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An Evaluative Framework for Feasibility Analysis: Grain Department Short Line Railroads

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INTRODUCTION

GRAIN SHIPPERS in midwestern states are faced with a dilemma of late concerning loss of their rail service through rail branch line abandonment. Also, service levels on many segments have deteriorated, effectively forcing the shipper to resort to an alternative mode. In 1981, for example, over 1400 miles of rail lines in North Dakota alone were identified as projected or potential candidates for abandonment (North Dakota State Highway Department). Grain shippers (country elevators) are highly dependent on the rail mode as a transportation outlet, as evidenced by the rail share of total grain movements.[1]

One alternative to loss of rail service is formation of a short line railroad over the affected rail line. Other alternatives may include resorting exclusively to truck service or relocation of the firm. Organization of the line as a short line railroad, however, would preserve rail service at the original plant location and possibly provide benefits to shippers not previously available.

OBJECTIVES

The general objective of this paper is to develop and test an evaluative framework for feasibility analysis of grain dependent short line railroads. Specific objectives are:

1. to identify advantages and disadvantages of forming grain dependent short line railroads
2. to identify ownership considerations and alternatives when considering short line railroad formation.
3. to apply the evaluative framework in a case study.
4. to evaluate the framework and its usefulness for grain short line railroads.

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EVALUATIVE FRAMEWORK

Advantages and Disadvantages of Grain Short Lines

Short line railroads may offer cost and service advantages over existing carriers in grain producing areas. Labor costs can potentially be lower because of the absence of restrictive union work rules. Many short line railroads in the U.S. operate with little or no employee union involvement (Levine, et. al.) Equipment needs of short line operations are also less than larger carrier simply due to the smaller scale of operations. Equipment required for many operations would be limited to locomotive power, service vehicles, tools, and track maintenance items. The firm may own or lease freight cars, or simply use connecting carriers cars.

Ownership of short line operations in of some cooperative form due to the grain producing areas would likely be vested interests in continued rail service. Area shippers may join to start the operation as a means of preserving rail service. Cooperative ownership may lend itself to a healthier firm due to the shippers interests in using the rail mode. Also, local financing may be easier to attract if shippers have committed themselves to the railroad operation.

Local short line operations have associated shortcomings, however. One of the most obvious is the initial purchase of operating right-of-way and track structure. The value to the owning carrier of salvageable materials and right-of-way may be greater than shippers are willing to pay for continued service.[2] Also, the initial cost may be pushed even higher if operating problems caused by previous deferred maintenance necessitate track rehabilitation.

Short line railroads which are dependent on grain traffic may have problems attracting traffic due to the physical characteristics and marketing patterns of the commodity. Due to the sheer mobility of grain and oilseeds, small changes in farmer price offerings due to changes in short line costs will divert grain from elevators using and/or owning the rail firm. Competitiveness within the grain elevator industry and the number and locality of such facilities would make it possible for farmers to choose among competing elevators when marketing grain. An elevator "board" price at stations on the short line which is not competitive with surrounding elevators would cause grain to be diverted away from the short line operation, further escalating average cost per bushel shipped.

Other drawbacks such operations may face include negotiating divisions of revenues with connecting carriers, attracting qualified railroad operating personnel, and seasonality of grain marketing. Also, grain producing regions are generally not complemented with a large industrial traffic base. Non-grain traffic would likely include agricultural inputs and other agriculturally related commodities. These commodities may constitute the only inbound traffic into the area.

Ownership and Purchase Considerations

The physical condition of the track structure and right-of-way will determine the eventual cost of purchasing the line and dictate necessary rehabilitation prior to start of operations. Pertinent to regular shipments of heavier cars of late is the weight of rail and the track's ability to support multiple car and trainload shipments. Supplemental to rail weight in determining strength of roadway are tie condition, ballast depth, condition of structures and stability of subgrade.

The number of shippers and volume of grain available relative to length of the line is critical to the high fixed cost nature of these short line operations. High grain density relative to length of the line will allow a larger traffic base without necessitating increasing the size of the firm's grain drawing trade area.

The carrying capacity of the track structure will also dictate the type of rail car arused over the short line's track. The trend for grain shipment has been toward heavier covered hopper car and away from boxcars (Association of American Railroads).

Historical rail/truck split for grain moving from a region may be critical to a short line operation. If regional marketing patterns have precluded truck shipments from the area, the short line would not possess even the potential for capturing competitive truck traffic. A study of historical modal share would reveal total potential grain volume in the area.

Many local grain producing areas are served by a single railroad. In cases where a short line operation was initiated in these areas, the connecting carriers may be reluctant to grant divisions of revenues due to the lack of intramodal competition. Rail captive grain producers may simply be hauling their grains to more distant elevators located on the same carrier's system. Also, applicable freight rates may not be sufficiently high to allow connecting carriers to share in carload revenues. Finally, strict intermodal competition may have been the primary reason for poor rail service initially. The short line would also be faced with this competition.

Calculation of Annualized Purchase and Operating Costs

Economic-engineering estimates of short line purchase and operating costs are computed on an annualized basis. The modal used was developed at Texas Tech University by Hise, et. al. Fixed costs of purchase and rehabilitation were separated into depreciable and non-depreciable components. Depreciable fixed costs included items such as track and right-of-way purchase and rehabilitation, while non-depreciable fixed costs included items such as management salaries and insurance expenses. Variable costs of operation included fuel, repairs, labor costs, etc.

Annualized fixed costs for depreciable items are computed as follows:

$$FOB_i = (FOB \times NUM)\ (1 + INST)$$

where FOB_i = installed cost of a building, machinery, or equipment item i

FOB = FOB cost of one unit (one machine, one square foot of building, etc.)

NUM = number of units required

INST = installation cost of one unit, based on a percent of FOB cost

$$DI_i = FOB_i \frac{R(1 + R)^{yrs}}{(1 + R)^{yrs-1}} - SAL_i \frac{R}{(1 + R)^{yrs-1}}$$

where DI_i = annual depreciation and interest cost of item i

R = interest rate
yrs = years of useful life
SAL_i = salvage value of item i in dollars

$$REP_i = (FOB)\ (NUM)\ (REP)$$

where REP_i = fixed repair costs of item i in dollars
REP = fixed repairs as a percentage of FOB cost

$$AEC_i = DI_i + REP_i$$

where AEC_i = annual equivalency cost of item i

Annualized costs for nondepreciable fixed cost items are computed:

$$AEC_k = (FOB + num)\ (1 + R)$$

where AEC_k = annual equivalency cost of item k
FOB = annual cost of one nondepreciable fixed cost item

Total annual equivalent costs of fixed items (both depreciable and nondepreciable) are calculated:

$$TFC = AEC_i + AEC_k$$

where TFC = total depreciable and nondepreciable fixed costs

Variable costs of operation are computed as follows:

$$VC_{ij} = (Num_j)\ (PR_i)$$

where VC_{ij} = variable cost of resource i at capacity utilization j
NUM_j = number of units of the resource required at capacity utilization j
PR_i = cost per unit for resource i

Interest on operating capital is computed as:

$$CO_j = TVC_j\ (R)$$

where CO_j = interest on operating capital at capacity utilization j
TVS_j = total variable cost at capacity utilization j

Total revenue is calculated as number of careloads times revenue per car. A detailed analysis of the cost estimation model is contained in Hise, et. al.

Output from the above madel gives an estimate of the profitability of the short line operation at a specified level of utilization or output. Estimates of total annualized fixed costs, variable costs, and total revenues are presented, as well as average costs and revenues. Firm profitability can then be evaluated on a per car basis or total net income basis.

At a specified level of output, and given certain cost assumptions, a breakeven analysis can be performed to evaluate the potential for feasibility of the short line operation. Given revenues per carload and the various cost components (fixed and variable), a minimum number of carloads necessary for profitable operation can be calculated. Density of regional grain production required for profitable operation can be computed once the size of trade area is defined. This may be particularly applicable since grain production in many wheat producing regions is limited relative to corn growing regions. Given production density or traffic levels, revenues per carload required for profitable operation can also be computed.

APPLICATION OF FRAMEWORK

The economic-engineering model was applied in a case study to a branch line located in southeastern North Dakota [Zink]. The 61 mile Burlington Northern line lies in an intensive grain producing area and was identified as a Category 2 line[3] on the BN System Diagram Map (10-1-81). The line terminates at Marion, ND and connects with the BN main line at Casselton, ND. The line is intersected at approximately its midpoint by the Soo Line, however an interchange would have to be constructed in order to ship cars on the Soo Line.

The Casselton-Marion line was chosen for analysis primarily because of its geographically competitive location relative to North Dakota's two railroads. If a short line operation was able to connect with both railroads, a more favorable division of rates and revenues might be negotiated. Grain produced within the area may gravitate to either railroad if the line is abandoned or formed into a short line; both railroads would prefer to ship the area's grain regardless of the branch lines eventual fate. This potential for competitive "bidding" for grain traffic is likely the lines most favorable point.

Potential drawbacks of a short line on this particular branch line lie generally within the nature of grain production and marketing within the region. Grain density and number of shippers relative to length of the line may be critical in determining the volume of traffic necessary to recover fixed capital costs of track and right-of-way purchase and rehabilitation.

Country grain elevators in North Dakota are located relatively close to each other. Even though the number of elevators has been diminishing for many years, the industry is still competitive due to a seeming overcapacity and the mobility of grain. Because of this price and service competition, any additional cost of operation caused by the short line operation which must be borne by grain shippers would be reflected in grain prices to farmers. These lower prices would reduce the grain volume shipped on the short line and compound the problem of fixed plant utilization.

Truck competition in the region would be a major concern for a short line operation. Two primary terminal grain markets — Duluth/Superior and Minneapolis/St. Paul — are located approximately 250 miles from the branch line. This distance lies within the range where trucks are generally thought to be competitive with rail transportation, particularly with a truck backhaul. In fact, trucks have shipped an average of 54 percent of the grain from elevators on the Casselton-Marion line in the past five years (Upper Great Plains Transportation Institute).

The short line railroad's share of the total rail revenues per carload were estimated to be approximately proportional to distance shipped by each carrier. Two revenue estimates were considered to evaluate the effects of changing divisions of revenues to the short line.

Results of the Casselton-Marion application indicate a severe revenue shortfall at existing traffic levels and specified revenues per carload (Table 1). In fact, revenues do not even cover variable costs of the firm. The operation is heavily weighted with fixed costs, comprising approximately 85 percent of total costs. The high fixed cost component is composed primarily of roadway purchase and rehabilitation costs (87 percent); remaining fixed cost items consist of equipment and vehicles, office equipment, and salaries.

When revenues per carload were doubled the operation was still not profitable. In fact, revenues would have to be increased more than sixfold in order to cover total costs of operation. At revenues per car of 300 dollars, over 6000 cars would have to be shipped in order to cover all costs of operation rather than the initial 1000 cars. In terms of grain volume and density, 6000 cars shipped would equate to approximately 20 million bushels shipped, as opposed to 3.3 million shipped under the initial scenario. Even under the most attractive of circumstances tested (higher revenues, interest rates halved, and lower rehabilitation costs) the operation was far short of recovering total costs. If grain shippers along the line were owners/operators of the short line, they would be required to subsidize the rail operation by approximately 12 to 30 cents per bushel at current traffic levels. Such a subsidy reflected in prices to farmers would devastate elevator operations.

TABLE 1

ANNUALIZED COSTS AND REVENUES OF A SHORT LINE RAILROAD OPERATION ON THE CASSELTON-MARION BRANCH LINE, NORTH DAKOTA, 1981

Total Fixed Costs	$861,756
Total Variable Costs	157,769
Total Costs	$1,019,525
Total Revenue	150,000
Total Net Revenue	$-869,525
Average Fixed Cost Per Car	$862
Average Variable Cost Per Car	158
Average Total Cost Per Car	$1020
Average Revenue Per Car	$150
Average Net Revenue Per Car	$-870

CONCLUSIONS

Grain dependent short line railroad operations need extremely high volumes and grain densities in order to support the high fixed cost nature of their operation. For the region tested, density of grain production was not nearly high enough to justify or economically support a short line railroad.

The evaluative framework for testing short line railroad feasibility is well suited where the traffic mix and volume is reasonably predictable, and where revenues and costs are also therefore predictable. An economic engineering approach such as this is dependent on the ability to accurately project the nature and scope of operations. Under such circumstances, an annual equivalent cost may be calculated and compared to projected revenues.

One problem with the above approach is the level of completeness and the accuracy with which all costs of operation are estimated and how realistically traffic levels and revenues are projected. Although grain dependent short line railroads are likely to be narrow in their scope of operations and not frequented by a variety of products, revenues and volume of traffic may not be accurately predictable due to the irregularity of annual grain production and the seasonality of grain shipments.

IMPLICATIONS FOR GRAIN DEPENDENT SHORT LINE RAILROADS

The high grain volume required of an area to support a short line operation may be difficult to find because of existing carriers retaining their service to such areas. Extremely low volume lines would not likely be profitable under any circumstances. However, line segments which are marginally profitable for larger carriers may be attractive for short line operations if proposed for abandonment by the larger railroad.

The degree of mobility of grain may be a problem for short line operators. Presence of captive shippers would be desirable for any rail operation, regardless of size. However, due to the developed road network and large capacity farm trucks in existence today, a completely captive grain shipper may be difficult to find.

Intermodal competition from over-the-road grain truckers may divert grain traffic from rail operations if railroads cannot compete with current truck rate/backhaul combinations. A short line's ability to capture this truck traffic may be crucial in its ability to remain viable.

Short line railroads in primarily grain producing areas may find it necessary to seek traffic other than grains and oilseeds. However, these agriculturally based economies may not have a significant industrial sector. The short line operation may find itself dependent on subsidies from outside sources such as local, state, or federal programs.

REFERENCES

Association of American Railroads, taken from Milling and Baking News' 1982 Grain Directory Buyers Guide, p. 150.

Hise, Billy R., Don E. Ethridge, and Dale L. Shaw, "Processing Plant Cost Estimation System Documentation and User's Guide," College of Agricultural Sciences Publication No. T-1-189, National Economics Division; Economics, Statistics, and Cooperative Service, Texas Tech University, Lubbock, Texas, April, 1980.

Levine, Harvey A., Graig F. Rockey, Clifford C. Eby, and John L. Dale. *Small Railroads*, Economies and Finance Department, Association of American Railroads, Book Crafters, Inc., Chelsea, Michigan, 1982.

Ming, Dennis R. and William J. Kuntz, "North Dakota Grain and Oilseed Transportation Statistics, 1981-82," Upper Great Plains Transportation Institute, NDSU, Fargo, January, 1983.

North Dakota State Highway Department, Intermodal Planning and Rail Assistance Division, System Diagram Map, 10-1-81.

Zink, Daniel L., "Analysis of Short Line Railroad Development in North Dakota," Upper Great Plains Transportation Institute, NDSU, Fargo, January, 1983.

North Dakota State Highway Department, Intermodal Planning and Rail Assistance Division, System Diagram Map, 10-1-81.

Zink, Daniel L., "Analysis of Short Line Railroad Development in North Dakota," Upper Great Plains Transportation Institute and Agricultural Economics Report, North Dakota State University, Fargo, forthcoming.

FOOTNOTES

1 Rail modal share of all grain and oilseed movements from North Dakota in the 1981-82 crop year was 69 percent (Ming, Kuntz).

2 The "Net Liquidation Value" (value of track materials and property less removal and selling costs) is presumably the price interested parties would have to pay for the operating right-of-way and track structure.

3 Being studied as a potential future abandonment case.