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COST-BENEFIT ANALYSIS FOR THE MINNESOTA RAIL SERVICE IMPROVEMENT PROGRAM METHODOLOGY AND A CASE STUDY

by

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Prepared for the

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INTRODUCTION

Study Objective

The objective of this study is to develop a methodology for evaluating the economic feasibility of participating in the Minnesota Rail Service Improvement Program by eligible individuals or groups.

Background

The Minnesota Rail Service Improvement Program provides for financial assistance from the state to rehabilitate eligible rail lines which contract with their users and the state. One of the requirements for participation is that rail users provide a minimum of one-third of the total capital. This capital contribution by the rail users will be repaid in full by the railroad according to a schedule in the contract, based on the volume of shipments.[1/]

The decision of whether to participate in such a program either as an individual shipper, a group of shippers, a railroad, or as a state agency is a major financial decision and should not be taken lightly. Railroad branches eligible for such aid are generally financially weak and consequently, investments in them entail capital risk both for the shipper and the state. For its part, the railroad must agree to provide a minimum level of

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[1/] For a full description see "Rules Implementing the Minnesota Rail Service Improvement Program".

service during the contract period. The railroad may not receive enough revenue to cover service costs and be obligated to accept operating losses for the contract period. The state has a limited amount of funds for rehabilitation, hence, one of the criteria for allocating funds is the economic potential of the branch line.

METHODOLOGY

Benefits of Rail User Investments

The benefits available from participating in the Rail Service Improvement program are basically the same as those of having rail service. This is because rail lines eligible for rehabilitation funds under the Minnesota Rail Service Improvement Program are in general "marginal" lines, i.e., they either do not meet Class II Federal Safety Standards or cannot support railcars with a gross weight of 263,000 lbs. Inability to support such a weight excludes the use of 100 ton grain hopper cars. These rail lines are generally in poor physical condition and usually do not generate sufficient revenue traffic for the railroad to consider major rehabilitation expense (or investment). Consequently, although not necessarily in imminent danger of abandonment, they will not survive without help as recent federal legislation encourages railroad consolidation and removes some of the constraints on abandonment.

The benefits of rail service in this study fall in three relatively distinct classes. First, are the "tangible" benefits to individual shippers

that can be measured in dollars and cents. Next are the "intangible" benefits to individual shippers, firms or small groups which although very real, cannot be measured in dollars and cents. The third class of benefits are those that do not accrue to individuals or groups but rather to the community as a whole. These "social" benefits are also intangible since it is difficult, if not impossible, to put a dollar and cents value on them.

Individual shippers when deciding whether to participate in the Minnesota Rail Service Improvement Program are primarily interested in the tangible benefits and costs but should also consider the intangible benefits accruing to them. The state and other governmental bodies are interested in the "social" benefits as well as the private benefits.

A gross measure of the "economic viability" of rail rehabilitation projects is the sum of the tangible benefits accruing to all shippers compared with the cost of the project. If the social benefits from two projects are the same, then the project with the highest "benefit/cost" ratio is most desirable.

The analysis of economic feasibility in this study is done first from the viewpoint of the individual shipper who is evaluating a business investment, and secondly from the vantage point of the state, which is interested in the overall comparison of benefits and costs.[1/]

[1/] The railroad line must also make an investment decision. The railroad must consider future revenues with and without rehabilitation, operating expenses, the proposed repayment schedule and its effect on cash flow. Analysis of the economic feasibility for the railroad is beyond the scope of this study.

Benefits of Rail Service

The tangible benefits of rail service to shippers may include:

1. Cost savings due to lower rates for rail than for other modes of transportation.

2. Cost savings from loading or unloading cargo for rail instead of for other modes.

3. Cost savings in handling oversize shipments by rail because railroads can carry larger and heavier loads than trucks.

4. Cost savings due to less loss or damage in handling or transit.

5. Cost savings from avoiding the capital expenses of adding facilities, such as truck docks or materials handling equipment to replace rail facilities.

6. Premiums (or avoided discounts) from buyers who prefer rail shipments because of rail services such as diversion or transit privileges, inspection, security, equipment characteristics, etc.

Another potential tangible benefit redundant to shippers after rehabilitation is reduced rates, say for multiple hopper shipments that are not now possible because of weight limitations.

These benefits are, of course, shipper specific and affect shippers differently. There is no guarantee that rail service will provide benefits.

In some cases it may be an additional cost. For instance, rate differences between rail and truck vary widely depending on both origin and destination and the specific commodity. In some cases, the rail rate is higher than the truck rate, and the rail user incurs a net cost over truck rates when he elects to use rail service. Similar examples of net costs can be demonstrated for most of the other points. The shipper must deduct such costs from benefits when attempting to determine the value of tangible benefits.

The intangible benefits of having rail service include:

1. The existence of intermodal competition for hauling goods and commodities. Effective competition holds down rates and provides incentive (or necessity) for improved service and increased efficiency. Many people view this as the most important benefit of rail service.
2. Railroads may provide better service in terms of operating schedules, type of equipment, transit or diversion privileges, free time, etc.
3. Rail facilities may be necessary for businesses that need oversized cargo shipments.
4. Lack of rail service may limit or restrict the growth of the businesses of the rail user's customers.
5. Lack of rail service and the resulting loss of tangible and intangible benefits may restrict or limit future growth of business in the area.

The social or community benefits of having rail service may include:

1. Reduced future investment in alternative transportation facilities, such as roads and highways. The number of heavy truck loads, which increase road and highway deterioration, are reduced by the presence of rail service. This may decrease total transportation costs to the community.

2. Maintenance requirements for competitive transportation modes are decreased, that is, highway life may be extended or maintenance costs reduced.

3. There may be decreased fuel consumption and/or decreased air pollution.

4. Businesses in the community, such as grocery stores and automobile dealers, may realize increased business due to tangible and intangible benefits received by the shippers with rail service. This results in larger payrolls and an increased tax base in the community.

5. Communities having rail service may have a competitive advantage in attracting new industry.

Several of these social benefits are not limited solely to communities having rail service but have an impact on a wider geographical area. For example, reduced highway construction or maintenance costs have a benefit for the entire State of Minnesota.

Costs Associated With User Investments

Under the Rail Service Improvement Program, a Shippers Association provides funds to be used by the railroad for rehabilitation. These funds are then repaid to the Shippers Association according to the volume of shipments originated at or received by participating shippers. Since the shipper's contribution is returned before the state's, there is very little risk of their capital not being returned if projections of future shipments are realistic. Consequently, the shipper is in effect making a low risk-interest free loan to the railroad for a set period of years. The primary cost to the shipper then, is the cost of his money during the time it is tied up in the rehabilitation project. This cost of money generally will be the highest of:

1. The interest rate on existing loans or new loans required to furnish the rehabilitation funds.
2. The interest rate on savings or the rate of return on alternative investments outside the firm.
3. The rate of return on alternative investments within the firm.

This cost will vary over the life of the contract being highest at the beginning of the contract when the railroad has use of the entire loan and decreasing as repayments are made and the amount of the loan is reduced.

Other costs to the shipper are the expenses associated with any additional investments required to obtain cheaper rates, such as investments in equipment to handle hopper cars. In such a case, the cost must also include amortization or depreciation as well as interest cost.

Decision Making Procedures

The decision making process for both shippers and State Planning can be broken down into the following steps:

1. Determine the total funds required for rehabilitation. Determine the probable requirement for funds from shippers, state, and the railroad.

2. Determine the current (or typical) annual volume of shipments, the maximum potential annual volume of shipments if the line is upgraded, and the probable volume of shipments after rehabilitation.

3. Determine the average shipper investment required per car based on current shipments in a typical 12-month period. This is the shipper's investment from step 1 divided by the number of cars from step 2.

4. Select one or more payback rates per car (or ton). The required payback rate will vary depending on the length of the contract (or the desired payback period if shorter than the contract period), the volume of shipments, and the proportion of shippers who participate. It may be desirable to investigate a range of payback

rates to get an idea of the "worst" and "best" and "most likely" situations under different volume and participation assumptions.[1/]

5. Determine the cost of money or interest rate to be used. Select the appropriate "Investment Cost Worksheet" and determine the shipper's (or group of shippers) discounted cost of the investment. Detailed instructions for the use of the "Investment Cost Worksheets" are furnished as Appendix A. Sample "Investment Cost Worksheets" for discount rates of 5, 8, 12 and 18 percent are included in Appendix A. Use the worksheet with the appropriate discount factor.

6. Determine the value of discounted net tangible benefits over the appropriate time frame. Appendix B contains detailed instructions on how to use the "Benefit Worksheets".

7. Determine what other benefits--intangible and social--should be considered.

8. Compare the total discounted costs and total discounted tangible benefits. Discounted costs and benefits rather than net costs and benefits are used in this analysis

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[1/] As the contract period is shortened, the payback per car has to increase. As the number of cars increases through volume or participation, payback per car can be decreased.

to account for the time value of money. Appendix C explains why discounted costs and benefits are used.

9. After you consider the benefit/cost ratio and the various intangible aspects, make the investment decision.

CASE STUDY -- Tracy to Gary, S.D., CNW Line

Rail User Information

Rail user information for the case study was obtained from responses of the 41 Minnesota rail users on the Tracy, Minnesota to Gary, South Dakota line, Chicago and Northwestern Railroad (CNW), to the "1976 Minnesota Rail Line User Questionnaire". Additional information was obtained from the "Record of Shipping" provided by 10 of these shippers.

Of the 41 rail users, 20 sent rail shipments in 1975. Ten of these were grain elevators. Several other rail users received rail shipments but use trucks exclusively for shipping out. Thirty-five rail users received goods by rail in 1975 including 14 firms that also shipped goods out by rail. Five of the grain elevators received rail shipments.

Commodities and goods received by rail include farm implements (11 users), fertilizer (7 users), buildings supplies, salt, tires, plywood and similar merchandise (7 users), lumber and poles (5 users), and foodstuffs and similar merchandise (7 users). Some shippers received more than one category of merchandise.

1975 Actual Rail Cars

The top portion of Table 1 summarizes the 1975 volume of shipments and receipts. Principal commodities are listed in the left column. The second column has the number of cars shipped. The principal commodities shipped out are grains and soybeans which accounted for over 95 percent of the outbound volume in 1975.

The lower portion of the table shows the number of cars received on the line. Over half of the 393 cars received were fertilizer. The next largest categories of cars received were lumber and poles, and farm implements. These three categories accounted for over 80 percent of the cars received. The last line shows that 1223 cars were originated by or delivered to destinations on the line.

The Burlington Northern Railroad (BN) also provides rail service to Marshall, Minnesota which is between Tracy and Gary. Sixteen of the 41 surveyed shippers have Marshall locations. Some have BN rail service. Some of these shippers would not be significantly affected by the loss of rail service on the CNW. Consequently, their participation in a rail rehabilitation program is more questionable than for shippers who depend entirely on CNW service. This potential lack of participation is reflected in the third column which contains the total cars shipped to and from locations other than Marshall. Outbound traffic for users relying entirely on CNW service is even more highly concentrated in grains. For these users, the three major categories of receipts (fertilizer, lumber and farm implements) account for

TABLE 1. Volume in Carloads 1975

Commodity	Cars shipped 1975	Cars shipped without Marshall	Total potential cars	Total potential cars without Marshall	Maximum probable cars	Maximum probable cars without Marshall
			SHIPMENTS			
Corn	377	321	596	524	486	422
Oats	246	225	246	225	246	225
Wheat	137	137	322	308	230	223
Beans	34	29	594	465	34	29
Other outbound	36	12	52	20	50	16
Total Outbound	830	724	1810	1542	1036	915
			RECEIPTS			
All commodities	393	279	1089	828	413	299
Total cars 1975	1223	1003	2899	2370	1449	1214

SOURCE: 1976 Minnesota Rail Line User Survey (41 users)

95 percent of total receipts. A total of 1003 cars were originated at or delivered to locations on the line other than Marshall.

Potential Volume

The fourth column gives an estimate of the potential volume of the line in terms of boxcars. This was obtained by converting the total tonnage of truck shipments shipped or received by the 41 rail users into the number of rail cars required to haul that tonnage. This number was added to the number of rail cars shipped. The fifth column is obtained in the same manner and contains the potential volume of boxcars without Marshall shipping locations.

However, because of the truck competition all of this "potential" volume would not move by rail even if the line were upgraded and rail service were improved. The last two columns are an estimate of the "maximum probable" volume of rail shipments after rehabilitation.

Oat shipments now virtually all go by rail so no increase is possible for oats. Large increases in outbound rail shipments of corn, wheat, and soybeans are possible. However, it is unlikely that any additional rail shipments of soybeans will be made. Existing truck rates to Dawson and Mankato, the destinations for the soybeans, are well below minimum rail rates and there is no reason to expect this situation to change.

On the other hand, more corn and wheat might go by rail if hopper car service were available. An arbitrary estimate of one-half of the corn and wheat shipped by truck in 1975 was added to 1975 rail shipments to give an estimate of the "maximum probable" rail shipments of corn and wheat.

"Potential" and "maximum probable" receipts of commodities were also estimated. Currently over 80 percent of the dry fertilizer and lumber and poles come by rail. Hopper cars and better service will increase this percentage but not many more carloads will be required to raise rail shipments to 90 percent. These are the only categories of inbound shipments estimated to increase for the "maximum probable" after rehabilitation. The large increase in "potential" inbound cars is due to the large quantities of feed trucked in. This was the equivalent of about 450 boxcars. However, for the "maximum probable" it was assumed that the feed was not being shipped long distances and that trucks would retain a rate advantage over rail.

Summary of Volume Data

The 1975 data show that a total of 1223 rail cars originated at or were delivered to locations on the line. One thousand-three were for locations other than Marshall. If all movement of commodities to and from the 41 users went by rail, volume would increase by over 120 percent to 2899 cars with and 2370 cars without Marshall. However, due to the nature of the commodities and their origins and destinations, a total of 1449 cars including Marshall and 1214 cars without Marshall is more likely. This means that under stable business conditions rail volume is not likely to increase more than 20 percent due to improved facilities and service.

The shipping level of 1000 cars approximates the 1975 volume of shipments for all shippers except those in Marshall and represents 100 percent shipper participation.

Analysis (All shippers except Marshall)

The methodology described in the previous section was applied in this analysis with various combinations of payback amounts, volumes and benefits:

Shippers investment	$1,000,000
Payback amounts	$100/car
	$200/car
Discount (Interest) Rates	5%
	8%
	12%

Shipping Volume:

1,000 cars per year consisting of:

Outbound:	225 oats
	487 corn and wheat
Inbound:	288 fertilizer, lumber and merchandise

Benefits:

Freight rate differences:

- corn, wheat, oats (truck rate lower than rail)	-5.5¢/cwt.
- fertilizer, lumber, merchandise	+$6/ton

Price advantages:

- corn, wheat	+3¢/bu.
- oats	+9¢/bu.

The $100 per car payback will return the shipper investment in 10 years. The $200 per car payback will return the shipper investment in 5 years. The benefits are based on current rate differences and price differentials as reported by shippers. Only rate differences and price differentials were included in the benefits.

Table 2 shows the benefits from rail service to the 25 non-Marshall rail shippers. These total to approximately $172,000 per year when benefits are reduced by the favorable rate differences of truck over rail for grain. At current truck and rail rates, Table 2 indicates that rail shippers of corn and wheat have a net loss of $3.00 per car. It was assumed that shippers will ignore this small cost per car and ship by rail to take advantage of intangible benefits, such as the availability of transit and diversion privileges and to obtain the payback from the railroad. If all shipments of corn and wheat were made by truck, annual benefits would be $1461 higher but the payback period and/or payback amount, would have to be adjusted because of the reduced rail volume. If the entire adjustment were in the length of the payback period, the payback period would have to be nearly doubled. The benefit-cost ratio would decline and be less favorable in most cases. If the entire adjustment were in the payback amount the amount per car would have to be nearly doubled. The benefit-cost ratio would increase and be more favorable. However, these alternatives were not analyzed because a volume reduction of nearly 50% would cause the project to be rejected on other grounds.

TABLE 2. Annual Benefits, 1000 Cars/Year

Commodity	Number cars	Rate difference	Price advantage	Total	Total with equal rates
Corn, wheat	487	-$66/car (-5.5¢/cwt)	$63/car 3¢/bu.	-1,461	30,681
Oats	225	-$66/car (-5.5¢/cwt)	$337.50/car 9¢/bu.	61,088	75,938
Fertilizer, lumber, merchandise	288	$390/car $6/ton	-- --	112,320	112,320
			TOTAL	171,947	218,939

The benefits would be nearly $219,000 per year if there were no difference between truck and rail rates. Truck rates for grain to the Twin Cities have typically been as high or higher than rail rates. Some shippers believe that truck and rail rates to the Twin Cities will be competitive in the future.

The cumulative discounted benefits for the $172,000 and $219,000 benefit levels were computed for both 5 and 10 year periods (tables 3 and 4). Discount factors of 5, 8, 12 and 18% were used. Cumulative discounted benefits at the $172,000 benefit level are shown in the third column of the tables and in the fifth column for the $219,000 level.

Investment cost worksheets were completed for $100/car and $200/car payback levels for 5, 8, 12 and 18% discount factors. Total discounted costs over the payback period are shown in the second column of tables 3 and 4.

Tables 3 and 4 also include the year in which discounted benefits equal discounted costs (columns four and six). Table 3 shows that with a 5 percent discount rate and a $200/car payback, the shippers discounted benefits in the second year of the program are larger than the total discounted costs, regardless of whether rail and truck grain rates are equal or rail grain rates exceed truck rates. Table 5 illustrates cumulative discounted benefits at a 5 percent discount factor over 10 years. It should be noted that no benefits accrue in the first year because it is assumed that rehabilitation will take one year.

TABLE 3. Comparison of Discounted Costs and Benefits Based on $1,000,000 Shipper Investment and 1,000 Cars/Yr., Payback $200 per Car
Payback Period 5 Years
Benefit Period 5 Years

Interest/ Discount Rate	Total Discounted Cost	Discounted Benefits Rail Grain Rates Exceed Truck Rates	Year Discounted Benefits Equal Discounted Cost	Discounted Benefits Rail Grain Rates Equal Truck Rates	Year Discounted Benefits Equal Discounted Cost
5%	134,150	580,835	2	739,574	2
8%	201,456	527,360	3	671,485	3
12%	279,072	466,319	4	593,761	3
18%	374,508	392,038	5	499,180	4

TABLE 4 . Comparison of Discounted Costs and Benefits, $1,000,000 Shipper Investment and 1,000 Car/Yr.
Payback $100/Car
Payback Period 10 Years
Benefit Period 10 Years

Interest/ Discount Rate	Total Discounted Cost	Discounted Benefits Rail Grain Rates Exceed Truck Rates	Year Discounted Benefits Equal Discounted Cost	Discounted Benefits Rail Grain Rates Equal Truck Rates	Year Discounted Benefits Equal Discounted Cost
5%	227,895	1,164,250	3	1,482,432	3
8%	328,968	994,367	4	1,266,121	3
12%	435,024	818,121	5	1,041,709	4
18%	550,494	626,917	8	798,250	6

TABLE 5. Example of Cumulative Discounted Benefits for 5% Discount Rate and $172,000 Benefit Level

Year	Annual Benefits	Discount Factor	Discounted Benefits	Cumulative Discounted Benefits
1	0	.953	0	0
2	$171,946	.907	155,955	155,955
3	171,946	.864	148,561	304,517
4	171,946	.823	141,511	446,029
5	171,946	.784	134,806	580,835
6	171,946	.746	128,272	709,107
7	171,946	.711	122,253	831,361
8	171,946	.677	116,407	947,769
9	171,946	.645	110,905	1,058,674
10	171,946	.614	105,575	1,164,249

For an 8 percent discount rate, discounted benefits equal total discounted costs in the third year for both rate situations. For a 12 percent discount rate, discounted benefits equal total discounted costs in the third year for equal rail and truck rates and in the fourth year when rail rates exceed truck rates. For an 18 percent discount rate, discounted benefits do not equal total discounted costs until the fifth year with lower truck rates and in the fourth year for equal rates.

Note that as the discount rate increases, total discounted costs increase while discounted benefits decrease. In fact, if money were to cost just a little more than 18 percent then the cumulative discounted benefits over the 5 year payback period would be less than the total discounted costs when rail rates exceed truck rates. In that case, a shipper could not justify investing in rail rehabilitation on the basis of the tangible benefits.

Table 4 summarizes discounted costs and benefits for a $100/car payback and a 10 year payback period. Discounted benefits are larger than in Table 3 because the benefits are summed over a 10 year period. The results are still favorable although the number of years required until discounted benefits equal costs has increased. Note that the discounted costs have increased substantially even though the shippers' initial investment is the same as in Table 3. This is due to the longer period of time that interest is paid (or foregone) on the shippers' investment.

Analysis (Major User Participation Only)

The previous analysis assumed that all shippers participated in the rail rehabilitation program. The number of cars for which a payback was made was equal to the total 1975 volume level. This section describes a similar analysis done with the assumption that only the major shippers who had expressed interest in rehabilitation would participate. All costs, rates and interest rates remain the same. The only difference is that the payback and benefits are based on 670 cars per year instead of 1000. Table 6 shows annual benefits totaling more than $75,000 to these major shippers when rail grain rates exceed truck rates and over $112,000 if rail rates equal truck rates. Table 7 lists the cumulative discounted benefits for 8 years for 5, 8, 12 and 18% and total discounted costs for a $200/car payback. Table 8 provides the cumulative discounted benefits for 15 years and total discounted costs for a $100/car payback. The third column in each table is for the $75,000 level of annual benefits and the fifth column is for the $112,000 annual benefit level. Because of the smaller number of cars and the constant investment, $1,000,000, the required payback period increases to 8 years at $200/car and to 15 years at $100/car.

Because of the longer payback period, discounted costs are higher than in Tables 3 and 4. Discounted benefits to participating shippers are less because there are fewer shippers benefiting. (Total benefits to area rail users remain the same but some of those benefiting would not be sharing in the costs.) The railroad would be better off at either payback level than

Table 6. Annual Benefits, 670 Cars/Year

Commodity	Number Cars	Rail Rate Advantage	Rail Price Advantage	Total Rail Grain Rates Exceed Truck Rates	Total Rail Grain Rates Equal Truck Rates
Corn, Wheat	433	$-66/cars (-5.5¢/cwt)	$63/car (3¢ bu.)	-1,299	27,279
Oats	135	$-66/car (-5.5¢/cwt.)	$337.50 (9¢/bu.)	+36,653	45,563
Fertilizer, Lumber & Merchandise	102	$+390/car (+6¢/ton)	---- ----	+39,780	39,780
			TOTAL	$75,132	$112,622

Table 7. Comparison of Discounted Costs and Benefits
$1,000,000 Shipper Investment and 670 Cars/Yr.
Payback $200 Per Car
Payback Period 8 Years
Benefit Period 8 Years

Interest/ Discount Rate	Total Discounted Costs	Discounted Benefits Rail Grain Rates Exceed Truck Rates	Year Discounted Benefits Equal Discounted Costs	Discounted Benefits Rail Grain Rates Equal Truck Rates	Year Discounted Equal Discounted Costs
5%	182,718	414,136	4	620,770	3
8%	268,255	362,143	6	542,836	4
12%	363,450	306,169	10+	458,933	6
18%	472,689	242,681	never	363,767	15

TABLE 8. Comparison of Discounted Costs and Benefits, $1,000,000 Shipper Investment and 670 Cars/Yr.
Payback $100 Per Car
Payback Period 15 Years
Benefit Period 15 Years

Interest/ Discount Rate	Total Discounted Costs	Discounted Benefits Rail Grain Rates Exceed Truck Rates	Year Discounted Benefits Equal Discounted Costs	Discounted Benefits Rail Grain Rates Equal Truck Rates	Year Discounted Equal Discounted Costs
5%	307,055	708,434	6	1,061,908	5
8%	428,046	573,419	10	859,527	7
12%	544,643	444,715	35	666,607	11
18%	659,151	318,866	never	477,966	never

under the previous analysis because they would essentially have an interest free loan for a longer period of time. The railroad's cash flow or profit is then increased in the first years of the period because it doesn't have to make a $100 or $200 per car payback for 330 of the cars hauled on the line.

The time required for cumulative discounted benefits to equal total discounted costs has increased substantially from the 1000 car payback situation. Benefit/cost ratios of 2 and 3 to 1 are still available at either payback level for a 5 percent discount factor. However, it should be noted that there is now a 15 year investment period for the $100/car payback level, that is, benefits accrue for 15 years rather than 10.

It should be noted that for a 12 percent discount rate with rail grain rates higher than truck rates, cumulative benefits do not equal costs until the 10th year while the payback period is only 8 years. When the payback is only $100/car and the discount factor is 12 percent, it takes 35 years for discounted benefits to equal total discounted costs. At an 18 percent interest rate, discounted tangible benefits will never equal total discounted costs for the $100/car payback and for the $200/car payback with a low truck rate.

Individual Shipper Analysis

The preceding analysis demonstrated that with the assumption of participation by two-thirds or more of the shippers from locations other than Marshall, the shippers' total discounted benefits exceed total discounted costs over a range of discount factors and payback amounts. However,

benefits will not be the same for all shippers. Tangible benefits vary depending on the product or commodity being shipped or received, the distance moved, handling characteristics, alternative markets, etc.

The following analysis is based on examples which are believed to be typical of benefits for different kinds of shippers. The examples are all based on shippers who handle a total of 100 cars a year.

Example 1.	70 cars of corn and wheat 30 cars of oats Truck rates equal rail rates
Example 2.	70 cars of corn and wheat 30 cars of oats Truck rates are less than rail rates
Example 3.	100 cars of fertilizer
Example 4.	100 cars of corn and wheat Truck rates equal rail rates
Example 5.	100 cars of corn and wheat Truck rates less than rail rates
Example 6.	100 cars of oats Truck rates equal rail rates
Example 7.	100 cars of oats Truck rates less than rail rates

Cost and benefits were computed for 5, 8 and 12 percent discount rates for these seven examples. Each shipper was assumed to invest $100,000 with payback periods of 10 and 5 years.

A summary of these computations is provided in Tables [9] and 10. These tables demonstrate the difference in the profitability of the investment in rail rehabilitation due to the type or mix of commodities. A

TABLE 9. Summary of Discounted Costs and Discounted Benefits Over a 10 Year Payback Period ($100,000 Investment - 100 Cars Per Year - $100 Per Car)

Discount Rate	Total Discounted Cost	70 cars corn & wheat 30 cars oats		100 cars fertilizer		100 cars oats		100 cars corn & wheat	
		Cumulative Discounted Benefits	Year Benefits Equal Cost	Cumulative Discounted Benefits	Year Benefits Equal Cost	Cumulative Discounted Benefits	Year Benefits Equal Cost	Cumulative Discounted Benefits	Year Benefits Equal Cost
5% Rail grain rates equal truck rates	$22,790	$98,416	3	$264,069	2	$228,521	2	$42,657	6
5% Truck grain rates less than rail rates	$22,790	$53,728	5	$264,069	2	$183,833	2	Rail increases costs	never
8% Rail grain rates equal truck rates	$32,897	$84,056	4	$225,537	2	$195,176	3	$36,433	9
8% Truck train rates less than rail rates	$32,897	$45,888	6	$225,537	2	$157,008	3	Rail increases costs	never
12% Rail grain rates equal truck rates	$43,502	$69,158	6	$185,562	3	$160,582	3	$29,975	25
12% Truck grain rates less than rail rates	$43,502	$37,755	13	$185,562	3	$129,130	4	Rail increases costs	never

TABLE 10. Summary of Discounted Costs and Discounted Benefits Over a 5 Year Payback Period ($100,000 Investment - 100 Cars Per Year - $200 Per Car)

Discount Rate	Total Discounted Cost	70 cars corn & wheat 30 cars oats		100 cars fertilizer		100 cars oats		100 cars corn & wheat	
		Cumulative Discounted Benefits	Year Benefits Equal Cost	Cumulative Discounted Benefits	Year Benefits Equal Cost	Cumulative Discounted Benefits	Year Benefits Equal Cost	Cumulative Discounted Benefits	Year Benefits Equal Cost
5% Rail grain rates equal truck rates	$13,415	$49,099	2	$131,742	2	$114,007	2	$21,281	4
5% Truck grain rates less than rail rates	$13,415	$26,804	3	$131,742	2	$91,712	2	Rail increases costs	never
8% Rail grain rates equal truck rates	$20,146	$44,579	3	$119,613	2	$103,511	2	$19,322	6
8% Truck grain rates less than rail rates	$20,146	$24,337	5	$119,613	2	$83,269	2	Rail increases costs	never
12% Rail grain rates equal truck rates	$27,908	$39,419	4	$105,768	2	$91,530	3	$17,086	9
12% Truck grain rates less than rail rates	$27,908	$21,520	7	$105,768	2	$73,631	3	Rail increases costs	never

fertilizer shipper with a rail rate advantage of $6/ton clearly has a favorable benefit/cost situation in all cases. An elevator with only corn and wheat to ship cannot justify an investment based on benefits. However, an elevator with all of its rail shipments composed of oats has a very favorable benefit/cost situation. An elevator with a combination of 70 cars of corn and wheat and 30 cars of oats has a favorable benefit/cost ratio for 5 and 8 percent discount factors. At a 12 percent discount rate, equal rail and truck rates or intangible benefits would be necessary to justify the investment.

The differences shown in Tables 9 and 10 demonstrate the importance to individual shippers of evaluating their proposed investment in terms of their expected future commodity mix and their cost of money.

Summary and Conclusions

1. Favorable benefit/cost ratios clearly exist if all shippers participate with $200 or $100/car paybacks at 5, 8 or 12 percent discount rates.

2. Favorable benefit/cost ratios exist at 5 and 8 percent discount rates with $200/car paybacks if shippers representing only two-thirds of the volume participate. At a 12 percent discount rate, the project has a favorable benefit/cost ratio, assuming equal truck and rail rates. However, if truck rates for grain are lower than rail rates, with a 12 percent discount rate, the project is not viable on the basis of tangible benefits. At an 18 percent discount rate, it is not viable for either rate situation.

3. At a $100/car payback and the participation of two-thirds of the shipment volume, the project is viable at 5 percent discount rate. It is marginal at an 8 percent discount rate if only tangible benefits are considered.

4. At a $100/car payback rate, two-thirds participation and a 12 percent or 18 percent discount rate, the tangible benefits considered in this study are inadequate to justify the rehabilitation expense.

5. The $100/car and $200/car payback levels are based on the capacity of boxcars and not that of hopper cars. If the rail line is rehabilitated, and hopper cars are used, the number of cars will decline by about 40 percent because boxcars have a capacity of 60 tons/car, while hopper cars have a capacity of 100 tons/car. Consequently payback amounts should be negotiated in terms of dollars per ton, or bushels, or some other unit independent of car size and not in terms of cars.

6. Volume increases were not considered in the analysis. Growth in volume shipped by rail should increase tangible benefits and reduce the payback period. This will result in more favorable benefit-cost ratios. However, volume increases will not automatically occur if the rail line is rehabilitated. Potential for short run increases in volume is probably no more than 20 percent.

7. Individual users may differ greatly in the benefits they derive from rail rehabilitation. The individual user analysis showed that benefit-cost ratios for dry fertilizer users and for elevators shipping large

proportions of oats were much larger than elevators shipping only corn and wheat.

APPENDIX A

Instructions for Use of "Investment Cost Worksheets":

Attachments A-1 to A-3 are Investment Cost Worksheets for interest or discount rates of 5, 8, and 12 percent. Worksheets for other interest or discount rates can be constructed by putting the appropriate discount factors in column (4). These factors, can be obtained from standard texts or be computed from the formula:

$$\text{Discount factor for year } n = \frac{1}{(1+i)^n}$$

where n is year and i is the interest rate.

For example, for an interest rate of 8 percent, the discount factor for year 1 is

$$D = \frac{1}{(1+.08)^1} = \frac{1}{1.08} = .926$$

and for year 2

$$D = \frac{1}{(1+.08)^2} = \frac{1}{1.1664} = .857$$

The procedure for using the worksheet is:

1. Determine the total investment. Write this number on the appropriate blank in the upper left corner of the worksheet.

2. Determine the payback per unit shipped (car, ton, cwt.) - Write this amount in the appropriate blank in the upper right corner.

3. Determine the number of units shipped and received per year. If the same number each year, write in the upper right corner and go to step 4. (If the volume changes from year to year, draw two additional columns to the right of column (5) on the worksheet. Label the first new column "Volume (6)" and the second new column "Payback Amount (7)". Put the yearly volume on the appropriate line in column 6.)

4. If the volume of shipments and receipts is the same each year, multiply the quantity by the payback to obtain the payback/year. Write this in the appropriate blank in the upper right part of the worksheet. (If the volume changes from year to year, multiply the yearly volume in column (6) by the payback amount and put the product (the amount paid back each year) in column (7).

5. Put the capital investment at the beginning of Year 1 in column (1), Year 1. In most cases, this will be the same as the total investment determined in step 1.

6. Determine the investment in Year 2. If the payback is the same each year, this is done by subtracting the payback/year in the upper right from the amount in column (1) - Capital Investment Beginning of Year. The investment in Year 3 is found by subtracting the payback from Investment in Year 2 and so on until the balance is zero.

If the volume of shipments and subsequent payback varies by year, then the procedure is to subtract column (7) from

column (1) and put the result in Year 2. Then subtract column (7) in Year 2, the amount paid back in Year 2, from column 1 and put the result in Year 3, continuing until there is a balance of 0 in column (1).

7. Multiply column (1), Capital Investment for each year, by column (2), the interest rate. Put the results for the appropriate years in column (3).

8. Multiply column (3), Interest Cost, by column (4), the Discount Factor. Put the result in column (5). This gives the discounted cost for each year.

9. Sum column (5). This gives the total discounted cost over the payback period.

Examples: Figure A-1 is a completed investment cost worksheet for a 5 percent interest rate, a total investment of $30,000, a payback per car of $60, and a shipment volume of 100 cars per year that is expected to be constant for the next several years.

The capital investment decreases by $6,000 per year from $30,000 in Year 1, to $6,000 in Year 5 and 0 in the 6th year. Actual interest cost is $1,500 (30,000 x 5 percent in Year 1) declining to $300 in Year 5 as the shipper's investment is paid back. The discounted cost for Year 1 is $1,430 (1,500 x .953). Total discounted cost is $4,025.

Figure A-2 is a completed investment cost worksheet for a similar situation except that the volume of shipments is expected to increase at a rate of 10 percent a year. Annual shipment volume is found in column (6) and the annual payback is found in column (7).

Capital investment in Years 3-5 is less because of the increased payback in Years 2-4. Consequently interest and discounted cost are less.

INVESTMENT COST WORKSHEET 5 % DISCOUNT (INTEREST) RATE PAYBACK/CAR/TON $60

TOTAL INVESTMENT $30,000 100 CARS PER YEAR PAYBACK/YEAR $6,000

EAR	Capital Investment Beginning of Year (1)	Interest Rate (2)	Interest Cost (3)	Discount Factor (4)	Discount Cost (5)
1	30,000	5%	1,500	.953	1,430
2	24,000	5%	1,200	.907	1,088
3	18,000	5%	900	.864	778
4	12,000	5%	600	.823	494
5	6,000	5%	300	.784	235
	TOTAL DISCOUNTED COST				4,025
6		5%		.746	
7		5%		.711	
8		5%		.677	
9		5%		.645	
10		5%		.614	
11		5%		.585	
12		5%		.557	
13		5%		.530	
14		5%		.505	
15		5%		.481	

FIGURE A-1

INVESTMENT COST WORKSHEET 5% DISCOUNT (INTEREST) RATE PAYBACK/CAR/TON $60
TOTAL INVESTMENT $30,000 100 CARS /YEAR - (increasing 10% a year) PAYBACK/YEAR

YEAR	Capital Investment Beginning of Year (1)	Interest Rate (2)	Interest Cost (3)	Discount Factor (4)	Discount Cost (5)	Shipment Volume (6)	Payback Amount (7)	
1	30,000	5%	1,500	.953	1,430	100	6,000	
2	24,000	5%	1,200	.907	1,088	110	6,600	
3	17,400	5%	870	.864	752	121	7,260	
4	10,140	5%	507	.823	417	133	7,980	
5	2,160	5%	108	.784	85	146	8,760	
	TOTAL DISCOUNTED COST				3,772			FIGURE A-2
6		5%		.746				
7		5%		.711				
8		5%		.677				
9		5%		.645				
10		5%		.614				
11		5%		.585				
12		5%		.557				
13		5%		.530				
14		5%		.505				
15		5%		.481				

INVESTMENT COST WORKSHEET 5 % DISCOUNT (INTEREST) RATE

TOTAL INVESTMENT _____

PAYBACK/CAR/TON _____

PAYBACK/YEAR _____

EAR	Capital Investment Beginning of Year (1)	Interest Rate (2)	Interest Cost (3)	Discount Factor (4)	Discount Cost (5)	
1		5%		.953		
2		5%		.907		
3		5%		.864		
4		5%		.823		
5		5%		.784		
						ATTACHMENT A-1
6		5%		.746		
7		5%		.711		
8		5%		.677		
9		5%		.645		
10		5%		.614		
11		5%		.585		
12		5%		.557		
13		5%		.530		
14		5%		.505		
15		5%		.481		

INVESTMENT COST WORKSHEET 8 % DISCOUNT (INTEREST) RATE

TOTAL INVESTMENT _____

PAYBACK/CAR/TON _____

PAYBACK/YEAR _____

YEAR	Capital Investment Beginning of Year (1)	Interest Rate (2)	Interest Cost (3)	Discount Factor (4)	Discount Cost (5)	
1		8%		.926		
2		8%		.857		
3		8%		.794		
4		8%		.735		
5		8%		.681		
						ATTACHMENT A-2
6		8%		.630		
7		8%		.583		
8		8%		.540		
9		8%		.500		
10		8%		.463		
11		8%		.429		
12		8%		.397		
13		8%		.368		
14		8%		.340		
15		8%		.315		

INVESTMENT COST WORKSHEET 12 % DISCOUNT (INTEREST) RATE

TOTAL INVESTMENT _____

PAYBACK/CAR/TON _____

PAYBACK/YEAR _____

YEAR	Capital Investment Beginning of Year (1)	Interest Rate (2)	Interest Cost (3)	Discount Factor (4)	Discount Cost (5)
1		12%		.893	
2		12%		.797	
3		12%		.712	
4		12%		.636	
5		12%		.567	
					ATTACHMENT A-3
6		12%		.507	
7		12%		.452	
8		12%		.404	
9		12%		.361	
10		12%		.322	
11		12%		.287	
12		12%		.257	
13		12%		.229	
14		12%		.205	
15		12%		.183	

APPENDIX B

Instructions for "Benefit Worksheets"

Attachments B-1 to B-3 are worksheets to determine discounted benefits for 5, 8, and 12 percent discount rates. Factors for other discount rates can be obtained from standard texts or by following the procedure outlined in Appendix A.

1. Determine the categories of tangible benefits such as reduced rates or cost savings that are provided by rail service and their value in dollars or cents per unit. Put rate differences in column (2), loading, handling or damage savings in column (4) and price differences in column (6). Benefits and savings should have a plus sign. If there are increased costs they should have a negative sign.

   Benefits and cost savings might vary by commodity. If there are several commodities with different benefits, it might be necessary to use separate worksheets for each commodity.

2. Determine the quantities to be shipped each year in appropriate units and put these quantities in columns (1) and (7).

3. Determine savings for each year. Multiply column (1) times column (2) and put the result in column (3). Multiply the number of cars to be shipped times column (4) and put the result in column (5). Multiply column (6) times column (7)

and put the result in column (8) for each year. Add column (3) plus column (5) plus column (8) for each year. Put the result in column (9), the total benefits column.

Note that there is zero savings in Year 1. This is because it is assumed that rehabilitation will take 1 year and abandonment would not otherwise occur in that period. Benefits then start at the beginning of the second year.

Benefits should initially be computed for that same number of years as the payback period (from the Investment Cost Worksheet).

4. Column (9), Total Benefits, is multiplied by the discount factor for that year. The result is placed in the discounted benefits column.

5. Complete the cumulative discounted benefits column.

6. If two or more worksheets were necessary because of several commodities, add the cumulative discounted benefits together.

Figure B-1, B-2, and B-3 are examples of completed Benefit Worksheets.

Figure B-1 is a Benefit Worksheet for a firm handling 30 65-ton cars of fertilizer a year. Rail benefits are assumed to consist of freight savings of $6 a ton and labor saving of two man hours per car if hopper cars could be used. An entry of $6 is made in column (2) and an entry of $10 (2 hours times an assumed labor cost and fringes of $5 per hour) is made in column (4). Total annual tonnage is 1950 tons (65 times 30 cars). Freight savings are $6 times 1950 tons, or

$11,700. This goes in column (3). Labor savings of $10 times 30 cars or $300 goes in column (5). Total benefits in Year 2 are the sum of columns 3, 5, and 8 or $12,000. Since volume is assumed to be the same in subsequent years, $12,000 can be used for benefits for Years 3, 4, and 5 without further computations. If volume projection were different, similar computations would have to be done for each year.

Total benefits are then multiplied by the discount factor to get discounted benefits of $10,884 for Year 2, $10,368 for Year 3, etc. Cumulative discounted benefits are $10,884 after Year 2 and $40,536 after Year 5.

Figure B-2 is an example of a Benefit Worksheet for an elevator that ships 20 cars of oats and 50 cars of corn a year. In this case, rail rates are $.055 higher than truck rates so there are costs or minus values in columns (2) and (3). There are no savings from loading or handling but there are price differentials for rail of 9 cents a bushel for oats and 3 cents a bushel for corn. In this case when the costs in column (3) are combined with the benefits in column (8), net total annual benefit of $5,280 is obtained in column (9). After discounting, the cumulative benefits after 5 years are $17,836.

Figure B-3 shows the results of the final benefits worksheet for a firm that received 30 cars of fertilizer (the first example) and shipped 20 cars of oats and 50 cars of corn (the second example). The total cumulative benefits are obtained by combining the results of the separate worksheets.

BENEFIT WORKSHEET FOR 5% DISCOUNT (INTEREST) RATE
NUMBER OF CARS 30 PER YEAR FERTILIZER - 65 TONS PER CAR

EAR	Total ton/cwt/ bu. (1)	Rate Differ- ence $/ton/ cwt/bu. (2)	Sub Total (1)x(2) (3)	Savings from loading etc. per car (4)	Sub total number cars x (4) (5)	Price advant- age per bushel (6)	Number bushels (7)	Sub total (6)x(7) (8)		Total benefits (3)+(5) +(8) (9)	Dis- counted factor	Dis- counted benefits	Cumula- tive discounte benefits
1			0		0			0		0	.953	0	0
2	1,950	$6	11,700	$10	300					12,000	.907	10,884	10,884
3	1,950	$6	11,700	$10	300					12,000	.864	10,368	21,252
4	1,950	$6	11,700	$10	300					12,000	.823	9,876	31,128
5	1,950	$6	11,700	$10	300					12,000	.784	9,408	40,536
6											.746		
7											.711		
8											.677		
9											.645		
10											.614		
				FIGURE B-1									
11											.585		
12											.557		
13											.530		
14											.505		
15											.481		

BENEFIT WORKSHEET FOR 5% DISCOUNT (INTEREST) RATE
NUMBER OF CARS 70 PER YEAR

20 CARS OATS - 3750 BU/CAR
30 CARS CORN - 2100 BU/CAR

EAR	Total ton/cwt/ bu. (1)	Rate Differ- ence $/ton/ cwt/bu. (2)	Sub Total (1)x(2) (3)	Savings from loading etc. per car (4)	Sub total number cars x (4) (5)	Price advant- age per bushel (6)	Number bushels (7)	Sub total (6)x(7) (8)		Total benefits (3)+(5) +(8) (9)	Dis- counted factor	Dis- counted benefits	Cumula- tive discount benefits
1			0		0			0		0	.953	0	0
OATS	24,000	-.055	-1,320			.09	75,000	6,750					
2 CORN	60,000	-.055	-3,300	0	0	.03	105,000	3,150		5,280	.907	4,789	4,789
OATS	24,000	-.055	-1,320			.09	75,000	6,750					
3 CORN	60,000	-.055	-3,300	0	0	.03	105,000	3,150		5,280	.864	4,562	9,351
OATS	24,000	-.055	-1,320			.09	75,000	6,750					
4 CORN	60,000	-.055	-3,300	0	0	.03	105,000	3,150		5,280	.823	4,345	13,696
OATS	24,000	-.055	-1,320			.09	75,000	6,750					
5 CORN	60,000	-.055	-3,300	0	0	.03	105,000	3,150		5,280	.784	4,140	17,836
6											.746		
7											.711		
8											.677		
9											.645		
10											.614		
11											.585		
12											.557		
13											.530		
14											.505		
15											.481		

FIGURE B-2

BENEFIT WORKSHEET FOR 5 % DISCOUNT (INTEREST) RATE
NUMBER OF CARS 100 PER YEAR -- 30 CARS FERTILIZER, 20 CARS OATS, 50 CARS CORN

EAR	Total ton/cwt/ bu. (1)	Rate Differ- ence $/ton/ cwt/bu. (2)	Sub Total (1)x(2) (3)	Savings from loading etc. per car (4)	Sub total number cars x (4) (5)	Price advant- age per bushel (6)	Number bushels (7)	Sub total (6)x(7) (8)		Total benefits (3)+(5) +(8) (9)	Dis- counted factor	Dis- counted benefits	Cumula tive discoun benefit
1			0		0			0		0	.953	0	0
2										17,280	.907	15,672	15,672
3										17,280	.864	14,930	30,602
4										17,280	.823	14,221	44,823
5										17,280	.784	13,547	58,370
6											.746		
7											.711		
8											.677		
9											.645		
10											.614		
11											.585		
12											.557		
13											.530		
14											.505		
15											.481		

FIGURE B-3

BENEFIT WORKSHEET FOR 5 % DISCOUNT (INTEREST) RATE
NUMBER OF CARS _____ PER YEAR

EAR	Total ton/cwt/ bu. (1)	Rate Differ- ence $/ton/ cwt/bu. (2)	Sub Total (1)x(2) (3)	Savings from loading etc. per car (4)	Sub total number cars x (4) (5)	Price advant- age per bushel (6)	Number bushels (7)	Sub total (6)x(7) (8)		Total benefits (3)+(5) +(8) (9)	Dis- counted factor	Dis- counted benefits	Cumula- tive discount benefits
1			0		0			0		0	.953	0	0
2											.907		
3											.864		
4											.823		
5											.784		
6											.746		
7											.711		
8											.677		
9											.645		
10											.614		
				ATTACHMENT B-1									
11											.585		
12											.557		
13											.530		
14											.505		
15											.481		

BENEFIT WORKSHEET FOR 8 % DISCOUNT (INTEREST) RATE
NUMBER OF CARS _____ PER YEAR

AR	Total ton/cwt/ bu. (1)	Rate Differ- ence $/ton/ cwt/bu. (2)	Sub Total (1)x(2) (3)	Savings from loading etc. per car (4)	Sub total number cars x (4) (5)	Price advant- age per bushel (6)	Number bushels (7)	Sub total (6)x(7) (8)		Total benefits (3)+(5) +(8) (9)	Dis- counted factor	Dis- counted benefits	Cumula- tive discounte benefits
1			0		0			0		0	.926	0	0
2											.857		
3											.794		
4											.735		
5											.681		
6											.630		
7											.583		
8											.540		
9											.500		
0											.463		
				ATTACHMENT B-2									
1											.429		
2											.397		
3											.368		
4											.340		
5											.315		

BENEFIT WORKSHEET FOR 12 % DISCOUNT (INTEREST) RATE
NUMBER OF CARS _____ PER YEAR

EAR	Total ton/cwt/ bu. (1)	Rate Differ- ence $/ton/ cwt/bu. (2)	Sub Total (1)x(2) (3)	Savings from loading etc. per car (4)	Sub total number cars x (4) (5)	Price advant- age per bushel (6)	Number bushels (7)	Sub total (6)x(7) (8)		Total benefits (3)+(5) +(8) (9)	Dis- counted factor	Dis- counted benefits	Cumula- tive discount benefits
1			0		0			0		0	.893	0	0
2											.797		
3											.712		
4											.636		
5											.567		
6											.507		
7											.452		
8											.404		
9											.361		
10											.322		
				ATTACHMENT B-3									
11											.287		
12											.257		
13											.229		
14											.205		
15											.183		

APPENDIX C

Comparison of Discounted Costs and Benefits

Rationale

Costs and benefits are discounted over an appropriate time frame. This is necessary to account for the time-value of money. A dollar received now is worth more to an individual or business than a dollar to be received in one year. The dollar received now can immediately be used to earn interest or put to productive use. That is, in one year a dollar deposited at an interest rate of 6 percent will be worth $1.06. Similarly costs or expenses due at a future time are less costly to a business than expenses due now. An expense of $1.00 due immediately requires an expenditure of $1.00 cash. An expense of $1.00 due in one year requires fewer immediate funds. For example, if $.94 is deposited at 6 percent interest, after one year. $1.00 will be available for payment of expenses.

In analyzing rail rehabilitation projects it is necessary to adjust for the effect of the time-value of money because the costs and benefits occur at different times. The shippers' costs occur during the first years of the contract. Annual costs are largest in Year 1 and decline to zero.

On the other hand, there are no benefits to the shippers from improved rail service until after rehabilitation is completed. Once the line is rehabilitated, benefits should remain the same or increase due to increases in volume. Annual benefits will continue to accrue to shippers

after the payback period is completed for as long as the railline is maintained and operated. Consequently, the total cumulative benefits will not be fixed at the end of the contract period, but could continue for many years.

Discount Rate and Time Period

The discount rate appropriate for a rail user is the effective cost of money used in the business. This cost will generally be the highest of:

1. The interest rate on existing loans or on new loans required to furnish the rehabilitation funds.
2. The interest rate on savings or the rate of return on alternative investments outside the firm.
3. The rate of return on alternative investments in the firm.

The appropriate time period to use to determine costs and benefits may vary from user to user depending on their future plans and long term outlook. In general, the time period should be at least as long as the payback period. The only exception requiring a shorter time period would be if the user will not be using rail service through the entire period due to planned retirement, the expected closing of a part of the business, or the anticipation of no further need for rail service.

In some cases, a time period longer than the payback period may be appropriate especially if the payback period is only 3 to 5 years.

In the case study, all benefit cost ratios were based on company discounted costs and benefits over the expected payback period. Consequestly, the time period varied depending on the payback rate.

Decision Criteria

Two decision criteria were computed for the case study. The first was a benefit cost ratio. This is computed by dividing the total discounted benefits by total discounted costs. A ratio larger than 1 means that total discounted benefits over the period exceed total discounted costs. Similarly, a ratio less than 1 means that total discounted benefits are less than total discounted costs. It should be recognized that in this evaluation the benefit cost ratio can be increased by extending the time period since benefits continue beyond the payback period.

The second criteria used was the year in which cumulative discounted benefits first exceeded cumulative discounted costs. Since costs were always decreasing and benefits were constant, additional years would always have a favorable effect on the benefit cost ratio. The year in which cumulative discounted costs first equals benefits provides a criterium in which benefits are not affected by the length of the payback period.