# *THE LONG-TERM AVAILABILITY OF RAILROADS SERVICES FOR U.S. AGRICULTURE*

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## Disclaimer

## EXECUTIVE SUMMARY

Future customer demands, service availability, and industry investment decisions will shape the modal marketing decisions of the grain marketing sector. The Delphi survey technique is used to engage a cross-section of grain industry experts in sharing opinions regarding future trends for service, investment and marketing in the grain marketing sector. The survey produces several interesting expectations, including (1) further consolidation of the rail and elevator industries, (2) increasing prominence of the HAL cars in grain service, (3) an increase in rail rates from 1 to 4 percent annually over the next decade, (4) expanded use of shuttle/efficiency rail programs for major grains, (5) an increased use of market-based car ordering systems, (6) growth of the short line rail network, and (7) small market-scale, but large volume, increases in the share of grain marketed via container. The insights are valuable in understanding the future of the rail grain industry. These expert opinions will be considered in future research and discussions regarding longer-term implications government policy and market investment decisions in the rail grain sector.

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## INTRODUCTION

The U.S. rail system included 40 Class I rail carriers and 179,000 miles of road in 1980.[1] Farm products comprised 8 percent of the 23 million carloadings in that year, with the two largest grain hauling railroads accounting for 30 percent of the grain revenue carloadings (AAR, *The Grain Book*). In 2000, seven Class I rail carriers own 102,128 miles of road - a 43 percent decline from 1980. The most recent data showed that 6 percent of the total 25 million cars loaded were farm products (AAR, *Railroad Facts*). Although farm share of the total rail ton-miles has declined, total rail ton-miles have increased 46 percent over the past two decades, growing from 918,958 million in 1980 to 1,348,926 million in 1997 (AAR, *Railroad Facts*).

Tons of grains shipped via rail accounted for more than 42 percent of the total domestic and export disappearance of grains in 1995.[2] Approximately 64 percent of the wheat and 24 percent of corn and soybeans were marketed via rail between 1990 and 1995 (Vachal, et al 1998). While barges provide a cost-effective alternative for moving large quantities of grain and oilseeds from inland production areas to domestic and export consumption centers, they are limited in capacity and market access. Thus, rail service is a key component in the long-run competitiveness of the U.S. grain and oilseed industry in delivering product to domestic and international markets.

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[1]This represents the aggregate length of roadway of all line-haul railroads. It excludes yard tracks, sidings and parallel lines. Jointly-used track is counted only once (AAR, Yearbook).

[2]According to NASS data, the total disappearance of grains in 1995 was approximately 349 million tons. The 1995 Public Use Waybill sample shows approximately 148 million tons of grain being transported by rail.

The success of U.S. production agriculture is closely tied to a healthy and competitive rail system. Thus, it is important to understand recent changes in the railroad industry and in the services they offer agricultural shippers. The changes influence logistical choices and the distribution of risk, reward and cost along marketing channels.

The quantity, quality, scope, and price of rail service to the grain industry has evolved over recent decades, influenced by factors such as market developments, government policies, technological innovations, and investment decisions of the U.S. rail industry and its customers. This research describes trends in the rail service, and their impacts on agricultural shippers. A review of existing data and research is compiled to provide the base for understanding change that occurred in rail service for agricultural shippers over recent decades. A Delphi survey also is conducted so industry perceptions of recent change and future expectation can be incorporated into a forecast of emerging trends. Understanding these emerging trends in the context of their development is critical to making discerning resource allocation and policy decisions that affect the future of the rail grain industry.

## AGRICULTURAL SHIPPERS' MARKETING VIA RAIL - POST STAGGERS

With the recent era of rail network rationalization and consolidation, grain shippers continue to adapt to an ever-evolving logistical network. Two important components in this adaptation are investment and marketing decisions. Signals from the logistics marketplace include rates, service, and reliability. These signals are factored into an individual shipper's decision parameters that include access, risk tolerance, profit potential, customer demands, production characteristics, logistical alternatives, and opportunity cost. In understanding the decisions made by shippers serving production agriculture, rail tariff rates and historical shipping patterns are available. However, indicators of shipper perceptions of service and reliability are limited, and thus, often neglected in forecasting for policy and infrastructure decisions.

Rail service encompasses a broad scope of issues that surround these "price, efficiency and reliability" indicators. Rail rates and freight programs have evolved substantially over the past two decades as railroads have been given freedom to use differential pricing, service, and rate structures to grow their businesses and encourage shipper investment aimed at increasing efficiency for shipping via rail. Countless studies have addressed the impact that deregulation had on rail rates, service and industry health. Key findings of selected reports are reviewed in the following sections.

## Rate Structure

The structures of rail rates for major agricultural commodities currently cover a broad range of rail shipping options. The single car shipment, once the industry standard, is one of many shipment configurations. Four primary rail shipment sizes typically applied are single car, multicar, unit train, and shuttle train. Single car shipments include shipments of one to approximately 25 cars.[3] Multicar shipments include shipments of not fewer than 25 cars and not more than 49 cars.[4] Single car and multicar shipments generally are bound for domestic destinations. The final two shipment types are bound for larger domestic processors/feeders and

[3]The minimum and maximum number of cars included in each shipment type may vary slightly by rail carrier and commodity.

[4]Ibid.

export facilities.  Unit train shipments refer to shipments of 50 to 99 cars.[5]  Shuttle trains are shipments of 100-plus cars that meet certain railroad defined origin-destination requirements.[6] Although other shipment configurations exist, these shipment configurations provide a base for reviewing changes in the rail rate structure for bulk agricultural products.  The following paragraphs review some of the studies that examined changes in rail grain rates.

Boyer (1987), MacDonald (1989), Wilson (1992) and the General Accounting Office (1999) found that aggregate rail grain rates declined following regulation.  In 1987, Boyer examined the impact of deregulation on average rail rates.  Using average rate per ton-mile data from 1970 to 1985, he found that while real rail rates had decreased since deregulation, most of the decrease could be explained by increased train weights.  The author did not attempt to show the impacts that deregulation may have had in influencing train weights.

MacDonald examined the effects of deregulation on rail grain rates in his 1989 study. The author hypothesized that railroad regulation allowed railroads to act collectively as a cartel and caused rate equalization among shippers in regions, slowing down the adoption of cost-saving shipping methods such as unit trains.  Because the corn belt had effective intermodal competition before deregulation due to barge access, Macdonald believed that the elimination of the railroad cartel would have its largest impact in the plains states, where effective intermodal competition did not exist.  MacDonald considered tariff rates, origin-destination price spreads, and the waybill sample in his analysis of rate changes following deregulation.  He found that Great Plains tariff rates declined 1981 through 1986 and that much of the decrease was related to

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[5]Ibid.

[6]Ibid.

the introduction of multicar and unit train rates. In reviewing previous studies that examined origin-destination grain price spreads, he found that rates in the Great Plains increased prior to passage of the Staggers Rail Act, but dropped sharply after its passage. Rail rates in the Corn Belt merely continued on an existing declining trend.

MacDonald found several statistics of interest in his review of the waybill data: (1) rates for export wheat shipments dropped an average of 15.5 percent between 1981 and 1985, and an average of 8.4 percent for export corn shipments after controlling for other factors - if one attributes increases in shipment size to deregulation, the decreases are even larger; (2) competition among railroads has a strong effect on rail rates and this effect increases with distance from barge loading facilities, supporting MacDonald's belief that intramodal competition will have a larger influence on rates where intermodal competition is weak; (3) intermodal competition has a strong influence on rail rates; and (4) rail rates have dropped more in the Plains than in the Corn Belt presumably because the Corn Belt had effective intermodal competition before deregulation. Thus, the statistical results supported the author's contention that deregulation removed railroad cartel power and the power to equalize rates within regions.

In a study of rail rates for various commodities, Wilson (1992) found that the initial impacts of deregulation were mixed, but that by 1988 rates on most commodities had declined as a result of deregulation. In a later study, Wilson and Wilson (1998) examined the effects of deregulation on aggregate rail rates for barley, corn, sorghum, soybeans, and wheat. For these commodities, they found that real rail rates per ton-mile dropped from 40 to 71 percent between 1980 and 1995. They determined that the 1995 rates were between 42 and 55 percent lower for the five commodities than they would have been without deregulation. Their statistical examination showed little change in real rail rates prior to deregulation, followed by a larger initial decrease after deregulation with continued decreases of smaller magnitude over time after deregulation. The authors attributed the rate reductions to technological change resulting from the increased flexibility provided by deregulation. The authors did not consider the effects of competition or regional characteristics in their analysis.

The most recent comprehensive study of rail grain rates was completed by the U.S. General Accounting Office (1999). To examine the rate setting environment in the 1990's, GAO reviewed literature in professional journals and trade publications, and reviewed legislation related to railroad regulation and decisions issued by the Surface Transportation Board (STB), formerly the Interstate Commerce Commission (ICC). They premised that one element that could potentially influence the rate setting environment was increasing industry concentration. GAO found that 95 percent of all revenue ton-miles transportation by rail were transportation by the five largest railroads in 1997, an increase from approximately 75 percent of all revenue ton-miles accounted for by the five largest railroads in 1990.

Another element highlighted by GAO as a potential influence in future rate setting was a potential slow down in productivity gains. Railroad productivity gains have been significant since deregulation, and have continued into the 1990s. These productivity gains are largely responsible for decreased rates and improved viability of the railroad industry. However, GAO pointed to emerging rail capacity constraints and limited potential for further productivity gains from mergers as indicators that such productivity gains may be dissipating. Rail rate setting also could be influenced by railroad financial health, due to the role played by revenue adequacy in the STB’s regulation of rates. GAO found that while railroad financial health has improved, most Class I railroads were not revenue-adequate under STB determinants in 1997. In addition, rail rate setting in the 1990s also was affected by demand conditions and regulatory changes beyond the STB, such as Clean Air legislation and electric utility deregulation.

The GAO employed the Carload Waybill Sample to examine changes in average rates and rate indexes through the 1990s. Rates for specific traffic corridors, commodities, and distance intervals were considered. It was found that rail rates have decreased overall since 1982, dropping 42 percent between 1982 and 1996, but that rate declines dropped from 4.6 percent annually in the 1980s to 4.0 percent annually in the 1990s. For farm products, the average annual real rate decreased from approximately 7 percent per year in the 1980s to 1 percent per year in the 1990s. In examining real rail rates for wheat and corn at various distances, they found that while medium-distance routes showed rate decreases, most long-distance routes showed real rates that have remained constant or increased since 1990. The GAO also found that competitive factors, shipment size, and length-of-haul influence rates.

As a final component in the study of rates, GAO examined the percent of shipments where the revenue to variable cost ratio was above 180 percent. They found that 23 percent of farm product revenues moved at R/VC above 180 percent in 1986, compared with a high of 32 percent in 1994 and a low of 21 percent in 1992. As expected, R/VCs were found to be higher for movements with fewer transportation alternatives.

## Rail Freight Programs

In addition to the development of grain rate structures that vary based on shipment size, a wide variety of shipment options designed to reduce shipper risks of not obtaining equipment in a timely manner have evolved. In general, these options place a premium on obtaining equipment in a timely manner. Thus, in addition to reducing risk for shippers, they also reduce equipment investment risk for railroads. Prior to deregulation, shippers obtained rail equipment through a tariff system - basically a first-come, first-serve scenario. Today's shippers have four options available for accessing rail service: (1) tariff orders, (2) long-term guaranteed freight, (3) short-term guaranteed freight, and (4) contracts. Expanded contract disclosure requirements implemented in the mid-1980s dissuaded many from the latter type of service. Thus, this review concentrates on options one through three.

Tariff orders allow shippers to place orders directly with the railroad. No guarantee is offered by the railroad for fulfilling the orders. If an order is accepted, it is filled based on fleet supply and demand conditions. Shippers may be penalized for cancellation of tariff orders.

Long-term guaranteed freight service typically involves a freight contract for a one- to three-year period. Long-term service such as the Burlington Northern Santa Fe SWAP cars or Union Pacific Pool cars, are privately-owned or leased cars that have been added to the general railroad fleet through some type of equipment/service exchange between the car owner/lessor and the rail carrier. With these programs, risk is shared though an equipment/service exchange agreement. For example, company A may place 100 cars into the general fleet of Railroad. In exchange, company A will receive 110 cars per month of guaranteed freight service. These agreements allow the railroad flexibility in fleet sizing, allow railroads a method for gaining traffic commitment from customers, and provide the shipper with an alternative for guaranteeing rail service. The service available with the agreements may then be used by the owner/lessor (Company A) or sold to another shipper (Company B).

Typically, when these cars are marketed from one shipper to another, they are done so under a longer-term agreement, but may be sold as shorter-term freight in the secondary freight market, depending on market conditions. For a longer-term agreement, the purchasing shipper will agree to accept a specific number of cars each month for the length of the contract. The purchasing shipper (Company B) typically pays a per-car premium to the owner/lessor (Company A) for this freight, because the service is guaranteed. The applicable freight charge for Company B is equal to the tariff rates plus or minus the market established premium or discount. The tariff portion of the rate is paid to the rail carrier, and the premium or discount is absorbed by the owner/lessor (Company A). Shipper cancellation and carrier non-delivery both are penalized for this freight type.

Short-term freight includes railroad "auction" programs and the secondary rail freight market. Railroad auction programs were initiated in the mid-1980s with the BNSF Certificate of Transportation (COT) program. Other railroads have since developed similar programs. With this program the railroad holds periodic (eg. weekly, monthly) electronic auctions in which they accept bids from shippers for future service. The bid floor typically is equal to the tariff rate. The applicable freight rate is then equal to the tariff rate plus any premium (or minus any discount), with the entire amount paid to the rail carrier. With these bids shippers guarantee service for a single shipment[7] or multiple shipment (eg. BNSF Shuttle COT), with penalties applied for non-performance by either the shipper or carrier. Service may be purchased up to six months in advance depending on carrier. This freight typically is transferrable between shippers, although railroad defined corridors/routes may limit this flexibility.

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[7]Shipment size will vary, depending on the service purchased.

A secondary market also exists for rail grain freight. This secondary market provides some liquidity in the rail grain car fleet allowing grain companies, brokers and individual shippers to buy or sell freight when projected grain flows have been under- or over-estimated. Railroad service guarantees and shipper performance obligations/penalties are transferred with the transactions. The following paragraphs highlight studies that have analyzed rail freight programs.

Studies by Pautsch et. al, (1991 and1995), Priewe (1997) and Wilson (1998) considered the systems available for pricing rail freight. Pautsch, McVey and Baumel (1991) reviewed the implications of various railcar allocation schemes for shippers. They reviewed the tariff rate system, auction based price-discovery and priority pricing systems. It was determined that tariff rates tended to be sticky, resulting in recurring shortages and surpluses of rail grain cars. The priority based pricing resulted in fluctuations in the quantity of cars demanded, but differed from the auction pricing-system in that all shippers paid the same price for the same type of car supply guarantee. The area of benefit to shippers under the demand curve (consumer surplus) and costs associated with unreliable car supply was greatest under the fixed tariff system. Priority pricing reduced the consumer surplus, but shippers also experienced decreased costs from a guaranteed car supply. Auction based (bidding) guaranteed car supply resulted in higher railroad profits and lower shipper welfare than with the priority pricing scenario.

In a 1996 analysis of guaranteed rail service, Pautsch, et. al provided estimates of the value of guaranteed rail service to shippers. The authors found that value of guarantee service increases when quality of guaranteed service increases, conventional service becomes less reliable, and when grain has to be stored on the ground.

Priewe and Wilson (1997) developed a model to analyze the effects of alternative shipper rail car ordering strategies on grain shipping and merchandising. A dynamic stochastic simulations model was developed based on inventory management, transportation choice, and scheduling theories. A range of strategies combining long-term contractual car guarantees, shorter-term auction-based car guarantees, and general tariff freight were evaluated to determine effects on payoff and risk. A strategy with intense use of short-term freight provided the greatest expected payoff, and rendered the highest associated risk. Use of the longer term contractual shipping guarantee reduced the typical cyclical shipping pattern and reduced risk to a degree, depending on the accuracy of projections for shipping demand. A tariff-based shipping strategy resulted in negative profits and the need to expand storage capacity. The effect of freight traded at discount values, on shipper strategies, was not considered in the model.

Wilson (1998) reviewed factors that have evolved and shaped the U.S. grain handling and transportation system in the recent era of deregulation. He specifically addressed innovations that have been developed by rail carriers as means for differentiating services they offer to their shippers. He found that changes in the U.S. grain handling and transportation system, within this deregulated environment, have induced efficiency enhancing investments throughout the system. Some of the key rail innovations that have contributed to gained efficiencies have included rate discounts to origins and destinations for efficient movements, a broader venue of car allocation alternatives, and more logistical choices for shippers.

**Rail Grain Resources**

The ability of rail carriers to service grain shippers is closely tied to the resource base available for grain shipping activities. This resource availability is impacted by infrastructure and operational components.  Key rail grain resources on the infrastructure part of the equation include hopper cars and track miles.  Operational components and their impact on resource availability often are considered by examining fleet cycle times and car productivity.  This section of the literature review examines rail infrastructure and operations studies.  The following paragraphs examine rail car supply.

Car supply often is a focus in the commitment and ability of rail carriers to serve the grain industry.  In their 1989 study, Norton and Klindworth presented estimates of the likely need for grain cars and the likely size of the active grain car fleet for 1989 through the year 2001.  Trends in domestic and export shipments of major grain along with fleet investment trends data were the basis for the projections.  Because rail car investment from 1982 to 1989 had been relatively flat, the authors suggested that investment in new grain cars likely would be minimal.  With regard to increasing fleet capacity through operational efficiencies, Norton and Klindworth concluded that even with marked improvements in cycle time the size for the grain car fleet would fall short in serving the needs of the grain sector through the year 2001.  In conclusion, they noted that additional research was needed to address (1) the adequacy of rail rates to induce future investment in new equipment and (2) what parties may participate in grain car investment given alternative incentives.

Beshers, et. al (1994) sought to develop an understanding of the causes of rail car supply problems and to identify measures that might improve the efficiency of rail transport of grain. The authors provided a background in the report with some basic data analysis.  Conclusions and premises presented in the report were based largely on interviews conducted with representatives of all levels of the grain industry.  The following conclusions were reached:

- Peak demand periods for rail grain cars are export-driven and seasonal.
- Railroads rely primarily on non-price systems for car allocations.
- End-users and exports have received grain on time during peak demand periods.
- Constraints on grain car pricing and investment include a 20-day notice for rate increases and the right of railroads to refuse to load shipper-owned cars when railroad cars are available.
- A potential solution to car shortages would allow railroads to offer prices on grain cars and movement, allow shippers to respond based on market conditions, and allow carriers to offer prices for private cars based on supply and demand.
- A market-based system for allocating grain cars would require a dispute resolution system and potentially a redefinition of the common carrier obligation.

In their discussion, the authors stated that increasing size of the grain car fleet to meet peak demand would be economically inefficient. They did, however, suggest that the current car pricing market may encourage railroads to undersize the fleet because railroads tend not to receive the extra revenue that would otherwise flow from peak demand for grain shipments. This extra revenue is instead absorbed primarily by the secondary rail freight market.

The authors concluded that the effect of the non-market system was to prevent more efficient elevators from fully exploiting their advantages over less efficient ones, and that some of the gains from efficient elevator operations would be passed on to farmers in the form of higher bids or higher refunds. Thus postulating that a non-market distribution of grain cars for purposes of equity, as directed via the common carrier obligation, is economically damaging to the grain production and distribution system and most of its participants.

Bortko, et. al (1995) employed a partial adjustment autoregressive model to evaluate factors that affect hopper car investment decisions of Class I railroads, private carriage, and railcar leasing companies. American Association of Railroad hopper car inventories between 1974 and 1991, were the base for understanding trends and shifts in the make-up of the U.S. rail hopper fleet. Independent variables in the model included real annual hopper car prices, average annual freight rates, real average annual yield on Moody's AAA corporate bonds, annual Class I railroad additions of hoppers (lagged one year), average annual tons per car, and a dummy variable for a technological shift, representing a large railroad investment in C113s (hopper cars) between 1979 and 1981, with the phase-out of inefficient boxcars.

The model did a good job of explaining Class I railroad investment, but failed to provide an adequate model for understanding the Private Carriage investment decision. It appeared the railroads and private investors responded to some of the same factors, but that they had different investment motives. During the 1964-1991 period, Class I railroad C113 investment was inversely related to rail price of C113s, real interest rates, and C113 tons per carload. It was directly related to real railroad price per carload of C113 commodities, C113 acquisitions lagged one year; and a technological change dummy variable. Although railroad use of unit trains was not considered as a factor in the model, the productivity gains associated with the shift to unit trains probably had a negative effect on C113 investment.

Another important determinant of the ability of rail carriers to save agricultural shippers is route miles. As aforementioned, Class I railroads have abandoned or sold off about 39 percent of the route miles they owned in 1980. Railroad abandonment has had an important impact on rural and agricultural regions nationwide. On the one hand, abandonment has resulted in: (1) increased transportation costs for affected shippers due to a shift of freight from rail to truck, (2) increased highway maintenance expenditures in affected regions, due to an increase in heavy truck traffic, and (3) regional declines in local business volumes, personal income, and the tax base. While rail line abandonment has created a negative impact in many communities, it has also resulted in benefits to other communities. The elimination of low-traffic lines along with other technological improvements by the Class I industry have resulted in railroad efficiencies that have benefitted shippers in areas still served by rail service. In many cases, such areas have realized: (1) reduced transportation costs, (2) reduced highway maintenance costs, and (3) increases in local business volumes, personal income, and the tax base as a result of improved efficiency.

Although the extent of rail abandonment occurring in the U.S. since deregulation is known to be large, few studies have examined the extent of rail abandonment by state or region. One study that did provide a nationwide assessment of the scope of rail abandonment in the U.S. was by Bitzan, Tolliver, Honeyman, Casavant, and Prater (1999). The study examined the scope of abandonment among U.S. regions, the characteristics of regions that were impacted most heavily by abandonment, and the varying impacts of abandonment in regions with different transportation characteristics, different commodities produced, and different levels of rurality.

Bitzan, et. al found that U.S. railroads filed for abandonment on more than 55,000 miles of rail line between 1980 and 1999. This amount represents nearly 30 percent of the total miles of road operated by Class I and II railroads at the end of 1979. Of the amount requested for abandonment, more than 48,000 miles were approved for abandonment, or about 87 percent of that requested. More than 43,000 miles of rail line actually were abandoned, representing nearly 23 percent of the total operated by Class I and II railroads in 1979.

Other findings of the study were:

7. More than half of the miles requested for abandonment between 1980 and 1999 were filed for abandonment before the end of 1985.

8. Abandonment occurred in transportation competitive regions much more extensively than in regions with few transportation options. Regions with truck

competitive commodities, a lot of duplicate rail service, and a close proximity to barge loading facilities were much more likely to experience abandonment than other regions.

9. Counties experiencing abandonment had a much lower rate of in-migration in the five years prior to abandonment than the average rate of in-migration for U.S. counties. This provided some support for the notion that at least some abandonments have been the result of a decline in local business volume, rather than the cause.

10. Several factors could influence the incidence of abandonment in the future. These include: (1) a much lower portion of light-density, unprofitable rail lines in existence today than in 1980; (2) a shift toward larger hopper cars, and the potential for Class I - short line interchange problems resulting from the increased track investment necessary to handle such cars; (3) a move toward shuttle train service by Class I railroads, the resulting reductions in costs, and the potential for such cost reductions to increase the drawing area for grains and other products; and (4) localized shifts in economic activity and the resulting changes in rail traffic densities.

11. The impacts of abandonment on local communities and shippers (increased shipping costs, decreased gross business volume and personal income, decreased property values, increased highway maintenance costs, decreased economic development opportunities) are much greater in regions with few transportation options than in regions with a great deal of transportation alternatives.

The study shed some light on the incidence of abandonment that has occurred and the potential for more abandonment in the future. Obviously, the rail service available to agricultural shippers has been affected by changes in the rail system resulting from abandonment.

One alternative to abandonment also has developed in the form of local and regional railroads (short lines). In many cases, lower track and equipment investment costs combined with lower labor costs due to less restrictive work rules for short-line labor have allowed short lines to operate profitably on previously unprofitable Class I light-density lines.

Since 1980, there have been more than 280 local and regional railroads (short lines) formed from track previously owned by Class I railroads in the U.S. that currently are operating

(Bitzan, et. al, 2000). These railroads operate on more than 29,000 route miles and haul more than three million carloads of freight annually. It is estimated that short line railroads participated in 33 percent of all U.S. rail carloadings in 1996 and originated nearly 18 percent of all U.S. carloadings in 1996 (Bitzan, et. al, 2000).

In addition to the benefits of continued service that such railroads have provided, several studies suggest that short line operation has resulted in improved service and reduced rates. Studies by Tolliver (1989a and 1989b) examined the benefits of potential short line railroad sales in North Dakota. He found potential cost savings from short line operation over Class I operation, particularly for large short line networks. In addition, he found favorable impacts from the sale of track to short line railroads on grain producers, highways, and other sectors of the local economy. These impacts included decreased transportation costs for shippers, increased regional business volume and personal income, and reduced highway investment costs.

A study by Dooley (1989) examined shippers' perceptions on quality of service changes resulting from the sale of light-density lines to short line railroads. The study found that shippers perceived an improvement in service resulting from the sales to short lines. Some shippers believed that more individual attention to shippers was possible because of the carriers size. Others thought that better working relationships resulted from local ownership and a commitment to the local community. However, some service problems, such as car supply, were perceived to be worse under short line ownership. Several other studies have examined similar issues related to the benefits of short line railroads, finding similar results.

Concurrent to the changes in rail route miles, changes in the grain elevator system have occurred. Shippers have invested in larger facilities to take advantage of volume discounts, resulting in rationalization of the elevator network. Few studies have examined grain elevator rationalization. One study by Vachal, et. al (1997) developed a model of survival time for North Dakota grain elevators. The study found several important factors influencing the survival of grain elevators. Factors having a positive influence on survival time included storage capacity, the number of services provided, the diversity of grains handled, the bushels of grain handled in a given year, and the average bushels handled by elevators in the county. Factors that have a negative influence on survival time included the proportion of the elevator's grain shipped by truck and the ownership of elevators by large companies. This model provides valuable insight into where future elevator rationalization may occur.

**Rail Service to Grain Shippers**

Service measures continue to be the enigma of the rail carrier-shipper relationship in the agricultural industry. Several attempts have been made to develop service indicators for this sector, but there is little agreement among parties that a representative measure can be offered as a service indicator. Reliability and customer perceptions form the underpinnings of what may be considered rail service. Pre-notification of car delivery, on-time deliveries, car cycle times, and bad car orders all are tangible service factors that may be used in an index of rail shipper reliability. Individual customer experiences also are considered as the rather intangible influence that works to shape value and performance of rail carriers in the context of service to grain shippers.

Many studies have examined tangible service factors, to ascertain trends in reliability and to propose methods for improving reliability. In their 1972 study of rail service reliability, Martland and Sussman considered shippers modal choice parameters in explaining the declining profitability of the railroad industry. Of the four decision criteria often considered - average trip time, trip time reliability, rate, and potential loss and damage - they suggested that the reliability factor was typically overlooked by researchers. According to the article's model, shippers go to the mode that minimizes direct and indirect costs. Thus, slow and unreliable trip times reduce railroad patronage as shippers consider the increased inventory costs resulting from unreliability.

Because of the importance of reliability in determining shipper patronage, the study examined a series of origin-destination (O-D) trip segments, considering origin yard time, haul time, and destination yard time to determine causes of unreliable service. They found that destination yard time accounted for 43 percent of the total variance in the O-D trip time. The analysis suggested that improvements in the destination yard may impact the O-D reliability more than other operational improvements.

In recent studies professing methods for increasing rail carrier reliability, Keaton (1992) and Kraft (1995) examined classification yards and demand variability, respectively. Due to the changing cars in the classification yards, single-carload freight services generally have been slow. Keaton assessed that timetables would impact this problem. He explained that in the yard, much of the dwell time is experienced before the humping process to assemble trains. Through the use of better timetable design, dwell time could be reduced. By using timetable design effectively, rail carriers can load and unload any time, and adapt to any changes made.

The main idea behind Kraft's research was to establish a clear relationship between the amount of demand variability and reliability in the railroad industry. The possible future could be the priority car system, which would help improve reliability problems in the railroad system and maintain low costs. The biggest hurdle to this system is making sure shippers know that increased reliability does not mean added cost.

The shipper's perspective of the impacts of rail regulatory reform were considered in the 1986 study by Grimm and Smith. A survey was conducted to ascertain shipper perceptions of service quality, rates, railroad management, and overall performance following the Staggers Rail Act. In their analysis, the authors named four dimensions of service quality as most important: speed, reliability, loss and damage, and car supply. Shippers who were surveyed perceive substantial improvement in railroad rates, service quality, and management performance since the passing of the Staggers Act. Most respondents thought rail carriers had maintained or improved service in the post-Staggers period. However, the study found the small shippers experienced less improvement in rates, service quality, and overall satisfaction, relative to medium and large shippers. Further research efforts with a greater representation of piggyback, produce and coal shippers, along with a larger sample of small shippers, would be useful. Given the benefits from deregulation, the results show that re-regulation would not be good for a large number of shippers.

In his 1997 essay, Gallamore discussed the relationship between rail regulatory reform and service innovations that were spurred by deregulation of the rail industry. Gallamore highlighted some of the mechanisms through which innovations were adopted as a result of deregulation. He listed cash flow improvement, a change in corporate and managerial culture, new relationships with customers, and the proliferation of short line railroads as mechanisms used to adopt innovation in the industry. Deregulation's widely recognized effect of improving the financial health of the rail industry allowed railroads to make needed replacements in track structures and locomotives, which were deferred, in many cases, due to poor financial conditions. Gallamore argued that the replacements were made with track and locomotives embodying new technology. The author also posed that deregulation led to an increased focus on customers, the consideration of non-traditional solutions to problems, and the cooperation across different functions within railroads. This shift in focus led to such innovations as increased use of computerized systems and information technology. New relationships with customers occurred because deregulation allowed long-term contracts between railroads and shippers. As a result, improvements have been made in interline services and an increase in containerization has occurred. Finally, because of deregulation and the passage of the Northeast Rail Services Act, railroads were allowed to operate without unionized work forces. This opened the door for the proliferation of short line railroads, and their role in preserving local rail service while improving Class I viability.

The most recent review of grain shipper perceptions of rail service was completed by the U.S. General Accounting Office (1999). In assessing changes in railroad service quality occurring in the 1990s, they reviewed literature related to measuring service quality, reviewed railroad and shipper statements regarding rail service quality, and interviewed shippers and carriers. GAO found that shippers perceived service quality deteriorated in the 1990s. In a survey conducted by GAO, 63 percent of all shippers and 57 percent of grain shippers indicated that service quality was somewhat or far worse in 1997 than in 1990.

Service issues, grain shippers noted, were related to diminished car availability in peak and normal periods, inconsistent delivery times, inconsistent pick-up times, and long transit times. While shippers were dissatisfied, only 25 formal service complaints were filed in the

1990s. Shippers partially attributed service problems to a lack of competitive alternatives, partially resulting from mergers. Railroad officials, on the other hand, believed that service had improved between 1990 and 1997. However, while they felt service was adequate, they agreed that there was room for improvement. They believed that service problems were partially attributable to capacity constraints from industry downsizing and inadequate railcar supply. Railroads also acknowledged problems in adjusting to the UP/SP merger as contributing to service problems in 1997. Finally, GAO found that good measures of industry performance do not exist. Considering this and other research that has addressed rail service for the grain industry in recent decades, the next section of the study draws on expert opinion regarding the future of the rail grain industry.

## DELPHI SURVEY

A primary goal of this project is to convey industry opinion regarding the future of rail service for the grain shipping sector. Industry insights into the continued evolution of rail service represent a valuable resource in visioning and planning for the future of the grain industry. These insights of the rail grain sector do not lend themselves to traditional economic research applications. Therefore, the Delphi technique was employed to compile industry opinion regarding future trends in the rail industry and rail services that might be available to U.S. grain shippers.

The Delphi survey is an important research tool, valuable in forecasting and as a means of communication. This research method provides a unique opportunity to gather expert opinions devoid of the “consensus” goal that panel discussion typically languish in - allowing researchers to communicate not only the median response, but those responses which may be somewhat nonconformist (Linstone and Turo, Helmer).

"Delphi is the name of a set of procedures for eliciting and refining the opinions of a group of experts" (Dalkey, 1972). The Delphi procedure is characterized by three features which distinguish it from the usual methods of committee interaction. These are: (1) anonymity, (2) interaction with controlled feedback, and (3) statistical response (Dickey and Watts, 1978).

The Delphi had its foundation in the 1950s with "Project Delphi," the name given to an Air Force-sponsored Rand Corporation study concerning the use of export opinion. The objective of the original study was to "obtain the most reliable consensus of opinion of a group of experts... by a series of intensive questionnaires interspersed with controlled opinion feedback" (Linstone and Turo). The initial Locken Delphi was characterized by a strong emphasis on the use of consensus, by a group of "experts," as the means to converge on a single model or position on some issue. In contrast, the Kantian Delphi, a modified form of the original Delphi, elicits alternatives for a comprehensive overview of the issue. Locken "consensus" is better suited to setting up a communication structure among an already informed group that possesses the same general core of knowledge. Kantian "contributory," attempts to design a structure which allows many "informed" individuals in different disciplines or specialties to contribute to an issue that is broader in scope (Linstone and Turo). A Kantian form of the Delphi survey is best suited for the goals of this project.

The Delphi survey technique has been widely used across industries, issues, and goals. It has been applied to the rail-grain industry in previous studies. Tolliver (1989) used a Delphi survey to forecast grain production trends. These production trends were then used to estimate impact that change in the grain production volumes might have on local elevator and road infrastructure. Lynch, Imada, and Bookbinder (1994) employed the Delphi technique in predicting the future state of the Canadian Logistical System. Delphi survey was used by Vachal, Bitzan and Baldwin (1997) to ascertain expert opinion regarding the future of the Canadian grain marketing system in their review of a North American grain marketing system. These studies, along with applications in other sectors, were reviewed in developing this Delphi application.

## Methodology

The conventional Delphi survey consists of four phases: (1) exploration, (2) group views, (3) exploration of group views, and (4) final feedback for consideration (Linstone and Turo). The central component of each phase is a questionnaire developed to elicit information from the expert panel participants. The exploratory phase is completed with the initial questionnaire. In this questionnaire, the "experts" are asked to provide unbounded answers to defined questions. This initial questionnaire is the base for developing questionnaires two through four. In this series of questionnaires, experts are offered summaries of the previous questionnaire. The summaries include statistical response data and comments from participants. Experts are asked, with each round, to make any changes to their previous response for questions and offer comments to support their answer. These comments are shared with the panel in the next survey round. The Delphi process is noted for its flexibility, thus, has been modified in a variety of applications.

## Data Collection

A series of questionnaires provided the means of data collection for this project. Two data elements identified, for satisfying project objectives, are expert opinion regarding specific issues and expert comment regarding their future expectations for rail service for grain shippers. In the initial questionnaire, respondents were asked to draw on their experiences and market knowledge to make predictions regarding the future of rail service for grain shippers. The predictions were elicited through a series of numeric responses to brief synopses of various topics. These synopses were based on information gathered in the literature review and through secondary data sources. Respondent answers provided unbounded expert opinion regarding their expectations for the future of infrastructure, marketing, investment, customer demands, and technology in the rail grain shipping sector.

The format for the initial survey was based on information gathered in a review of literature and samples of previous Delphi surveys, both discussed in a previous section of this report. Content for the initial survey was based on project goals. Specific questions were formed based on knowledge gathered through the review of literature and discussions with individuals in the public and private sectors of the grain industry. An initial survey was drafted and presented to the USDA for comments. The survey was then finalized, after revisions were made to incorporate USDA suggestions (Appendix A).

A critical task in administering a successful survey is definition of a potential participant list considering experience, location, and activity in the rail grain industry. Twenty-seven companies initially were contacted via phone and invited to participate in the Delphi survey (Appendix B). Project goals, questionnaire content, Delphi process and participant roles were discussed during these conversations. Most individuals had a positive response to the approach and accepted the invitation to participate in the survey.

The Delphi application completed for this project included a series of three questionnaires.[8] The initial survey (Round 1) was distributed to 26 individuals. Twenty-three usable returns provided a response rate of 88 percent. A high response rate was critical to the validity of this survey, given the short initial mailing list and the diversity of activities and interests among the group. Round 1 responses were summarized through a series of tables and graphs depicting the median, and range of responses. A summary of the responses to each question in the survey was provided to each respondent in Round 2 of the Delphi process. In addition, each respondent was provided with their answers submitted in the initial round. Respondents were asked to make any changes to their responses and submit comments supporting their answers. These revised answers and comments were then incorporated in the Round 3 questionnaire and shared with the other respondents. Each individual received the comments, along with the median and range of the Round 2, and their Round 2 answers in a Round 3 questionnaire. Respondents were asked to finalize answers and submit any additional comments with Round 3, the final round of the Delphi survey. The final round numeric responses, along with comments from questionnaire Rounds 2 and 3, are discussed in the following Delphi results section. The source for individual comments and responses remain confidential.

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[8]A planned fourth round of the survey was eliminated because it would have been rather redundant given that median ranges were well defined after Round 2.

## DELPHI RESULTS

The Delphi technique was employed to elicit expert opinion regarding the future of rail service for grain shippers. The predictions and comments presented in this section of the report reflect responses from participants representing a cross-section of the rail grain industry including elevators, commercial grain companies, grain merchants, and Class I and Class II railroads located throughout the United States. As this group makes important investment and marketing decisions, their opinions and comments are valuable in discussing future rail grain industry infrastructure, investment decisions, research endeavors, and policy development.

### Industry Trends

The North American rail mergers currently are receiving attention in industrial and political arenas. Seven Class I railroads currently operate in the United States. This reflects an 82 percent reduction in the number of companies operating as Class I carriers, compared to the 1980 industry profile (AAR). Respondents expect this trend to continue over the next decade, with a majority of the respondents predicting that the 2010 U.S. rail system will include four Class I carriers. Seventy-seven percent of the respondents expect a rail industry that includes either three or four railroads. It was suggested that recent Surface Transportation Board hearings, such as the March 2000 hearing titled "Major Rail Consolidations and Present, Future Structure of North

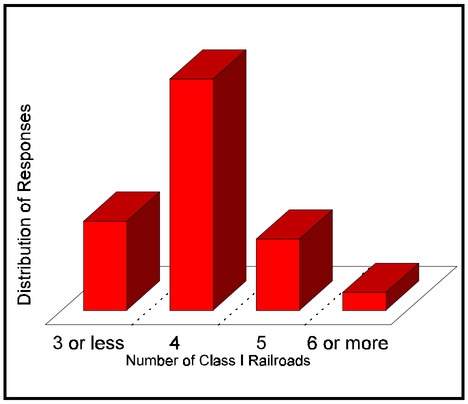


**Figure 1.** Number of Class I Railroads in 2010

American Rail Industry," and service dissatisfaction during recent mergers may slow the merger trend, but that competitive pressures will continue to encourage mergers in the rail industry. Surface Transportation Board, or other government interaction, was the only influence offered as a long-term deterrent to this trend.

Assets available for grain shippers are an important factor in the future of the rail grain industry. A broad measure of assets and market access, though not specific to the grain industry, is the number of track miles operated by the U.S. rail industry. In 1997, the U.S. rail network included 171,285 miles of track (AAR). Based on the median answer response of 155,000 miles, respondents expect railroads to abandon about 10 percent of the track they operate by 2010, compared to the 1997 track miles.

Respondents offered several comments to reinforce their expectations regarding track miles. Expected abandonment was attributed to four primary factors: (1) technology will increase capacity of main lines, allowing railroads to rationalize networks; (2) shuttle stations will expedite abandonment of grain dominated branch lines; (3) will likely be a product of continued rail consolidation activities; and (4) increased loadings of 286,000- and 315,000-pound cars will be prohibitive for operating some non-mainline track. Respondents who expected limited abandonment or an increase in track miles suggested that short lines will pick up any track spun off by the Class I carriers and improved technology and a

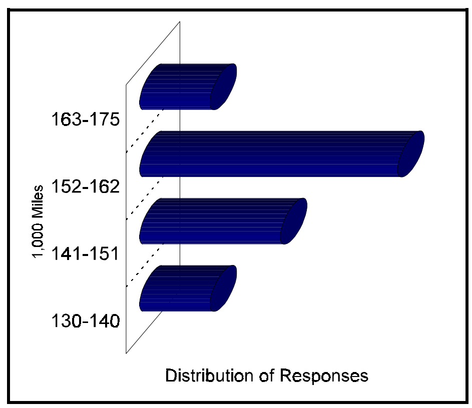


**Figure 2**. U.S. Track Miles in 2010

growing economy should allow railroads to grow, offering evidence such as new track being built into western U.S. coal fields.

Hopper cars were identified as one indicator of assets available for rail grain shippers. The U.S. hopper car fleet included 330,026 cars (capacity of 4,000 cubic feet and over) in the third quarter of 1999 (USDA, AAR). The responses for expected 2010 fleet size ranged from 225,000 to 340,000 cars. A median expectation for 300,000 hopper cars to be available in 2010 reflects an expected 10 percent reduction in the U.S. hopper car fleet. Based on questionnaire comments, the supply/demand situation does not make new car building an economically attractive option in the current market. It also was suggested that this reduction reflects improved fleet utilization, which would allow railroads to use larger shipments and higher capacity cars to move more grain with fewer cars, rather than a reduced level of commitment to grain shippers. The trend in ownership of this asset type was not addressed in this study, but respondent comments suggest that it may be an important factor in discussing rail rates and future investment.

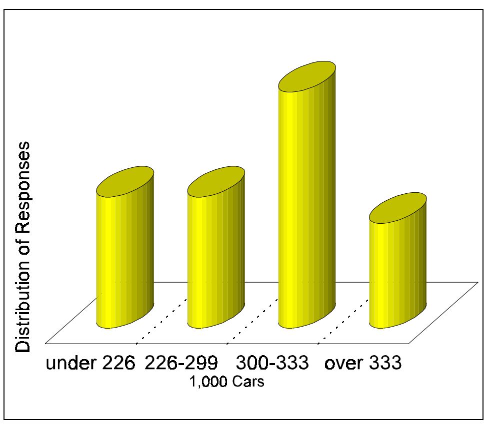


**Figure 3**. Hopper Cars in the 2010 U.S. Rail Fleet

Car capacity is an important attribute of the U.S. hopper fleet. It is directly related to total fleet capacity and indirectly related to the fleet available for shippers/receivers unequipped to meet infrastructure demands of heavier cars. The economic advantages associated with the 286,000-pound and 314,000-pound heavier axle load (HAL) cars have been estimated at a net cost savings of 5 to 7 percent per ton-mile compared to the 263,000-pound car (Hargrove, 1991). Thus, as cars are retired and new investment dollars are appropriated for car purchases, buyers typically order HAL cars. The "car of choice" for the grain industry in recent years has been the 286,000-pound car. This trend has important implications for fleet capacity and shippers/receivers located on light-density lines.

Approximately 10 percent of the cars in the U.S. hopper car fleet currently are 286,000-pound and greater (USDA). To gauge the rate of the transition of the fleet to the HAL cars, respondents were asked to predict the year in which the 286,000-pound and greater cars would constitute more than 50 percent of the U.S. fleet. The median response from the experts was 2010. Responses ranged from 2005 to 2050, with 64 percent predicting that the 286,000-pound and heavier cars will become the dominate car type in the U.S. hopper fleet sometime between 2007 and 2010. Support offered for a transition earlier than 2010 is that all hopper cars ordered since 1997 have been 286,000-pound. In addition, some railroads have been moving smaller cars into fertilizer or specialized service, or as car leases expire, not renewing

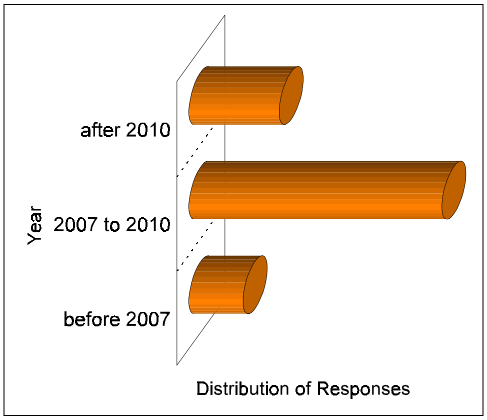


**Figure 4**. Year Cars with 286,000-pound Capacity and Greater will be a Majority of Cars in the U.S. Hopper Fleet

the leases on the smaller cars. Comments endorsing a longer cycle for the shift to the HAL cars were based on investment decisions. Respondents stated that current market-based compensation for private car ownership fails to support additional new construction, offering that the current return of 15 to 18 cents per mile will not support investment in heavy axle cars for the grain industry. Rail investment in this rolling stock is also expected to be minimal because investment dollars were expected to be channeled toward technology, infrastructure, and locomotives. In addition, the rate of retirement of the current fleet was expected to be slower because the age of the current fleet will not strongly influence the shift for 15 years.

Although responses provided a 45-year range for when the U.S. grain industry might be served primarily by 286,000-pound and heavier cars, a narrow window between 2007-2010 accounted for a majority of the responses, suggesting that this event will likely occur during the next decade. The benefits of the additional fleet capacity will be an important consideration in the potential for growth in the rail grain sector. On a less certain front, it is an eminent factor in deciding the future of shippers/receivers not equipped to handle these larger cars, often located on Class II rail lines and Class I light-density branch lines.

A final industry trend considered in this section is the potential for small lot movements in a market dominated by large volume shipments. Container shipments of traditional bulk grains have received attention in recent literature as a means for producer and grain merchandisers to diversify. The container market allows shippers to control product attributes based on customer specifications. Typically, these sales require premiums, relative to bulk marketing, to cover additional agronomic, conditioning, handling, freight, management, and administrative costs. The level of additional cost varies significantly, depending on customer demands. Suppliers may choose to serve this rather specialized segment of the grain market based on individual economic criteria.

It is estimated that currently less than one percent of annual U.S. grain is marketed via container. Delphi participants were asked to predict the trend for this market by estimating the percent of U.S. grain that would be marketed by container in 2010. Based on responses, this market will continue to be a small niche segment of the U.S. grain industry. Growth, however,

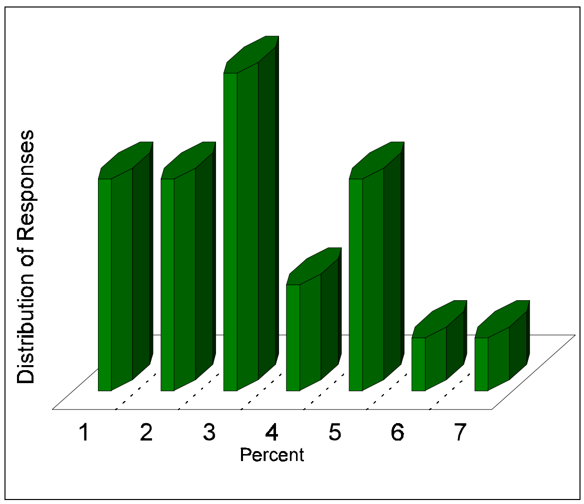


**Figure 5**. Percent of Annual U.S. Grain Shipments that will be Marketed via Container in 2010

will be significant, as the median response of 3 percent reflects a 300 percent increase in volumes. Responses ranged from 1 to 7 percent. Some respondents suggested that this market would experience little or no growth due to cost. Others attributed their outlook for increased use of the container marketing system to expected growth in demand for specialty products.

**Procurement**

Procurement encompasses the grain drawing activities of the grain industry. Market trends, technological advancements and investment decisions all work to shape this segment of the grain marketing channel. Elevators offer producers a means of gathering a mass of grain at a single marketing point for sale to domestic and export buyers. Elevators may provide other services such as grain conditioning and storage, but their primary function in the grain marketing channel has been to accumulate a critical mass that allows producers to share in the economies of scale inherent to shipping commercial bulk grain.

Understanding future expectation for the elevator industry provides insight into expectations for the grain procurement sector, such as producer access to markets, producer delivery distances/costs, local road requirements, and local grain infrastructure. More than 10,000 licensed grain facilities are included in today's U.S. country elevator network. Approximately 8,000 of the facilities purchase grain from farmers. In the Delphi questionnaire, experts were asked how many elevators they expected to be buying grain from farmers a decade from now. Based on the median answer of 6,000, Delphi experts prognosticate that approximately one in four of these elevators will cease to exist as a viable market for producers' deliveries 10 years from now.

As illustrated in Figure 6, there is a wide variation in expectations for the country elevator industry, with future numbers ranging from at 2,800 to 9,000 elevators. Respondents commented that consolidation in the grain industry and investment in larger, more efficient facilities will lead to additional rationalization of the existing network. Those supporting accelerated rationalization of the system attributed it to mergers and producer internet marketing. Those

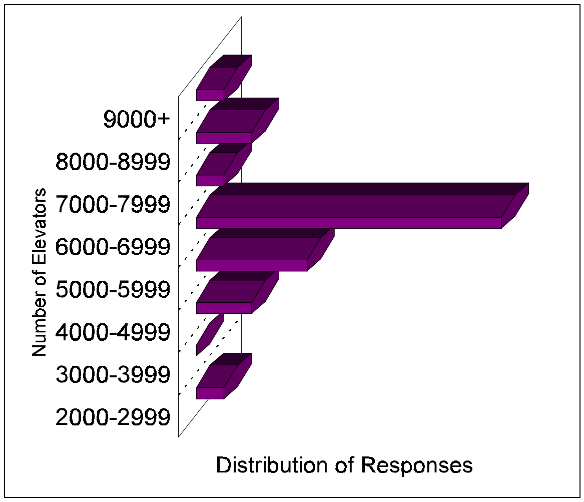


**Figure 6**. Number of Local Elevators that will Buy Grain from Farmers in 2010

predicting that fewer than 2,000 elevators would close, offered that a great deal of consolidation has already occurred. This group also suggested that the farm to first local elevator business allegiance will not change dramatically, allowing elevators to retain traffic through customer loyalties. Given the wide range of expectation for this industry, it seems evident that the local elevator industry is in the midst of adapting to an ever changing marketplace. The future of this industry will be determined by the functions it can efficiently satisfy in participating in a system designed to deliver a competitively priced product that meets customer demands.

In addition to infrastructure, it is important to assess the future demands that the grain industry may place on the rail industry. Volume plays an important role in defining demand, and thus, in the level and type of resources the grain sector may demand/support. Although production levels provide a good proxy for total grain volumes, the Delphi process went beyond production trends to garner expert opinion regarding the trends in decision-making of grain shippers. Specifically, the questionnaire addressed a key factor in demand for rail service, modal

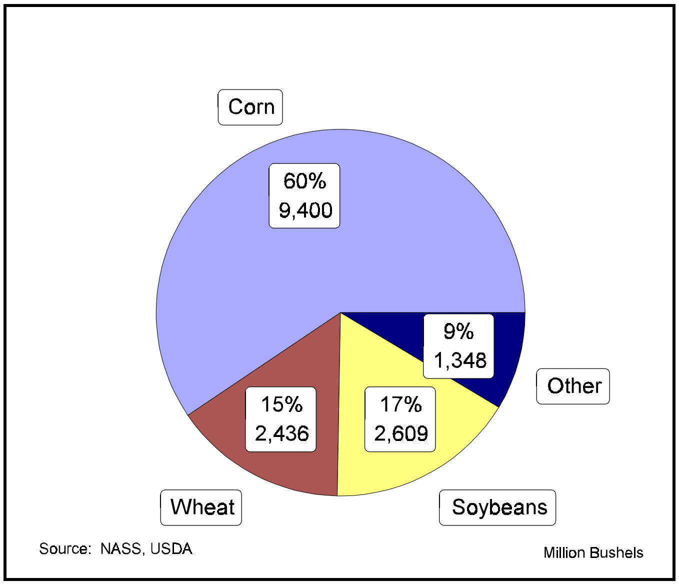


**Figure 7**. U.S. Grain and Oilseed Production, Average 1996-98

choice. Modal choice is influenced by many factors such as rates, accessibility, service, customer demand, consistency, flexibility, time, etc. To gauge future decision making, respondents were asked to estimate the modal prevalence of rail in marketing corn. Corn was selected because it accounted for 9.4 million bushels, or 60 percent of the U.S. grain production between 1996 and 1998 (NASS, USDA). Thus, even small shifts in modal delivery choice by the grain industry would have implications for the future demand of grain shippers for rail capacity.

Based on a ratio of rail shipments to production, approximately 24 percent of the U.S. corn shipments were marketed via rail between 1990 and 1995. Based on Delphi responses, the demand for corn rail shipments will increase by 25 percent over the next decade. The median expectation for the percent of U.S. corn to be marketed via rail was 30 percent, with answers ranging from 20 to 63 percent. More demand for corn rail shipments was attributed to

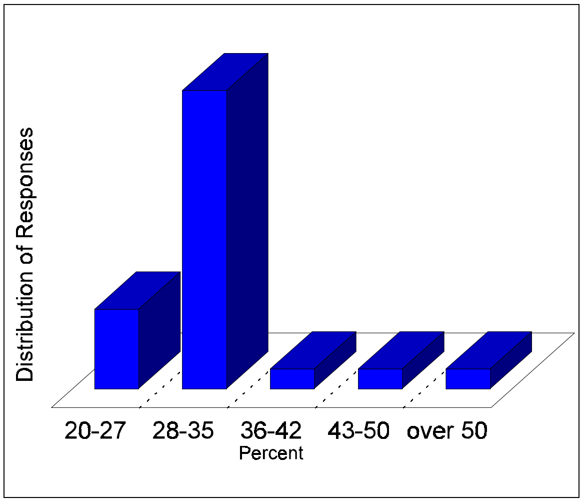


**Figure 8**. Percent of Annual Corn Production Marketed Via Rail, Estimate for 2010

migration of livestock feeders from the southeast to the west, expansion by receivers to facilitate larger inbound rail shipments, expected growth in Pacific Northwest served foreign demand, and an expectation that larger unit grain originators will capture a share of the local domestic truck market. A more pessimistic view of the growth potential for corn rail shipments was supported by suggestions that identity-preserved corn may move by truck, even for long hauls, and that growth in the domestic corn processing sector may create an expanded market for local truck deliveries.

Beyond volumes, another important factor in addressing the future for rail grain transportation is service. The type of service, such as single car versus shuttle train, may affect investment decisions, infrastructure requirements, equipment supply, market access, and other transportation related factors. Shuttle programs have been offered by railroads as a means to increase capacity through efficiency gains. Potential gains for shippers participating in the efficiency programs will depend on shippers' ability to use this type of rail service and absorb a share of the efficiency. To further gain insight into the future of rail shuttle programs, Delphi participants were asked about trends in shuttle-type movement of corn and wheat. In 1999, approximately 50 percent of U.S. rail corn shipments and10 percent of U.S. rail wheat shipments were made in shuttle/efficiency train. Respondents predicted shuttle/efficiency service would account for 72 and 37 percent of the U.S. rail corn and wheat shipments, respectively, by 2010. These levels of demand for the shuttle/efficiency service reflect an expected increase in demand of 44 and 270 percent for corn and wheat shuttle/efficiency service, respectively.

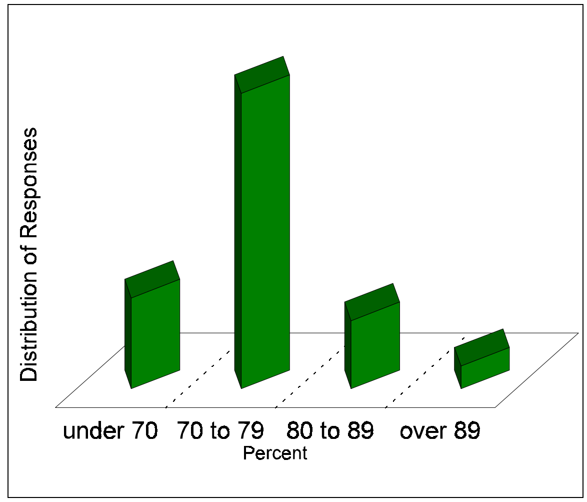


**Figure 9**. Percent of Rail Corn Shipments that will be Marketed Shuttle in 2010

Based on the range of answers, 60 to 95 percent, all respondents expected an increase in the share of rail corn shipments that would be attributed to shuttle/efficiency programs. Respondents with less aggressive expectations for growth in that market discussed factors related to biotechnology such as the current genetically modified organism (GMO) issue and technological innovations that will create a more refined sector of customer demand dependant on factors such as variety and specific traits. In addition, it was suggested that most of the "new capacity" for this market is already in-stream. Respondents supporting a greater than median share for shuttle/efficiency trains in the future attributed their predictions to expectations for domestic and export market demand, such as movement of feedlots to the west and Mexico

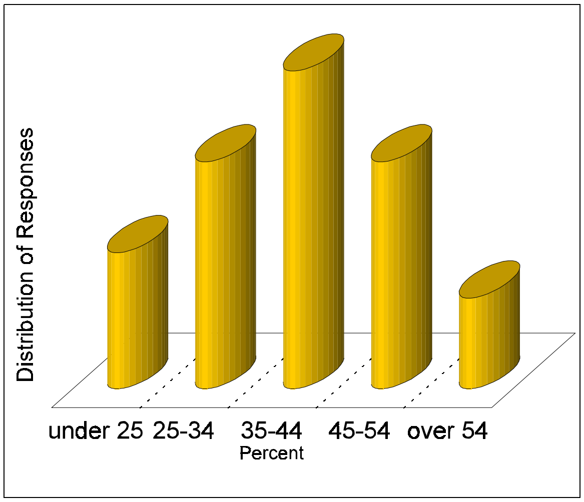


**Figure 10.** Percent of Rail Wheat Shipments that will be Marketed via Shuttle in 2010

market potentials, and continued investment by shippers, receivers, and railroads in shuttle capacity.

Expectations for the wheat shuttle/efficiency train market also is expected to attract a larger share of the rail wheat shipments, with responses ranging from 14 to 65 percent for 2010. The key limiting factors in the application of shuttle/efficiency trains to the wheat market appear to be the domestic market and segregation issues attached to milling industry demands, based on participant comments. In addition, based on production density, the draw area requirement for wheat was expected to limit the market advantage that might be gained shipping wheat via shuttle/efficiency. Respondents expecting a greater-than median share for shuttle/efficiency trains in the wheat market offered origin investments, application of single-line eastbound movements, and receiver investments as supporting evidence. Although shuttle/efficiency trains are not a new concept, more aggressive marketing by rail carriers to shippers and receivers, and investment decisions in recent times have increased interest in this type of rail service. Expectations for future demand by this sector of the rail grain industry have important implications for rail customer rates, service, car supply, and investments, regardless of their decision to actively participate in this market.

## Short Line Rail Industry

The short line rail industry operates about 49,600 miles, or 29 percent, of the track miles included in the U.S. rail network. In addition, short lines originated approximately one-third of the total U.S. farm product shipments in 1996. Short line railroads currently provide service on many light-density lines in rural areas which are grain dependant. In some cases, the grain gathering services performed by these railroads generate a substantial portion of the annual operating revenue. Thus, future expectations for the success of short line railroads by rail grain industry experts provide critical insight into expected grain flow patterns that affect infrastructure needs and rural economies.

To ascertain expert view on the future of the short line rail industry in the grain industry, participants were asked to estimate what the short line share of U.S. track miles and rail farm product shipments would be in 2010. Based on median responses, the short line industry is expected to increase track miles by about 17 percent and maintain its market share in the origination of U.S. farm products. Predictions for track miles ranged from 30,000 to 75,000. An

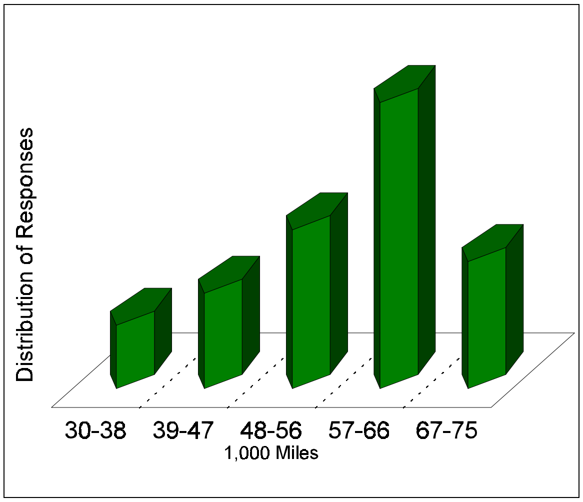


**Figure 11**. Track Miles the Short Line Rail Industry will Operate in 2010

expected decline in short line track miles was supported by comments about uncertainty in short line ability to accommodate heavy axle loads, such as 286,000 and 315,000 pound cars, and competitiveness of trucks in providing grain gathering services. In addition, respondents offered that facility investments on Class I main lines may allow these upgraded facilities to expand draw areas to encompass all or part of a neighboring short line's draw area. In contrast, expectations for growth in short line track miles was attributed to continued joint marketing ventures with Class I railroads and expectations for continued rationalization of the Class I network, with lower-volume domestic markets being spun-off to the short line industry.

Although short line market share of rail farm product shipments is expected to remain stable, based on the median, predictions ranged from 15 to 60 percent. This range reflects expectations for a 55 percent decline to a 76 percent increase in the short line share. A shrinking short line share of the rail farm products market was attributed to two primary factors - competitive alternatives, such as truck alternatives and shuttle train marketing; and infrastructure,

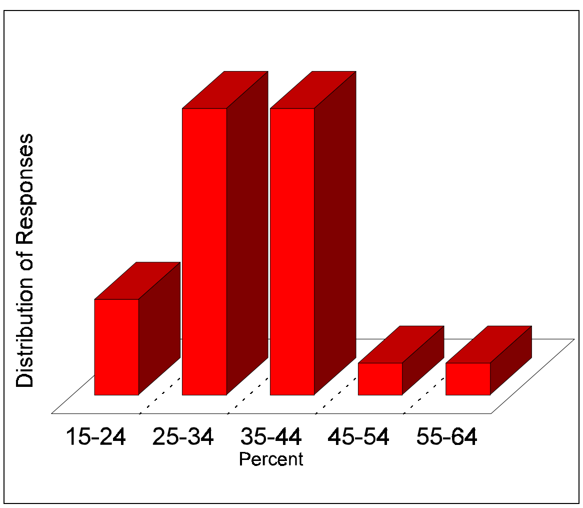


**Figure 12**. Short Line Share of Rail Farm Product Originations in 2010

with a current issue being the ability of short lines to facilitate heavy axle load cars. Comments supporting a larger share of farm product originations for short lines included a continued presence for short lines as originators for major grain handlers and strong allegiance in the producer-local elevator relationship.

## Rail Carrier-Shipper Interaction

Three components of the grain rail carrier-shipper relationship were included in the Delphi process: rates, car ordering and customer service. Each of these factors is important in discussing the future of rail carrier-shipper relationships, as success is interdependent. Rates offer a rather tangible measure of the cost of rail service for shippers seeking to access specific markets via demand. Dependence on tariff orders for car supply provides insight into car supply for shippers, and the ability of the grain industry to forecast market demand. Customer service encompasses a rather broad span of the rail-shipper relationship, influenced by rail performance and shipper expectations. Factors considered in evaluating the state of this relationship range from fleet utilization to on-time delivery to response time for customer inquiries. These three facets of the rail carrier-grain shipper relationship were addressed individually in the Delphi questionnaire.

The rates that grain industry expect to pay in the future provide important insight into the future competitiveness of the U.S. rail grain industry. In real terms, aggregate U.S. farm product rail rates declined seven percent annually during the 1980s and continued to decline one percent annually during the 1990s. Delphi participants were asked to indicate their expectations for the rail rate trend by predicting what the average annual real rate trend for farm products would be over the next decade. More than two-thirds of the respondents expect rail rates for farm products to increase by 1 to 4 percent annually over the next decade. The median response was an expected annual real rate increase of 1 percent, suggesting that the declining rate trend shippers experienced during the 1980s and 1990s will be reversed, and shippers will experience a real rail rate increase over the next decade.

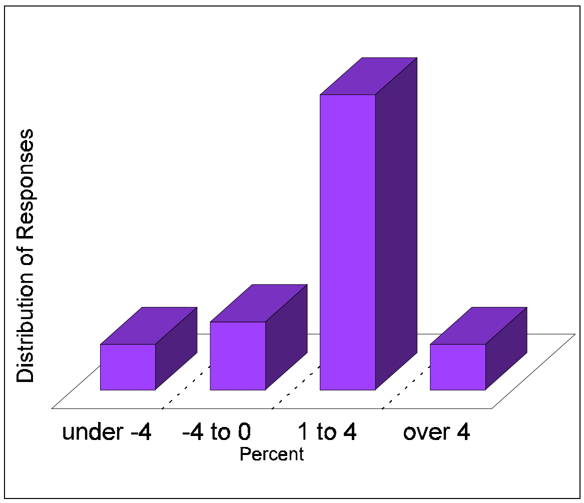


**Figure 13**. Expected Average Annual Real Rail Rate Trend for the Next Decade

Comments from the experts foreseeing a declining rail rate trend for farm products attributed answers to market pressures for lower delivered costs and an inability of railroads to raise prices. In addition, respondents expected a change in the profile of the typical farm product rail service, with railroads eliminating options for less efficient farm product movements and shippers increasing use of lower rate options such as unit trains. Expectations for higher rates were attributed to industry consolidation, and a resulting lack in competition. It was suggested that in addition to the "rate" component of rail service, car ownership costs should be considered as trends in rail/shipper ownership of this asset are an important factor in assessing the "total" rail freight bill for grain shippers.

Insights into the practices of railcar ordering are important in understanding shipper ability to access car supply, flexibility of the rail marketing system, car ownership trends, and the ability of the grain industry to forecast demand. Based on the median survey response, the Delphi experts expect utilization of tariff orders to decline for grain shippers. In 1997, approximately 25 percent of the U.S. rail grain tonnage moved via freight ordered through tariff car programs. Respondents expect a 40 percent decline in the use of a tariff ordering options by 2010, with about 15 percent of the rail grain tonnage expected to move via tariff ordered freight during that year. A range of 10 to 80 percent was offered for this Delphi question. Several comments were offered regarding the use of the tariff system for accessing the rail market. Individuals expecting growth in tariff orders attributed it to potential for rail carriers to extract premiums and potential use in countering any market dominance complaints. In addition, it was noted that there is no statutory definition for the common carrier obligation to provide cars or service. Those expecting the grain industry to move away from the tariff system suggested that employment of unit trains, need for predictable service, and benefit/cost of alternative ordering programs that offer service guarantees are all market factors that will increase demand for car orders through other programs.

The final topic address in the Delphi service was quality of rail service. Rail customer service is often afforded considerable literature and attention during times when carriers are experiencing market or operational problems in serving customer demands. Although attempts have been made to address the issue of service "quality," an industry consensus on the appropriate service measures has not been reached. The Delphi survey of grain industry experts offered an opportunity for gathering general input into potential measures that might be considered in evaluating the service the rail industry provides to grain shippers over time. Respondents suggested the measures listed in Table 1, including market share, days in transit, bad car orders, and on-time placement.

**Table 1. List of Rail Customer Service Measures, Suggested by Delphi Respondents**

| | |
|---|---|
| 1. Days at Origin & Destination, Yard Dwell Time at Origin/Destination, AAR Terminal Dwell Time Report | 7. On-Time Placement |
| | 8. Bad Car Orders |
| 2. Cycle Times for O-D pairs (consistency) | 9. ETA vs. Actual Spot, Accuracy of Pre-Advise for Car Placement/Delivery |
| 3. Days in Transit | 10. Car Placement +/- Customer Want Date, Avg. for Fleet |
| 4. Surface Transportation Reports | 11. Loss and Damage Claims |
| 5. Standard Deviation of Transit Time | 12. Customer Satisfaction Surveys, and |
| 6. Market Share | 13. Customer Support. |

Considering the suggested measures, availability, cost, and validity of individual measures are key factors. Each of these items will be considered in future discussions about indicators of rail service for grain shippers. Although some of the measures suggested may reflect railroad operating efficiency rather than "quality of service," respondent answers would suggest the measures may be used in some indicator for customer service.

## CONCLUSION

It is evident that future demand trends and investment decisions by the elevator and processing industries, and the availability and quality of rail services will continue to influence the modal decisions of the grain marketing sector. It is important to make an assessment of the quality and quantity of rail services available in the future and the types of shipper investments that will be made in the future rail grain sector.

This study performs a Delphi survey of grain market experts to assess the future availability and quality of rail services for the agricultural sector. The survey produces several interesting future expectations, including (1) further consolidation of the rail and elevator industries, (2) increasing prominence of the HAL cars in grain service, (3) an increase in rail rates from 1 to 4 percent annually over the next decade, (4) expanded use of shuttle/efficiency rail programs for major grains, (5) an increased use of market-based car ordering systems, (6) growth of the short line rail network, and (7) small market-scale, but large volume, increases in the share of grain marketed via container.

The insights ascertained through the Delphi process are valuable in understanding the future of the rail grain industry. These expert opinions will be considered in future research and discussions regarding longer-term implications government policy and market investment decisions in the rail grain sector.

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## APPENDIX A

## RAIL SERVICE FOR GRAIN SHIPPERS, DELPHI SURVEY INITIAL QUESTIONNAIRE

This questionnaire is the first in a series of questionnaires that will be administered to ascertain expert opinions regarding the future of rail service for the U.S. grain industry.

The following table provides a base for rounds two through four. Comments and aggregate response ranges will be provided for respondents following each round. You may modify responses and share comments in each questionnaire. Sources of individual responses/comments remain confidential. Please answer questions one through fifteen in the following table.

| | **Answer** |
|---|---|
| 1. Seven Class I railroads operate in the U.S. How many Class I railroads will be operating in the U.S. in 2010? | |
| 2. The U.S. rail network included 171,285 track miles in 1997. How many miles of track will be included in the 2010 U.S. rail system? | |
| 3. Short line railroads operated approximately 49,600 miles of track in 1997. How many miles of track will short lines operate in 2010? | |
| 4. Short line railroads originated approximately 34% of U.S. farm product shipments in 1996. What percent of U.S. grain shipments will be originated by short lines in 2010? | |
| 5. Today's U.S. country elevator network includes over 10,000 licensed facilities, approximately 8,000 of these facilities purchase grain from farmers. How many country elevators will purchase grain from farmers in 2010? | |
| 6. U.S. hopper car fleet included 330,026 cars (capacity of 4,000 cubic feet and over) in Q3-1999. How many hopper cars (4,000+ cu. ft.) will be included in the 2010 fleet? | |
| 7. In 1999, approximately 10% of the cars in the U.S. hopper car fleet were at least 286,000 lb capacity. In what year will cars of 286,000 lbs and over account for 50% of the U.S. fleet? | |
| 8. Rail accounted for approximately 24% of the U.S. corn shipments between 1990 and 1995. What percent of U.S. corn will be marketed via rail in 2010? | |
| 9. Shuttle/efficiency train shipments accounted for approximately 50% of U.S. corn rail shipments in 1999. What percent of U.S. rail corn shipments will be via shuttle/efficiency train in 2010? | |
| 10. Shuttle/efficiency train shipments accounted for approximately 10% of U.S. wheat rail shipments in 1999. What percent of U.S. rail wheat shipments will be via shuttle/efficiency train in 2010? | |

| | Answer |
|---|---|
| 11. Currently, less than one percent of annual U.S. grain shipments are marketed via container. What percent of U.S. grain shipments will be marketed by container in 2010? | |
| 13. Analysis indicates, in real terms, that aggregate U.S. farm product rail rates declined 7% annually during the 1980s and continued to declined 1% annually during the 1990s. What will the average annual real rate trend for farm products be over the next decade? (Please indicate + or - with %) | |
| 14. Approximately 25% of U.S. rail grain tonnage moved via tariff car orders in 1997. What percent of U.S. rail grain tonnage will be marketed via the tariff car ordering system in 2010? | |
| 15. Do measures exist to evaluate the quality of rail service to shippers (not railroad operating efficiency)? If yes, please list measures.<br><br>List of Measures: | |

Name (Please Print): ________________________________________

Comments:

## APPENDIX B.

## LIST OF COMPANIES INVITED TO PARTICIPATE IN THE DELPHI SURVEY

| **Company** | **Location** | **Activity** |
|---|---|---|
| Archer Daniels Midland | Decatur, IL | Commercial Grain |
| Ag Processing Inc | Omaha , NE | Commercial Grain |
| Benson-Quinn | Minneapolis, MN | Grain Merchant |
| Burlington Northern Santa Fe | Fort Worth, TX | Class I Rail |
| Cargill | Minneapolis, MN | Commercial Grain |
| Cassidy Grain Co | Frederick, OK | Grain Shipper |
| Cenex Harvest States | St. Paul, MN | Commercial Grain |
| CN/IC Railroad | Chicago, IL | Class I Rail |
| ConAgra | Omaha, NE | Commercial Grain |
| CP Rail | Minneapolis, MN | Class I Rail |
| CSX Transportation Co | Jacksonville, FL | Class I Rail |
| DeBruce Grain Inc. | Kansas, MO | Grain Shipper |
| Demeter Commodities L.P. | Fowler, IN | Grain Shipper |
| Dakota Minnesota and Eastern Railroad | Brookings, SD | Class II Rail |
| Farmers Commodities Corp | Eden Prairie, MN | Grain Merchant |
| Farmland Industries Inc | Kansas City, MO | Commercial Grain |
| General Mills | Minneapolis, MN | Commercial Grain |
| Iowa Interstate Railroad | Iowa City, IA | Class II Rail |
| Montana Rail Link | Missoula, MT | Class II Rail |
| N.I.K | Kearney, NE | Grain Shipper |
| Nofolk Southern Corp. | Roanoke, VA | Class I Rail |
| Rail Tex | San Antonio, TX | Class II Rail |
| RRVW Rail Co. | Wahpeton, ND | Class II Rail |
| BTR Cooperative | Churchs Ferry, ND | Grain Shipper |
| Schoular Company | Overland Park, KS | Grain Shipper |
| The Andersons | Maumee, OH | Grain Shipper |
| Union Pacific Railroad | Omaha , NE | Class I Rail |