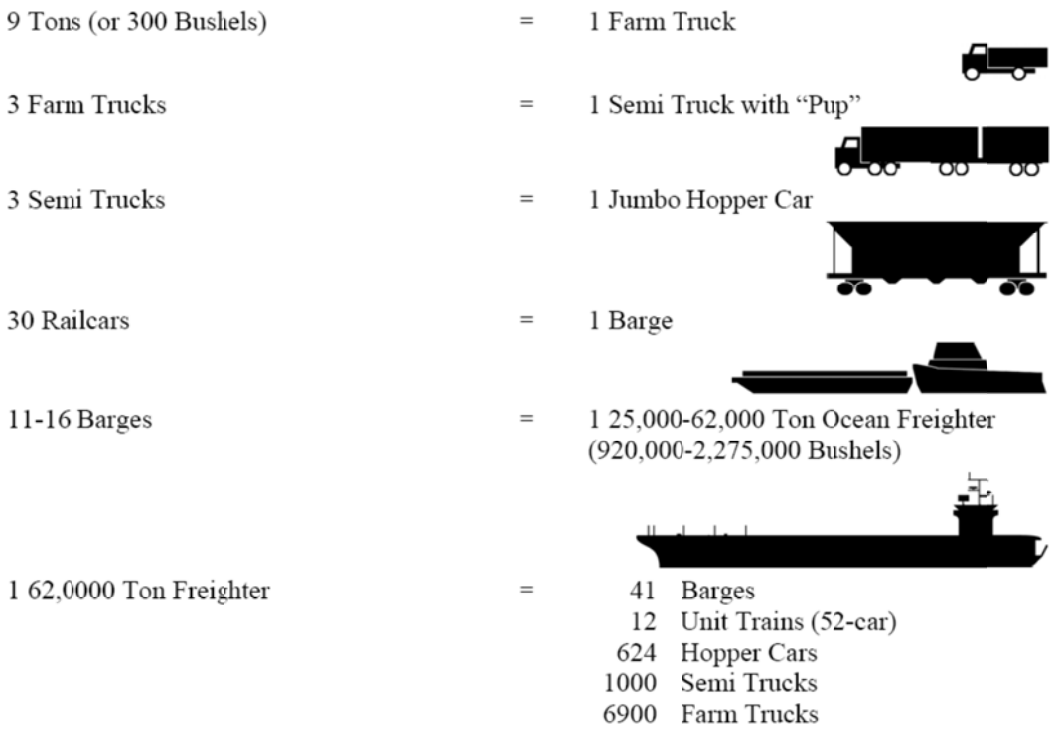
These large shuttle loading facilities provide efficiencies in rail system movement because they can load 110 rail cars, i.e., a unit train, and ship them directly to the next terminal, typically a seaport. Trains are able to gain maximum efficiency with single-point loading, long-distance trips, less car handling, and better utilization of rolling stock.

Historically, Montana producers relied upon smaller, local elevators, which provided train service in 52-car units, 26-car, or fewer. The new shuttle loading facilities can load a 110-car train with 370,000 bushels of grain, more than double and quadruple the previous industry standards. The Montana Wheat and Barley Committee estimates that a state-of-the-art shuttle facility costs about $4 million with the following minimum specifications:

- Seven thousand feet of track to accommodate 110 empty and 110 loaded cars;
- Two 20,000-bushel shipping legs;
- Two 20,000-bushel receiving legs;
- One hundred 10-foot platform scales;
- Two receiving pits; and
- At least 1 million-bushel storage capacity.

Figure 5.7 compares storage capacity across each typical transportation mode. Knowing the carrying capacity of a 62,000-ton freight ship, typical in Pacific Northwest ports, shows the volume of trains and trucks necessary to fill one of these ships. A freighter load is equivalent to 12 52 car unit trains, 624 jumbo hopper rail cars, and about 6,900 farm truck loads. With fewer and more centralized grain loading facilities, the distance from farm to elevator has increased. If that increment is 20 miles, the additional burden on the roadways needed to fill a single freight ship amounts to 138,000 miles.

Figure 5.7 Relative Storage Capacities of Transportation Modes



Source: Montana Wheat and Barley Committee.

Currently, there are 15 existing and planned 110-car shuttle loading facilities in Montana. Table 5.2 provides a detailed list of facilities along with the current owner/operator, capacity, and year the facility became operational.

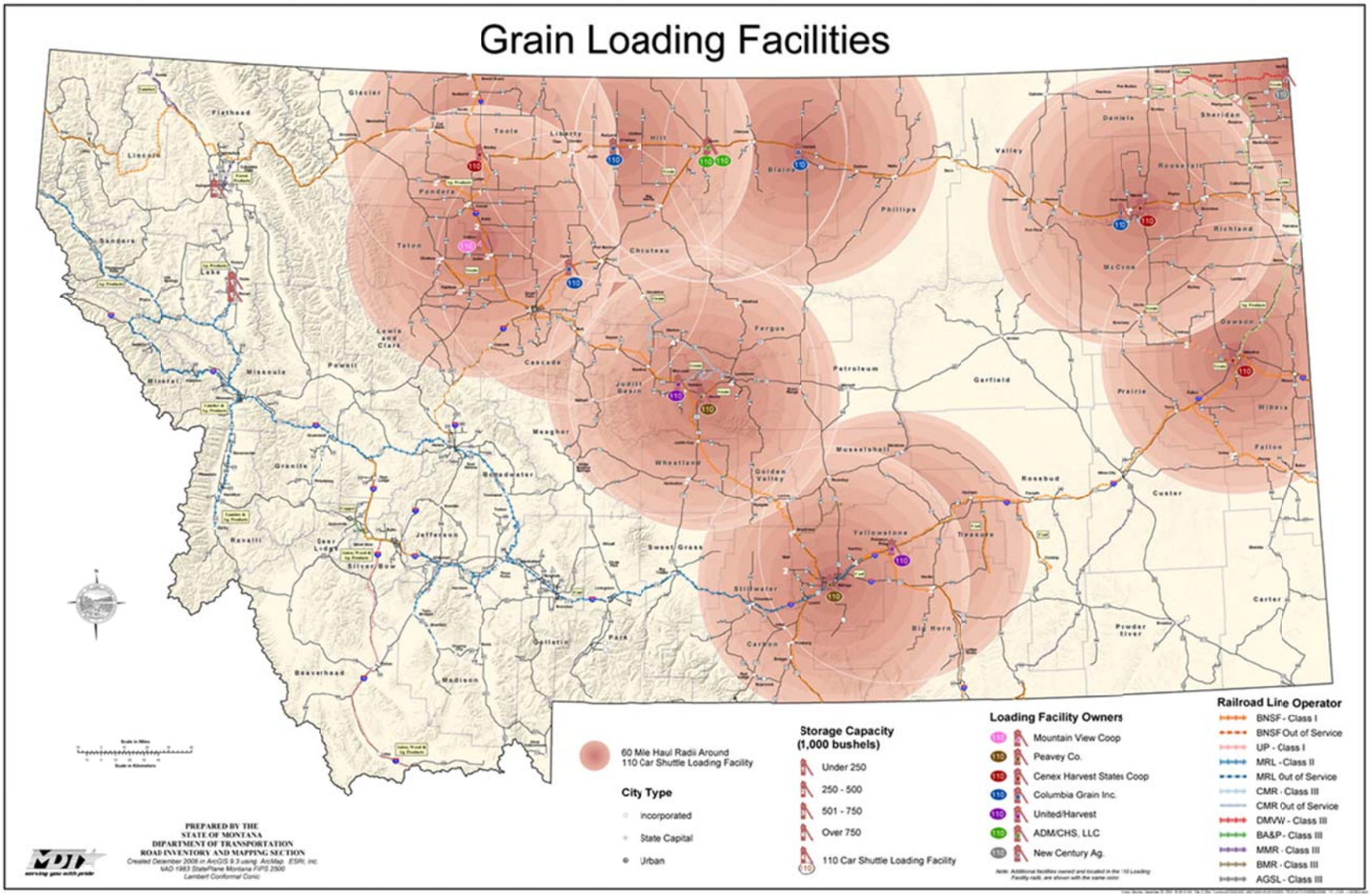
Table 5.2 Current Grain Shuttle Facility Locations

BNSF Facility Number	Name	Location	Year Operational	Loading/ Unloading	Storage Capacity (Bushels)	Track Capacity (Cars)
508	Peavey Co	Billings	April 2000	L	1,700,000	110
558	Columbia Grain Inc.	Harlem	November 2001	L	620,000	115
561	ADM/CHS, LLC	Havre	December 2002	L	1,700,000	110
562	ADM/CHS, LLC	Havre	December 2000	L	240,000	110
581	CHS Inc.	Macon	April 2000	L	970,000	110
603	Columbia Grain Inc.	Rudyard	November 2000	L	2,000,000	110
608	CHS Inc.	Shelby	December 2003	L	3,200,000	162
2353	Mountain View Coop	Collins	December 2001	L	873,000	110
2358	CHS Inc.	Glendive	June 2001	L	850,000	110
2364	United Harvest, LLC	Pompeys Pillar	December 2003	L	700,000	112
2387	Columbia Grain	Kasa Point (Wolf Point)	June 2006	L U	800,000	110
2456	United Harvest, LLC	Grove (Moccasin)	January 2000	L	625,000	110
518	Columbia Grain, Inc.	Carter	May 2008	L	710,000	110
588	Peavey Co.	Moore	March 2009	L	1,000,000	110
	New Century Ag.	Westby	Spring 2009	L		110

Source: www.bnsf.com/markets/agricultural/elevator/shuttle/shuttle.html#MT. Verified with elevator operators.

Previous industry surveys and market research completed by MDT indicate that a 60-mile radius is the typical distance within which the facilities attract business from producers (a majority of producers responding to surveys report hauling grain distances of 60 miles or less). Figure 5.8 plots 60-mile radii on each of the existing shuttle facilities. The map shows current locations of the facilities in Montana, including three recent facilities in Carter, Moore, and Westby.

Figure 5.8 Montana Grain Loading Facilities



5.4 IMPLICATIONS OF GRAIN SHUTTLE FACILITIES

The increasing prevalence of larger grain elevators represents a substantial shift in transportation demand for the regional economy of eastern Montana. Producers must typically travel further to reach shuttle facilities, and they tend to use larger trucks to do so. As a result, roads and highways are expected to have accelerated maintenance needs; and roadways also must plan to accommodate access and turning movements by larger trucks. Grain shuttle facilities affect independent grain elevator operators. Short-line railroad operators in the region also may be affected. Potentially negative effects to producers, independent elevators, and short-lines are somewhat balanced by positive impacts for rail and elevator operators, benefits that may move downstream to producers in the form of better prices and services, better market access and greater regional competitiveness.

Haul Distance

The Montana Wheat Barley Committee studied grain shipping trends and summarized the findings in the *Montana Rail Grain Transportation Survey 2007*.[65] That survey indicates that grain elevator markets are developing into larger, more concentrated shuttle operations. As a result, the study argues, transportation costs are shifting from railroads to farm producers in the form of higher transportation costs to producers, and higher costs to governments to maintain roadway networks. The study includes these further findings:

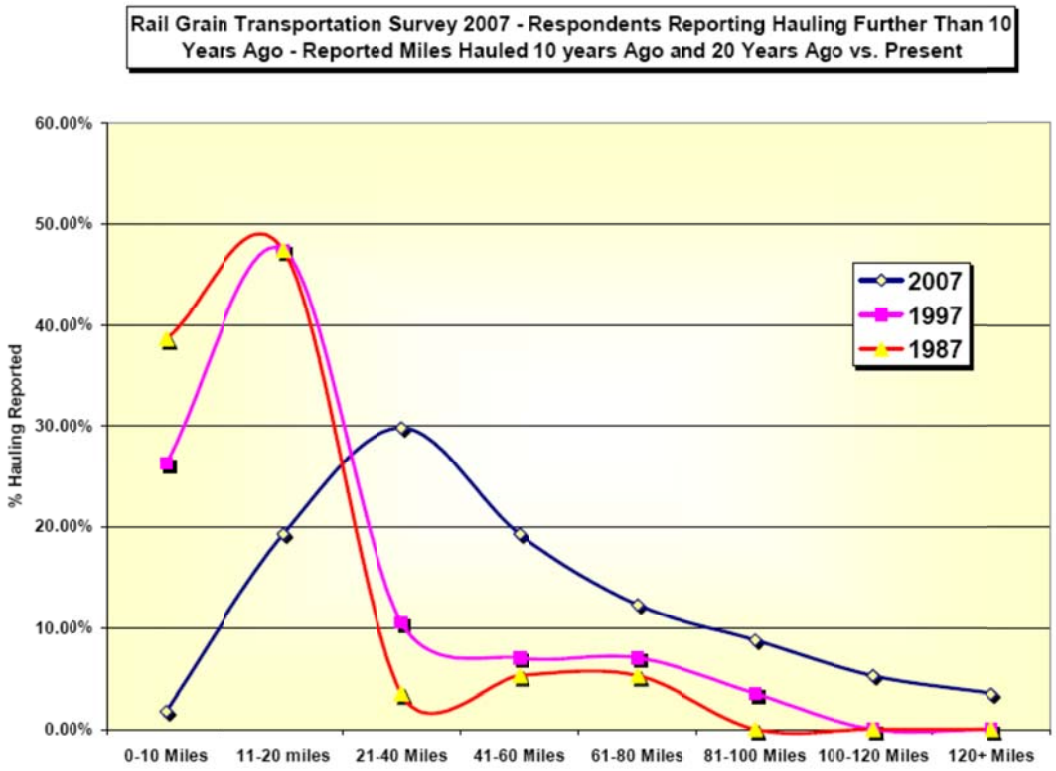
- Compared to 10 and 20 years ago, producers report they are hauling their grain further distances from farm to rail, primarily over state and county highway systems.
- In 2007, about 21 percent of producers reported hauling less than 20 miles to rail service, compared to about 73 percent in 1997. Respondents in some counties indicated average hauling distances of 80 to 120 miles.
- Ninety-two percent of Montana producers have the capability to store all or most of the grain they produce. This shift was begun by some government incentive programs, remains because of a less seasonal market for wheat, and also remains as a means of hedging against rail car shortages or elevator pluggings. During elevator pluggings, many producers wait for rail car shortages to abate; those that hauled to more distant elevators reported unloading delays.
- The study concludes that the increasing dominance of shuttle loading facilities have increased costs to producers. Railroads appear to be reaping the financial benefits of these and other efficiency improvements.

[65] *Montana Rail Grain Transportation Survey and Report 2007*, Prepared for the Montana Wheat and Barley Committee in Cooperation with the Montana Department of Transportation, Whiteside and Associates, November 2008.

The 2007 survey also illustrates how length of haul to rail service has increased in the advent of shuttle loading facilities. Figure 5.9 shows these trends.

Figure 5.9 Rail Grain Transportation Survey Respondents Reporting Lengths of Haul

1987 to 2007

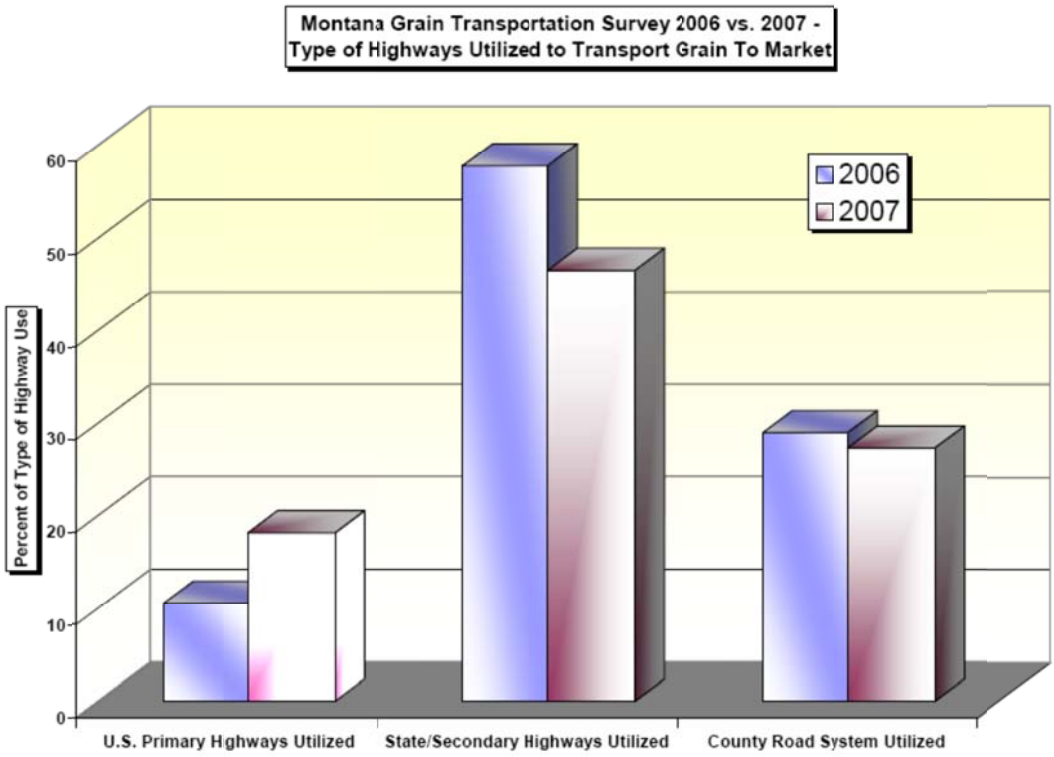


Source: 2007 Rail Grain Transportation Survey, page 25.

Seventy percent of respondents reported they now haul grain longer distances than they did 10 years ago (before the advent of the shuttle loading facilities). According to these survey results, average lengths of haul were 41.60 miles in 2007, up 84 percent from the 1997 average haul of 22.84 miles.

The 2007 Rail Grain Transportation Survey also reports that the majority of these grain hauling moves are occurring on state secondary roads and country roads. Figure 5.10 shows results from the 2007 survey, which indicate some trends toward more use of primary state highways, but still a clear majority of movements on lower classification roads.

Figure 5.10 Type of Roadways Used to Transport Grain to Elevators
2006 to 2007 Survey Results



Source: 2007 Rail Grain Transportation Survey, page 29.

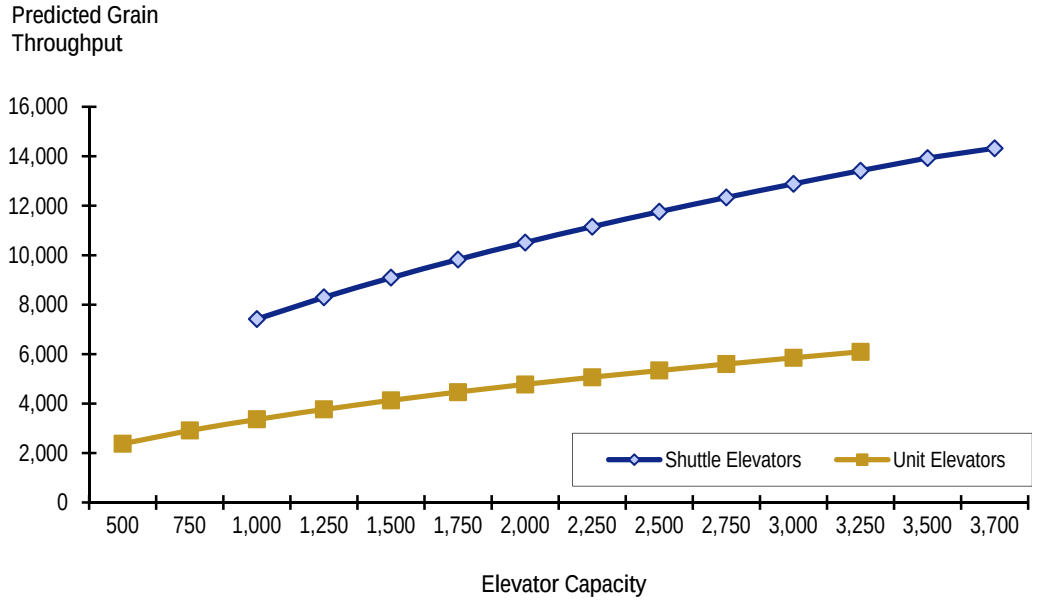
Trip Generation

The Upper Great Plains Transportation Institute estimated trip generation rates of large grain elevators in a 2006 North Dakota case study that established methods for traffic impact estimation.[66] The study compared data from shuttle facilities (i.e., those with rail car capacities of 110 or more cars) and smaller "unit" facilities (with 50 to 100 rail car capacities).

[66] Upper Great Plains Transportation Institute, *Trip Generation Rates for Large Elevators: A North Dakota Case Study*, Journal of the Transportation Research Board, No. 1966, Washington, D.C., 2006, pp. 88-95, or at trb.metapress.com/content/fm867m41682qn420/fulltext.pdf.

In general, the study notes that both grain throughput and truck traffic generated by these facilities varies with grain storage capacity, with more storage capacity predicting more transportation impacts. Notably, the study finds that shuttle facilities have nearly double (1.97 times) the grain throughput with comparable storage (Figure 5.11). This is explained by the larger facilities being able to move grain more efficiently onto large unit trains that cycle between the elevator and destination (typically port) facilities.

Figure 5.11 Estimated Average Throughput of Large Grain Elevators
By Grain Storage Capacity (1,000 Bushels)



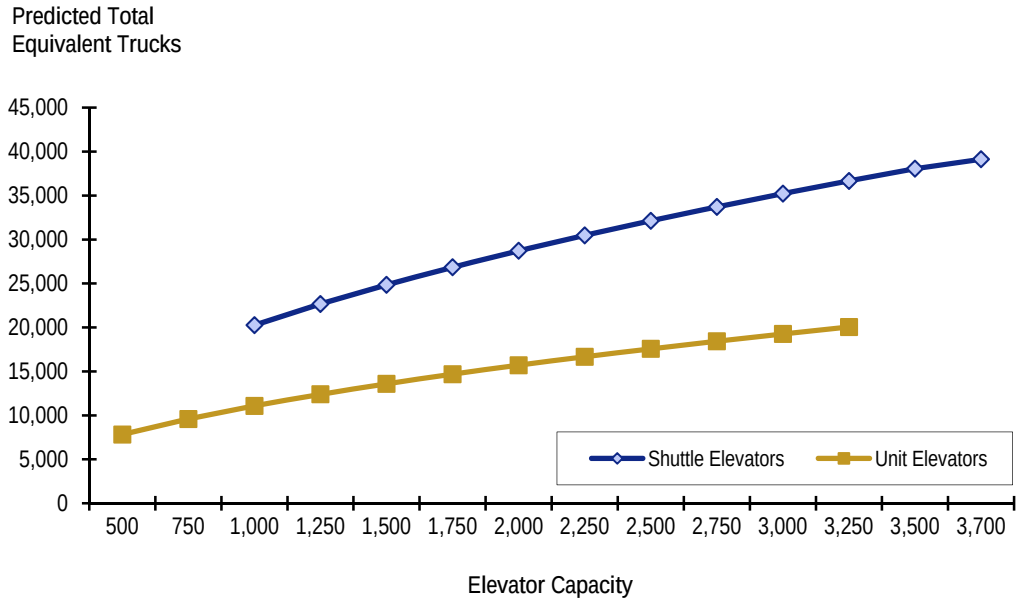
Source: *Trip Generation Rates for Large Elevators: A North Dakota Case Study* (2006).

The impacts on roads are more than double (about 2.20 times) the traffic load impact, as measured by "equivalent single-axle loads," or ESALs (Figure 5.12). (ESAL calculations are used to establish a pavement damage relationship for axles carrying different loads; one ESAL is an 18,000-pound single-axle with dual tires.) The larger impact is explained by the higher throughput plus more frequent use of larger, heavier trucks to deliver grain to the elevator. The research notes that the implications for highway system planning include predictable need for large truck access and for pavement design.[67]

[67] To attempt to gauge whether empirical evidence from Montana was available to support the suspected trends, samples of both Automatic Traffic Recorder (ATR) and Weigh-in-Motion (WIM) data were collected from select locations near elevator facilities along U.S. Highway 2 in the northern portion of the state. Ideally, truck traffic volume increases could be correlated with both shuttle facility operational dates and

Footnote continued

Figure 5.12 Predicted ESALs for Shuttle and Unit-Sized Grain Elevators
By Grain Storage Capacity (1,000 Bushels)



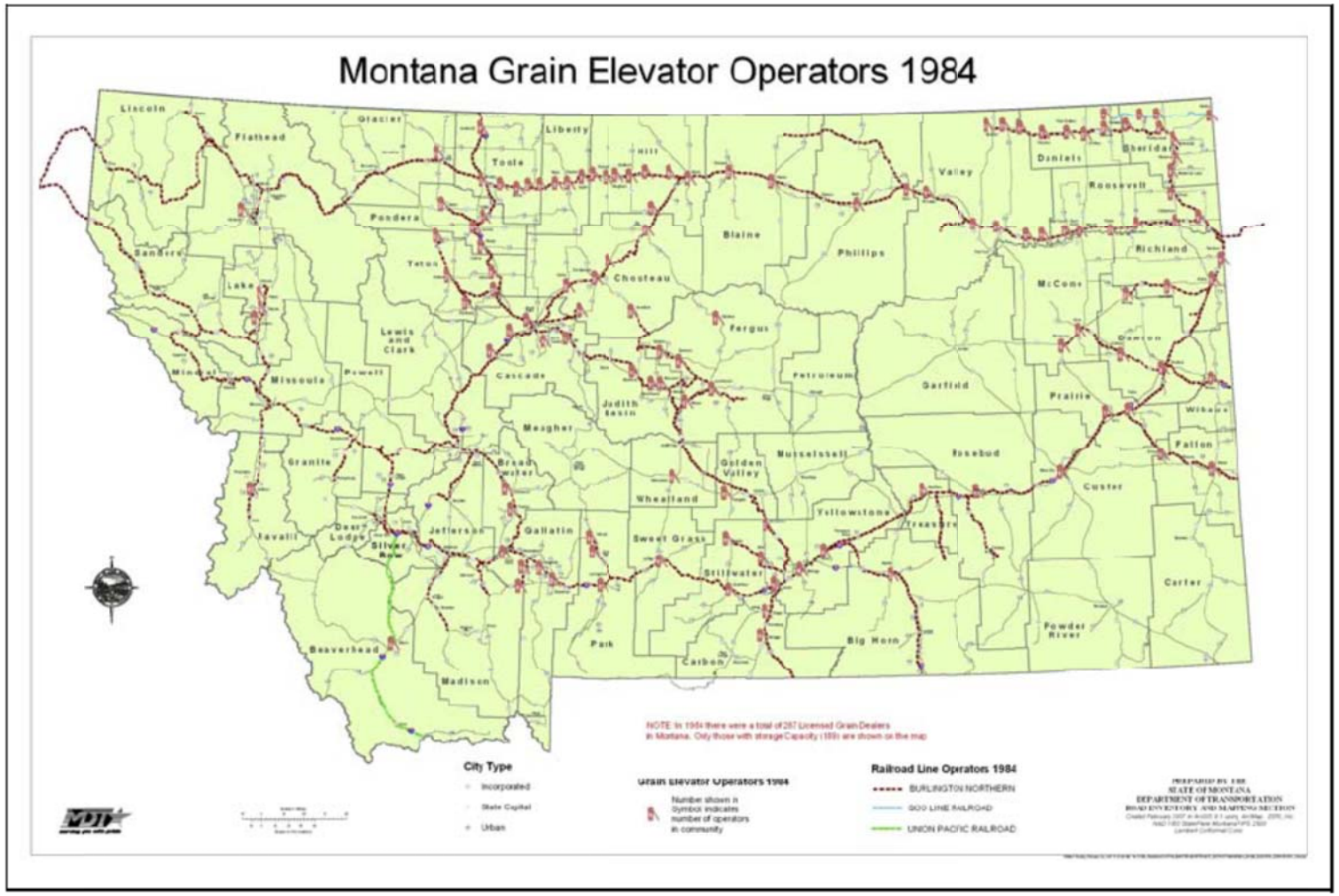
Source: *Trip Generation Rates for Large Elevators: A North Dakota Case Study* (2006).

Shuttle Loading Facility Effects on Grain Elevator Numbers

The 2007 Survey reports that Montana had 189 grain elevators in 1984, and 121 elevators by 2006. Figures 5.13 and 5.14 show the distribution of grain elevators in the State in 1984 and 2006, respectively.

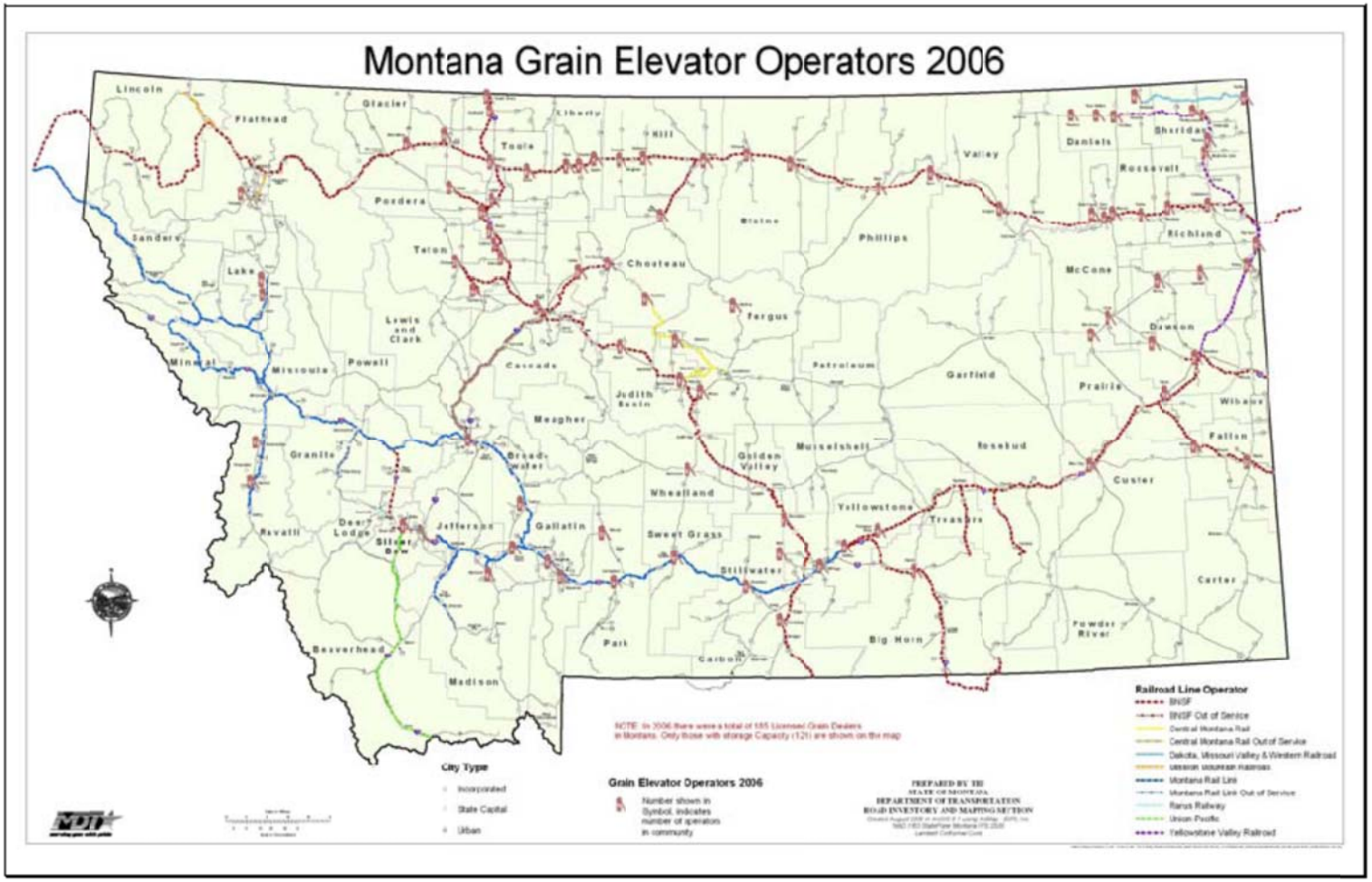
even seasonal grain harvests. While ATR reveal spikes in truck traffic along select rural highway segments, it is difficult to substantiate that it is due to grain truck traffic increases. For a slightly finer grain of detail, but with fewer sites available, WIM data was observed to identify bidirectional average monthly vehicle weights as classified by the 13 category FHWA system. This data proved to be inconclusive as well. One location, near Carter, revealed highly unbalanced eastbound and westbound traffic weights, favoring westbound traffic, though it is unclear whether westbound truck traffic was destined for grain facilities or freight terminals in Great Falls. A more detailed study of state and county roads near shuttle loading facilities, involving truck counts over time, would permit the Montana Department of Transportation to more clearly identify the implications of these longer grain hauls on state and county roads.

Figure 5.13 Montana Grain Elevator Operators
1984



Source: 2007 Rail Grain Transportation Survey, page 8.

Figure 5.14 Montana Grain Elevator Operators
2006



Source: 2007 Rail Grain Transportation Survey, page 9.

The Montana State Attorney General published a report on rail rates and service that also discusses grain shipment issues in detail.[68] The Railroad Rate Report found that Montana grain shippers pay rail rates that are high in relation to railroad costs (as measured by the revenue to variable cost ratio, R/VC[69]), and higher than other states that ship wheat to Pacific Northwest ports. 2007 R/VC ratios for shipments from shuttle facilities (a weighted average R/VC of 275 percent for shipments to Portland terminals and 262 percent for shipments to Vancouver terminals) are slightly higher than ratios for nonshuttle facilities (a weighted average R/VC of 250 percent for shipments to Portland terminals, and 248 percent for shipments to Vancouver terminals).[70] The nonshuttle R/VC measurements reflect higher railroad costs associated with nonshuttle transport and, therefore, do not represent actual rates being charged to nonshuttle shippers.

Both the 2007 Rail Grain Transportation Survey and the 2009 Railroad Rate Report attribute the rise of the shuttle loading facilities to preferential rate treatment by the railroads in order to reduce rail operating costs. In preparing this grain shuttle facility analysis, a number of Montana grain producers and grain producer groups were interviewed. These Montana grain industry experts also pointed out that grain shuttle facility ownership was becoming more consolidated and less often owned and operated by local producer-owned cooperatives. Table 5.2 lists the operators of these shuttle facilities, all of which also operate grain export terminal facilities in the Pacific Northwest ports. This means that these grain shuttle facilities enable grain export companies to integrate grain collection closer to the producer, controlling both ends of the rail moves from shuttle loading facilities to export grain elevators. Thus, the shuttle loading facilities help the railroads and grain exporters to gain economies of scale.

The 2007 Rail Grain Transportation Survey also reported that measures of rail transport service were marginally improving. Sixty-five percent of respondents reported that they experienced elevator plugging at some point during the 2007 harvest, down from 78 percent experiencing elevator plugging during 2006. Fifty percent of respondents reported that they experienced multiple pluggings during the 2007 harvest, down from 54 percent in the 2006 harvest. Sixty-seven percent of grain producers responding in the 2007 survey express the judgment that the elevator pluggings are a result of a shortage of rail cars. The report also discusses how the plugging phenomenon also could reflect shortcomings in how

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[68] *Railroad Rates and Services Provided to Montana Shippers: A Report Prepared for the State of Montana*, State Attorney General's Office, prepared by John Cutler, Andrew Goldstein, G.W. Fauth III, Thomas Crowley, and Terry Whiteside, February 2009.

[69] Section 7.0 of this Rail Plan Update discusses this measure in more detail in the discussion of rail competition issues at the state and national level.

[70] R/VC calculations taken from Figure 8, page 11 and Figure 10, page 12 of the 2009 Railroad Rate Report.

elevator operators request rail cars. The report notes that railroads are expanding their communication and market intelligence gathering activities so that they can anticipate harvest-related rail car needs. The report concludes that resolution of the problems will require improved coordination between elevator operators and railroads.

5.5 CONCLUSIONS

The expansion of grain shuttle loading facilities seems to be a market function of railroads seeking to reduce operating costs and expand utilization of rail cars and of grain exporting companies to extend their reach closer to grain producers. For some grain producers in closer proximity to these shuttle loading facilities, this change offers lower rail transportation costs and higher rail car availability. These benefits are not experienced by all grain producers, however. Some producers must haul their products longer distances and have fewer competitive elevator options. Farm trucks are thus traveling longer distances on secondary state and county roads, with effects on pavement quality and maintenance costs. Market forces that reduce the number of nonshuttle elevators also may reduce the ability of grain producers to have transportation options for their alternative crops grown for crop rotation or to respond to consumer trends.