MOTT TO MANDAN BRANCHLINE: REVENUE ADEQUACY

By

Daniel L. Zink
Denver D. Tolliver

UGPTI Staff Paper No. 39

December 1982

MOTT TO MANDAN BRANCHLINE: REVENUE ADEQUACY

BY

DANIEL L ZINK, RESEARCH ASSOCIATE
DENVER D. TOLLIVER, RESEARCH ASSOCIATE

UPPER GREAT PLAINS TRANSPORTATION INSTITUTE
NORTH DAKOTA STATE UNIVERSITY
P. O. BOX 5074
FARGO, NORTH DAKOTA 58105

DECEMBER 1982

MOTT-MANDAN BRANCH LINE: REVENUE ADEQUACY

By

Daniel L Zink and Denver D. Tolliver*

INTRODUCTION

The Mott to Mandan branch line in southwestern North Dakota is listed as a Category 1 line on the most recent System Diagram Map (7/1/82). Cessation of service on this line would leave a large geographical area void of rail service, resulting in longer hauls in over-the-road or farm trucks to rail lines. The New England to McLaughlin, SD branch line, formerly owned by the Milwaukee Road, has been dismantled. Therefore, abandonment of the Mott-Mandan line would leave void of rail service an area between the Burlington Northern (BN) main line and old Milwaukee main line, and from the Missouri River practically to North Dakota's western border. This area encompasses all or portions of ten North Dakota counties.

The purpose of this paper is to determine the revenue adequacy of traffic on the Mott-Mandan line in terms of its ability to justify continuation of current service levels and/or rehabilitation of the track structure.

This paper is divided into two sections. The first section contains an estimation of the grain traffic that elevators on the line may be able to attract given the current and projected locations of subterminal elevators. The second section contains revenues attributable to that grain traffic, and costs associated with those movements.

---

*Research Associates, Upper Great Plains Transportation Institute, North Dakota State University, Fargo.

SECTION I: TRADE AREA AND GRAIN VOLUME ESTIMATES OF THE MOTT-MANDAN BRANCH LINE

The effective trade area of elevators on the Mott-Mandan branch line will depend on many factors. These factors are presented and discussed in this section.

The advent of subterminal elevators and multiple car rates usage in the area will have a significant effect on the branch line's drawing territory. Main line stations, both north and south of the branch line, which may be able to use a 26 or 52 car rate, will provide competition for grain in southwestern North Dakota. If subterminal elevators are not constructed on the Mott-Mandan branch line, its trade area or drawing territory will be reduced as some farmers ship grains to elevators on mail lines where net farm prices are higher (this assumes non-competitive truck rates and service).

Competing Elevators

Two subterminal elevators are currently operating in the area, a 52 car loading subterminal at Dickinson (Cargill, Inc.) and a 52 car loading subterminal at Boyle (Southwestern Grain Cooperative). Several other elevator operators in the area have made inquiries as to possible constructing facilities or upgrading existing elevators. For purposes of this analysis, several elevators on both the north main line (Mandan to Beach, ND) and south main line (Bowman to McLaughlin, SD) were assumed to construct or upgrade to be able to load 26 car trains. Elevators on the Mott-Mandan branch line were assumed to be competing with the following elevators (each elevator's associated rate used is given in parentheses):[1]

[1]Rail rates were taken from the Minneapolis Grain Exchange Grain Rate Book No. 17, published by the Transportation Department, Minneapolis Grain Exchange, Minneapolis.

NORTH MAIN LINE		SOUTH MAIN LINE	
Dickinson	(52)	Scranton	(26)
Boyle	(52)	Hettinger	(26)
Richardton	(26)	Lemmon, SD	(26)
Hebron	(26)	Morristown, SD	(26)
Glen Ullin	(26)	Watauga, SD	(26)
New Salem	(26)	McIntosh, SD	(26)
Mandan	(26)	Walker, SD	(26)
		McLaughlin, SD	(26)

New England and Regent are presently members of the Southwest Grain Cooperative. Their respective freight rates were computed by adding the 52 car rail rate at Boyle (Gladstone) to the cost of trucking grain from each country station.[2] These freight rates, as well as distances between stations, were used to define trade areas of elevators on the Mott-Mandan branch line.

Trade Areas

The boundary of trade areas between two elevators will be determined by the net farm price to producers having access to both markets. This net farm price will be affected by two variables: 1) the elevator "board" price, which will be determined by the price at the terminal market, freight rates, and elevator management skills; and 2) the distance from farms to the elevator, and the per bushel cost of that haul. In mathematical notation,

[2]Truck costs used were $1.05 per running mile. See Wilson, Wesley, Ken Casavant, and Gene Griffin, "Costs and Characteristics of Operating Interstate Motor Carriers of Grain," Upper Great Plains Transportation Institute and Agricultural Economics Report, North Dakota State University, forthcoming.

$$Fp = Ep - TC/bu\ mi\ (D)$$

where: Fp = net farm price

Ep = elevator board price

TC/bu mi = farm truck costs per unit of distance

D = distance to elevator

At some point between two competing elevators, the net farm price of hauling to the two markets will be equal. That is, the producer would be indifferent as to which elevator he would haul to; his net price per bushel would be the same. This point where the net farm price is equal at both elevators would define the boundary of market areas. Producers on the "Elevator A" side of this point would receive a higher price per bushel by shipping to Elevator A than Elevator B, and vice versa. For example, the straight line distance between Mott and Dickinson is approximately 41 miles. At some point along this 41 mile segment the net farm price to producers would be equal hauling to either elevator. Assuming a 52 car elevator in Dickinson and a 26 car elevator in Mott, that point of equal net return can be identified as follows:

$$Ep_M - \$.0035/bu.\ mi\ (X) = Ep_D - \$.0035/bu.\ mi.\ (41-X)$$

$$.818 - .0035X = .908 - .0035(41) + .0035X$$

$$X = 7.6\ miles$$

Therefore, Mott's drawing territory or trade area would extend 7.6 miles from Mott towards Dickinson.[3] Dickinson's portion of the trade area along that line segment would be 41 minus 7.6 or 33.4 miles long.

Four scenarios were analyzed in the process of defining the size and location of the branch line's trade area. Different combinations of subterminal elevator sizes were analyzed at four stations on the line -- Mott, Elgin, Carson, and Flasher. First, production was estimated for the Mott trade area assuming a 52 car subterminal was built in Mott, while other stations on the line were single car shippers. Second, estimates of grain available were made assuming 26 car single origin shippers were located in Mott and Elgin while the remaining were single car stations. Third, a 26 car (single origin) elevator was located in Mott, while 26 car multiple-origin elevators were located in Elgin, Carson, and Flasher. Finally trade area estimates were calculated if a 52 car elevator was located in Mott, and 26 car multiple-origin elevators were located in Elgin, Carson, and Flasher. Locations of various types of elevators and their associated rate structure used for the four scenarios are summarized below.

[3]Terminal market prices and country elevator margins are assumed equal for each elevator. Therefore, elevator "board" prices in each case would be equal to the terminal market price (constant) less transportation costs and margins (also constant). The only figure which is critical to outcome of the equation is the freight rate differential.

SCENARIO 1		SCENARIO 3	
Mott	(52 car)	Mott	(26 car single origin)
Elgin	(single car)	Elgin	(26 car multiple origin)
Carson	(single car)	Carson	(26 car multiple origin)
Flasher	(single car)	Flasher	(26 car multiple origin)
SCENARIO 2		**SCENARIO 4**	
Mott	(26 car single origin)	Mott	(52 car)
Elgin	(26 car single origin)	Elgin	(26 car multiple origin)
Carson	(single origin)	Flasher	(26 car multiple origin)
Flasher	(single origin)	Flasher	(26 car multiple origin)

Scenario 1

The size of the Mott trade area as defined under Scenario 1 (52 car elevator at Mott) is shown in Table 1. Under Scenario 1, Mott's trade area extended an average of 20.1 miles outward for eastbound grain and 25.4 miles for westbound grain. The distinction between eastbound and westbound shipments was made due to the differing rate structures for the two destinations (Pacific Northwest and Minneapolis-Duluth). Figure 1 is a diagram of the general shape and location of Mott's trade area under Scenario 1.

TABLE 1. DISTANCES FROM MOTT TO COMPETING ELEVATORS DEFINING MOTT TRADE AREA, SCENARIO 1.

		DISTANCE INCLUDED IN MOTT TRADE AREA	
COMPETING ELEVATOR	**TOTAL DISTANCE**	**EASTBOUND GRAIN**	**WESTBOUND GRAIN**
	---------- MILES ----------		
Dickinson	41.2	20.6	20.6
Boyle	36.6	18.3	18.3
Hebron	38.8	16.0	19.4
Glen Ullin	38.8	15.1	19.4

TABLE 1. DISTANCES FROM MOTT TO COMPETING ELEVATORS DEFINING MOTT TRADE AREA, SCENARIO 1.			
		DISTANCE INCLUDED IN MOTT TRADE AREA	
COMPETING ELEVATOR	TOTAL DISTANCE	EASTBOUND GRAIN	WESTBOUND GRAIN
	---------- MILES ----------		
New Salem	54.6	17.9	27.3
Richardton	35.6	18.7	17.8
Scranton	43.7	32.1	34.7
Hettinger	30.6	18.7	28.2
Lemmon, SD	31.3	12.2	28.5
Morristown, SD	43.5	15.8	34.6
Regent	11.5	27.8[a]	27.7
New England	28.3	27.9	27.5

[a] Actually encompasses Regent and extends beyond.

The westbound rate structure favors elevator operations on the Mott line relative to the eastbound rates. Therefore, the trade area for westbound grain is slightly larger than for eastbound grain. A weighted average of east- and westbound shipments gives an overall or single estimate of the actual trade area. An estimate of the available grain production contained within this trade area is presented in Table 2.

Adjusted production in each trade area (east- and westbound) was weighted by the proportion of grain historically moving to each destination. This procedure was necessary due to the difference in size between trade areas if all grain was assumed to move west under the westbound rate structure, or if all movements moved to eastern markets under the eastbound rate structure.

TABLE 2. ESTIMATED PRODUCTION CONTAINED WITHIN THE MOTT TRADE AREA, SCENARIO 1.					
	ADJUSTED ESTIMATED PRODUCTION IN TRADE AREA[a]				
COUNTY	EAST	WEST	PROPORTIONED SHIPPED EAST[b]	PROPORTION SHIPPED WEST	WEIGHTED AVERAGE PRODUCTION IN TRADE AREA
	- - - BUSHELS - - -		(%)	(%)	(BUSHELS)
Adams	237,193	1,463,935	43.4	56.6	931,529
Bowman	--	--	43.4	56.6	--
Slope	--	--	43.4	56.6	--
Stark	3,055	--	43.4	56.6	1,326
Hettinger	4,677,427	4,747,763	43.4	56.6	4,717,237
Morton	--	--	72.9	27.1	--
Grant	116,303	411,358	72.9	27.1	196,263
Sioux	--	340	72.9	27.1	92
					5,846,447

[a] Production estimates were adjusted to compensate for grain that is consumed as feed or seed on farms where grown, not marketed through grain elevators (**SOURCE**: North Dakota Crop and Livestock Reporting Service).

[b] Five year average of proportion of all grains shipped from Crop Reporting Districts 7 and 8 to the Pacific Northwest and the eastern markets of Minneapolis/St. Paul and Duluth/Superior (**SOURCE**: Upper Great Plains Transportation Institute, unpublished data).

Grain available for merchandising in the Mott trade area under Scenario 1 was estimated to be approximately 5.8 million bushels. Most of this available grain was located in Hettinger County, with smaller amounts grown in Grant, Sioux, Stark, and Adams Counties.

Scenario 2

Under Scenario 2, 26 car elevators were assumed to be in operation in both Mott and Elgin. Total grain available to the Mott elevator was approximately 2.6 million bushels (Table 3). Grain available to Elgin under Scenario 2 was approximately 1.0 million bushels (Table 4). Combined production for both elevators was about 3.6 million bushels.

Scenario 3

Similar estimates of available grain were made assuming a 26 car single origin elevator was located at Mott and elevators at Elgin, Carson, and Flasher utilized a 26 car multiple origin rate on westbound grain and a three car rail rate on eastbound grain. Total estimated grain production contained in the cities' trade areas under Scenario 3 was approximately 3.7 million bushels (Table 5).

Scenario 4

Available grain production was also estimated assuming a 52 car subterminal elevators was constructed at Mott, while Elgin, Carson, and Flasher elevators used the 26 car multiple origin rate westbound and the three car rate eastbound. Estimated grain production contained within each trade area is presented in Table 6. Total production included in the branch line's trade area was approximately 6.9 million bushels.

TABLE 3. ESTIMATED PRODUCTION CONTAINED WITHIN THE MOTT TRADE AREA, SCENARIO 2.					
	ADJUSTED ESTIMATED PRODUCTION IN MOTT TRADE AREA[a]				
COUNTY	EAST	WEST	PROPORTION SHIPPED EAST[b]	PROPORTION SHIPPED WEST	WEIGHTED AVERAGE PRODUCTION IN MOTT TRADE AREA
Adams	50,251	312,626	43.4	56.6	198,755
Bowman	--	--	43.4	56.6	--
Slope	--	--	43.4	56.6	--
Stark	--	--	43.4	56.6	--
Hettinger	2,645,071	2,260,041	43.4	56.6	2,427,144
Morton	--	--	72.9	27.1	--
Grant	--	7,222	72.9	27.1	1,957
Sioux	--	--	72.9	27.1	--
					2,627,856

[a] Production estimates are adjusted to compensate for grain that is consumed as feed or seed on farms where grown, not marketed through grain elevators (**SOURCE**: North Dakota Crops and Livestock Reporting Service).

[b] Five year average of proportion of all grains shipped from Crop Reporting Districts 7 and 8 to the Pacific Northwest and the eastern markets of Minneapolis/St. Paul and Duluth/Superior (**SOURCE**: Upper Great Plains Transportation Institute, unpublished data).

TABLE 4. ESTIMATED PRODUCTION CONTAINED WITHIN THE ELGIN TRADE AREA, SCENARIO 2.					
	ADJUSTED ESTIMATED PRODUCTION IN ELGIN TRADE AREA[a]				
COUNTY	EAST	WEST	PROPORTION SHIPPED EAST[b]	PROPORTION SHIPPED WEST	WEIGHTED AVERAGE PRODUCTION IN ELGIN TRADE AREA
Adams	--	10,683	43.4	56.6	6,047
Bowman	--	--	43.4	56.6	--
Slope	--	--	43.4	56.6	--
Stark	--	--	43.4	56.6	--
Hettinger	555,779	217,151	43.4	56.6	364,116
Morton	--	52,304	72.9	27.1	14,174
Grant	442,190	1,138,104	72.9	27.1	630,783
Sioux	--	--	72.9	27.1	--
					1,015,120

[a] Production estimates are adjusted to compensate for grain that is consumed as feed or seed on farms where grown, not marketed through grain elevators. (**SOURCE**: North Dakota Crop & Livestock Reporting Service).

[b] Five year average of proportion of all grains shipped from Crop Reporting Districts 7 and 8 to the Pacific Northwest and the eastern markets of Minneapolis/St. Paul and Duluth/Superior (**SOURCE**: Upper Great Plains Transportation Institute, unpublished data).

TABLE 5. GRAIN PRODUCTION CONTAINED IN THE MOTT, ELGIN, CARSON, AND FLASHER TRADE AREAS, SCENARIO 3.	
ELEVATOR LOCATION	AVAILABLE PRODUCTION
	(BUSHELS)
Mott	2,889,766
Elgin	156,502
Carson	275,881
Flasher	389,402
TOTAL	**3,711,551**

TABLE 6. GRAIN PRODUCTION CONTAINED IN THE MOTT, ELGIN, CARSON, AND FLASHER TRADE AREAS, SCENARIO 4.	
ELEVATOR LOCATION	AVAILABLE PRODUCTION
	(BUSHELS)
Mott	6,212,413
Elgin	68,194
Carson	273,388
Flasher	391,872
TOTAL	**6,945,867**

SUMMARY

Four combinations of elevator sizes and locations were analyzed and market territories estimated for each. Under each of the situations, the elevators were assumed to be competing against 52 car subterminals at Dickinson and Gladstone, and 26 car elevators at all other stations along the two main lines to the north and south. A summary of the various combinations of elevators on the branch line and their respective available grain volumes is presented in Table 7.

TABLE 7. ELEVATOR CONFIGURATIONS AND GRAIN VOLUMES CONTAINED IN RESPECTIVE TRADE AREAS.				
ELEVATOR CONFIGURATION			INDIVIDUAL ELEVATOR VOLUME	BRANCH LINE VOLUME
			(BUSHELS)	(BUSHELS)
1.	Mott	52 car subterminal	5,846,447	5,846,447
2.	Mott	26 car single origin	2,627,856	
	Elgin	26 car single origin	1,015,120	3,642,976
3.	Mott	26 car single origin	2,889,766	
	Elgin	26 car multiple origin	156,502	
	Carson	26 car multiple origin	275,881	
	Flasher	26 car multiple origin	389,402	3,711,551
4.	Mott	52 car subterminal	6,212,413	
	Elgin	26 car multiple origin	68,194	
	Carson	26 car multiple origin	273,388	
	Flasher	26 car multiple origin	391,872	6,945,867

From these estimates, it is obvious that grain volume available to elevators on the Mott-Mandan branch line is highly dependent upon the types of multiple car rates used by elevators on the line. Those elevators able to use the 52 or 26 car single origin rate appear to be able to draw sufficient grain to support their operations. Stations utilizing only the 26 car multiple origin and three car rate are precluded from drawing large volumes of grain by competition from 26 car shippers to the north and south. For example, Elgin's grain volume in Scenario 4 was estimated at only 68,194 bushels--hardly enough to justify operations. This is due to competition from elevators on the north and south main line, as well as from the 52 car elevator at Mott.

These bushel volumes are estimates of the **maximum** amount of grain that would be available to each elevator. These estimates are based on two variables -- comparative rail rates and distances between competing elevators. Several non-quantifiable factors that

may affect the amount of grain actually shipped by rail include: truck rates, the incidence of truck backhauls and resultant intermodal competition, both present and future; managerial skills of different elevator operations; shippers' attitudes toward carriers; level of member patronage to elevators, and the railroad's attitude toward various service levels on the branch line.

SECTION II. REVENUES AND COSTS ASSOCIATED WITH GRAIN SHIPMENTS AND REHABILITATION OF THE MOTT-MANDAN BRANCH LINE

Revenues accruing to the railroad from grain movements originating on the Mott-Mandan line as well as costs of operation are presented in this section. Also, annualized costs of rehabilitation are presented under two levels of rehabilitation expenditures. These revenues and costs are compared for each of the four scenarios outlined in Section I and comparisons made as to the profitability of the line.

Revenues

Total revenues to the railroad were calculated using current rail rates[4] and the estimated grain volume from each elevator. Table 8 contains revenue estimates for the four scenarios outlined in Section I of this paper. Total projected revenues were highest under Scenario 4 (52 car shipper at Mott and 26 car multiple origin shippers at Elgin, Carson, and Flasher) and totaled 6,037,089 dollars. The lowest projected revenue estimates are under Scenario 2 (26 car single origin shippers at both Mott and Elgin).

[4]Rail rates were taken from the Minneapolis Grain Exchange Grain Rate Book, No. 17, **op. cit.**

TABLE 8. RAILROAD REVENUES FROM GRAIN SHIPPED ON THE MOTT-MANDAN BRANCH LINE.		
SCENARIO	GRAIN VOLUME ESTIMATE	TOTAL REVENUES
	(BUSHELS)	($)
1.	5,846,447	5,072,566
2.	3,642,976	3,356,226
3.	3,711,551	3,426,431
4.	6,945,867	6,037,089

Branch Line Rehabilitation Costs

Track rehabilitation costs were also allocated to grain traffic on the branch line to evaluate if costs of upgrading the track structure can also be justified. Two levels of track rehabilitation were considered. First, annual equivalent costs (AEC) of a complete rehabilitation were computed. The rehabilitation procedure included installation of heavier rail, as well as tie replacement and ballast installation. Total per-mile costs of $180,000 were annualized over the life of the rail, ties, and ballast. Annual equivalent costs under the full rehabilitation were $2,128,853 (see Appendix for details of AEC estimates).

Second, costs of a lighter rehabilitation procedure were estimated. All rail was assumed left in place, only ties and ballast costs were estimated. Per mile costs of $25,000 were annualized over the life of the rehabilitation project. Total annualized equivalent costs of the lighter rehabilitation project were 300,279 dollars.

Costs of Operation

Total costs of railroad operation associated with grain movements originating on the Mott-Mandan branch line were estimated and are presented in Table 9. These costs were estimated using Rail Form A procedures as outlined in "Multiple Car Rail Costs in North Dakota."[5] Separate cost calculations for the two rehabilitation estimates were necessary due to the distinct operating conditions specific for the two rehabilitation levels. Under the lighter rehabilitation, operating speeds were reduced due to the lighter-duty track condition.

TABLE 9. COSTS OF RAILROAD OPERATION, MOTT-MANDAN LINE.

		COSTS OF RAILROAD OPERATION	
SCENARIO	TOTAL BRANCH LINE VOLUME	LIGHT REHABILITATION	FULL REHABILITATION
	(BUSHELS)	---------- DOLLARS -------- ---	
1.	5,846,447	4,280,912	4,279,066
2.	3,642,976	2,747,304	2,746,098
3.	3,711,551	2,813,001	2,811,771
4.	6,945,867	5,012,973	5,010,810

Differences in railroad operating costs between the two rehabilitation levels were small relative to total costs of operation, ranging from $1,206 (Scenario 2) to $2,163 (Scenario 4). These differences in costs were due to the slower train speeds required under the lighter rehabilitation level and the resultant increase in car-days spent on the branch line.

[5]Unpublished Upper Great Plains Transportation Institute Report by Denver Tolliver, Research Associate, Upper Great Plains Transportation Institute, North Dakota State University, Fargo. October 1982.

SUMMARY

Summary statistics of revenues, railroad operation costs, track rehabilitation costs, and net railroad revenues are presented in Table 10. Revenues covered all costs of operation and rehabilitation under the light rehabilitation in all cases. However, under the full rehabilitation case, revenue shortfalls of over one million dollars occurred for each of the four scenarios.

The first scenario (52 car elevator at Mott) estimate of bushel volume was approximately 5.8 million bushels. Revenues from this movement were approximately $5.1 million. These revenues did cover total costs under the light rehabilitation, but fell short by $1.3 million under the full rehabilitation.

Scenarios 2 and 3 were the least lucrative of the four elevator configurations analyzed. Under light rehabilitation, revenues exceeded total costs by approximately $300,000 in both cases. Under the full rehabilitation scheme, revenues fell short of total costs by about $1.5 million.

Scenario 4 appeared to be the most promising of the four situations in terms of justifying operation and/or rehabilitation of the line. Revenues exceeded total costs by over $700,000 under the light rehabilitation scheme, but still fell short of costs by $1 million under full rehabilitation.

CONCLUSIONS

It does appear that grain traffic on the Mott-Mandan branch line is of sufficient volume to generate revenues capable of justifying retention of service if the light rehabilitation is performed. However, this conclusion is based on the premise that elevators on the line are upgraded or reconstructed to accommodate multiple car movements, preferably movements in 52 car trains. Also, this analysis assumes 100 percent rail shipment under the multiple car rate situations described in Section I. Before full rehabilitation of the line can be economically justified, additional revenues would be necessary from non-grain traffic. Indications are that grain traffic cannot be expanded much beyond the estimates provided previously. Any added traffic would have to come from the movement of coal.

In order to justify full rehabilitation of the line, additional net revenues of approximately 1.0 to 1.5 million dollars would have to be realized. Grain traffic cannot be expected to carry the cost of a complete rehabilitation of the line.

TABLE 10. SUMMARY OF PROJECTED REVENUES AND COSTS, MOTT-MANDAN BRANCH LINE.				
SCENARIO	TOTAL BRANCH LINE VOLUME	REVENUE OR COST CATEGORY	LIGHT REHABILITATION	FULL REHABILITATION
	(BUSHELS)		- - - - - DOLLARS - - - - -	
1.	5,846,447	Revenues	$5,072,566	$5,072,566
		Operation Costs	4,280,912	4,279,066
		Rehabilitation Costs	300,279	2,128,853
NET			**$ 491,375**	**$(1,335,353)**
2.	3,642,976	Revenues	$3,356,226	$3,356,226
		Operation Costs	2,747,304	2,746,098
		Rehabilitation Cost	300,279	2,128,853
NET			**$ 308,643**	**$(1,518,725)**
3.	3,711,551	Revenues	3,426,431	3,426,431
		Operation Costs	2,813,001	2,811,771
		Rehabilitation Costs	300,279	2,128,853
NET			**$ 313,151**	**$(1,514,193)**
4.	6,945,867	Revenues	6,037,089	6,037,089
		Operation Costs	5,012,973	4,909,214
		Rehabilitation Costs	300,279	2,128,853
NET			**$ 723,837**	**$(1,000,978)**

APPENDIX

Annual Equivalent Cost Estimates of Rehabilitation

Annual equivalent costs of rehabilitation were computed by annualizing the initial cost of track components over the useful lives of each. The formula used in the analysis was adopted from a previous study by Hise, **et. al.**[6] The general form of the formula is:

where:

AEC	=	annual equivalent cost of materials
PCH	=	installed cost of materials
R	=	interest rate
YRS	=	years of useful life
SAL	=	salvage value of materials

Many underlying assumptions are contained in the estimates of annual costs of track rehabilitation. These involve useful life of track components, cost of individual components, salvage values, and interest rates.

Rail life of North Dakota branch lines is more a function of time rather than tonnage due to the light-density nature of these rail segments. Rail life, therefore, is assumed to be 60 years. Ties and ballast are assumed to have a useful life of 30 years. Purchase costs of track components were obtained from a variety of sources. Rail costs were obtained from the Burlington Northern Annual Report (1981). Cost of ties and ballast were obtained from reports of previous track rehabilitation projects. Salvage value of rail was

---

[6]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 Economic Division, Economics, Statistics, and Cooperative Service, Texas Tech University, Lubbock, April 1980.

assumed to approximate used rail price (BN Annual Report), while ties reusable for rail purposes and landscaping were assumed to be worth $15 and $4 in salvage, respectively. The interest rate used was specified at the Association of American Railroad's quarterly cost of capital (11.7 percent). Total costs of the rehabilitation projects ($180,000 per mile and $25,000 per mile) were known prior to estimation of annualized costs. Therefore the component costs quoted above were used proportionately to arrive at the total cost figures. Annual equivalent costs of the two rehabilitation projects are presented below.

Annual Equivalent Cost Estimates -- Full Rehabilitation