DAKOTA, MISSOURI VALLEY & WESTERN'S SOUTHERN DIVISION

BENEFIT COST ANALYSIS

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ABSTRACT

The Oakes to Moffit branch line (the Wishek Line) has been analyzed using North Dakota's rail-line Benefit-cost model which has been employed in previous studies. The methodology has been reviewed and accepted by the FRA. It was updated in 1992 so that the analysis period, discount rate, and treatment of project costs were consistent with the new FRA benefit-cost procedures. The benefit-cost methodology is described in Appendix C. Only the major assumptions, costing techniques, and results are included in this section.

The analysis was performed by the Upper Great Plains Transportation Institute using data provided by the Dakota, Missouri Valley and Western Railroad and transportation statistics maintained by UGPTI. Using a discount rate of four percent, the overall benefit cost ratio for the project is 19.70. The project outlay will be recovered from discounted benefits by the year 1998. Thus, the pay-back period is approximately five years.

INTRODUCTION

Mile Post	Town	1992 Car-Loadings
263.9	Oakes	N/A
266.8	Norway	366
280.7	Fullerton	745
288.6	Monango	1203
310.2	Kulm	339
317.3	Fredonia	394
330.6	Lehr	18
341.0	Wishek(2)	920
351.0	Burnstad	33
362.3	Napoleon	598
372.3	Kintyre	428
379.2	Braddock	124
360.4	Ashley	412

Table 1:1992 Car-Loadings

The branch line extending from Moffit to Oakes (the *Wishek line*) consists of 127 miles of railroad in south-central North Dakota on the Dakota, Missouri Valley & Western (DMVW) system. There is also a branch line leading 21 miles south from Wishek to Ashley. The line serves a total of 14 shippers in 12 towns. The DMVW has enjoyed a modest increase in car-loadings over the last two years since it began operations. Traffic figures for 1992 are shown in Table 1.

Base line traffic consists exclusively of grains originated on the line. Service is twice weekly originating from Oakes, where traffic is interchanged with the Soo Line. Though the line is physically connected to Burlington Northern track at Moffit, the Braddock to Moffit portion was not used by the predecessor railroad (Soo Line) for several years prior to DMVW's inception. The lack of attention by the former owner, coupled with light track materials and mitigating circumstances have resulted in the only practical interchange point being located in Oakes.

The proposed project entails replacing ten miles of sixty pound rail with ninety pound rail between Kulm and Monango. The rail currently in place is over 100 years old and is failing at an unacceptable rate. Very few rail anchors are in place which has resulted in longitudinal movement (or *running*) of the rail.

The project site is in a key location, as two-thirds of the traffic originated on the branch line must transverse the location on its way to interchange. Although the roadbed has benefited from a sledding project ten years prior, the rail was not replaced thus causing difficulties in maintenance. The project is located on a grade, the majority of which is one percent. The longitudinal forces from trains moving up and down the hill coupled with the lack of rail anchors have created severe problems with rail maintenance[1].

The remainder of the benefit-cost analysis consists of a description of train operations and the existing physical condition of the track structure. Following this are the costing procedures and calculations. Finally, the project benefits and costs are outlined.

Operations and Current Line Conditions

Regular train service is scheduled twice weekly. Trains leave Oakes Monday and Thursday with two to three locomotives headed towards Wishek (see Figure 1 for reference). Cars are distributed between Oakes and Wishek as needed. If the train consists of cars destined towards Ashley, one locomotive is removed at Wishek with the appropriate number of cars and the train crew continuing towards Ashley. The crew then dead-heads back to

[1]The remainder of the line is also in need of attention. The DMVW has inserted nearly 16,000 ties and two additional miles of rail over the past two years. More attention will be needed in the future to replace the remaining light rail and perform additional tie and ballast reconditioning.

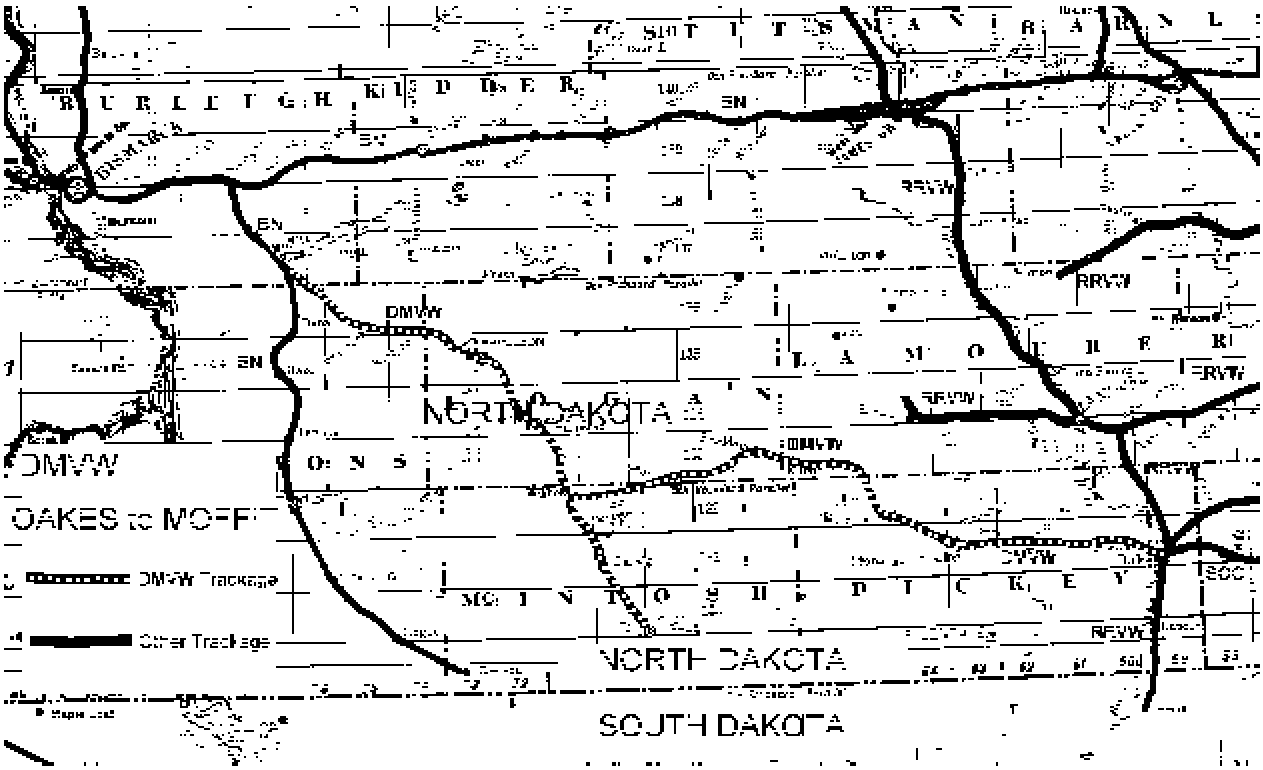

Figure 1: DMVW, Oakes to Moffit

Wishek and takes the remaining locomotive(s) and cars towards Braddock. Often times, the train does not go beyond Napoleon or Kintyre due to infrequent shipments from Braddock.

Once the cars on the West end of the line are released by the shipper, the process is reversed until the train arrives back in Oakes. If things operate smoothly, the train makes it to Oakes before Soo Line arrives for interchange. This does not always happen. West of Monango, trains are currently operated at ten miles per hour due to light rail and poor subgrade conditions.

On days when the temperature is above 90 degrees, trains are unable to be operated between Monango and Fredonia, and west of Wishek due to the sixty pound rail. The light rail coupled with a low anchor population leaves the track prone to sun-kinks. The situation has deteriorated to the point where the track is often closed during hot days and during portions of the spring when the subgrade is wet. This results in difficult train scheduling as trains can only be operated at night.

Currently, there are twenty-four miles of sixty pound rail between Fredonia and Monango. The railroad has made rail replacement their first priority due to the large amount of traffic moving over this section of track. All rail west and south of Wishek is also sixty pound.

Subgrade conditions between Fredonia and Lehr are substandard. There is little or no indication of ballast work being done since 1942. Currently, the ties are located in soil. When it rains, they are located in mud. The result is poor track alignment, premature tie failure, and rail failure due to over-stress. The DMVW has had to operate a tamper over this segment during much of the year simply to keep it passable. While substantial tie work has been completed, complete ballast replacement will have to be completed in the near future to insure the integrity of the track.

Soo Line performed a sledding project east of Fredonia in 1984. This portion of track has excellent alignment and plenty of crushed rock ballast. Consequently, this segment meets (and some cases exceeds) FRA Class 2 standards. Nevertheless, an aging tie population will need attention in the near future. Some of the ties under the sixty pound rail are showing detrimental effects because of the old rail. However, the propagation of tie defects will be resolved with rail replacement.

The ballast condition between Lehr and Wishek is fair. The entire section consists of pit-run rock. However, the track suffers primarily from a few spots of poor drainage. Tie condition over this segment is acceptable. Therefore, major rehabilitation of this segment is not expected.

The track from Wishek to Napoleon resembles that between Fredonia and Lehr. The difference is that the traffic demand is substantially less. The extent of future rail rehabilitation projects along this segment have yet to be determined.

Between Napoleon and Braddock, the track is poor, but passable. Traffic over this segment has never justified large rehabilitation efforts. The tie population is less than comfortable and the ballast is poor. However, given the light traffic density, normal maintenance is probably the best strategy for keeping this segment open.

The DMVW has trackage rights between Moffit and Bismarck over the Burlington Northern. This is the only link between the Bismarck Division of the DMVW and the southern trackage. The thirteen miles of track between Braddock and Moffit were not operated for several years prior to DMVW's inception. Had it been properly maintained, this segment of track would resemble the track east of Braddock. In spite of its condition, the DMVW has made efforts to keep this track open. It has served as a vital link when trains have been stranded west of Oakes due to out-of-service track.

The Ashley spur south of Wishek is in very poor condition. The rail is bent and failing at high rates. Tie condition is very bad. Roughly half of the in-place ties have failed. Most of the remaining good ties are made from untreated Ceder, and are beginning to fail as well.

Ballast is scarce. Since this twenty-mile segment only serves one shipper in Ashley, it is believed that this track will probably be abandoned within the next five years.

All other aspects of the branch line (crossings, bridges, and switches) seem to be in fair to good condition. The primary concern lies with the rail and the ballast conditions. The DMVW has begun to take some initiative in rehabilitating the track. It is believed that this project will encourage DMVW to continue to reinvestment in the track until the viable portions of the branch line are in good operating condition.

Base Case Scenario

If the line is not rehabilitated, a thirty mile section of track west of Monango will have to be closed and abandoned within five years. Due to the problems mentioned with the trackage west of Braddock, the only viable interchange point with the Soo Line (at Oakes) would be severed. Therefore, if this portion of the track is not rehabilitated, then all of the track west of Monango will probably have to be abandoned (including the Monango to Kulm segment).

The facilities in Oakes are not adequate for servicing and maintaining locomotives. Moreover, the only link between the southern lines and Bismarck would no longer exist. Thus, it seems unlikely that the DMVW would continue to operate the Oakes to Monango trackage. Consequently, it is assumed that the twenty-five miles of track west of Oakes will be operated by Soo Line after the Monango to Kulm segment is abandoned. This would be a logical scenario since the track is actually leased from Soo line by the DMVW.

The affected shippers would have limited options after abandonment; they would have to ship their grains to Minneapolis and Duluth by truck, or transship their grains through another

rail station in the region. The average cost to haul grain directly to market by truck was $0.94 per hundred weight. At this cost, transshipment becomes a viable alternative.

Jamestown was chosen as the trans-loading point for several reasons. First, the size of the closest facilities of the size needed to handle the increased volume of grain that would result from abandonment of the Monango to Kulm segment. Second, being located on Burlington Northern's main line, the Jamestown elevator should enjoy better rates than elevators located on branch lines. Finally, Jamestown is located on a line with easy access to both east and west markets. The average cost to transship the grain via Jamestown is $0.5376 per cwt which is less than the cost to truck the grain to market. Thus, it was assumed that the traffic would shift to transshipped via Jamestown.

Since the base case reflects abandonment, the net liquidation value (NLV) of in-place track assets must be added to the project cost. Due to the condition of the track assets, the net liquidation value is (i.e. it would cost more to remove and sell the track materials than it would to leave them in place after abandonment). Therefore, the net liquidation value of existing track assets is not used in any cost calculations.

Project Scenario

The track structure will have to be rehabilitated to insure the long-term viability of operations. The track condition at the project location is good with the exception of the existing rail. It is assumed that the DMVW will continue their efforts to rejuvenate the rest of the line as funds become available.

Rehabilitation will allow for the speed over the project segment to be increased from ten to twenty miles per hour. No further increase in speed can be realized as the DMVW does not employ a dispatcher (the FRA mandates that no train may be operated over twenty miles per hour unless under the supervision of a dispatcher). Operational savings in terms of reduced train, labor, fuel, maintenance cost will be realized from the project.

Due to the nature of the project, the analysis was performed in two parts. The Oakes to Monango portion of the movement was considered to be off-branch, as the fate of this track segment is not dependent on the implementation of the project. The remaining traffic was assumed to be generated from Wishek to Braddock. It was assumed that the Ashley trackage would be abandoned and grain from Ashley would be trans-loaded at Wishek (the only trans-loading alternative). Trackage west of Braddock was not considered in the analysis because it's status will not affect the operational cost of the branch line. If the Braddock to Moffit trackage had any existing traffic base, or the potential for said traffic base, then the situation would be different.

No increases in 1992 traffic levels were assumed in the analysis. It can be difficult to predict future traffic levels as the result of rail rehabilitation. It was felt that the existing traffic represents a level that could be consistently realized regardless of changes in market demands. The base traffic level originating from Oakes to Monango is 2,314 cars. The traffic base west of Monango is 3,266 cars.

Table 2: Dakota, Missouri Valley & Western R.R. Rail Replacement, Dakota Subdivision: MP 299.8 to 309.8			
Cost Item	**Quantity (Units)**	**Unit Cost**	**Cash Cost**
Materials:			
Rail, 90# SH	1584 tons	$ 230.00/ton	$ 364,320
Joint Bars	3,200 pr.	10.00/pr	32,000
Tie Plates	62,000	1.25 ea.	77,500
Rail Anchors	35,000	1.00 ea	35,000
Track Spikes	550 kegs	65.00/keg	35,750
Track Bolts	128 kegs	145.00/keg	18,560
Washers	13,000	0.20 ea.	2,600
Tie Plugs	130,000	0.005 ea.	650
Labor:			
Project Supt.	11 weeks	650.00/week	7,150
Rail Foreman	660 hours	11.50/hour	7,590
Clean-up Foreman	660 hours	11.50/hour	7,590
Laborers	7,260 hours	8.50/hour	61,710
Fringes & Insurance	48%		40,339
Equipment:			
Supt. Pickup	11 weeks	300.00/week	3,300
Foreman's Pickup (2)	22 weeks	300.00/week	6,600
Burro Crane	3 months	5,500.00/mo.	16,500
Spike Puller	3 months	2,500.00/mo.	7,500
Bolt Machine	3 months	1,500.00/mo.	4,500
Spike Machine	3 months	3,500.00/mo.	10,500
Anchor Machine	3 months	1,500.00/mo.	4,500
Fuel & Oil	3 months	4,500.00/mo.	13,500
Sales Tax	6%		33,983

Operational Costs

Operational costs were derived from a number of sources. Maintenance and labor costs were applied from statistics kept at the UGPTI. Train and car hire costs were computed using the R-1 Annual Report from the Soo Line (DMVW's predecessor). Fuel expenses and overhead costs were computed from data supplied by the DMVW. Though not all costs were derived from DMVW, they are all within ranges of similar railroads operated in the region. As mentioned prior, the Ashley branch and the trackage west of Braddock were not considered in the costing analysis. On-Branch costs can be found in Table 3; Off-Branch costs in Table 4.

On-Branch Costs

The normalized maintenance of way (NMOW) is an average computed for the different track conditions found along the branch line. The NMOW figure is an annual equipment cost representing the failure of individual track components with age. A sight inspection was performed in 1991, with careful documentation of track work completed since. The range found for the NMOW figure varied from $1500 per mile on the better portions of track, to nearly $12,000 on the worst.

Maintenance overhead costs include section gang expenses, plus associated administrative costs. Due to the fact that abandonment would eliminate the need for two sections, this cost was assumed to only be 10% fixed. The result is a rather high (but accurate) maintenance overhead cost.

Under current operating conditions, the average time to traverse the line from Monango to Braddock is twelve hours, assuming there is no side trip to Ashley. This trip is made twice weekly (104 times per year) with either two or three locomotives depending upon availability of equipment. An average of 2.5 locomotives was used per trip. A regional average for fuel consumption is 15 gallons per hour, per locomotive. This includes both time running and time idling.

The DMVW has entered into a special car rental agreement with the Soo Line where rail cars are rent-free for the first 48 hours, or until the shipper releases the car. Car hire then becomes the standard rate. The time spent traversing the line has resulted in the DMVW paying large amounts of car rental costs on traffic on the east end of the line (these are the larger shippers which get cars

Table 3: On-Branch Costs (Base Case) Monango to Braddock		
Normalized Maintenance of Way (NMOW)	$6,290.62/mile (avg) * 90 miles	$ 566,156.00
Maintenance Overhead (10% fixed)	$2,501/mile * 90 miles * 90%	202,581.00
Train Crew	104 trips * 2 directions * 2 crew * $16/hour	79,872.00
Train Costs	2.5 locomotives * 104 trips * 2 directions * [(12 hours/trip * $1.9989/locomotive hour) + (90 miles * $0.1957/locomotive mile)]	21,631.90
Fuel	2.5 locomotives * 104 trips * 2 directions * 12 hours/trip * 15 gph * $0.80/gallon	74,880
Car Hire	3266 cars * $17.8049/car + 182372.8 car-miles * $0.0556/car-mile	68,294.38
Overhead	$1403.6697/mile * 90 miles + $280.9264/mile * 90 miles * 30% variable	133,915.29
Net Liquidation Value	Negative - N/A	0.00
Total On-Branch Costs		**$ 1,147,330.57**

before the rest of the line is serviced). The assumption was made that the time on-line which the DMVW actually pays for car rental averages 24 hours per car over the entire line. This is added to the cost of moving the traffic loaded in one direction.

Overhead costs include administration, taxes, and lease costs. These were figured on a per mile basis. The lease cost was assumed to be 100% variable. The remaining portion of the overhead costs was assumed to be only 30% variable. The branch line generates one-third of

DMVW's traffic, which would have a substantial impact on the overhead costs if it were to be eliminated.

As mentioned before, the existing net liquidation value of the line is negative. Therefore, no cost was associated with the return on investment (ROI) of the in-place track assets.

Off-Branch Costs

A relatively large amount of traffic is generated on the eastern-most portion of the line. As a result, the Off-Branch cost associated with the Monango to Braddock traffic constitutes only 58 percent of the costs from Monango to Oakes. The remaining 42 percent represents the cost used in the Base Case of the benefit-cost analysis. If the western part of the branch line is abandoned, and the eastern portion reverts to Soo Line operation, the remaining 42% of the costs will be needed to compare shipping cost differentials between the two railroads. The maintenance overhead cost was assumed to be 10% variable to make-up the remaining variable cost associated with the rest of the line.

Table 4: Off-Branch Costs Monango to Oakes		
NMOW	24.7 miles * 60 ties/mile/year * $25/tie * 58%	$ 21,489.00
Maintenance Overhead (90% fixed)	24.7 miles * $2,501/mile * 10%	6,177.47
Train Crew	104 trips * 2 directions * 2 crew * 2 hours/trip * $16/hour * 58%	7,720.96
Train Costs	2.5 locomotives * 104 trips * 2 directions * [(2 hours/trip * $1.9989/locomotive hour) + (24.7 miles * $0.1957/locomotive mile)] * 58%	2,663.61
Fuel Costs	2.5 locomotives * 104 trips * 2 directions * 2 hours/trip * 15 gph/locomotive * $0.80/gallon * 58%	7,238.40
Car Hire	3,266 cars * 24.7 miles * $0.0566/car mile	4,565.93
Overhead	[($1,403.6697/mile * 24.7 miles) + ($280.9264/mile * 24.7 miles * 30% variable)] * 58%	21,316.34
NLV	$64,814.80 * 58%	37,592.58
Total Off-Branch Costs		**$ 108,764.29**

The Off-Branch cost from Oakes to Minneapolis/Duluth was computed using URCS. The Off-Branch cost increased by the Soo Line is $0.2632 per hundred weight. This yields a total shipment cost via rail of $0.4553 per hundred weight.

The estimated shipping cost for stations between Oakes and Monango is $0.2876 per hundred weight. This was computed by allocating the remaining Off-Branch costs to the traffic generated off-branch. This figure was then added to the Soo Line URCS cost from Oakes to destination.

Under the Base Case assumption, the Oakes to Monango portion of the line would revert back to Soo Line operation. Therefore, the Soo Line cost from Norway, Fullerton, and Monango was computed to the Minneapolis/Duluth market. It was found that there was actually a reduction in costs after abandonment for those three shippers of $0.0105 per hundred weight shipped.

Project Benefits

North Dakota utilizes a detailed benefit-cost methodology which computes the change in producers' and consumers' surpluses resulting from rehabilitation. Five major classes of non-duplicative benefits are usually computed: (1) cost savings on existing traffic due to efficiency gains, (2) shipper profits on new traffic, (3) railroad profits on new traffic, (4) avoidable highway costs, and (5) secondary economic benefits (i.e. business volume and income effects) resulting from shipper profits on new traffic. The computational approaches yields conservative estimates of benefits since only the consumers' surplus on new traffic is considered in estimating secondary benefits. Furthermore, the process guards against double-counting of benefits.

In this analysis, it is unlikely that any new traffic will be generated from rehabilitation. Thus, only two classes of benefits (cost savings and avoidable highway costs) are considered. The reduction in these costs is shown in Table 5. Normalized maintenance is reduced because of increased tie and rail life resulting from the project. However, this cost savings is partially offset

by an increase in the cost of capital resulting from new rail assets being placed in the line. The remaining costs are reduced due to the increase in train speed.

Cost Item	Old Value	New Value	Change
NMOW	$ 119,340	$ 15,000	$ 104,340
Train Crew	6,656	3,328	3,328
Train Costs	2,057	1,537	520
Fuel	6,240	4,160	2,080
Cost of Capital	0	(25,040)	(25,040)
Annual Change in Costs			**$ 85,228**

Table 5:Annual reduction in operational costs over 10 mile project segment.

The cost savings on existing traffic result from the difference in truck and rail costs. In general, the cost to haul grains is such that railroads can provide cheaper transportation to most markets. In this analysis, if rail service is lost the only shipping alternative will be to either truck grain from the elevators to market, or to another elevator to trans-load the grain into rail cars.

Statistics have shown that the average cost to move grain by truck is approximately $1.20 per vehicle mile. Grain trucks are capable of hauling 53,400 pounds of grain per trip (at 80,000 lbs gross weight). The weighted average between all stations and Minneapolis/Duluth is 418 miles. This computes to a truck cost of $0.9394 per hundred weight to ship grain by truck.

This direct haul cost is high enough that the trans-loading of grain from truck to rail cars must be evaluated. As discussed prior, the chosen trans-shipment point is Jamestown. The average highway distance to this point is from stations on the line 79.9 miles. This produces a truck cost of $0.1796 per hundred weight. The average trans-loading cost is $0.08 per hundred weight. The rail cost from Jamestown to Minneapolis/Duluth (computed using URCS) is $0.2781 per hundred weight. Thus, total trans-shipment costs are $0.5376. This is lower than the long-haul truck rate. Therefore, it was assumed that all grain will be trans-shipped if the line is abandoned.

The total shipper benefits are computed by adding the cumulative shipper benefits of the Oakes to Monango line segment to the benefits from Monango to Braddock. The benefits are derived by subtracting the Project Scenario shipping costs from the Base Case Scenario. This is computed on an annual basis and discounted over ten years. The result is a savings of 2.87 million dollars over ten years (see Appendix B).

By investing money in the Wishek Line, the state will prevent an increase in highway replacement and maintenance costs resulting from increased truck traffic. This increase would commence when the line is abandoned in the fifth year of the Base Case. Pavement damage from the 12,248 additional truck trips was analyzed using a pavement damage model developed by the UGPTI. A savings in highway costs of 12.57 million dollars was calculated over the next ten years. Precise calculations can be found in Appendix A.

BENEFIT COST ANALYSIS

The components of the benefit-cost equation are cost savings on existing traffic, plus pavement damage savings, divided by the project cost, plus the net liquidation value of the rail assets currently in-place. Specific year-by-year calculations can be found in Appendix B. The resulting calculation of the benefit-cost ratio then appears as follows:

$$\frac{Shipping\ Benefits + Highway\ Costs}{Project\ Cost + NLV_{Assets}} = \frac{\$3,027,515 + \$12,568,950}{\$791,642 + \$0} = 19.70$$

Appendix A

Truck Traffic Calculations

Basic Costing Parameters:

Fuel Efficiency:	8 mpg
Fuel Tax:	$0.17 per gallon
Registration Cost:	$0.01056 per vehicle mile
Average Rail Car Load:	200,000 pounds
Average Truck Load:	53,400 pounds
Trucks per car-load:	3.75
Cost per ton-mile:	$0.0576

Truck Traffic to Jamestown

Station	Truck Trips	Route	Mileage
Kulm	1271	ND 13	14 miles
		US 281	36
Fredonia	1478	ND 56	1
		ND 13	22
		US 281	36
Lehr	68	ND 13	35
		US 281	36
Wishek	3450	ND 13	45
		US 281	36
Burnstad	124	County	6
		ND 3	33
		I-94	47
Napoleon	2243	ND 3	26
		I-94	47
Kintyre	1605	FAC 1504	4
		ND 34	10
		ND 3	25
		I-94	47
Braddock	465	County	6
		ND 34	19
		ND 3	25
		I-94	47
Ashley	1545	ND 11	43
		ND 281	63

Annual Increase in Highway Costs: $2,804,943

Appendix B

Detailed Benefit Calculations

Changes in Shipping Cost: DMVW Monango-Braddock

Year	Unit Cost, Base Case	Unit Cost, Rehabilitation	Volume Shipped	Change in Shipping Cost	Present Value	Shipping Cost Savings
1	0.4555	0.4425	6532000	84916	0.961538	81650
2	0.4555	0.4425	6532000	84916	0.924556	78509
3	0.4555	0.4425	6532000	84916	0.888996	75490
4	0.4555	0.4425	6532000	84916	0.854804	72586
5	0.5376	0.4425	6532000	621193	0.821927	510575
6	0.5376	0.4425	6532000	621193	0.790315	490938
7	0.5376	0.4425	6532000	621193	0.759918	472055
8	0.5376	0.4425	6532000	621193	0.730690	453899
9	0.5376	0.4425	6532000	621193	0.702587	436442
10	0.5376	0.4425	6532000	621193	0.675564	419655

Changes in Shipping Cost: DMVW Oakes-Monango

Year	Unit Cost, Base Case	Unit Cost, Rehabilitation	Volume Shipped	Change in Shipping Cost	Present Value	Shipping Cost Savings
1	0.2802	0.2802	4628000	0	0.961538	0
2	0.2802	0.2802	4628000	0	0.924556	0
3	0.2802	0.2802	4628000	0	0.888996	0
4	0.2802	0.2802	4628000	0	0.854804	0
5	0.2771	0.2802	4628000	-14346	0.821927	-11792
6	0.2771	0.2802	4628000	-14346	0.790315	-11338
7	0.2771	0.2802	4628000	-14346	0.759918	-10902
8	0.2771	0.2802	4628000	-14346	0.730690	-10483

Changes in Pavement Damage

Year	Cost per Ton-Mile	In-State Ton-Miles	Annual Highway Cost	Present Value	Highway Costs
1	0.0576	0	0	0.961538	0
2	0.0576	0	0	0.924556	0
3	0.0576	0	0	0.888996	0
4	0.0576	0	0	0.854804	0
5	0.0576	48696924	2804943	0.821927	2305459
6	0.0576	48696924	2804943	0.790315	2216787
7	0.0576	48696924	2804943	0.759918	2131526
8	0.0576	48696924	2804943	0.730690	2049544

Cumulative Benefits

Year	Shipment Cost Savings	Avoidable Highway Costs	Annual Benefits	Cumulative Benefits
1	81650	0	81650	81650
2	78509	0	78509	160159
3	75490	0	75490	235649
4	72586	0	72586	308236
5	498783	2305459	2804242	3112478
6	479599	2216787	2696387	5808865
7	461153	2131526	2592679	8401544
8	443416	2049544	2492961	10894505
9	426362	1970716	2397078	13291583
10	409963	1894919	2304883	15596465
Total	**3027515**	**12568950**	**15596465**	