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Expanding the Effective Use of the Rail System in Rural Minnesota

Matthew Pahs

In Minnesota, the rail network is an integral component of the transportation system. It has not only been a key player in the growth of the state, but remains a significant factor in a multimodal freight transportation system supporting current farms and businesses in rural Minnesota. The cost-effective long-haul transportation of both bulk commodities and manufactured goods provides Minnesota with market access from a geographic location that is challenged in its distance to and from those markets. In 2007, railroads moved more commodities, at a lower cost per ton mile, than at any time in their history. They continue to be three to four times more fuel efficient and cost effective than long-haul trucking for land transportation of high-volume moves. Over twenty railroads operate in the state, including four major railroads, providing an economic link to markets around the world. Minnesota has a relatively high percentage of freight moved by rail compared to other states, over 30% by tonnage, due partially to the presence of the iron deposits and Great Lakes terminals in the north and diverse agricultural production in a majority of the rest of the state. Minnesota currently is home to the eighth largest rail system in the nation.

Bulk movements of iron ore, coal, grains, ethanol, and aggregates from terminals scaled for trainload-sized shipments have become the norm on major railroads and have reshaped the economics and distribution patterns for commodity movements in the state. Most local distribution and collection of goods, including virtually all less-than-carload, package, and express shipments, are moved by truck rather than by railroads. In addition, long distance domestic and international cargo is now routinely transported in standardized shipping containers ("marine" or "intermodal" containers), offering costs well below truck transport as well as providing enhanced cargo protection and security. Final distribution of these cargo containers

is performed by truck from a few centrally located container transfer yards, including three in the state, and supplemented by significant container distribution by truck to and from Chicago. Gaining access to this container service has been difficult for smaller railroads serving rural Minnesota.

As major freight railroads have recently concentrated on trainload lots of bulk cargo and long-distance transport of containerized cargo, there is a move to the use of heavier cars. Major railroads are using increasingly heavier railcars to reduce costs, requiring smaller railroads to use the same standard cars. Smaller railroads may find difficulty in financing improvements to track and bridges to meet this standard.

Development of the biofuel industry in Minnesota has created an opportunity for railroads. As demand for ethanol and biodiesel increases, the need to transport these fuels to distant markets will provide opportunities to rural Minnesota.

In 2007, the Minnesota Department of Transportation (Mn/DOT) completed a freight study for Southwest Minnesota. The study identified key issues related to the freight system in Minnesota, including potential opportunities and challenges. This article will discuss the existing rail system in Minnesota and expand upon the findings of the 2007 study with specific attention to issues facing railroads and the shippers that use the system in rural Minnesota.

The rail system in Minnesota

Starting in 1862, the rail system grew parallel to Minnesota's population growth and in fact shaped much of Minnesota's distribution of cities and businesses across its rural frontiers. At the system's peak of 9,362 miles in 1930, the vast majority of Minnesota's population was within ten miles or less of daily passenger and freight service. A network of rail corridors existed in the state that was formative for the economy in key business sectors, including agriculture, forestry, energy, and mining. Railroad route mileage has been reduced since 1980 to approximately 4,500 miles, although the system generally still offers wide geographic coverage. Despite this significant reduction, Minnesota still has the eighth largest rail system in the nation, based on rail miles.

Railroads are divided into three classes of operation — Class I, II and III — assigned by the federal Surface Transportation Board. These classes are based upon the railroad company's gross operating revenues and generally reflect the type of service provided: long haul (Class I), regional (Class II), and local (Class III).

The majority of route miles in the Minnesota rail system today are owned and operated by four Class I Railroads: BNSF Railway

(1,598 miles), Canadian Pacific (750 miles), Union Pacific (462 miles), and the Canadian National (436 miles). These railroads provide long-haul service across the United States and Canada and offer interchange to national and international markets. The DME, the only Class II, or regional railroad in Minnesota, operates on 472 miles of track.

The remainder of the state's route mileage is operated by 16 Class III railroads (totaling 763 miles) and three private railroads (totaling 57 miles). These smaller railroads, also referred to as short line railroads, continue to provide important local and regional access for businesses. Most are relatively low-volume lines that experience peak traffic around the grain harvest season. Other major commodities transported include taconite, aggregate, clay, and ethanol.

Opportunities and challenges: Shuttle train service

During the past two decades, Class I railroads have realized dramatic productivity gains in coal and more recently in grain transportation using the shuttle train service concept. Shuttle trains (i.e., unit trains contracted on a full trainload basis) are dedicated to one commodity that can be rapidly loaded and unloaded, and railcars must be able to be quickly cycled for the next load. Common attributes of the shuttle train concept include: farm delivery to elevators by five-axle tractor semi-trailer combination trucks; an average farm-to-elevator haul of up to 75 miles; and elevators loading a full train of high-capacity (100-ton payload) railroad hopper cars. Elevators must be able to load an entire 100- to 110-car unit train in 15 hours or less.

The Class I shift to 70- to 125-car shuttle trains is due in part to a focus on long-haul grain movement from Minnesota to distant domestic markets in the Pacific Northwest and the Gulf of Mexico. Terminals that loaded grain in blocks of 26, 54, and then 75 rail cars only a few decades ago are increasingly moving in these larger 100+ rail car sets. The types of grain shuttled in Minnesota include corn, soybeans, wheat, and distillers dried grains (DDGS). The latter is a byproduct of ethanol production, serving as animal feeds and protein supplements similar to corn and soy meal. As the average size of ethanol plants grow, their primary product of liquid ethanol is also now moving in shuttle trains of specialized tank cars to all points in the nation.

The grain shuttle trains provide an efficient service for the Class I railroads and for large grain farmers located near the shuttle loaders. It puts additional pressure, however, on the rail network

to accommodate loading and unloading of these long trains and requires longer sidings for trains to wait for other trains to pass. In addition, it has created problems for some of the regional and short-line railroads and other shippers. For example, many farmers wishing to take advantage of the lower shuttle train rates are forced to truck their grain 75 to 100 miles to the nearest shuttle loading elevator.

The average equipment cycle time for unit trains hauling grain is 18 to 24 days, but often can be turned completely within 10 days. This compares to single car loads and small blocks of cars that historically took 30-90 days for the equipment to be returned. Using grain shuttle trains, the Class I railroads hope to replicate productivity gains they have demonstrated in coal transportation in the past three decades, essentially a "conveyor on wheels," but scheduled to fit the varying needs, destinations, and markets of the grain trade.

Shuttle train elevators must be able to load a shuttle train within a specified time limit, often 12-15 hours, using hopper cars able to carry 100 tons in a car having a loaded gross vehicle weight of at least 286,000 pounds each. Elevators must also have track structure in place so that an empty 110-car train (over a mile long) can be easily placed for loading and minimal switching by the rail carrier.

From the viewpoint of some of the regional and short-line railroads, the Class I railroads appear to be phasing out smaller shipments in favor of shuttle trains and longer lengths of haul. A common concern is that the Class I railroads will offer discounted shuttle rates to shippers, but will not offer the same lower rates to short lines so they can solicit 100+ cars from multiple shippers. In addition, grain transportation rates are sometimes lowest for elevators that can commit to consecutive loading of shuttle trains.

Another concern is that the shuttle trains receive priority during car shortages, exacerbating the problem for shippers without shuttle-loader access. Despite this concern, principally, on the part of small shippers and elevators, the improved car utilization and shorter operating cycles have essentially eliminated the majority of car shortage issues that proved almost disastrous to the American grain industry during the 1950s, '60s and '70s. In addition, because shuttle train service focuses on the more profitable long-haul service to the Pacific Northwest and the Gulf of Mexico, a reduction in rail service at competitive rates to ports on the Mississippi and Lake Superior has been occurring, as well as increased truck activity in the form of longer hauls and more concentration of traffic around shuttle terminals as previously discussed.

In Minnesota, three Class I railroads, the BNSF, Union Pacific, and Canadian Pacific, offer similar shuttle train contracts and service. They are joined by several regional and short line rail carriers that participate in these contract terms and structures for several on-line shippers. Although some short line railroads are able to transport rail cars bearing a weight of 263,000 pounds, the 286,000-pound hopper car requirement has made it more difficult for several of Minnesota's short line railroads to interline grain shipments with Class I carriers. Many of Minnesota's short lines are unable to carry the heavier cars without substantial track replacement or maintenance and bridge replacement or reinforcement. Current contract and tariff structures do not allow enough short line cost recovery in the revenue sharing formulas to address this problem, and shippers have been averse to paying extra to their local carrier in most cases. The Federal Railroad Administration (FRA), the Association of American Railroads, and the Class I railroads are also evaluating the feasibility of moving to a heavier car specification for four-axle cars, at 315,000 pounds gross weight. This may be the norm in five years, further exacerbating the infrastructure investment dilemma for short line railroads.

Currently, 61 of Minnesota's more than 650 licensed elevators can meet shuttle train loading requirements. In order to meet the required loading speeds and hold 75-110 grain hoppers at one time on dedicated sidings, the majority of shuttle elevators have had to invest from $1 million to $3 million in capital improvements. In return, the financial incentives for shuttle train loading can run from $70 to $100 per car tied to the loading site with similar incentives for qualified unloading facilities, or up to 30% less than a single carload rate for an average haul.

The collection area for grain going to these facilities usually covers a 75-mile radius, compared to local elevator collection that historically was within 15 miles. Because of the rail rates and the collection areas they promote, many areas in Minnesota and the Dakotas have experienced 80% of their export crop moving through 10% to 15% of the total number of elevators distributed throughout the rural areas. This has led to a reduction in use of local elevators across rural Minnesota, often causing them to go out of business or be shifted to use as local farm storage during the off season.

With the current trend toward more on-farm consumption for value-added agriculture products (livestock and poultry), and local consumption of grains for ethanol and biofuels, some in the industry have raised concerns about an overbuilt capacity of shuttle train facilities. Given the investment requirements, it is likely that only the largest elevators or those associated with large international grain firms will survive future market consolidations.

Opportunities and challenges: Intermodal

In addition to the use of shuttle train operations to increase efficiencies, there is also a trend towards intermodal shipping. Rail intermodal shipping involves the transportation of freight in intermodal containers, sometimes referred to as "marine" containers. They are transferable between other modes of transportation, such as trucking. Freight transport efficiencies can be achieved with intermodal shipping, including reduced transfer time, reduced overall transport time and cost, reduced damages and loss, and improved security.

The dramatic increase in demand for intermodal transportation services is being driven primarily by global trade and imports of consumer goods to the United States. In addition, food security issues are contributing in part to the growing demand of containerized intermodal shipments. There are also operational efficiencies that support containerized grain shipping: containerization makes it easier to satisfy consumers with specific shipping needs; containerization allows the producer full control of the product from the field directly to the customer rather than the process of trans-loading or handling a commodity multiple times via several different modes of transport from field through local collection terminals to the final destination; and, by retaining control of container loading, farmers may extract higher prices for premium or specialty products without marketing through an intermediary.

Freight security has always been an issue in regard to pilfering and theft, but several high profile food crises recently (e.g. mad cow disease, genetically altered seed, salmonella, etc.) resulted in new protocols that now apply to food and grain shipments to many international markets. Identity Preserved (IP) food products and the need to trace grain and food through the supply chain to export markets now dictate the use of sealed intermodal containers.

The containerized delivery of grain is typically accomplished in one of two ways: bagged or packaged grain from the farm is palletized, trucked to a transload warehouse, and loaded into containers; or bulk grain from the field is loaded directly into a container that has been sanitized and lined with a plastic bag, then sealed. At that point, containers are drayed (locally trucked) to the nearest intermodal rail ramp, from where it moves by container unit trains to a seaport. Utilizing containers, the specialized grain producer can control the individual shipment from the farm to its final overseas destination rather than merely from the farm to the first elevator.

The demand is increasing for localized access to intermodal/

containerized freight in rural Minnesota. A short line intermodal rail service in Montevideo provides localized loading of intermodal containers and a guaranteed immediate transfer of those containers by a short line railroad to a Class I long-haul containerized train service via the Twin Cities to major U.S. seaports for connections to final destinations in Asia, Europe and Latin America. These regularly scheduled, expedited shipping services are provided to ethanol producers for DDGS, to growers and processors of Identity Preserved food-grade soybeans and wheat products, and to other value-added soybean feed and specialized grains. Demand likely exists in other parts of rural Minnesota for similar local intermodal access to distant markets via an efficient and cost-competitive service. The challenge is coordinating this innovative short line railroad service with Class I railroad services.

Development and operating costs for intermodal container terminals on short line railroads have been shown to be significantly lower than those on Class I railroads. In addition, shorter truck hauls and lower drayage costs contribute to the economies of developing short line intermodal terminals, improving the shipper's profitability, market price competitiveness, and the health of the local agricultural economy. However, obtaining rail cars and containers, particularly during periods of high demand, is a major issue of concern and a roadblock to the expansion of local container access. The marine and rail companies do not have the assets to disperse a large number of containers to local sites throughout the rural areas and not have them returned promptly with revenue loads in them. If this issue can be resolved and appropriate agreements with railroads can be achieved, rural intermodal container terminals could provide shippers in rural Minnesota with another rail option, making more effective use of the rural rail system.

Opportunities and challenges: Size and weight

Increasing weight capacity on rail continues to be an issue for short line and regional railroads. Class I railroads, including the UP and BNSF, have implemented new maximum gross weight for four-axle freight cars, increasing the recent maximum of 263,000 pounds to 286,000 pounds gross weight per car. They have also required that regional and short line railroads that interchange cars with them be able to handle the heavier cars. This is a concern for short lines already operating with marginal track and bridge structures and 10-mile-per-hour speed limits.

To remain competitive, regional and short line railroads with marginal conditions may choose to adopt the use of heavier cars,

without major infrastructure upgrades. The upgrade of ties and roadbed, rail size, and bridge capacity is expected to require financial investments above and beyond the financial capacity of many rail operators to pay for or be covered by existing revenue streams. The lack of profitability and capital to make these necessary improvements threatens their long-term viability and in turn the locally responsive service and local access to major markets they provide. In addition, shippers on regional and shore lines who own their sidings and yards would also need to upgrade their track.

Currently, the Class I railroads are considering a further upgrade to 315,000 pounds maximum gross car weight. While many consider the 286,000-pound limit a manageable problem, the same parties consider the 315,000-pound limit completely unworkable for many lines with substandard track and light bridges. While these new, heavier car designs require larger wheels, bearings, and metallurgical improvements as well as testing and FRA approvals, their wide-scale adoption will very likely occur in the near future, possibly in the next five years.

This poses a potential for reducing the railroad system's rural capacity and access for shippers on short and branch lines at a time when it is most needed for economic expansion. The structural challenges are analogous to those faced by local and county roads under heavier truck and farm equipment loads. The actual track structure may even survive at very low operating speeds and marginal conditions, but bridges in particular may be prone to catastrophic failure under the bigger cars, effectively embargoing the line and shutting down the entire rail operation for all users on that route or branch.

The other main constraint to expanded railroad operations is vertical clearance above the rail. This is a concern particularly for Class I railroads, due to the movements of extra-height equipment like tri-level auto racks and double-stack container well cars for intermodal service. Many railroads do have vertical clearance obstructions, restricting operations of trains using these cars. For many of these lines, vertical clearances for signals, bridges, and power lines, among other objects, need to be increased to at least 23 feet. Vertical clearance issues are not a major concern on many short line railroads, where this specialized equipment normally does not run.

Horizontal clearance issues may curtail some oversize/over-width shipments, such as wind turbine components, that may need transportation in the near future. As demand increases for wind energy generation equipment, shippers may wish to use regional or

short line railroads to deliver equipment across Minnesota. This has been tested successfully on at least one short line in Minnesota and may be possible on many other short line railroads, although this service is not currently being utilized.

Opportunities and challenges: Biofuels

The increasing use of biofuels has created opportunities for rural Minnesota by offering another market for agricultural commodities. Ethanol and biodiesel are the two main types of biofuels, i.e., renewable, non-fossil fuels, produced from biomass sources such as corn and sugar cane, and vegetable oils such as canola and soybean oil. A majority of all biofuels are moved from production plants to blending locations via rail, creating opportunities for railroads and rural production locations.

The origins of the biofuels industry in the United States can be traced back to the oil price shocks of the mid-1970s and early 1980s. During that time, federal and state governments underwrote several research initiatives to accelerate the commercial development of biofuel technologies. In 1980, the Minnesota Legislature passed a tax credit for agricultural alcohol gasoline (more commonly referred to as the "blender's credit") that reduced the state fuel tax liability for blenders mixing ethanol and gasoline in Minnesota. In turn the credit reduced state transportation funds while having little effect on the level of in-state ethanol production. When the blender's credit failed to spawn a sizeable state ethanol industry, lawmakers reworked the subsidy, and in 1986, the legislature created the ethanol development fund to make direct payments to Minnesota ethanol plants per gallon of ethanol produced. The payment amount has changed many times but for most of the 1990s hovered around 20 cents per gallon. As a result of these incentives, Minnesota has become a leader in developing the ethanol industry.

The future of U.S. agriculture will be significantly impacted by the biofuels industry. Since 2000, biofuels have become the largest U.S. renewable energy source for the massive transportation fuel industry. There are many potential benefits to biomass fuels such as reducing America's dependence on imported foreign oil, reducing air and water pollution and offering new marketing opportunities for rural Minnesota. The industry's growth also poses new problems in commodity distribution, resource use including water and power for the plants, competition with food production and livestock feeds, and a continuing vulnerability to petroleum price variations.

Rail service is particularly critical for ethanol plants, transporting 60% or more of their outbound product, including ethanol and

byproducts such as DDGS, via rail. Service is provided to national markets, as well as for some inbound traffic to plants. Without the rail connections, virtually any ethanol plant cannot remain viable as most of their production is traded into national markets. Because ethanol plants now require more and longer sidings to accommodate unit trains and other rail loading requirements, these facilities have become more expensive to construct.

Opportunities and challenges: Increased freight traffic

Because of the increased market opportunities provided by new and expanding shuttle train service, intermodal service, and development of the biofuel industry, safety is an increasing concern at rail grade crossings. Increases in truck traffic and/or train traffic at highway/rail grade crossings may require enhancements to grade crossing safety, including active warning devices such as flashers and gates. Rail switching operations near plants, new rail crossings of roadways, and increased train speeds may also increase safety concerns. Mn/DOT's statewide grade crossing safety improvement program implements safety enhancements at crossings with existing conditions that exhibit the highest potential risk; the program does not accommodate safety enhancements needed due to newly introduced development.

The majority of collisions with trains occur on local, county, and CSAH (County State Aid Highway) roads, indicative of the large number of at-grade crossings and lower levels of protection at a large percentage of these rural railroad grade crossings. Although the number of crashes and fatalities at grade crossings has been trending downward over time, occasional grade crossing accidents do continue to occur.

The growth in farmer owned and operated heavy trucks and larger, slow farm equipment suggests that Operation Lifesaver, an education program that provides educational material to schools and civic organizations, and state-supported grade crossing safety education programs would be well served to begin focusing on agricultural areas and the agricultural user.

Minnesota Rail Service Improvement program

To help prevent the loss of rail service on lines potentially subject to abandonment by railroads, the Minnesota Legislature in 1976 created the Minnesota Rail Service Improvement (MRSI) program. Using state-developed eligibility rules, the state and rail users enter into contracts with railroads for rail line rehabilitation or contractors for rail service improvements. For rehabilitation

projects, when the project is completed, the railroad repays the state and rail users out of the operating revenues produced on the line. These reimbursements are returned to the Minnesota Rail Service Improvement Program account to fund future projects. For capital improvement projects, the shipper repays the state over a period of 10 years.

These funds were loaned to rail users and rail carriers to rehabilitate deteriorating rail lines, to improve rail-shipping opportunities, and to preserve and maintain abandoned rail corridors for future transportation use. Previously, funds have been used for improving, extending and moving rail sidings, construction of grain storage bins, fertilizer storage, building warehouses along the rail siding, and improving the speed of loading into rail cars. The success of this program has enabled it to fund itself for the last 25 years. MRSI provides funding for projects in the following categories:

Rail Purchase Assistance: If a railroad line has not been abandoned and is to be used for continued rail service, the MRSI Program can provide regional rail authorities funding up to 50% of the costs in the purchase of railroad corridors, if the rail authority is willing to operate the railroad line for rail freight transportation.

Capital Improvement Loans: This is a revolving loan program where loans are offered for capital improvements related to an increase in rail transportation, either to improve service or facilities. This may include construction of extended sidings to allow shuttle train operation, trackside storage and equipment. Since about 1992, the loans have had a $200,000 cap per project. The project must be competitively bid and supported by the servicing railroad. In 2008, the legislature authorized the use of funds to make capital improvements directly to railroads.

Rail Rehabilitation Loans: This program provides low- or no-interest loans to rehabilitate and preserve rail lines. A rail authority, rail line owner, or carrier may qualify for a 15-year loan at negotiated rates. If a rail authority owns the property, the state can provide up to 80% of the project costs with the rail authority providing 10% and the shippers providing the other 10% of the project costs. If the rail line is owned by a private carrier, the state can provide up to 70% of the project costs, 20% by the railroad and 10% by the shippers to complete the

project costs. State funds can be used for a rehabilitation if the line is in a deteriorated condition and the improvements have the probability of keeping the line in operation and viable, both for the railroad and for the on-line shippers. The line must be returned to at least FRA Class I standards, 10-mile-per-hour safe operating speeds with 263,000-pound cars and continuously maintained during the 15-year loan term.

Rail User & Rail Carrier Loan Guarantee: This program guarantees up to 90% of a loan to assist rail users and carriers in obtaining loans.

State Rail Bank: This program aims to acquire and preserve abandoned rail lines for a future transportation use, including reinstalling rail lines when needed.

Funding for the MRSI Program is provided by the Legislature through bonding or general fund appropriation. The level of funding offered to the MRSI Program directly relates to the amount of assistance available to short line railroads in Minnesota.

Conclusions

Minnesota has one of the largest rail networks in the country, providing a multimodal freight transportation system to and from rural Minnesota. Twenty railroads operate in the state, providing an economic link to markets around the world.

Due to the trend toward shuttle train operations and intermodal containerization, rural Minnesota shippers have more and better opportunities to connect to distant locations via efficient rail services. The ability to move Minnesota agricultural commodities such as corn, wheat, and soybeans long distances on rail has provided Minnesota farmers with a significant cost-effective access to markets. In addition, development and expansion of the biofuel industry in Minnesota provides new value-added uses for Minnesota's agricultural commodities, providing expanded market opportunities and more income for the rural agricultural community.

These opportunities also present challenges, however. Access to container service has been difficult for smaller railroads serving rural Minnesota. Shuttle facilities necessitate longer farm-to-elevator truck hauls for delivery of commodities. Increasing weight on rail lines is threatening structural integrity of the short line rail system. Short line railroads may find difficulty in financing improvements to track and bridges to accommodate heavier loads. In addition, safety

at rail grade crossings is a growing concern with increased rail and roadway traffic, particularly around major shuttle and intermodal facilities that generate a lot of freight traffic.

MRSI funding is available for short line railroads. The purpose of the program is to help prevent the loss of rail service in Minnesota, and therefore, rail lines that would be potentially subject to abandonment or otherwise in need of improvements are eligible for funding through this program. The level of funding for MRSI is ultimately decided by the Minnesota Legislature.

Mn/DOT is currently developing a Comprehensive Statewide Freight and Passenger Rail Plan that will identify issues, trends, and deficiencies on the rail system in Minnesota. This plan will not only set priorities for investment on rail lines in the state, but examine appropriate levels of funding for preservation and rehabilitation. With increased public and private investment in the rail system likely in the near future, new opportunities will become available for rural shippers in Minnesota that use the rail system.