

RAILROAD INDICES HANDBOOK

TECHNICAL TASK DIRECTIVE: 4
RAIL RELATED ANALYSIS
TECHNICAL SUPPORT

Prepared for

TRANSPORTATION SYSTEMS CENTER
U.S. DEPARTMENT OF TRANSPORTATION
KENDALL SQUARE
CAMBRIDGE, MASSACHUSETTS 02142

Prepared by

DYNATREND INCORPORATED
21 CABOT ROAD
WOBURN, MASSACHUSETTS 01801

30 APRIL 1981

TABLE OF CONTENTS

	<u>Page No.</u>
1.0 INTRODUCTION	1-1
Final Monitoring Indices	1-5
Purpose	1-6
Using the handbook	1-8
2.0 TRACK SYSTEM SAFETY -- TOTAL TRACK RELATED ACCIDENTS PER BGTM	2-1
Average freight train speed	2-10
Miles of track maintained per MOW labor hour	2-14
Ratio of transportation cost to railway operating revenue	2-18
Ratio of switching locomotive miles to thousands of total freight car miles	2-22
3.0 TRACK SYSTEM SAFETY -- TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM	3-1
Miles of track maintained per MOW labor hour	3-10
Ratio of railway operating expenses to railway operating revenues	3-14
Average freight train speed	3-18
Ratio of total debt to total assets	3-22
New rail installed in tons per mile	3-26
Average number of trips per car	3-30
4.0 TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES	4-1
Average freight train speed	4-10
Miles of track maintained per MOW labor hour	4-14
Ratio of railway operating expenses to railway operating revenues	4-18
Ratio of total debt to total assets	4-22
Ratio of new to relay rail installed	4-26
Ratio of manufactured tons to raw material tons carried	4-30

TABLE OF CONTENTS (Concluded)

	<u>Page No.</u>
5.0 SYSTEM PRODUCTIVITY--GROSS TON MILES PER FREIGHT TRAIN HOUR	5-1
Average haul	5-10
Average number of freight cars per train	5-14
Number of main track related accidents per billion gross ton-miles	5-18
Transportation costs in 1967 dollars per million gross ton-miles	5-22
Ratio of income available for meeting fixed charges to fixed charges	5-26
6.0 HOLDING COMPANY STATUS	6-1
Miles of continuously welded rail to total track miles	6-8
Maintenance-of-equipment costs in 1967 dollars per unit of rolling stock	6-12
Ratio of earned surplus to total assets	6-16
Ratio of railway related taxes paid to net railway operating revenue	6-20
APPENDIX	
Deflation factors	A-2
Bibliography/References	A-4
Railroad Data	A-7

RAILROAD INDUSTRY GUIDANCE
INTRODUCTION

The U.S. Railroad Industry consists of a complex economic and regulatory system. In addition to the national economic factors which affect business in general (such as money supply, inflation, recession), the railroad industry must operate within regulatory constraints imposed by the Interstate Commerce Commission and the Federal Railroad Administration. Therefore, the status of each railroad vis-a-vis the economic health and safety record is determined by the interrelationship of a variety of economic factors as well as conditions that come under the management of each railroad company.

The Interstate Commerce Commission, under the sponsorship of the Federal Railroad Administration, is engaged in a track research program to develop and evaluate track structure safety performance standards aimed at reducing the economic safety of the nation's rail industry. These standards, when established, will assist the railroad industry in a variety of ways including safety, cost reduction, and efficiency. This program provides a set of criteria which will help in the selection of track in the future. The program is a part of the effort to improve the safety performance of the railroad industry.

INTRODUCTION
SECTION 1.0

Thirty-four railroads, located on the eastern coast, have been studied to generate the index. These railroads include the Cape Fear, Carolina, and the U.S. Note that the track layout is included in the study. The study was conducted in the fall of 1977. Four railroads were excluded due to data unavailability.

- 1. U.S. and Lake Erie
- 2. Erie, Ontario & Western
- 3. Long Island
- 4. Norfolk, Maine & New Brunswick

RAILROAD INDICES HANDBOOK INTRODUCTION

The U.S. railroad industry operates in a complex economic and regulatory environment. In addition to the national economic factors which affect business in general (e.g., money supply, inflation, recession), the railroad industry must operate within regulatory constraints imposed by the Interstate Commerce Commission and the Federal Railroad Administration. Therefore, the status of each railroad vis-a-vis its economic health and safety record is determined by the interrelationships of a variety of exogenous events as well as conscious decisions made by the management of each railroad company.

The Transportation Systems Center, under the sponsorship of the Federal Railroad Administration, is engaged in a Track Research Program to develop and evaluate track structure safety performance standards aimed at improving the operational safety of the nation's rail industry. These standards, when enacted, will impact the railroad industry in a variety of areas including safety, operations and economics. This handbook presents a set of nineteen indices which have been analytically derived to assist in the identification and measurement of change in the railroad industry as a result of introducing safety performance standards, other exogenous events, and the decisions of each railroad's management.

Thirty-three railroads, listed on the facing page, have been studied to generate the indices. These railroads constitute the major Class I railroads in the U.S. Note that the Rock Island is included in this effort due to the time frame studied (1967-1977). Four railroads were excluded due to their unique operating environments. They are:

- o Bessemer & Lake Erie
- o Elgin, Joliet & Eastern
- o Long Island
- o Duluth, Missabe & Iron Range

**RAILROAD INDICES HANDBOOK
INTRODUCTION**

**CLASS I RAILROADS IN THE UNITED STATES
CALENDAR YEAR ENDING DECEMBER 31, 1979**

EASTERN DISTRICT

Baltimore & Ohio
Boston & Maine
Chesapeake & Ohio
Conrail
Delaware & Hudson
Detroit, Toledo & Ironton
Grand Trunk Western
Norfolk & Western
Pittsburgh & Lake Erie
Western Maryland

SOUTHERN DISTRICT

Clinchfield
Florida East Coast
Illinois Central Gulf
Louisville & Nashville
Seaboard Coast Line
Southern System

WESTERN DISTRICT

Atchison, Topeka & Santa Fe
Burlington Northern
Chicago & North Western
Chicago, Milwaukee, St. Paul & Pacific
Colorado & Southern
Denver & Rio Grande Western
Fort Worth & Denver
Kansas City Southern
Missouri - Kansas - Texas
Missouri Pacific
St. Louis - San Francisco
St. Louis Southwestern
Soo Line
Southern Pacific
Union Pacific
Western Pacific
*Rock Island

*Included because study done for period 1967-1977.

RAILROAD INDICES HANDBOOK INTRODUCTION

The identification, evaluation, and selection of indices for inclusion in this handbook was pursued in a systematic manner. Initially, a "shopping list" of indices hypothesized as being indicators of a railroad's economic, safety, and operational status was compiled (Ref. 8). This set of indicators was evaluated to identify which indices could be supported with publicly available data sources. Indices for which data were unavailable were identified and excluded from further consideration.

The next major step in the process entailed a qualitative analysis of the ability of each index to detect changes in the railroad industry. A case study approach was adopted to evaluate the indices and demonstrate their ability to detect and measure change (Ref. 9) within two railroads. This effort demonstrated that the approach was viable. Furthermore, the number of potentially valid indices for monitoring the industry was reduced.

The final stage of the process focused on the validation of the indices as indicators of change across the total population of Class I railroads. In light of the complex environment in which the railroads operate, the multivariate statistical technique discriminant analysis was employed as the primary validation tool. Discriminant analysis enables the researcher to identify a set of characteristics, in this application the indices, which "best" differentiate between two or more populations (groups of railroads with like safety, operational, and economic characteristics). Moreover, the technique is able to identify and discount variables (indices) which are redundant and/or lack discriminating ability. Users of this handbook desiring a more in-depth technical description of this process are encouraged to consult the References appearing in the Bibliography.

The set of indices selected for monitoring and included in this handbook are listed on the facing page.

**RAILROAD INDICES HANDBOOK
FINAL MONITORING INDICES**

1. New rail installed in tons per mile
2. Miles of track maintained per MOW labor hour
3. Ratio of railway operating expenses to railway operating revenues
4. Average freight train speed
5. Ratio of total debt to total assets
6. Average number of trips per car
7. Ratio of new to relay rail installed
8. Ratio of manufactured tons to raw material tons carried
9. Average haul
10. Average number of freight cars per train
11. Transportation costs in 1967 dollars per million gross ton miles
12. Number of main track related accidents per billion gross ton miles
13. Ratio of income available for meeting fixed charges to fixed charges
14. Maintenance-of-equipment costs in 1967 dollars per unit of rolling stock
15. Ratio of railway related taxes paid to net railway operating revenue
16. Miles of continuously welded rail to total track miles
17. Ratio of earned surplus to total assets.
18. Ratio of transportation cost to railway operating revenue.
19. Ratio of switching locomotive miles to thousands of total freight car miles.

RAILROAD INDICES HANDBOOK INTRODUCTION -- PURPOSE

This handbook has been developed to assist in the detection, measurement, and assessment of change in the railroad industry. In order to accomplish this end, a set of indices was analytically derived which are capable of monitoring key changes in the safety, operational, and economic status of the nation's Class I railroads. Within each of these areas, the indices are defined, their computation and source of data are delineated and guidelines on their interpretation in isolation and within the framework of other relevant indices are presented. The value of each index from 1967 to 1977, by railroad group, are graphically portrayed as well as listed in tabular format for ease of reference.

Although these indices have been selected as a result of a rigorous analytical process, users of the handbook should temper their interpretation of each index and group of indices with the following observations:

- The indices detect and measure changes typically monitored by top level railroad management. As such, they do not provide low level visibility for detecting changes which have only minor impacts on a railroad's safety, operational, and economic stance.
- The indices should not be interpreted in isolation. An analyst should have an understanding of the major events, both endogenous and exogenous to the industry, which bring about change.

Finally, users of this handbook should note that the indices are indicators of change and do not imply the existence of any causal relationships.

The facing page lists several sources of information on the railroad industry which can provide insight into the reasons behind changes in the indices.

RAILROAD INDICES HANDBOOK INTRODUCTION -- PURPOSE

KEY RAILROAD INDUSTRY INFORMATION SOURCES

1. Annual reports of the railroads
2. Railway Age
3. Railroad Track and Structures
4. Track Cyclopedia
5. Moody's Transportation Manual
6. A.R.E.A Bulletins

RAIL INDICES HANDBOOK

INTRODUCTION -- USING THE HANDBOOK

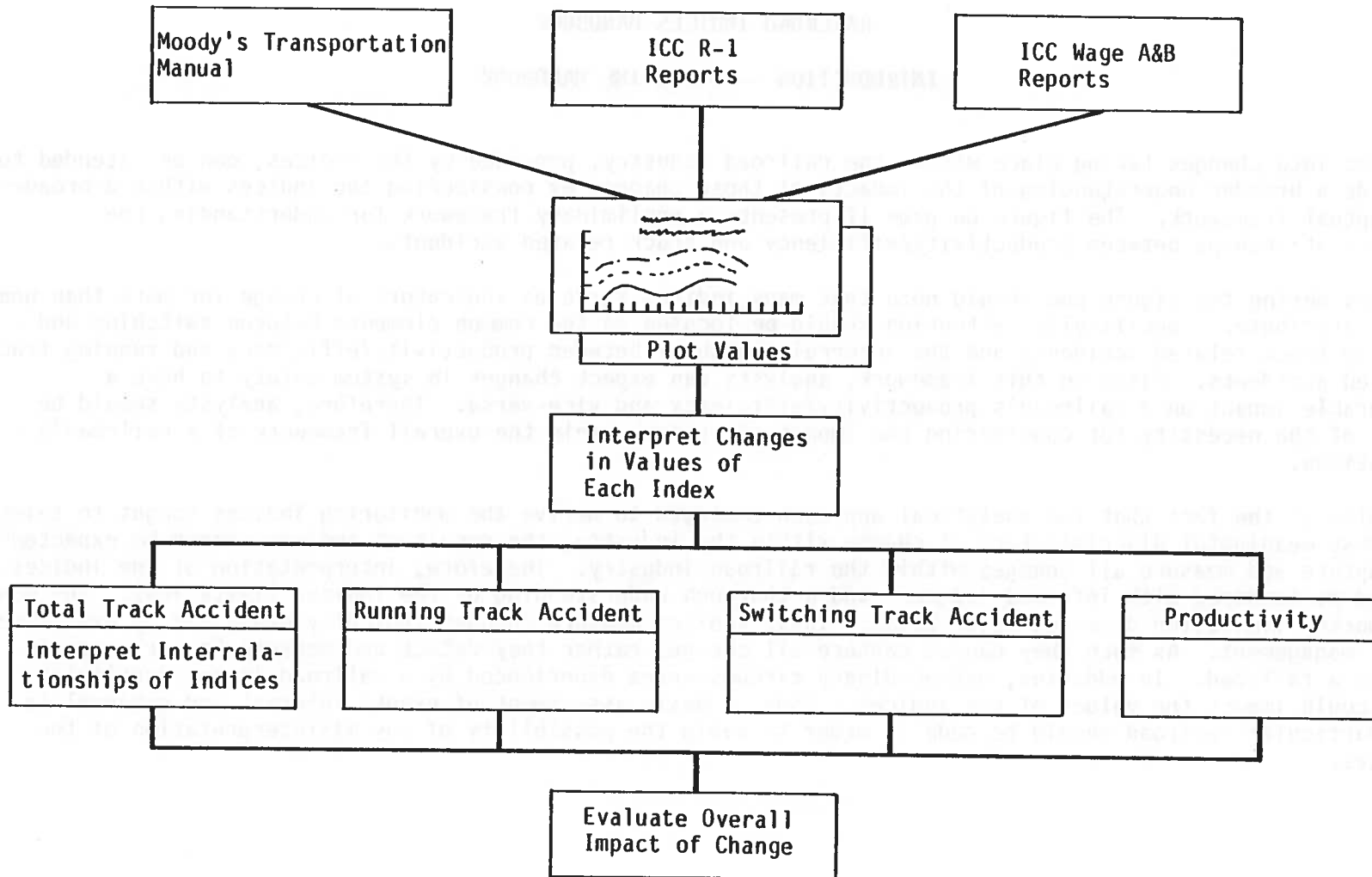
This handbook has been designed to serve as an analytical tool for use in monitoring changes and assessing impacts in the railroad industry. Towards this end, the handbook contains the following information for each group of indicators:

- o A definition of the groups and railroad membership in each group.
- o A brief overview of the interrelationships between the key monitoring indices and an example of how new values for each of the indices can be evaluated to provide an integrated portrait of a railroad's characteristics vis-a-vis other railroads.
- o An explanation of the meaning, method of computation, and interpretation guidelines for each index. In addition to a graphic portrayal of the data by group, a tabular listing of the information is provided for future reference.

Additionally, the appendix contains the values of each index for each of the thirty-three railroads over the time period 1967-1977. This will enable analysts to compare future values of an index for a particular railroad with historical data.

The process of detecting and monitoring change is depicted on the facing page. Initially, data is extracted from the three primary sources of information employed to develop the indices. Each index should then be plotted on the appropriate graph and its value interpreted according to the guidelines associated with it. Indices within each group should then be evaluated as a set to identify and measure the general changes in a railroad's safety, economic and operational characteristics. Finally, the groups and the indices within each group should be assessed as a whole. This final stage of evaluation is discussed in greater detail on the following page.

RAILROAD INDICES HANDBOOK
INTRODUCTION -- USING THE HANDBOOK

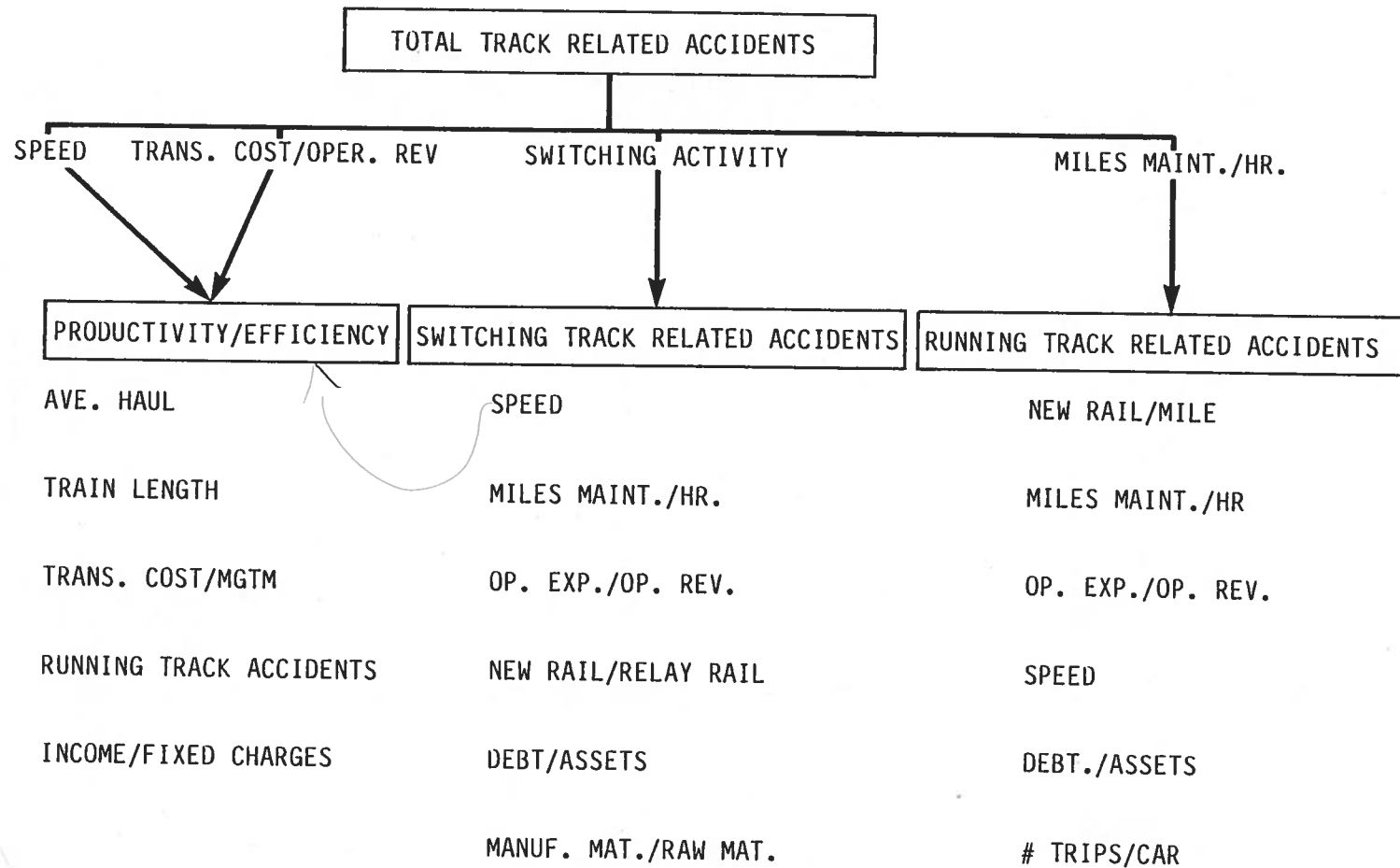


RAILROAD INDICES HANDBOOK
INTRODUCTION -- USING THE HANDBOOK

Insight into changes taking place within the railroad industry, provided by the indices, can be extended to provide a broader understanding of the impacts of those changes by considering the indices within a broader conceptual framework. The figure on page 11 presents a preliminary framework for understanding the interrelationships between productivity/efficiency and track related accidents.

In considering the figure one should note that many indices serve as indicators of change for more than one basic attribute. Specifically, attention should be focused on the common elements between switching and running track related accidents and the interrelationships between productivity/efficiency and running track related accidents. Based on this framework, analysts can expect changes in system safety to have a measurable impact on a railroad's productivity/efficiency and vice-versa. Therefore, analysts should be aware of the necessity for considering the impact of change within the overall framework of a railroad's operations.

In spite of the fact that the analytical approach employed to derive the monitoring indices sought to select the most meaningful discriminators of change within the industry, the resultant indices cannot be expected to capture and measure all changes within the railroad industry. Therefore, interpretation of the indices should be tempered with informed judgment and a thorough understanding of the indices limitations. The most noteworthy limitation deserves reiteration: These indices measure changes typically evaluated by executive level management. As such they cannot capture all change; rather they detect and measure "major" changes within a railroad. In addition, extraordinary circumstances experienced by a railroad in any particular year could impact the values of the indices. Thus, a basic assessment of events internal and external to any particular railroad should be made in order to avoid the possibility of any misinterpretation of the indices.



ALF431

INTERRELATIONSHIPS BETWEEN FUNCTIONS

TRACK SYSTEM SAFETY -- TOTAL TRACK RELATED ACCIDENTS PER BGTM

SECTION 2.0

TRACK SYSTEM SAFETY -- TOTAL TRACK RELATED ACCIDENTS PER BGTM

Total track related system safety is evaluated using the index total track related accidents per billion gross ton miles. This index was constructed by dividing total track related accidents by billion gross ton miles of traffic using ICC R-1 data. As this measure increases in magnitude, a railroad's track related safety record declines.

Over the period 1967 to 1977, the thirty-three major Class I railroads comprised three distinct groups -- railroads with high, moderate, and low track related accident records. The group membership of each railroad is presented in the facing table.

Four indices have been analytically derived which can be monitored to detect and measure changes in a railroad's safety characteristics. These indices are:

- o Average freight train speed
- o Miles of track maintained per MOW labor hour
- o Ratio of transportation cost to railway operating revenue
- o Ratio of switching locomotive miles to thousands of total freight car miles

TRACK SYSTEM SAFETY -- TOTAL TRACK RELATED ACCIDENTS PER BGTM

**HIGH ACCIDENT
RAILROADS**

Pittsburgh & Lake Erie
Rock Island
Missouri-Kansas-Texas
Chicago & North Western
Boston & Maine
Louisville & Nashville
Kansas City Southern
Chicago, Milwaukee,
St. Paul & Pacific

**MODERATE ACCIDENT
RAILROADS**

Western Maryland
Illinois Central Gulf
Conrail
Detroit, Toledo & Ironton
Soo Line
Delaware & Hudson
Fort Worth & Denver
Baltimore & Ohio
St. Louis-San Francisco
Seaboard Coast Line
Colorado & Southern
Chesapeake & Ohio
Grand Trunk Western
Southern System

**LOW ACCIDENT
RAILROADS**

Clinchfield
Burlington Northern
Missouri Pacific
Florida East Coast
Norfolk & Western
St. Louis Southwestern
Atchison, Topeka & Santa Fe
Western Pacific
Southern Pacific
Denver & Rio Grande Western
Union Pacific

TRACK SYSTEM SAFETY -- TOTAL TRACK RELATED ACCIDENTS PER BGTM

Changes in the value of this system safety indicator may result in a railroad assuming the characteristics of another accident group. Using the coefficients listed below, in conjunction with the value of each monitoring index, analysts can detect changes in the safety characteristics of a railroad with respect to other railroads and with respect to its own history.

Average freight train speed	0.220032
Miles of track maintained per MOW labor hour	-1557.853
Ratio of transportation cost to railway operating revenue	-12.80061
Ratio of switching locomotive miles to thousands of total freight car miles	-0.059933
Constant	4.00523

Summing the products of the value of each index with its associated coefficient and adding the constant will result in a score which can be evaluated against the continuum on page 2-7. The average score of each safety group is provided as a reference point when evaluating changes in the values of the indices.

EXAMPLE

Ability to Detect and Measure Change:

The Illinois Central Gulf Railroad experienced a sharp increase in its total number of track related accidents per billion gross ton miles during the years covered by this analysis (1967 thru 1977). The following significant changes in monitoring indices were recorded during this period and would have alerted an analyst to the existence of a changing accident environment.

o Average Freight Train Speed

- Steady decrease of 33.9% between 1967 and 1972
- Increased 42.2% in 1973 and then remained steady
- Overall decrease for the period was 4.9%

- Ratio of Transportation Cost to Railway Operating Revenue
 - Generally steady increase with small perturbations in 1971 and 1976
 - Overall increase for the period was 6.7%
- Ratio of Switching Locomotive Miles to Thousands of Total Freight Car Miles
 - A steady decline of 23.6% from 1968 to 1972
 - A steady increase of 12.4% from 1972 to 1977
 - Overall decrease for the period was 12.5%

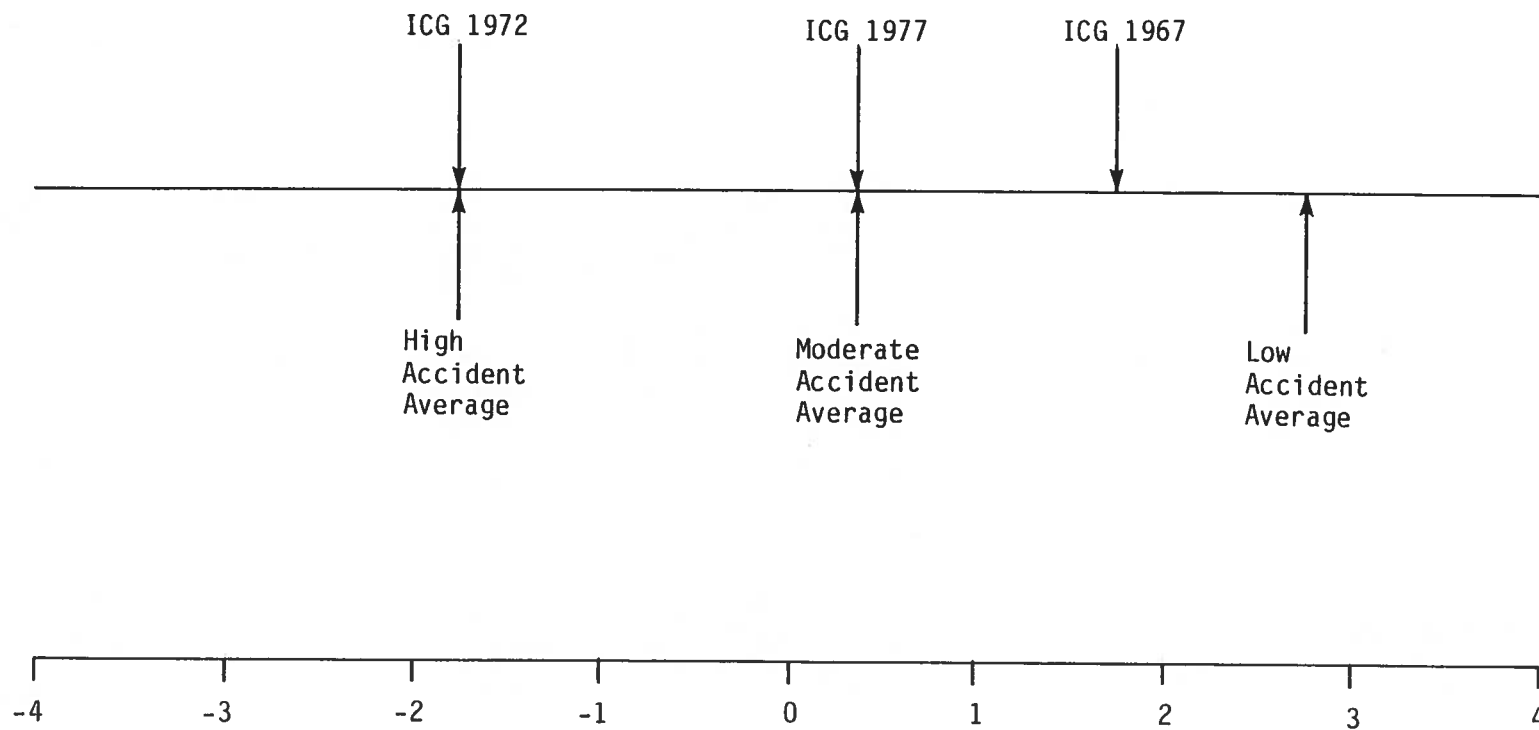
(Note: This is a counter indication to the direction of the other indices and the aggregate score, but appears to agree with the other data in pointing to 1972 as a year requiring further analysis)

- Miles of Track Maintained per MOW Labor Hour
 - Generally steady increase of 29.4% between 1967 and 1975 (except 1972 and 1974)
 - Decline of 10.8% from 1975 to 1977
 - Overall increase for the period was 15.4%

These four indices signalled changes in this system safety indicator. The Illinois Central Gulf's composite score generally decreased over the 11 year period with sharp declines in 1972 and 1975. Its overall decline was from .1916 to -.6322, with scores of -1.4557 in 1972 and -1.2094 in 1975. This change results in movement along the continuum plotted on the next page in a direction toward the characteristics of the high accident group. In 1972, this railroad had actually assumed a score associated with the high accident group.

In comparing these scores with the Illinois Central Gulf's total track related accident rate, a similarity is seen. The total track related accident rate increases fairly consistently over the period from .542 to 4.167 (669%).

TRACK SYSTEM SAFETY -- TOTAL TRACK RELATED ACCIDENTS PER BGTM



TRACK SYSTEM SAFETY -- TOTAL TRACK RELATED ACCIDENTS PER BGTM

The following worksheet can be used to derive a score for a railroad along the continuum on page 2-7.

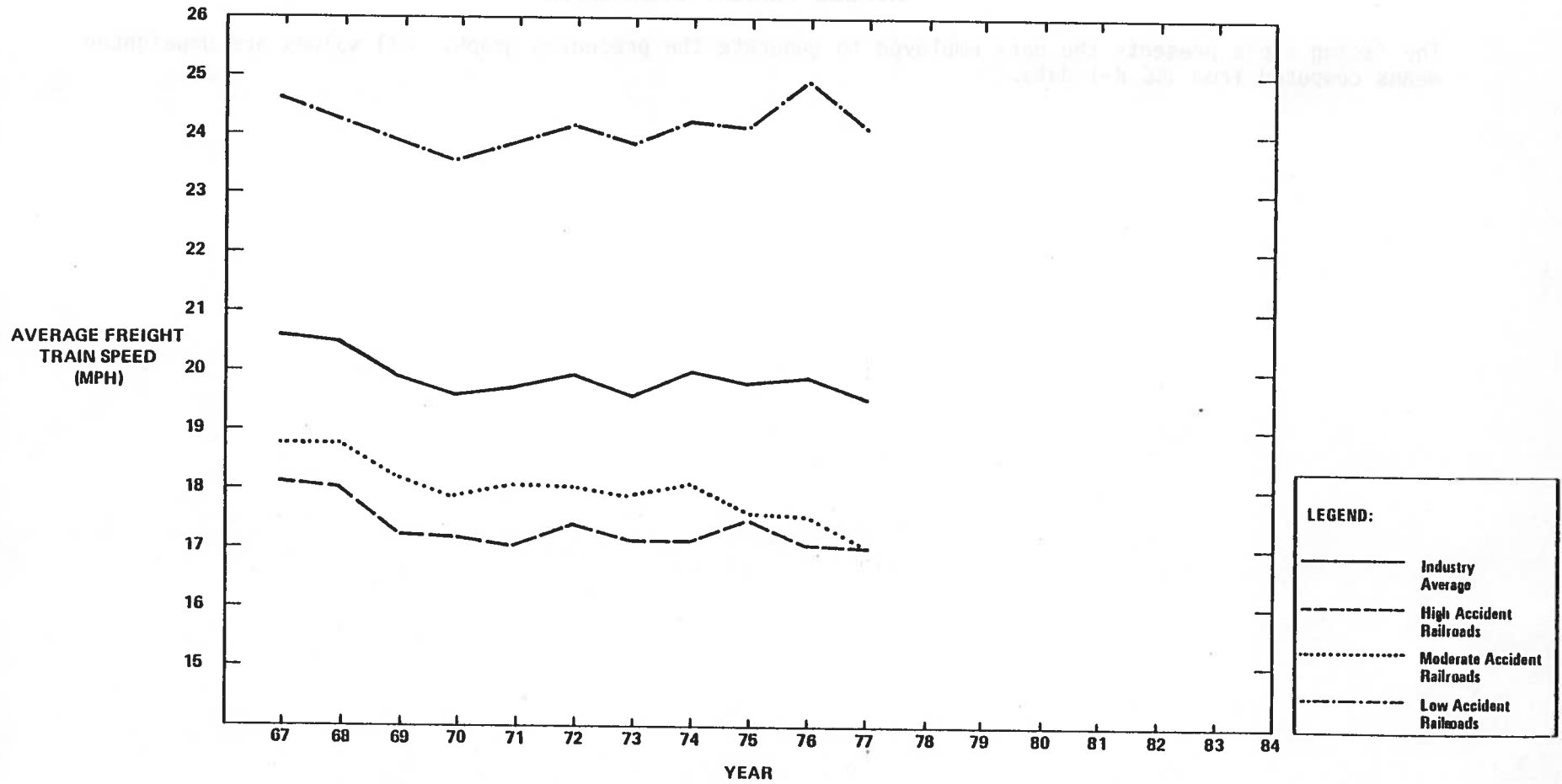
Freight train miles	<input type="text"/>			
	÷	=	<input type="text"/>	X 0.220032 =
Freight train hours	<input type="text"/>			<input type="text"/>
				+
Miles of track maintained	<input type="text"/>			
	÷	=	<input type="text"/>	X -1557.853 =
MOW labor hours	<input type="text"/>			<input type="text"/>
				+
Transportation cost	<input type="text"/>			
	÷	=	<input type="text"/>	X -12.80061 =
Railway operating revenue	<input type="text"/>			<input type="text"/>
				+
Switching locomotive miles	<input type="text"/>			
	÷	=	<input type="text"/>	X - 0.059933 =
1,000 freight car miles	<input type="text"/>			<input type="text"/>
				+
				<u>4.00523</u>
			Railroad Score	<input type="text"/>

**TRACK SYSTEM SAFETY -- TOTAL TRACK RELATED ACCIDENTS PER BGTM
AVERAGE FREIGHT TRAIN SPEED**

This monitoring index is computed by dividing freight train miles by freight train hours. Both data elements are available from the ICC's R-1 reports and values for each group and the industry aggregate are plotted on the facing page. Usually, larger values of this index are indicative of a good track system safety record, as the imposition of slow orders due to poor track characteristics are kept to a minimum.

Average freight train speed is the most important index for detecting and monitoring changes in system safety. Typically, minor improvements in freight train speed will have detectable impacts on total track related accidents per billion gross ton miles.

**DISCRIMINANT CATEGORY: TOTAL TRACK RELATED ACCIDENTS PER BILLION GROSS TON MILES
 INDEX : AVERAGE FREIGHT TRAIN SPEED (MPH)**



**TRACK SYSTEM SAFETY -- TOTAL TRACK RELATED ACCIDENTS PER BGTM
AVERAGE FREIGHT TRAIN SPEED**

The facing table presents the data employed to generate the preceding graph. All values are unweighted means computed from ICC R-1 data.

DISCRIMINANT CATEGORY: TOTAL TRACK RELATED ACCIDENTS PER BILLION GROSS TON MILES				
INDEX: AVERAGE FREIGHT TRAIN SPEED (M.P.H.)				
Year	Industry Average	High Accident Railroads	Moderate Accident Railroads	Low Accident Railroads
67.	20.5392	18.1548	18.7517	24.6910
68.	20.4129	18.0533	18.7086	24.2905
69.	19.8590	17.2403	18.2480	23.8139
70.	19.6028	17.1901	17.8571	23.5566
71.	19.7226	17.1203	18.0539	23.7264
72.	19.9216	17.3517	18.0061	24.2212
73.	19.6399	17.1333	17.8580	23.8979
74.	19.9481	17.1275	18.1853	24.2431
75.	19.7387	17.4008	17.5505	24.2240
76.	19.8777	17.1321	17.5559	24.8078
77.	19.4470	17.0568	17.0959	24.1702

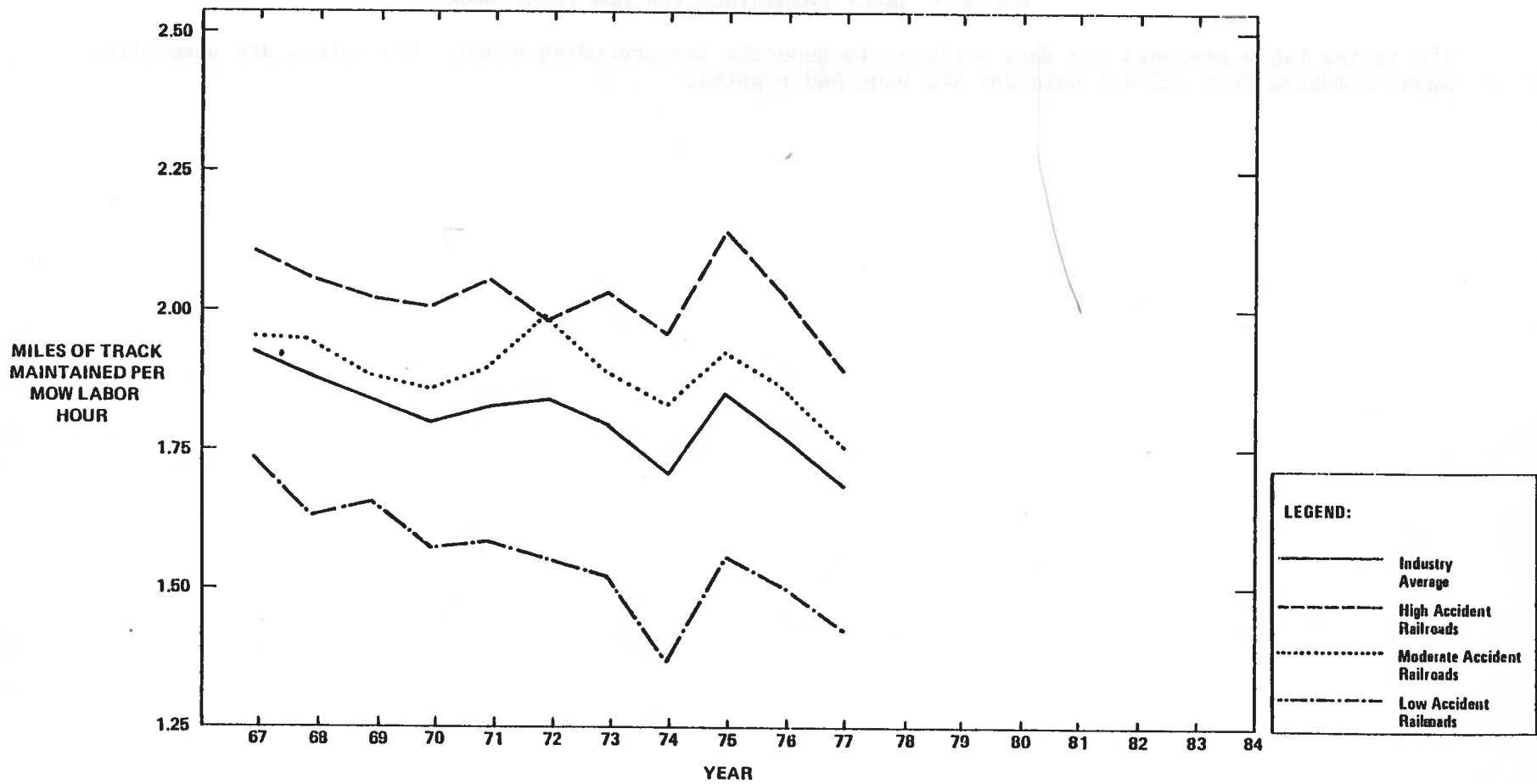
**TRACK SYSTEM SAFETY -- TOTAL TRACK RELATED ACCIDENTS PER BGTM
MILES OF TRACK MAINTAINED PER MOW LABOR HOUR**

Dividing miles of track maintained, available in the ICC R-1 report, by MOW labor hours worked, extracted from the ICC Wage A and B report, will generate this monitoring index. This monitoring index serves as a measure of maintenance-of-way (MOW) labor activity. Small values of this index are indicative of significant expenditures of labor on MOW.

Miles of track maintained per MOW labor hour is of approximately equal importance to average freight train speed in monitoring changes in total track related accidents per billion gross ton miles. Relatively small improvements in this monitoring index usually result in a railroad assuming the characteristics of a lower frequency accident group.

The graph on the facing page illustrates the differences in the values of the monitoring index between groups of railroads with different accident characteristics as well as the industry aggregate.

**DISCRIMINANT CATEGORY: TOTAL TRACK RELATED ACCIDENTS PER BILLION GROSS TON MILES
INDEX : MILES OF TRACK MAINTAINED PER MOW LABOR HOUR**



ALF3241-22

**TRACK SYSTEM SAFETY -- TOTAL TRACK RELATED ACCIDENTS PER BGTM
MILES OF TRACK MAINTAINED PER MOW LABOR HOUR**

The facing table presents the data employed to generate the preceding graph. All values are unweighted means computed from ICC R-1 data and ICC Wage A&B reports.

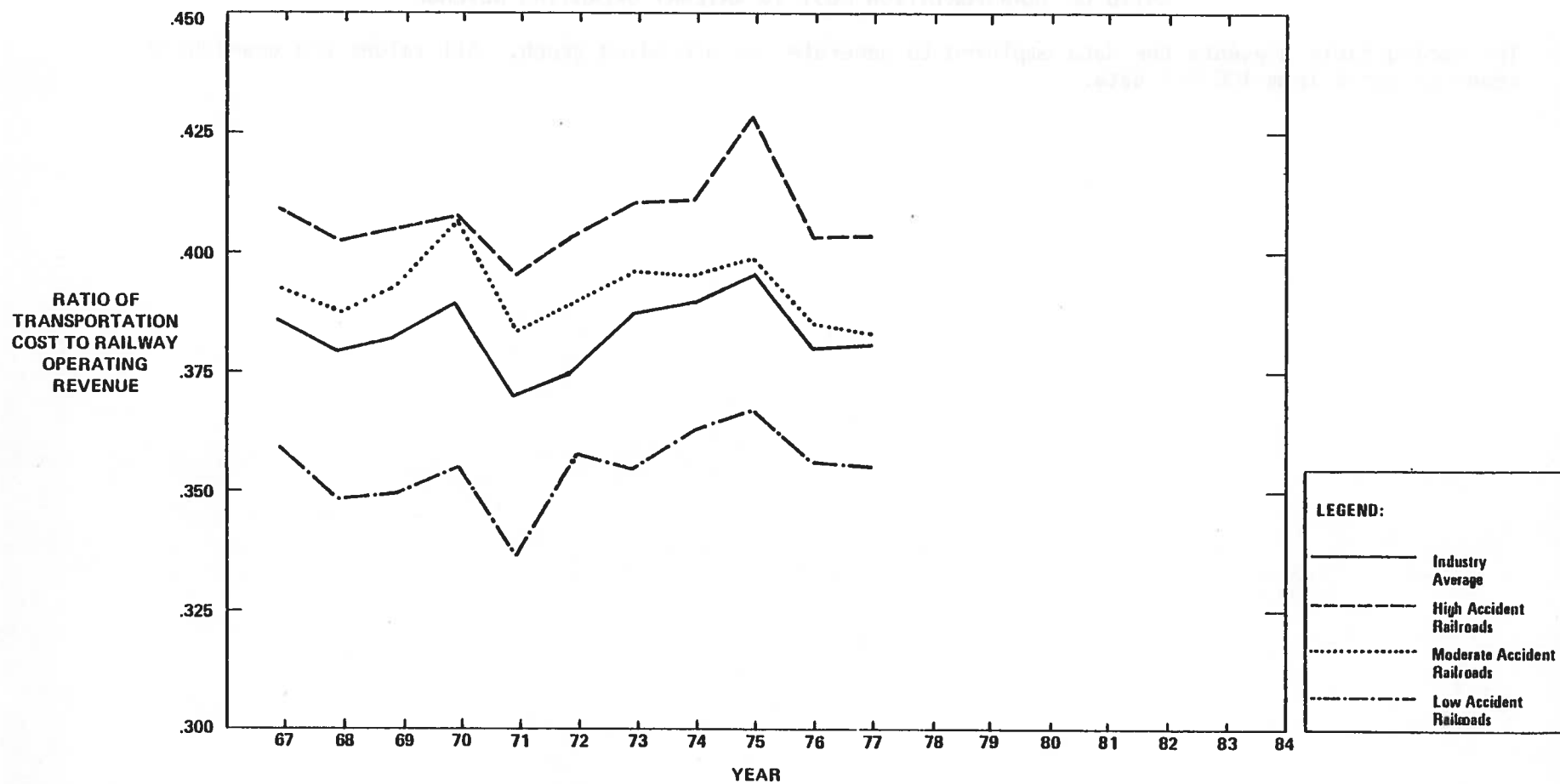
DISCRIMINANT CATEGORY: TOTAL TRACK RELATED ACCIDENTS PER BILLION GROSS TON MILES				
INDEX: MILES OF TRACK MAINTAINED PER MOW LABOR HOUR				
Year	Industry Average	High Accident Railroads	Moderate Accident Railroads	Low Accident Railroads
67.	1.9221	2.1079	1.9516	1.7320
68.	1.8736	2.0560	1.9475	1.6249
69.	1.8446	2.0234	1.8900	1.6519
70.	1.7975	2.0020	1.8602	1.5590
71.	1.8256	2.0557	1.8930	1.5748
72.	1.8389	1.9853	1.9916	1.5514
73.	1.7957	2.0256	1.8379	1.5140
74.	1.7068	1.9557	1.8309	1.3571
75.	1.8521	2.1454	1.9169	1.5552
76.	1.7555	1.9751	1.8502	1.4947
77.	1.6345	1.6904	1.7774	1.4176

**TRACK SYSTEM SAFETY -- TOTAL TRACK RELATED ACCIDENTS PER BGTM
RATIO OF TRANSPORTATION COST TO RAILWAY OPERATING REVENUE**

This monitoring index is derived from ICC R-1 data by dividing transportation costs by railway operating revenue. It affords a measure of how much operating revenue is absorbed by transportation costs. Decreases in the value of this index are indicative of improvement in the railroad's overall efficiency.

The ratio of transportation cost to operating revenue is relatively important when monitoring changes in railroad safety using the measure total track related accidents per BGTM. As the facing graph indicates, railroads with low accident frequencies also have low values of the monitoring index. Relatively minor improvements in this index are usually accompanied by a reduction in total track related accidents per BGTM.

**DISCRIMINANT CATEGORY: TOTAL TRACK RELATED ACCIDENTS PER BILLION GROSS TON MILES
INDEX : RATIO OF TRANSPORTATION COST TO RAILWAY OPERATING REVENUE**



ALF324 1-25

**TRACK SYSTEM SAFETY --TOTAL TRACK RELATED ACCIDENTS PER BGTM
RATIO OF TRANSPORTATION COST TO RAILWAY OPERATING REVENUE**

The facing table presents the data employed to generate the preceding graph. All values are unweighted means computed from ICC R-1 data.

DISCRIMINANT CATEGORY: TOTAL TRACK RELATED ACCIDENTS PER BILLION GROSS TON MILES

INDEX: RATIO OF TRANSPORTATION COST TO RAILWAY OPERATING REVENUE

Year	Industry Average	High Accident Railroads	Moderate Accident Railroads	Low Accident Railroads
67.	0.3354	0.4086	0.3930	0.3589
68.	0.3792	0.4029	0.3898	0.3484
69.	0.3920	0.4050	0.3945	0.3454
70.	0.3901	0.4081	0.4051	0.3565
71.	0.3597	0.3900	0.3840	0.3366
72.	0.3776	0.4041	0.3900	0.3426
73.	0.3566	0.4133	0.3963	0.3549
74.	0.3986	0.4139	0.3949	0.3522
75.	0.3752	0.4287	0.3987	0.3553
76.	0.3304	0.4038	0.3854	0.3572
77.	0.3794	0.4038	0.3837	0.3561

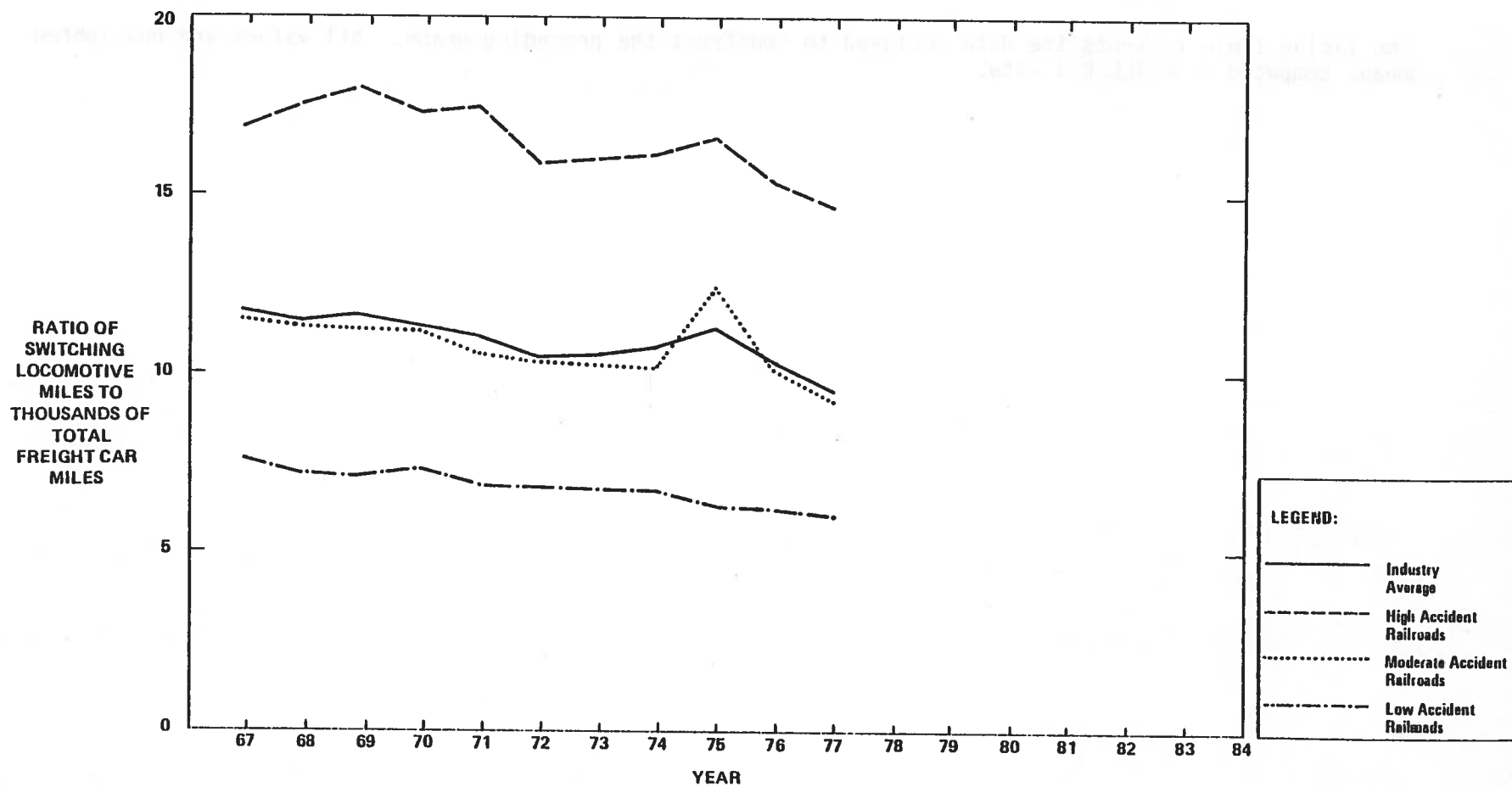
**TRACK SYSTEM SAFETY -- TOTAL TRACK RELATED ACCIDENTS PER BGTM
RATIO OF SWITCHING LOCOMOTIVE MILES TO THOUSANDS OF TOTAL FREIGHT CAR MILES**

This monitoring index is designed to reflect the amount of yard activity within a railroad and is computed by dividing total freight car miles into switching locomotive miles. This index measures the relative amount of switching and yard activity and is indicative of the efficiency of a railroad's operations. More accidents tend to occur in yards and sidings where track maintenance does not receive the same priority as on the main line.

The facing graph illustrates the differences in switching activity for each safety group and the industry as a whole. Low accident roads have typically had half as much yard activity as high accident railroads.

Generally this index is half as important as the previous three. Therefore, relatively large increases in yard activity are required before a railroad is likely to exhibit the characteristics of another accident group.

DISCRIMINANT CATEGORY: TOTAL TRACK RELATED ACCIDENTS PER BILLION GROSS TON MILES
INDEX : RATIO OF SWITCHING LOCOMOTIVE MILES TO THOUSANDS OF TOTAL FREIGHT CAR MILES



ALF3241-24

**TRACK SYSTEM SAFETY -- TOTAL TRACK RELATED ACCIDENTS PER BGTM
RATIO OF SWITCHING LOCOMOTIVE MILES TO THOUSANDS OF TOTAL FREIGHT CAR MILES**

The facing table presents the data employed to construct the preceding graph. All values are unweighted means computed from ICC R-1 data.

DISCRIMINANT CATEGORY: TOTAL TRACK RELATED ACCIDENTS PER BILLION GROSS TON MILES

INDEX: RATIO OF SWITCHING LOCOMOTIVE MILES TO THOUSANDS OF TOTAL FREIGHT CAR MILES

Year	Industry Average	High Accident Railroads	Moderate Accident Railroads	Low Accident Railroads
67.	11.5103	16.9968	11.5505	7.7562
68.	11.4584	17.5200	11.4280	7.1186
69.	11.4786	17.8296	11.3366	7.0410
70.	11.2819	17.2119	11.1539	7.1193
71.	11.0177	17.3710	10.6509	6.8539
72.	10.4397	15.9742	10.3056	6.7353
73.	10.4559	16.0527	10.2391	6.6540
74.	10.4798	16.2800	10.2323	6.5763
75.	11.3798	16.7483	12.3042	6.2989
76.	10.1861	15.6374	10.1220	6.2566
77.	9.5306	14.7469	9.3799	6.1087

TRACK SYSTEM SAFETY — TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM

SECTION 3.0

TRACK SYSTEM SAFETY -- TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM

Track System Safety can be decomposed to identify differences in the thirty-three Class I railroads on the basis of total running track related accidents per billion gross ton-miles. Railroads have been grouped according to the aforementioned index into three groups: low, moderate, and high accident railroads based on the Federal Railroad Administration's Railroad Accident and Incident Reporting System data over the time period 1967 to 1977.

Each railroad's membership in the three accident groups is portrayed on the facing page. The ability to detect and measure changes in a railroad's running track accident group membership can be observed by monitoring changes in the following key indicators:

- o Miles of track maintained per MOW labor hour
- o Ratio of railway operating expenses to railway operating revenues
- o Average freight train speed
- o Ratio of total debt to total assets
- o New rail installed in tons per mile
- o Average number of trips per car.

Together, these monitoring indices explain 82% of the differences between the three groups.

TRACK SYSTEM SAFETY--TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM

**High Accident
Railroads**

Missouri-Kansas-Texas
Rock Island
Chicago North Western
Chicago, Milwaukee,
St. Paul & Pacific

**Moderate Accident
Railroads**

Pittsburgh & Lake Erie
Western Maryland
Louisville & Nashville
Boston & Maine
Fort Worth & Denver
Baltimore & Ohio
Soo Line
Illinois Central Gulf
Kansas City Southern
Delaware & Hudson
Conrail
St Louis-San Francisco

**Low Accident
Railroads**

Colorado & Southern
Chesapeake & Ohio
Clinchfield
Detroit Toledo & Ironton
Grand Trunk Western
Southern System
Seaboard Coast Line
Burlington Northern
Missouri Pacific
Florida East Coast
Denver & Rio Grande Western
Atchison, Topeka & Santa Fe
St. Louis Southwestern
Norfolk and Western
Western Pacific
Southern Pacific
Union Pacific

TRACK SYSTEM SAFETY--TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM

Monitoring the values of the running track related accident indicators will enable analysts to identify changes in a railroad's running track accident characteristics with respect to other railroads or the railroad itself in prior years. A railroad's likely characteristics can be assessed by taking the product of the value of each index listed below and its associated coefficient:

Miles of track maintained per MOW labor hour	-1373.332
Ratio of railway operating expenses to railway operating revenues	- 10.20912
Average freight train speed	.059175
Ratio of total debt to total assets	- 3.910826
New rail installed in tons per mile	.248501
Average number of trips per car	- .012024
Constant	10.45551

Summing the products of each index with its associated coefficient and adding the constant will result in a score which can be evaluated against the continuum on page 3-7. The average score of each accident group is provided as a reference point when evaluating changes in the values of the indices.

ABILITY TO DETECT AND MEASURE CHANGE:

The Southern Railway underwent considerable change during the years covered by the analysis (1967 thru 1977). The following significant changes in monitoring indices occurred during this period and would have alerted an analyst to the existence of change.

- o Average Freight Train Speed
 - Increased 9.5% between 1969 and 1970
 - Overall increase for the period was 12.8%

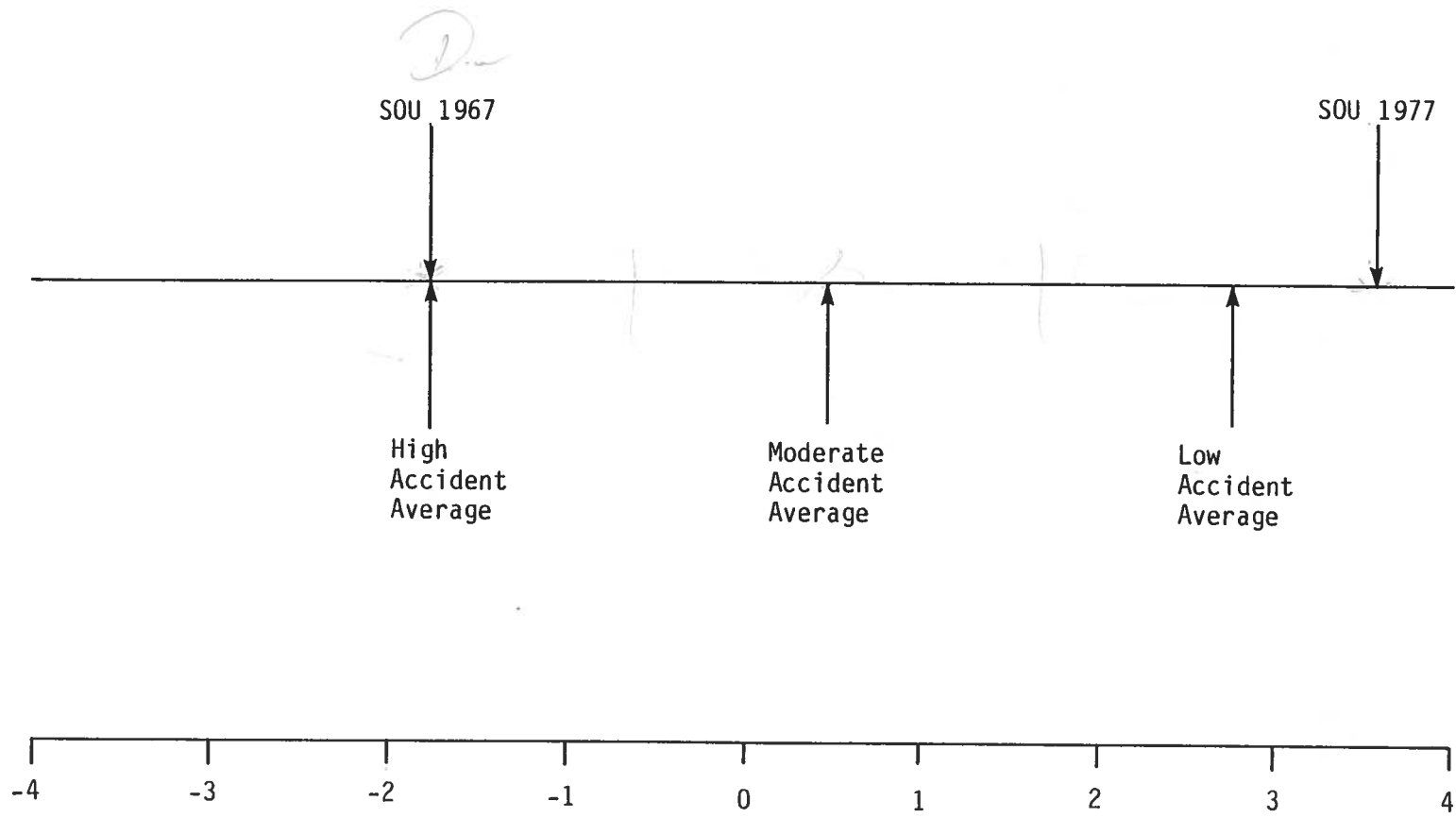
- o Debt to Asset Ratio
 - Steady decrease from 1967 to 1973
 - Overall decrease for the period of 13%

- New rail installed in tons per mile
 - Steady increase from 1967 to 1972
 - Overall increase for the period of 229%
- Miles of track maintained per MOW labor hour
 - Decreased 20.7% from 1967 to 1968
 - Overall decrease for the period of 44.1%

These four indices signalled changes in this system safety indicator. The railroad's composite score steadily increased over the 11 year period (two exceptions - 1970 and 1975) from - 1.8697 to 1.6085. This change results in substantial movement along the continuum plotted on page 3-7 and represents a change from the characteristics of the high accident group to those of the low accident group.

It is interesting to note that the Southern's running track related accident rate per BGTM rather consistently declined over this period from .653 to .307 (53%).

TRACK SYSTEM SAFETY--TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM



TRACK SYSTEM SAFETY -- TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM

The following worksheet can be used to derive a score for a railroad along the continuum on page 3-7.

Miles of track maintained	☐ ÷	=	☐	x -1373.332 =	☐
MOW labor hours	☐				+
Railway operating expenses	☐ ÷	=	☐	x -10.20912 =	☐
Railway operating revenues	☐				+
Freight train miles	☐ ÷	=	☐	x .059175 =	☐
Freight train hours	☐				+
Total debt	☐ ÷	=	☐	x -3.910826 =	☐
Total assets	☐				+
New rail installed (tons)	☐ ÷	=	☐	x .248501	☐
Total track miles	☐				+
Total Car Loadings	☐ ÷	=	☐	x -.012024 =	☐
Number of Serviceable Freight Cars	☐				+
					10.45551
				RAILROAD SCORE	☐

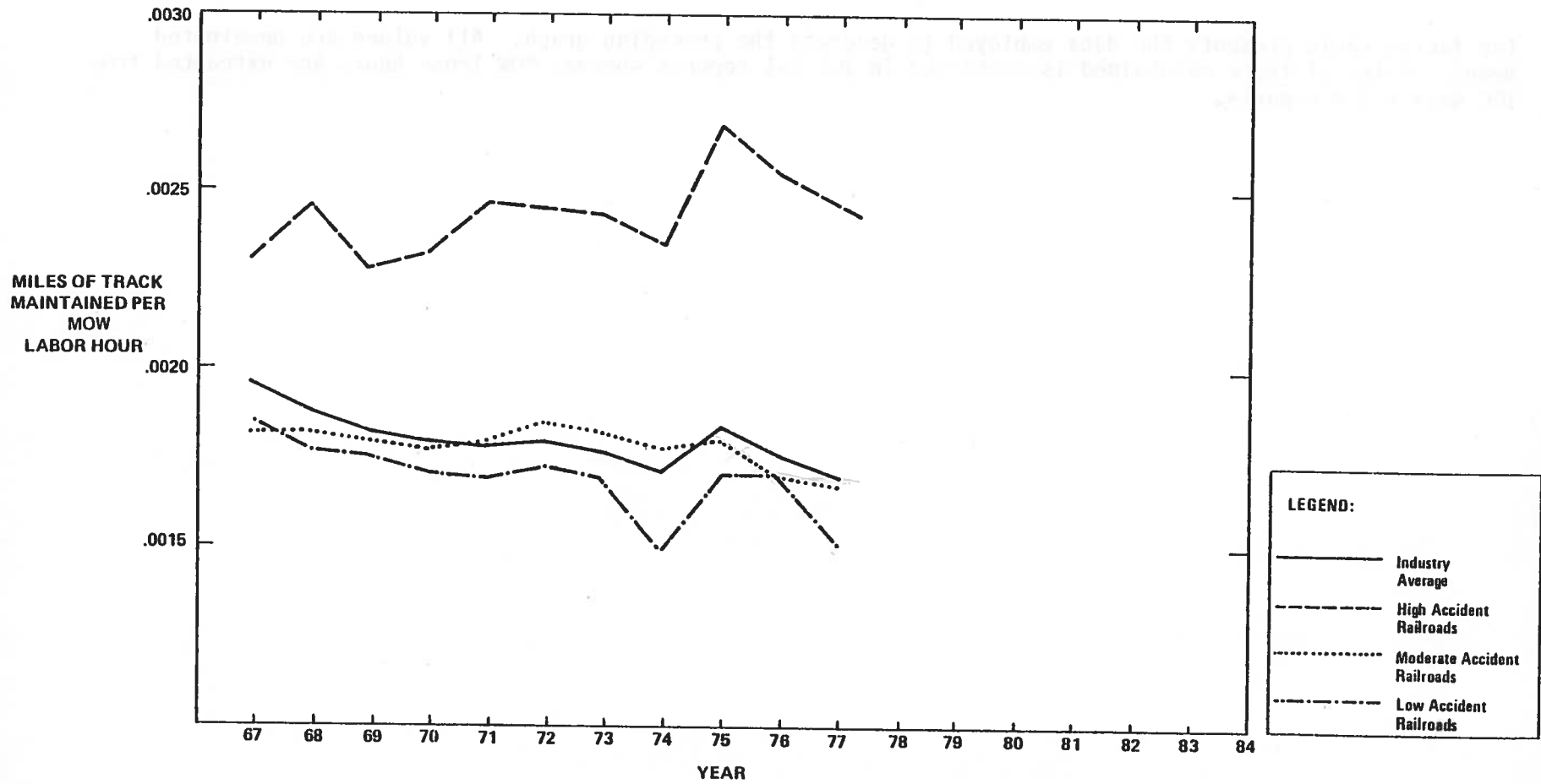
**TRACK SYSTEM SAFETY--TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
MILES OF TRACK MAINTAINED PER MOW LABOR HOUR**

Dividing miles of track maintained, available in the ICC R-1 report, by the number of MOW labor hours worked, extracted from ICC Wage A & B reports, will generate this monitoring index. This monitoring index serves as a measure of maintenance-of-way (MOW) labor activity. Small values of this index are indicative of significant expenditures of labor on MOW.

Miles of track maintained per MOW labor hour is of approximately equal importance to the ratio of railway operating expenses to railway operating revenues in monitoring changes in total running track related accidents. Relatively small changes in this monitoring index will usually result in a relatively large movement along the continuum.

The graph on the facing page illustrates the differences in values of the monitoring index between low, moderate, and high track related accident records.

**DISCRIMINANT CATEGORY: TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
INDEX: MILES OF TRACK MAINTAINED PER MOW LABOR HOUR**



ALF3241-14

**TRACK SYSTEM SAFETY--TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
MILES OF TRACK MAINTAINED PER MOW LABOR HOUR**

The facing table presents the data employed to generate the preceding graph. All values are unweighted means. Miles of track maintained is contained in ICC R-1 reports whereas MOW labor hours are extracted from ICC Wage A & B reports.

DISCRIMINANT CATEGORY: TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM				
INDEX: MILES OF TRACK MAINTAINED PER MOW LABOR HOUR				
Year	Industry Average	High Accident Railroads	Moderate Accident Railroads	Low Accident Railroads
67.	.0019221	.0023032	.0018594	.0018738
68.	.0018736	.0024109	.0018594	.0017765
69.	.0018446	.0022759	.0018094	.0017531
70.	.0017975	.0023365	.0017765	.0016855
71.	.0018266	.0024315	.0018287	.0016828
72.	.0018389	.0024003	.0018292	.0016972
73.	.0017967	.0023948	.0018548	.0016149
74.	.0017068	.0023544	.0017837	.0014978
75.	.0018521	.0027152	.0018281	.0016560
76.	.0017555	.0025796	.0016590	.0016439
77.	.0016344	.0024073	.0016303	.0015534

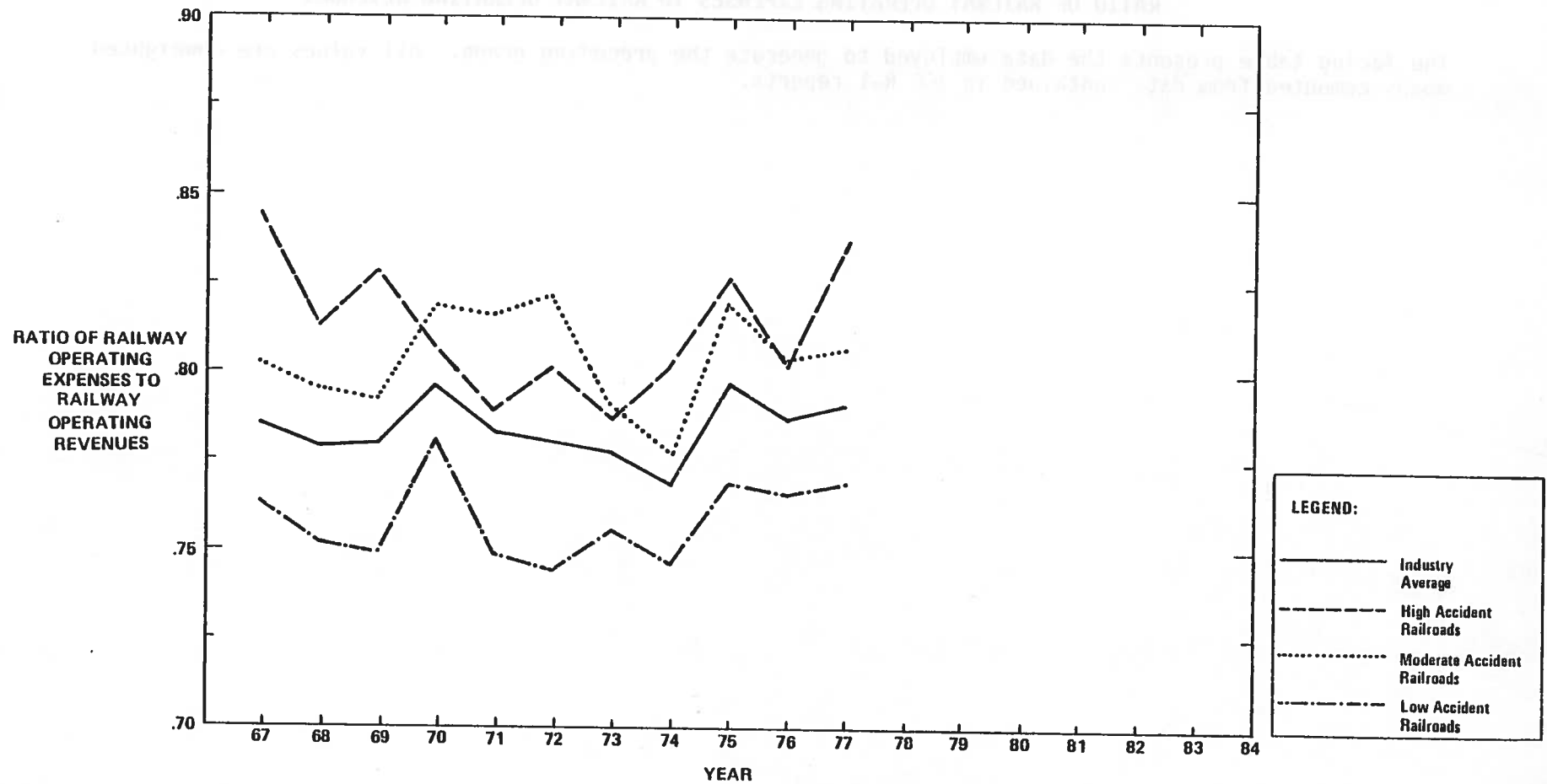
**TRACK SYSTEM SAFETY--TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
RATIO OF RAILWAY OPERATING EXPENSES TO RAILWAY OPERATING REVENUES**

This index measures the efficiency of railroad operations. Relatively low values of the index identify a railroad capable of operating with a smaller percentage of its operating revenue. The index is computed by dividing railway operating expenses by railway operating revenues. Both data elements required for computation of the index are available in ICC R-1 reports.

The ratio of railway operating expenses to railway operating revenues is one of the most important indices for distinguishing between railroads on the basis of total running track related accidents. Relatively small changes in the value of this monitoring index are likely to result in a large movement toward the characteristics of another accident group. The facing graph illustrates the differences in values of this index for three accident groups and the industry aggregate from 1967 to 1977.

DISCRIMINANT CATEGORY: TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM

INDEX: RATIO OF RAILWAY OPERATING EXPENSES TO RAILWAY OPERATING REVENUES



ALF3241-15

**TRACK SYSTEM SAFETY--TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
RATIO OF RAILWAY OPERATING EXPENSES TO RAILWAY OPERATING REVENUES**

The facing table presents the data employed to generate the preceding graph. All values are unweighted means computed from data contained in ICC R-1 reports.

TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
 AVERAGE (CALCULATED FROM DATA)

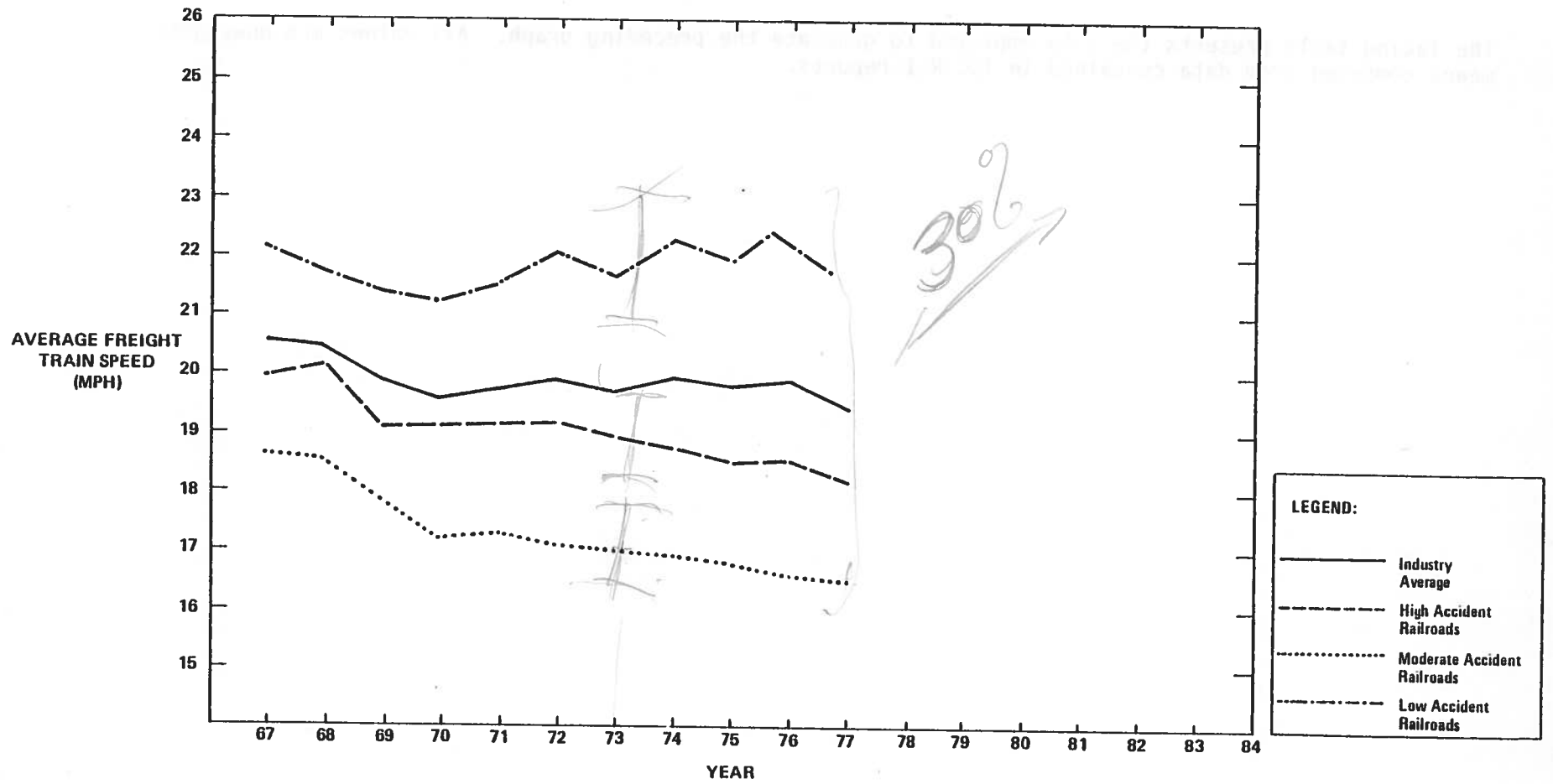
DISCRIMINANT CATEGORY: TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM				
INDEX: RATIO OF RAILWAY OPERATING EXPENSES TO RAILWAY OPERATING REVENUES				
Year	Industry Average	High Accident Railroads	Moderate Accident Railroads	Low Accident Railroads
67.	0.7859	0.8424	0.8022	0.7511
68.	0.7761	0.8107	0.7994	0.7515
69.	0.7764	0.8298	0.7954	0.7497
70.	0.7932	0.8094	0.8166	0.7728
71.	0.7782	0.7351	0.8155	0.7496
72.	0.7768	0.8006	0.8187	0.7416
73.	0.7713	0.7870	0.7940	0.7516
74.	0.7643	0.8017	0.7736	0.7490
75.	0.7950	0.8226	0.8251	0.7573
76.	0.7834	0.8023	0.8033	0.7549
77.	0.7894	0.8264	0.8092	0.7557

**TRACK SYSTEM SAFETY--TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
AVERAGE FREIGHT TRAIN SPEED**

This monitoring index is computed by dividing freight train miles by freight train hours. Both data elements are available in ICC R-1 reports and the values for each accident group and industry aggregate are plotted on the facing graph. Larger values of this index are indicative of a good running track accident record. Lower average freight train speeds are usually indicative of a less than optimal track structure, resulting from the imposition of a number of slow orders on specific segments.

Average freight train speed is a relatively weak index for monitoring changes in running track related accidents. Relatively large changes in the value of this index are required before a railroad will assume the characteristics of another accident group.

**DISCRIMINANT CATEGORY: TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
INDEX : AVERAGE FREIGHT TRAIN SPEED**



**TRACK SYSTEM SAFETY--TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
AVERAGE FREIGHT TRAIN SPEED**

The facing table presents the data employed to generate the preceding graph. All values are unweighted means computed from data contained in ICC R-1 reports.

DISCRIMINANT CATEGORY: TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM

INDEX: AVERAGE FREIGHT TRAIN SPEED (MPH)

Year	Industry Average	High Accident Railroads	Moderate Accident Railroads	Low Accident Railroads
67.	20.5892	19.9393	18.6293	22.1255
68.	20.4129	20.1473	18.5590	21.7770
69.	19.8590	19.1512	17.8563	21.4322
70.	19.6028	19.1417	17.2487	21.3731
71.	19.7226	19.1371	17.3214	21.5554
72.	19.9216	19.1548	17.1246	22.0764
73.	19.6999	18.9069	17.0937	21.7331
74.	19.9481	18.8323	16.9771	22.3079
75.	19.7367	18.5508	16.4337	21.9559
76.	19.8777	18.5892	16.6999	22.4241
77.	19.4470	18.1538	16.5950	21.7544

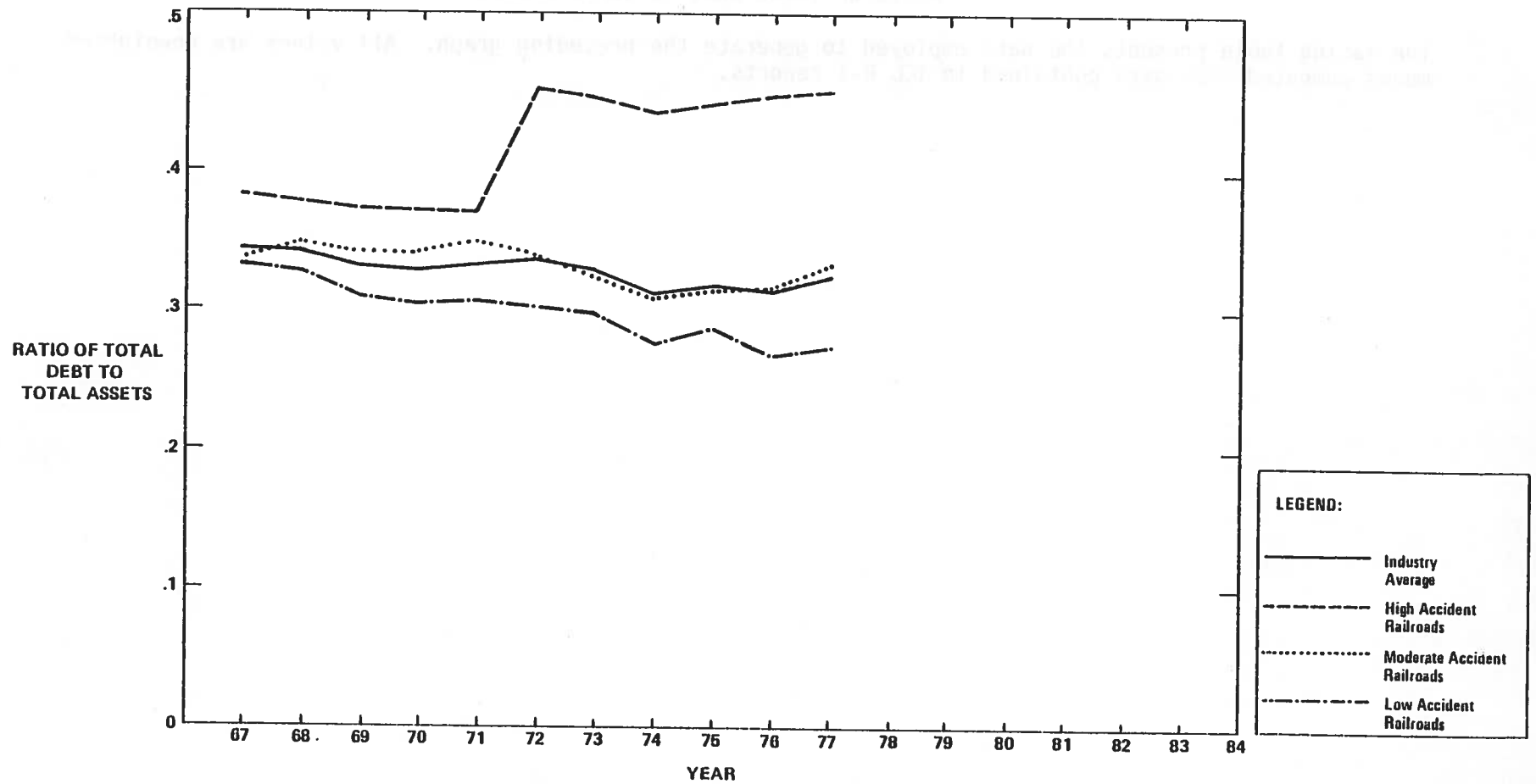
**TRACK SYSTEM SAFETY--TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
RATIO OF TOTAL DEBT TO TOTAL ASSETS**

The ratio of total debt to total assets affords a measure of the total funds provided by creditors to a railroad. The values of this index provide creditors with some idea of a railroad's ability to withstand losses without impairing the interests of creditors. The lower this ratio is, the more "buffer" that is available to creditors if the railroad becomes insolvent.

The monitoring index is derived by dividing total debt by total assets. Both data elements are contained in ICC R-1 reports. The facing graph presents the values of the index for low, moderate, and high accident groups as well as the industry aggregate. Low accident railroads have traditionally exhibited low values on this index, reflecting their good credit positions. High accident railroads, on the other hand, have typically had high index values, denoting a lack of internally generated funds.

This index is also an important measure of a railroad's running track accident characteristics. Moderate changes in the value of this index will usually result in a railroad assuming the characteristics of another accident group.

**DISCRIMINANT CATEGORY: TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
INDEX: RATIO OF TOTAL DEBT TO TOTAL ASSETS**



**TRACK SYSTEM SAFETY--TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
RATIO OF TOTAL DEBT TO TOTAL ASSETS**

The facing table presents the data employed to generate the preceding graph. All values are unweighted means computed from data contained in ICC R-1 reports.

DISCRIMINANT CATEGORY: TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM

INDEX: RATIO OF TOTAL DEBT TO TOTAL ASSETS

Year	Industry Average	High Accident Railroads	Moderate Accident Railroads	Low Accident Railroads
67.	0.3428	0.3786	0.3389	0.3367
68.	0.3406	0.3575	0.3481	0.3282
69.	0.3286	0.3745	0.3432	0.3063
70.	0.3268	0.3740	0.3407	0.3046
71.	0.3291	0.3729	0.3437	0.3053
72.	0.3358	0.4521	0.3392	0.3016
73.	0.3254	0.4522	0.3228	0.2956
74.	0.3103	0.4417	0.3101	0.2777
75.	0.3171	0.4484	0.3131	0.2372
76.	0.3141	0.4507	0.3157	0.2732
77.	0.3254	0.4585	0.3462	0.2741

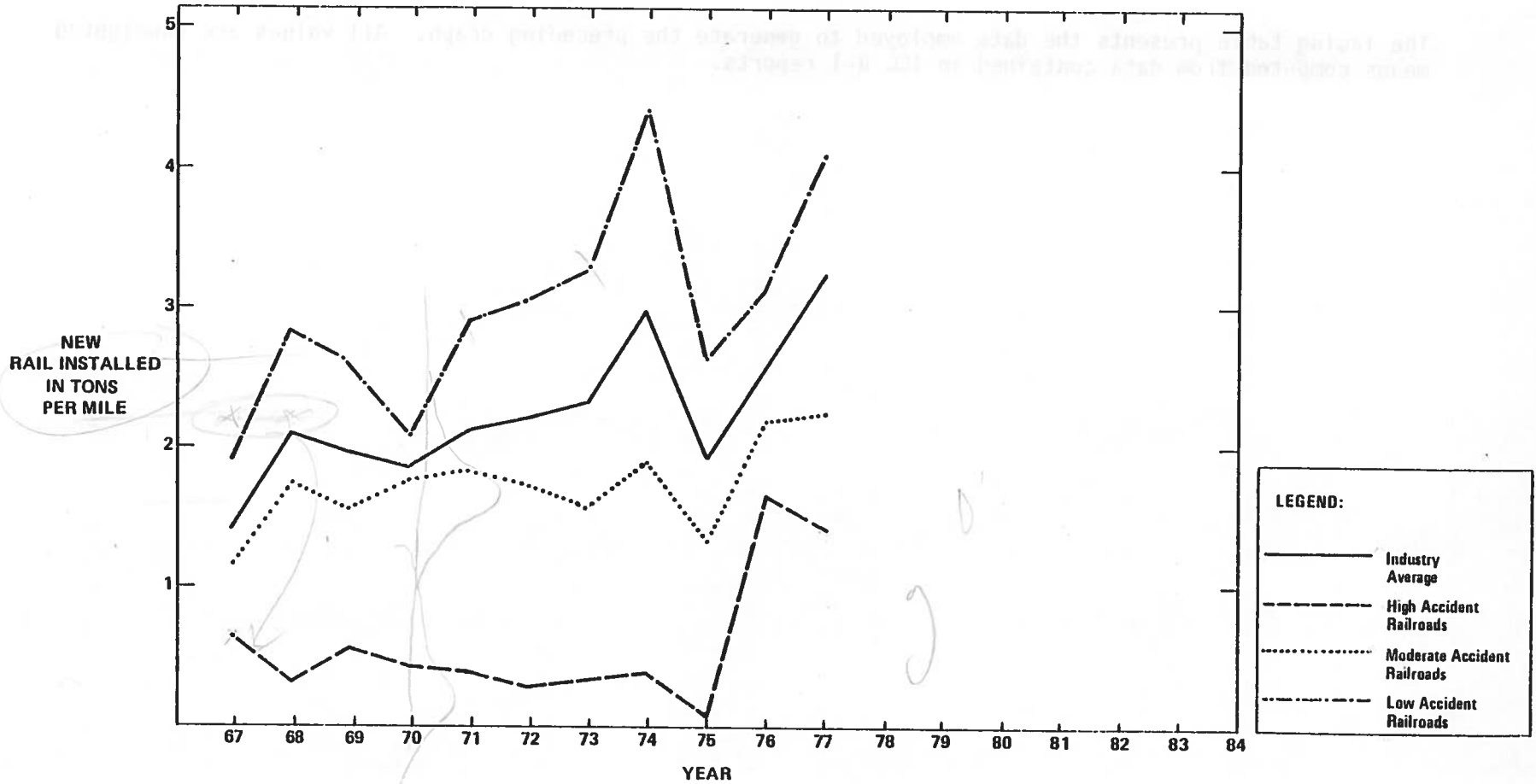
**TRACK SYSTEM SAFETY--TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
NEW RAIL INSTALLED IN TONS PER MILE**

This monitoring index is a measure of the quality of a railroad's track structure. New rail installations typically are indicative of the scale and scope of a railroad's scheduled MOW program, as rail installation typically takes precedence in MOW programs.

Low accident railroads have installed a greater amount of new rail per mile than the railroads in the moderate and high accident categories. Moreover, this monitoring index is a relatively good indicator of a railroad's running track accident record.

The values of the index portrayed on the facing graph were computed by dividing the tons of new rail installed by total track miles. Both data elements are available in ICC R-1 reports.

**DISCRIMINANT CATEGORY: TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
INDEX: NEW RAIL INSTALLED IN TONS PER MILE**



ALF3241-12

**TRACK SYSTEM SAFETY--TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
OF NEW RAIL INSTALLED IN TONS PER MILE**

The facing table presents the data employed to generate the preceding graph. All values are unweighted means computed from data contained in ICC R-1 reports.

DISCRIMINANT CATEGORY: TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM				
INDEX: NEW RAIL INSTALLED IN TONS PER MILE				
Year	Industry Average	High Accident Railroads	Moderate Accident Railroads	Low Accident Railroads
67.	1.4702	0.6247	1.2182	1.8470
68.	2.1029	0.2748	1.6998	2.8176
69.	1.9589	0.5452	1.5216	2.6003
70.	1.7533	0.4116	1.7015	2.1056
71.	2.1902	0.4027	1.7536	2.9189
72.	2.2209	0.3487	1.6809	3.0426
73.	2.3105	0.3572	1.5360	3.3144
74.	2.9395	0.4402	1.8143	4.4188
75.	1.8918	0.1976	1.3406	2.6796
76.	2.5348	1.9105	2.0231	3.2359
77.	3.2588	1.4590	2.6315	4.1422

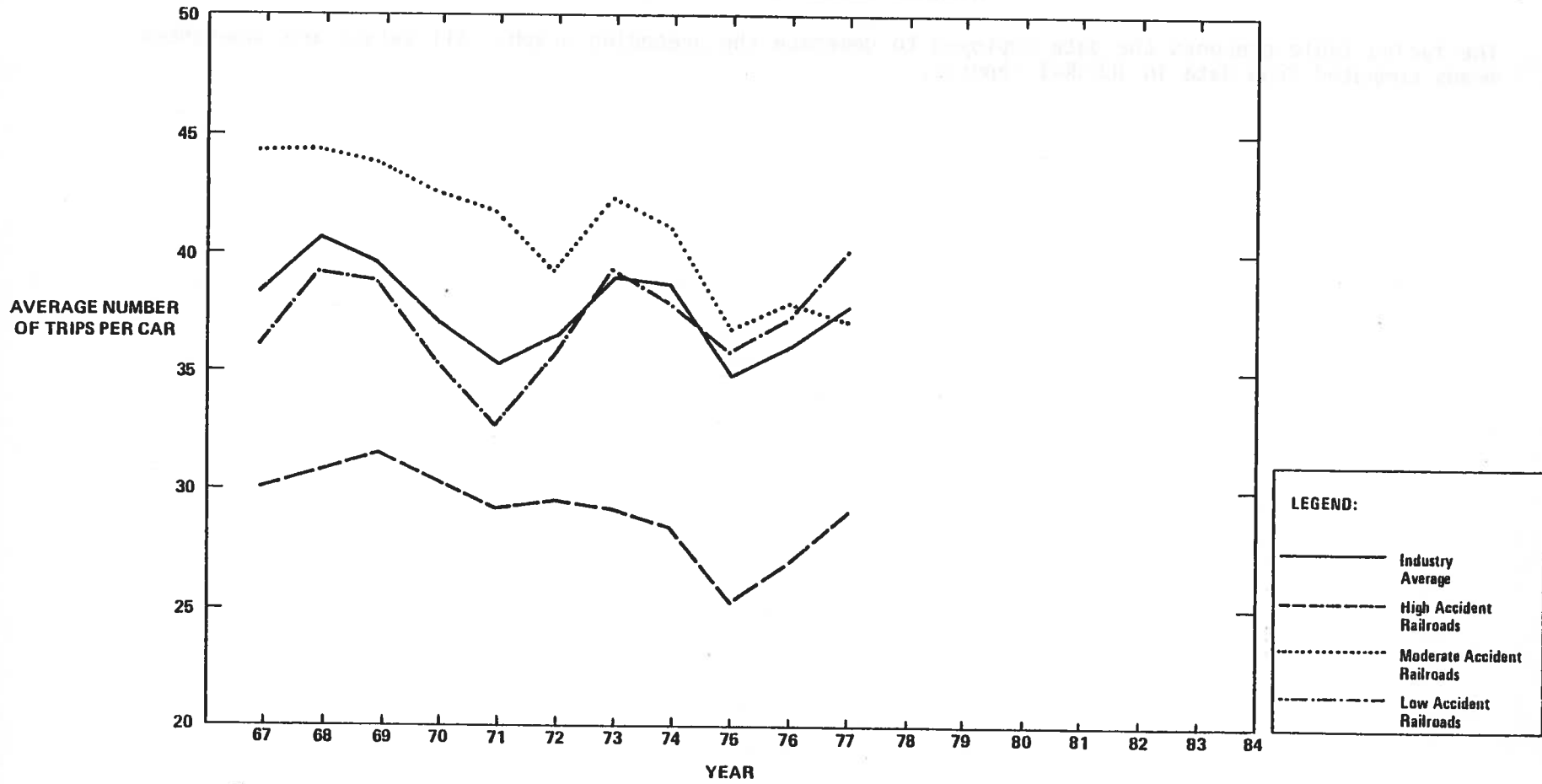
**TRACK SYSTEM SAFETY--TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
AVERAGE NUMBER OF TRIPS PER CAR**

The level of freight car utilization is measured by this monitoring index. It is computed by dividing total car loadings by the number of serviceable freight cars. Values for each accident group and for the industry as a whole are shown on the opposite page.

As can be seen from the graphs, lower values of this index are associated with a high running track related accident rate. As the average number of trips per car increases, denoting more efficient operations, railroads tend to be characterized into the low accident rate group. As the average number of trips per car increases further, the roads begin to be characterized into the moderate accident group. The latter phenomena is probably representative of railroads with high bad order rates which force them into inefficient over-utilization of cars. This in turn results in poor service because of breakdowns of cars due to a lack of adequate car maintenance.

The average number of trips per car is the weakest index of the six used to monitor this safety indicator. Relatively large moves in the index are required to affect a change along the continuum.

**DISCRIMINANT CATEGORY: TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
INDEX: AVERAGE NUMBER OF TRIPS PER CAR**



ALF3241-17

**TRACK SYSTEM SAFETY--TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM
AVERAGE NUMBER OF TRIPS PER CAR**

The facing table presents the data employed to generate the preceding graph. All values are unweighted means computed from data in ICC R-1 reports.

DISCRIMINANT CATEGORY: TOTAL RUNNING TRACK RELATED ACCIDENTS PER BGTM

INDEX: AVERAGE NUMBER OF TRIPS PER CAR

Year	Industry Average	High Accident Railroads	Moderate Accident Railroads	Low Accident Railroads
67.	38.3539	30.1423	44.2573	36.3577
68.	40.0082	30.9449	44.2506	39.0346
69.	39.5542	31.3727	43.6389	38.8551
70.	37.0538	30.3947	42.5424	35.1257
71.	35.4066	29.2513	41.8717	32.6717
72.	36.3015	29.4764	39.2044	35.8583
73.	39.1305	29.2620	42.3125	39.2054
74.	37.9222	28.4408	41.1426	37.8772
75.	34.9413	25.1339	36.9656	35.9392
76.	36.2528	27.2315	37.6168	37.4321
77.	37.6553	29.0211	37.2596	40.1051

TRACK SYSTEM SAFETY --- SWITCHING TRACK RELATED ACCIDENT INDICATORS

SECTION 4.0

MEMBERSHIP OF EACH TRACK IN THE TRACK GROUP IS DETERMINED BY THE TRACK GROUP. TRACK GROUP MEMBERSHIP CAN BE DETERMINED BY MONITORING CHANGES IN THE TRACK GROUP MEMBERSHIP.

TRACK GROUP MEMBERSHIP IS DETERMINED BY THE TRACK GROUP. TRACK GROUP MEMBERSHIP CAN BE DETERMINED BY MONITORING CHANGES IN THE TRACK GROUP MEMBERSHIP.

TRACK GROUP MEMBERSHIP IS DETERMINED BY THE TRACK GROUP. TRACK GROUP MEMBERSHIP CAN BE DETERMINED BY MONITORING CHANGES IN THE TRACK GROUP MEMBERSHIP.

TRACK SYSTEM SAFETY --- SWITCHING TRACK RELATED ACCIDENT INDICATORS

SECTION 4.0

TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES

Track System safety has been decomposed to identify differences in the thirty-three Class I railroads on the basis of switching track related accidents per million switching locomotive miles. Railroads have been grouped according to the aforementioned index into two groups, low accident railroads and high accident railroads, based on the Federal Railroad Administration's Accident and Incident Report System and ICC R-1 data over the time period 1967 to 1977.

Membership of each railroad in the two accident groups is portrayed on the facing page. Changes in a railroad's switching track accident group membership can be observed by monitoring changes in the following key indicators:

- o Average freight train speed
- o Miles of track maintained per MOW labor hour
- o Ratio of railway operating expenses to railway operating revenues
- o Ratio of total debt to total assets
- o Ratio of new to relay rail installed
- o Ratio of manufactured tons to raw material tons carried

Together, these indices account for 100% of the differences between the two groups.

SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES

LOW ACCIDENT RAILROADS	HIGH ACCIDENT RAILROADS
St. Louis Southwestern Chesapeake & Ohio Western Pacific Baltimore & Ohio Clinchfield Grand Trunk Western Florida East Coast Missouri Pacific Atchison, Topeka & Santa Fe Southern Pacific Union Pacific Norfolk & Western Denver & Rio Grande Western	Rock Island Chicago & North Western Pittsburgh & Lake Erie Kansas City Southern Missouri-Kansas-Texas Boston & Maine Illinois Central Gulf Louisville & Nashville Seaboard Coast Line Conrail Detroit, Toledo & Ironton Western Maryland Soo Line Fort Worth & Denver St. Louis-San Francisco Chicago, Milwaukee, St. Paul & Pacific Southern System Delaware & Hudson Colorado & Southern Burlington Northern

TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES

Monitoring the values of the switching track related accident indicators will enable analysts to identify changes in a railroad's switching accident characteristics with respect to other railroads or in relation to its own prior history. A railroad's likely characteristics can be assessed by taking the product of the value of each index listed below and its associated coefficient:

Average freight train speed	-.208815
Miles of track maintained per MOW labor hour	1865.755
Ratio of railway operating expenses to railway operating revenues	8.50249
Ratio of total debt to total assets	-1.091694
Ratio of new to relay rail installed	-.043664
Ratio of manufactured tons to raw material tons carried	.191563
Constant	-5.70949

Summing the products of each index with its associated coefficient and adding the constant will result in a score which can be evaluated against the continuum on page 4-7. The average score of each safety group is provided as a reference point when evaluating changes in the values of the indices.

ABILITY TO DETECT AND MEASURE CHANGE:

The Rock Island Railroad underwent considerable change during the years covered by this analysis (1967 thru 1977). The following significant changes in monitoring indices occurred during this period and would have alerted an analyst to the existence of change.

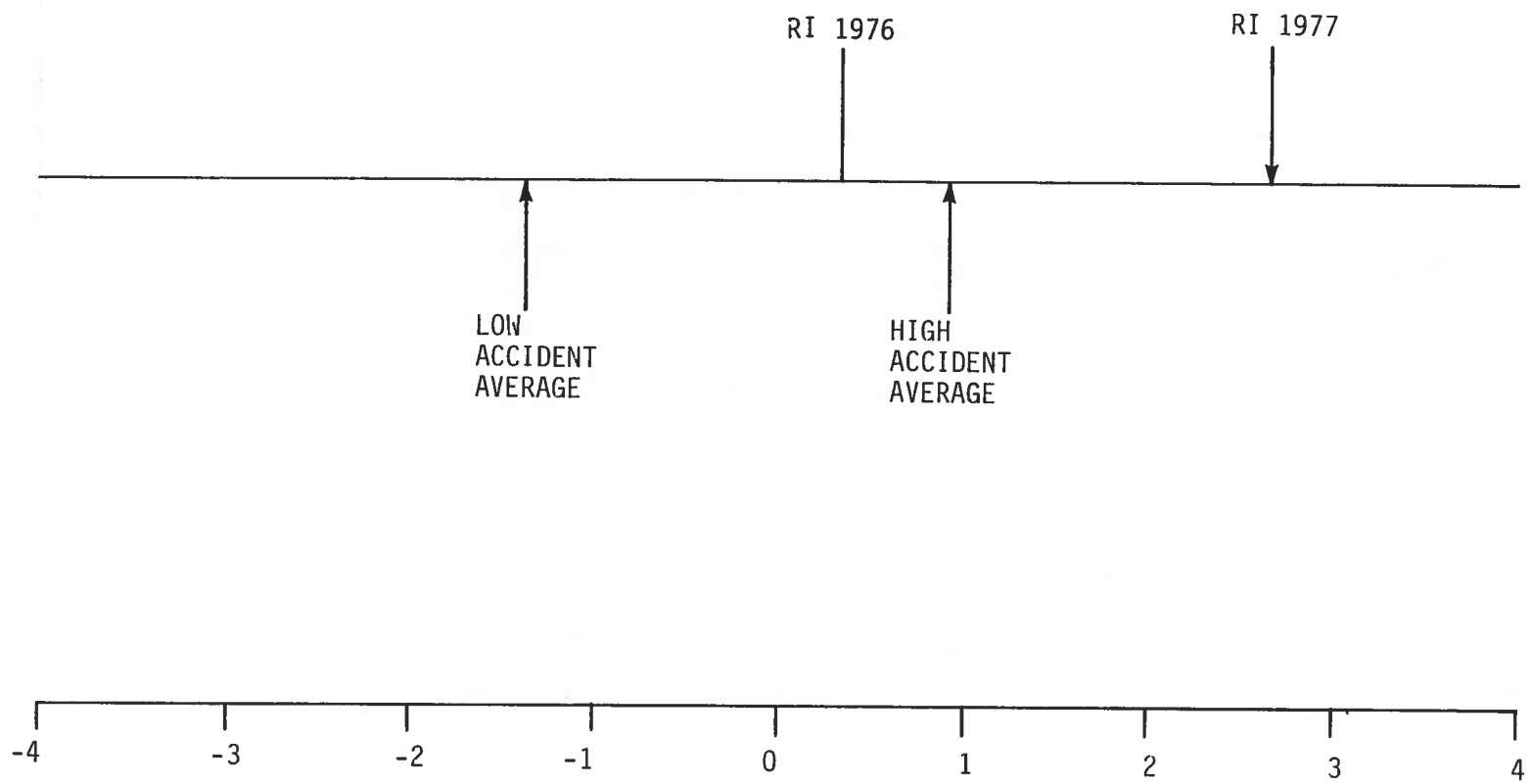
- o Average Freight Train Speed
 - Steadily decreased from 1967 to 1977 except in 1970 and 1972
 - Overall decrease for period of 22.1%

- o Ratio of Manufactured Tons to Raw Material Tons Carried
 - Generally trended downward with greatest change between 1967-1968 (14.3%)
 - Overall decrease for period of 26.6%
- o Miles of Track Maintained Per MOW Labor Hour
 - Steady increase of 49.9% between 1967-1976
 - Decreased in 1977 resulting in an overall increase for the period of 35.0%

These three indices signalled changes in the system safety characteristics of the Rock Island. The railroad's composite score steadily increased over the 11 year period (except 1976) from .4873 to 2.6623. This shift results in substantial movement along the continuum plotted on page 4-7 and represents a much stronger assumption of high accident group characteristics by the Rock Island Railroad.

Although this change in composite score is not absolutely correlated to the accident record, in this case the shift in accident group characteristics is borne out by a corresponding increase in the switching track related accident rate from 2.53 accidents per million switching locomotive miles to a rate of 41.493.

TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES



TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES

The following worksheet can be used to derive a score for a railroad along the continuum on page 4-7.

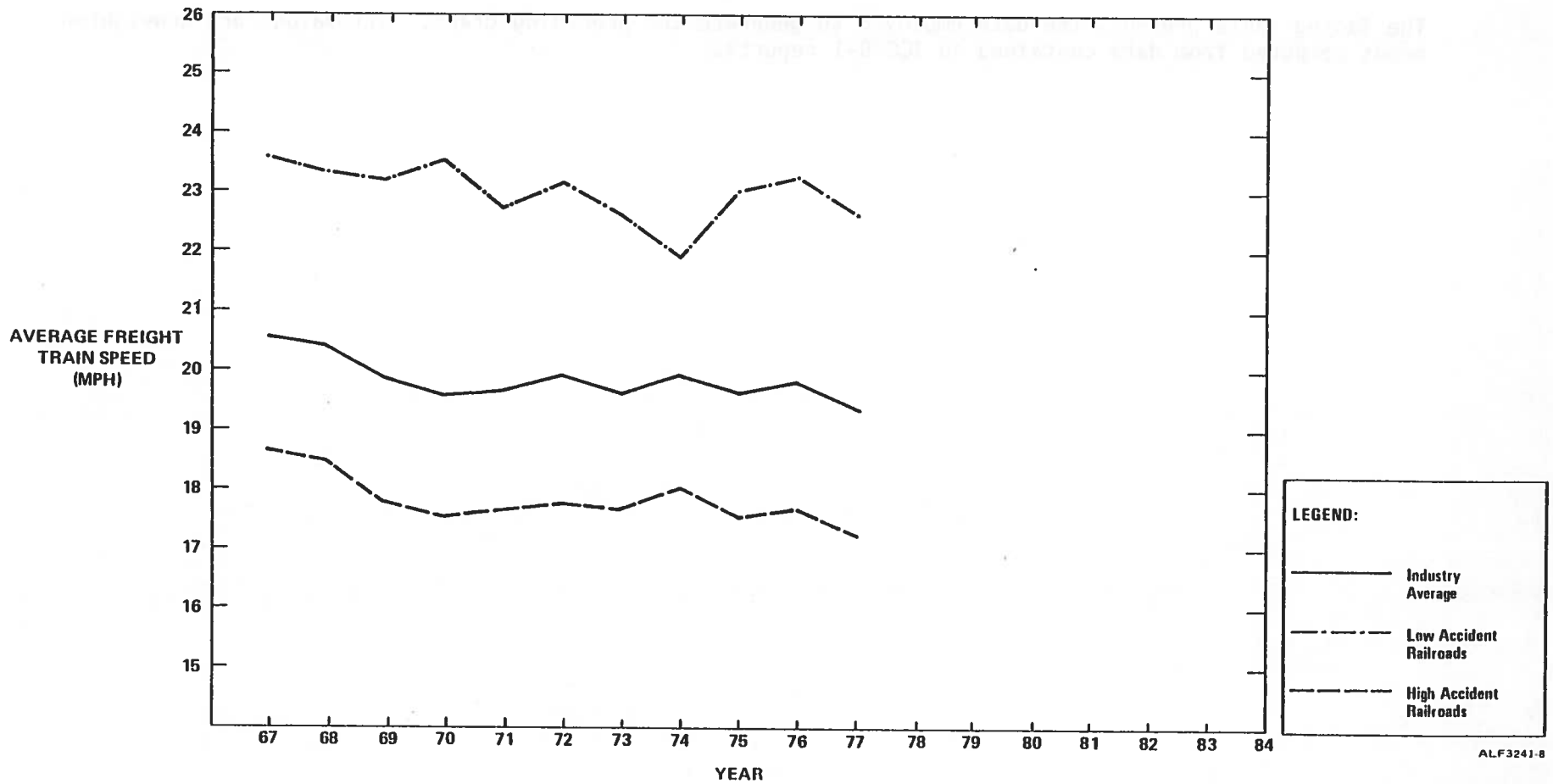
Freight train miles	<input type="text"/>	=	<input type="text"/>	x -.208815 =	<input type="text"/>
Freight train hours	<input type="text"/>				+
Miles of track maintained	<input type="text"/>	=	<input type="text"/>	x 1865.755 =	<input type="text"/>
MOW labor hours	<input type="text"/>				+
Railway operating expenses	<input type="text"/>	=	<input type="text"/>	x 8.50249 =	<input type="text"/>
Railway operating revenues	<input type="text"/>				+
Total debt	<input type="text"/>	=	<input type="text"/>	x -1.091694 =	<input type="text"/>
Total assets	<input type="text"/>				+
New rail installed	<input type="text"/>	=	<input type="text"/>	x -.043664 =	<input type="text"/>
Relay rail installed	<input type="text"/>				+
Manufactured tons carried	<input type="text"/>	=	<input type="text"/>	x .191563 =	<input type="text"/>
Raw material tons carried	<input type="text"/>				+
					<u>-5.70949</u>
			RAILROAD SCORE		<input type="text"/>

**TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
AVERAGE FREIGHT TRAIN SPEED**

This monitoring index is computed by dividing freight train miles by freight train hours. Both data elements are available from the ICC's R-1 reports. Values for both accident groups and the industry aggregate are plotted on the facing graph. Typically, larger values of this index are indicative of a good switching track safety record, which may be a reflection of less time being consumed by switching activity, better switching track conditions, and/or more efficient operations.

This index is the most important indicator of change in switching track accidents per million switching locomotive miles. In most situations, minor increases in average freight train speed will be accompanied by a significant change in a road's composite score along the continuum.

**DISCRIMINANT CATEGORY: SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
INDEX: AVERAGE FREIGHT TRAIN SPEED**



ALF3241-8

D-8

**TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
AVERAGE FREIGHT TRAIN SPEED**

The facing table presents the data employed to generate the preceding graph. All values are unweighted means computed from data contained in ICC R-1 reports.

DISCRIMINANT CATEGORY: SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES

INDEX: AVERAGE FREIGHT TRAIN SPEED (M.P.H.)

Year	Industry Average	High Accident Railroads	Low Accident Railroads
67.	20.5392	18.6041	23.6431
68.	20.4129	18.5193	23.3262
69.	19.9590	17.8349	22.8951
70.	19.6028	17.6586	22.5940
71.	19.7226	17.7722	22.7232
72.	19.9216	17.8095	23.1724
73.	19.6999	17.7572	22.6886
74.	19.9481	18.0259	22.9655
75.	19.7387	17.5915	23.0421
76.	19.8777	17.6725	23.2704
77.	19.4470	17.3435	22.6931

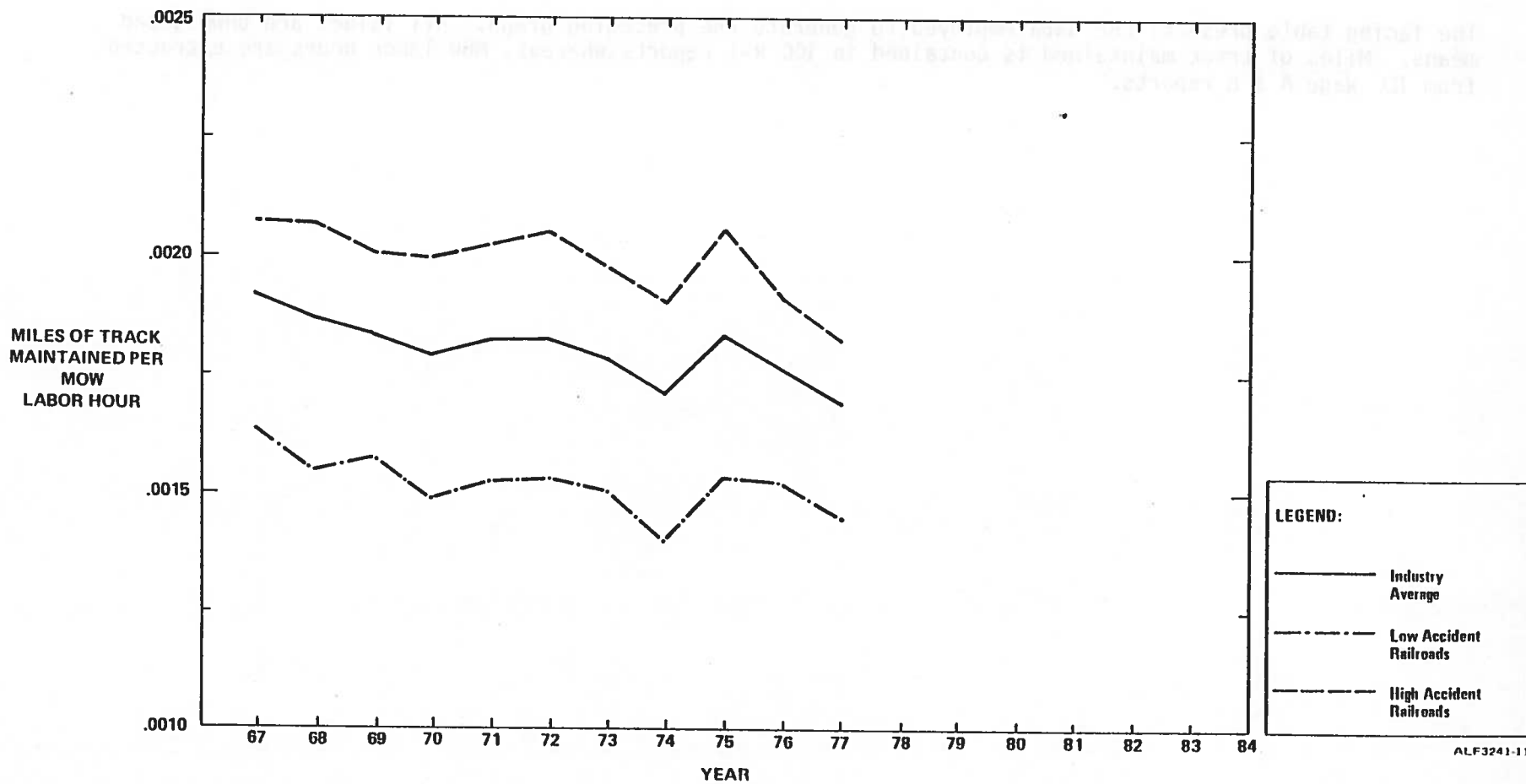
**TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
MILES OF TRACK MAINTAINED PER MOW LABOR HOUR**

Dividing miles of track maintained, available in the ICC R-1 report, by the number of MOW labor hours worked, extracted from ICC Wage A and B reports, will generate this monitoring index. This monitoring index serves as a measure of maintenance-of-way labor activity. Small values of this index are usually indicative of significant maintenance-of-way programs as railroad's expend more labor.

Miles of track maintained per MOW labor hour is of approximately equal importance to average freight train speed in monitoring changes in switching track related accidents. Relatively small improvements in this monitoring index usually result in a railroad assuming the characteristics of another accident group. Generally, decreases in this index will be attributable to better maintained track structures.

The graph on the facing page illustrates the differences in values of the monitoring index for railroads with low and high switching track accident records.

DISCRIMINANT CATEGORY: SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
INDEX: MILES OF TRACK MAINTAINED PER MOW LABOR HOUR



ALF3241-11

**TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
MILES OF TRACK MAINTAINED PER MOW LABOR HOUR**

The facing table presents the data employed to generate the preceding graph. All values are unweighted means. Miles of track maintained is contained in ICC R-1 reports whereas, MOW labor hours are extracted from ICC Wage A & B reports.

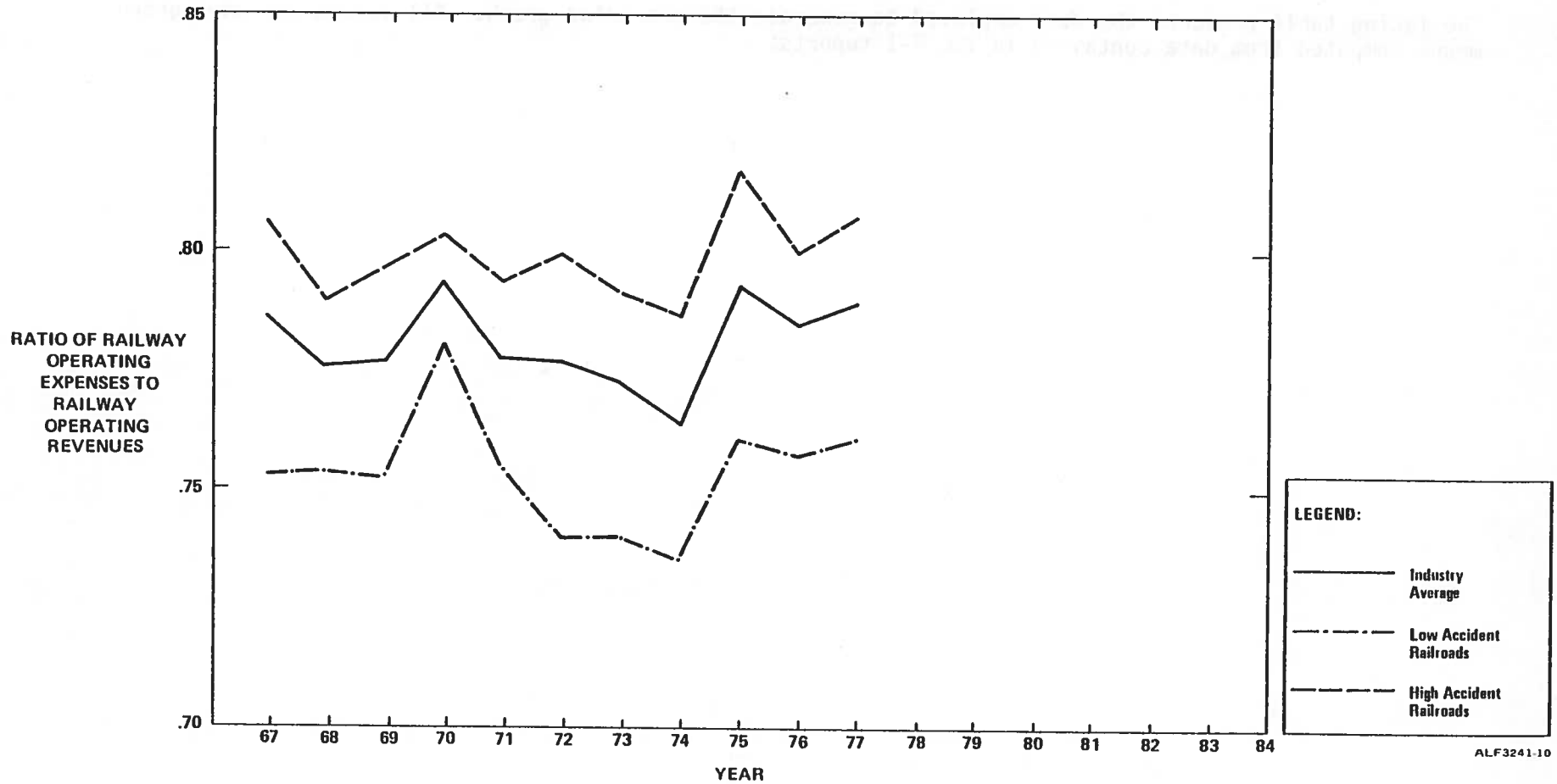
DISCRIMINANT CATEGORY: SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES			
INDEX: MILES OF TRACK MAINTAINED PER MOW LABOR HOUR			
Year	Industry Average	High Accident Railroads	Low Accident Railroads
67.	.0019221	.0020929	.0016373
68.	.0018736	.0020706	.0015512
69.	.0018446	.0020034	.0015798
70.	.0017975	.0019923	.0014978
71.	.0018266	.0020256	.0015209
72.	.0019389	.0020519	.0015275
73.	.0017967	.0019853	.0015055
74.	.0017068	.0019048	.0014021
75.	.0018521	.0020584	.0015347
76.	.0017565	.0019291	.0015178
77.	.0016849	.0018391	.0014476

**TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
RATIO OF RAILWAY OPERATING EXPENSES TO RAILWAY OPERATING REVENUES**

This index measures efficiency of railroad operations. Relatively low values of the index are associated with railroads which are capable of operating with smaller percentages of their operating revenues. The index is computed by dividing railway operating expenses by railway operating revenues. Both data elements required for computation of the index are available in ICC R-1 reports.

The ratio of railway operating expenses to operating revenues is of approximately equal importance to the preceding index in detecting and measuring changes in a railroad's characteristics vis-a-vis switching track related accidents. Modest changes in the value of the monitoring index are likely to signal a railroad's movement toward the characteristics of another accident group. The facing graph illustrates the differences in values of the index for the two accident groups and the industry aggregate from 1967 to 1977.

**DISCRIMINANT CATEGORY: SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
 INDEX: RATIO OF RAILWAY OPERATING EXPENSES TO RAILWAY OPERATING REVENUES**



ALF3241-10

**TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
RATIO OF RAILWAY OPERATING EXPENSES TO RAILWAY OPERATING REVENUES**

The facing table presents the data employed to generate the preceding graph. All values are unweighted means computed from data contained in ICC R-1 reports.

DISCRIMINANT CATEGORY: SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES

INDEX: RATIO OF RAILWAY OPERATING EXPENSES TO RAILWAY OPERATING REVENUES

Year	Industry Average	High Accident Railroads	Low Accident Railroads
67.	0.7359	0.8058	0.7536
68.	0.7761	0.7907	0.7537
69.	0.7764	0.7922	0.7520
70.	0.7932	0.8031	0.7790
71.	0.7782	0.7937	0.7543
72.	0.7768	0.7939	0.7411
73.	0.7713	0.7910	0.7410
74.	0.7543	0.7831	0.7354
75.	0.7951	0.8173	0.7509
76.	0.7934	0.8000	0.7579
77.	0.7894	0.8079	0.7509

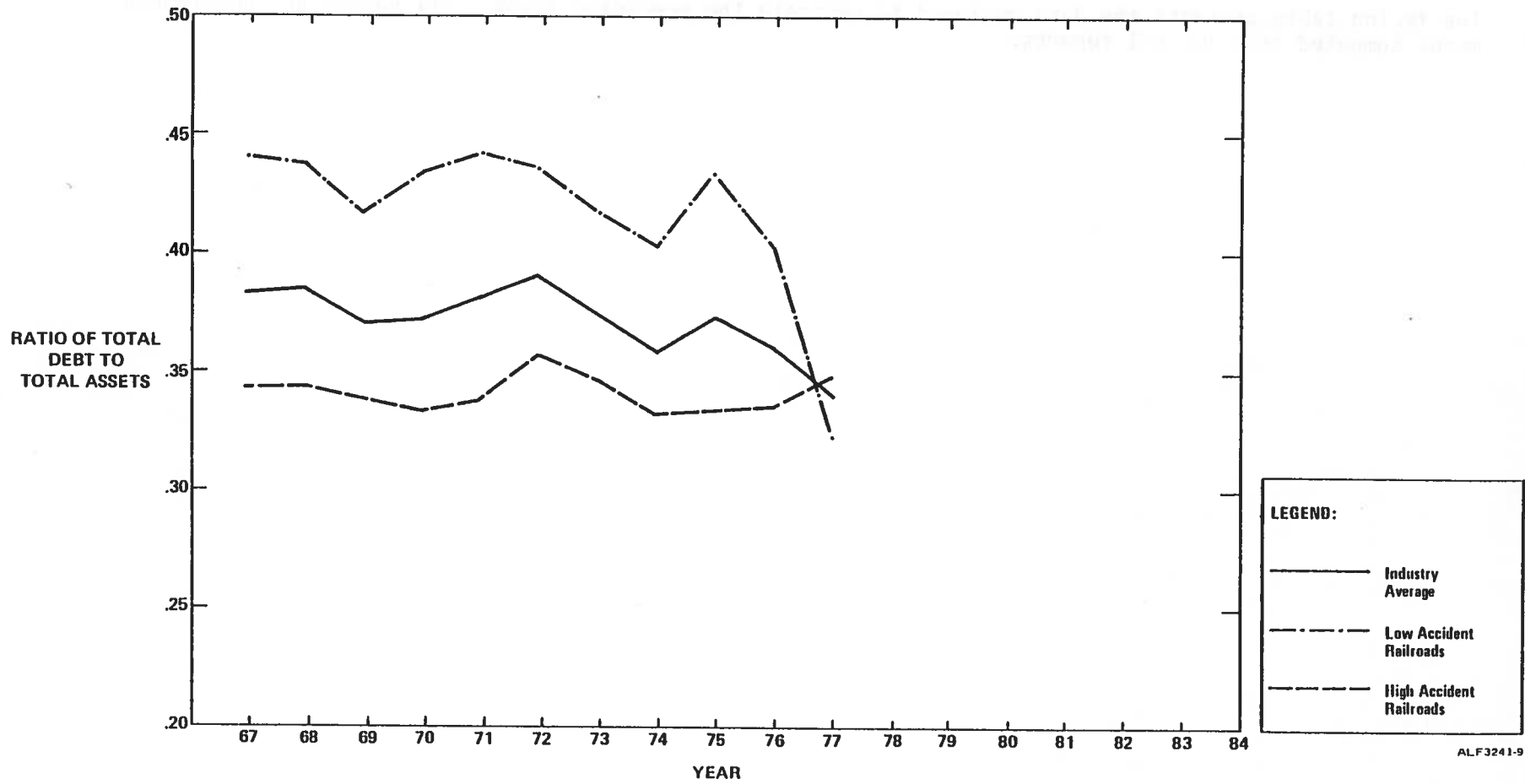
**TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
RATIO OF TOTAL DEBT TO TOTAL ASSETS**

The ratio of total debt to total assets affords a measure of the total funds provided by creditors to a railroad. Values of the index are often used by potential creditors as an indication of a railroad's ability to meet its financial obligations. Debt instruments are much more likely to be extended to firms with a solid history of earnings than to firms experiencing financial difficulties.

The monitoring index is derived by dividing total debt by total assets. Both data elements are contained in ICC R-1 reports. The facing graph presents the values of the index for low and high accident groups as well as the industry average. Low accident railroads have typically exhibited high values on this index.

This index is approximately half as important as average freight train speed and miles of track maintained per MOW labor hour in detecting and measuring changes in a railroad's switching track accident characteristics.

**DISCRIMINANT CATEGORY: SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
INDEX: RATIO OF TOTAL DEBT TO TOTAL ASSETS**



ALF3241-9

**TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
RATIO OF TOTAL DEBT TO TOTAL ASSETS**

The facing table presents the data employed to generate the preceding graph. All values are unweighted means computed from ICC R-1 reports.

TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
 RATIO OF NEW TO REPAIR RAIL ENGINES

DISCRIMINANT CATEGORY: SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES

INDEX: RATIO OF TOTAL DEBT TO TOTAL ASSETS

Year	Industry Average	High Accident Railroads	Low Accident Railroads
67.	0.3792	0.3404	0.4389
68.	0.3793	0.3413	0.4377
69.	0.3700	0.3376	0.4195
70.	0.3736	0.3349	0.4332
71.	0.3777	0.3374	0.4397
72.	0.3868	0.3552	0.4355
73.	0.3749	0.3444	0.4217
74.	0.3599	0.3313	0.4040
75.	0.3723	0.3325	0.4336
76.	0.3506	0.3328	0.4035
77.	0.3386	0.3434	0.3221

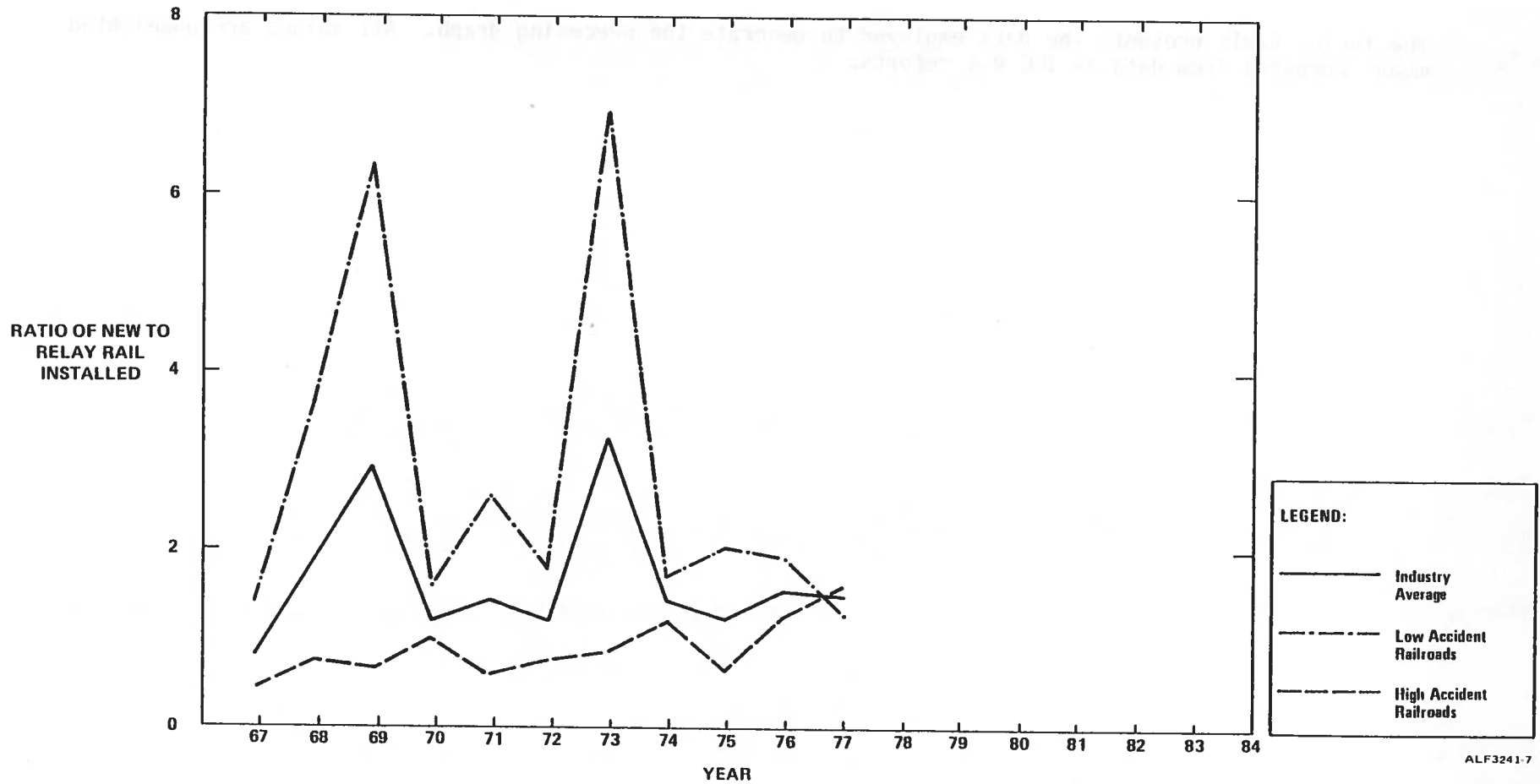
**TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
RATIO OF NEW TO RELAY RAIL INSTALLED**

This monitoring index serves as a measure of the quality of a railroad's track structure. Dividing new rail installed by relay rail installed will yield the index. Both data elements are available in ICC R-1 reports.

The facing graph portrays the values the index has taken from 1967 to 1977 for the two accident groups and the industry average. The use of relay rail, especially in yards and switching areas, has and continues to be a practice employed by most railroads. Installation of relay rail, however, is accompanied by a certain level of risk, as the rail has already been in service at another track location, and may be more susceptible to flaws. Use of significant proportions of new rail are indicative of sound maintenance-of-way programs, as reflected by low accident roads which have higher values on this index.

Relatively large changes in this index will usually cause a railroad to assume the characteristics of another accident group. Small fluctuations in the value of the index are unlikely to have a measurable impact on safety characteristics in general.

**DISCRIMINANT CATEGORY: SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
INDEX: RATIO OF NEW TO RELAY RAIL INSTALLED**



ALF3241-7

**TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
RATIO OF NEW TO RELAY RAIL INSTALLED**

The facing table presents the data employed to generate the preceding graph. All values are unweighted means computed from data in ICC R-1 reports.

DISCRIMINANT CATEGORY: SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES

INDEX: RATIO OF NEW TO RELAY RAIL INSTALLED

Year	Industry Average	High Accident Railroads	Low Accident Railroads
67.	0.8517	0.4529	1.4497
68.	1.8720	0.7136	3.6539
69.	2.9229	0.6795	6.3743
70.	1.0428	0.9584	1.1571
71.	1.3904	0.6019	2.5781
72.	1.1330	0.7567	1.8388
73.	3.2466	0.8475	6.9379
74.	1.3783	1.1320	1.6803
75.	1.1390	0.6524	2.0400
76.	1.5420	1.2378	1.9331
77.	1.4500	1.5786	1.2776

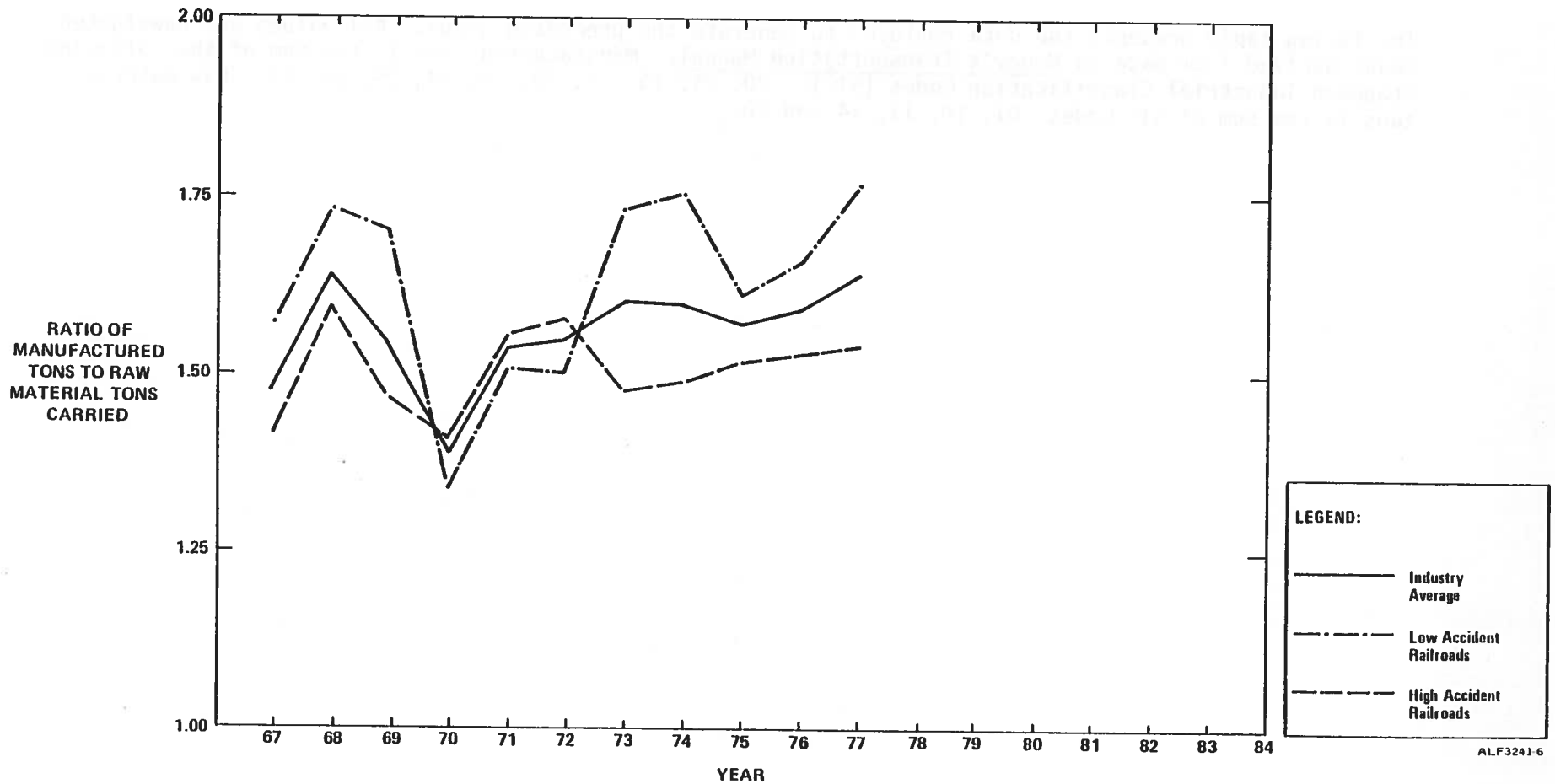
**TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
RATIO OF MANUFACTURED TONS TO RAW MATERIAL TONS CARRIED**

Both data elements are reported for Class I railroads in Moody's Transportation Manual. The index affords a measure of the types of commodities carried by a railroad as well as a railroad's marketing area or marketing strategy. Manufactured goods tend to produce more revenue per gross ton mile and generally have more stringent contractual delivery requirements than raw materials. Thus, the graph on the facing page may also reflect the service quality differences (on time delivery, low loss and damage) between railroads as perceived by shippers.

Increases in this index may be an indication of changes in a railroad's marketing strategy or changes in the perception of shippers toward improvements in a road's operations.

Large changes in the values of this index are necessary before a railroad assumes the characteristics of another accident group. The values of the index for both accident groups and the industry aggregate are portrayed on the facing graph.

**DISCRIMINANT CATEGORY: SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
 INDEX: RATIO OF MANUFACTURED TONS TO RAW MATERIAL TONS CARRIED**



**TRACK SYSTEM SAFETY -- SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
RATIO OF MANUFACTURED TONS TO RAW MATERIAL TONS CARRIED**

The facing table presents the data employed to generate the preceding graph. All values are unweighted means derived from data in Moody's Transportation Manual. Manufactured tons is the sum of the following Standard Industrial Classification Codes (SIC): 20, 24, 25, 28, 29, 32, 34, 36, and 27. Raw material tons is the sum of SIC Codes 01, 10, 11, 14 and 40.

DISCRIMINANT CATEGORY: SWITCHING TRACK RELATED ACCIDENTS PER MILLION SWITCHING LOCOMOTIVE MILES
INDEX: RATIO OF MANUFACTURED TONS TO RAW MATERIAL TONS CARRIED

Year	Industry Average	High Accident Railroads	Low Accident Railroads
67.	1.4735	1.4054	1.5783
68.	1.6436	1.5959	1.7321
69.	1.5518	1.4542	1.6945
70.	1.3598	1.4027	1.3178
71.	1.5462	1.5528	1.5174
72.	1.5534	1.5781	1.5122
73.	1.5384	1.4884	1.7345
74.	1.5392	1.4983	1.7517
75.	1.5570	1.5218	1.6331
76.	1.5355	1.5388	1.6574
77.	1.6352	1.5438	1.7784

SYSTEM PRODUCTIVITY - INDEX FOR 1987

System productivity is calculated using the index gross for index per freight in the base. This index is calculated with data from the Bureau of Economic Analysis (BEA) report, "Productivity and Efficiency in the U.S. Economy: The Role of the Federal Reserve and the Department of Commerce in the 1980s" (1987). The index is calculated as the ratio of the index for 1987 to the index for 1982.

The index for 1987 is calculated as the ratio of the index for 1987 to the index for 1982. The index for 1982 is set equal to 100. The index for 1987 is calculated as the ratio of the index for 1987 to the index for 1982, respectively.

The index for 1987 is calculated as the ratio of the index for 1987 to the index for 1982. The index for 1982 is set equal to 100. The index for 1987 is calculated as the ratio of the index for 1987 to the index for 1982, respectively.

SYSTEM PRODUCTIVITY

SECTION 5.0

- 1. Average index of freight per ton
- 2. Index of total work related activities per billion gross ton-miles
- 3. Index of total work related activities per billion gross ton-miles
- 4. Index of total work related activities per billion gross ton-miles

Additional factors can be found in Appendix A.

SYSTEM PRODUCTIVITY--GROSS TON MILES PER FREIGHT TRAIN HOUR

System productivity is evaluated using the index gross ton miles per freight train hour. This index, constructed with data from the Interstate Commerce Commission's R-1 reports, denotes how efficiently a railroad moves its traffic. Increases in the magnitude of this index are a reflection of improvements in a railroad's overall productivity.

The thirty-three major Class I railroads over the time period 1967-1977 were divided into three distinct groups based on the values of the index gross ton miles per freight train hour. These groups, presented in the facing table, represent railroads with high, moderate, and low productivity, respectively.

Five indices have been analytically derived which can be monitored to detect changes in a railroad's productivity relative to other Class I railroads. These measures are:

- o Average haul
- o Average number of freight cars per train
- o Number of main track related accidents per billion gross ton-miles
- o Transportation costs in 1967 dollars* per million gross ton-miles
- o Ratio of income available for meeting fixed charges to fixed charges

* Deflation factors can be found in Appendix A.

SYSTEM PRODUCTIVITY

HIGH PRODUCTIVITY RAILROADS

Union Pacific
Western Pacific
Atchison, Topeka & Santa Fe
Southern Pacific
Kansas City Southern
St. Louis Southwestern
Denver & Rio Grande Western
Clinchfield
Norfolk and Western
Burlington Northern
Pittsburgh & Lake Erie

MODERATE PRODUCTIVITY RAILROADS

Missouri Pacific
Milwaukee
Chicago, Milwaukee, St. Paul &
Pacific
Southern System
Seaboard Coast Line
St. Louis - San Francisco
Chesapeake & Ohio
Missouri-Kansas-Texas
Baltimore & Ohio
Soo Line
Delaware & Hudson
Conrail
Rock Island
Louisville & Nashville
Grand Trunk Western
Illinois Central Gulf
Chicago & North Western
Fort Worth & Denver

LOW PRODUCTIVITY RAILROADS

Florida East Coast
Western Maryland
Boston & Maine
Detroit, Toledo & Ironton

SYSTEM PRODUCTIVITY

Changes in the values of the monitored indices may result in a railroad assuming the characteristics of another of the productivity groups. Analysts can assess a railroad's likely characteristics by taking the product of the value of each index and the values listed below:

Average haul	- 0.008209
Average number of freight cars per train	- 0.079021
Number of main track related accidents per billion gross ton-miles	0.453374
Transportation costs in 1967 dollars per million gross ton-miles	0.700222
Ratio of income available for meeting fixed charges to fixed charges	- 0.000609
Constant	6.305435

Summing these products and adding the constant will result in a score which can be evaluated along the continuum on page 5-7. The average scores for each productivity group are provided as reference points when evaluating the impact of index changes on productivity.

ABILITY TO DETECT AND MEASURE CHANGE:

The Chesapeake and Ohio Railroad provides a good example of the ability of monitoring indices to detect change. A steady change in some of the indicators with a resultant change in the aggregate score during the period of this analysis (1967 thru 1977) would have been sufficient to alert an analyst to the fact that a substantial change was taking place and that it was in an unfavorable direction.

- o Average Number of Freight Cars Per Train
 - Generally trended downward with significant drops from 1970 to 1973 (18.7%) and 1975 to 1977 (9.1%)
 - Overall decrease for the period was 11.7%

- Average Haul
 - Steadily declined with notable exception in 1970
 - Overall decrease for the period of 18.5%
- Ratio of Income Available for Meeting Fixed Charges to Fixed Charges

- Steady increase of 161% from 1971 to 1976
- Overall increase for the period of 52%

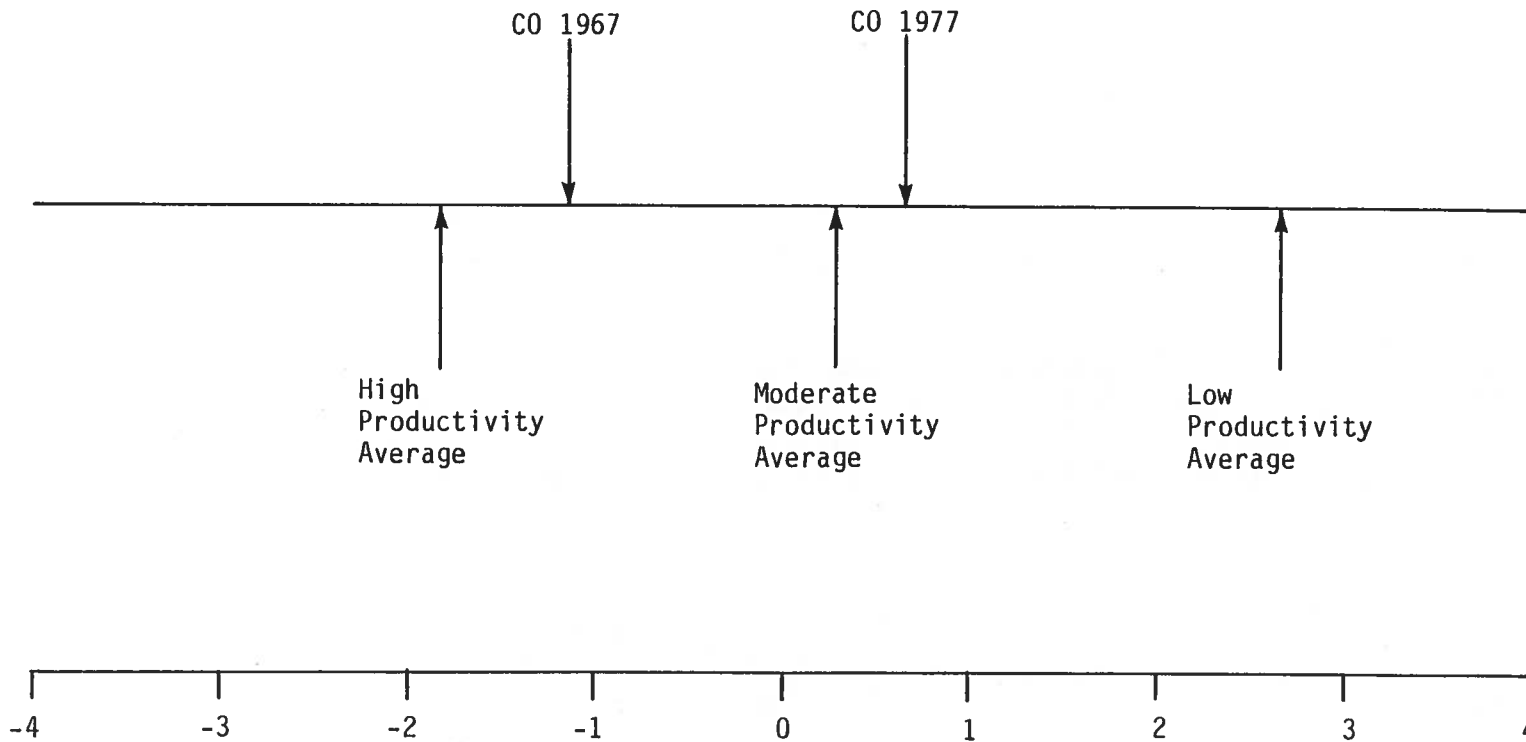
(Note: this change is counter to the direction of the other indices but it is much less significant in the aggregate. This great a change may have been indicative of a management decision to reduce debt rather than make capital investments in plant and equipment).

- Number of Main Track Related Accidents per BGTM
 - Steady and consistent increase with the exception of 1972
 - Overall change for the period of 274%

These four indices signalled changes in this system productivity indicator. The Chesapeake and Ohio's composite score increased sporadically but definitively over the 11 year period from -1.1282 to .4112. This change results in a substantial movement along the continuum plotted on the next page and represents a change from the characteristics of the high productivity group to those of the moderate productivity group.

During this same period of time, the Chesapeake and Ohio did actually experience a decline in productivity as measured by gross ton miles per train hour which fell from 85,355 in 1967 to 72,533 in 1977 (15%).

SYSTEM PRODUCTIVITY



SYSTEM PRODUCTIVITY

The following worksheet can be used to derive a score for a railroad along the continuum on page 5-7.

Revenue ton miles	[]				
	÷	=	[]	X -0.008209 =	[]
Revenue tons	[]				+
Freight car miles	[]				
	÷	=	[]	X -0.079021 =	[]
Freight train miles	[]				+
Main track related accidents	[]				
	÷	=	[]	X 0.453374 =	[]
Billion gross ton miles	[]				+
Transportation costs*	[]				
	÷	=	[]	X 0.700222 =	[]
Million gross ton miles	[]				+
Income available for meeting fixed charges	[]				
	÷	=	[]	X -0.000609 =	[]
Fixed charges	[]				+
					6.305435
					Railroad Score []

* Use deflation factors in appendix to obtain 1967 dollars.

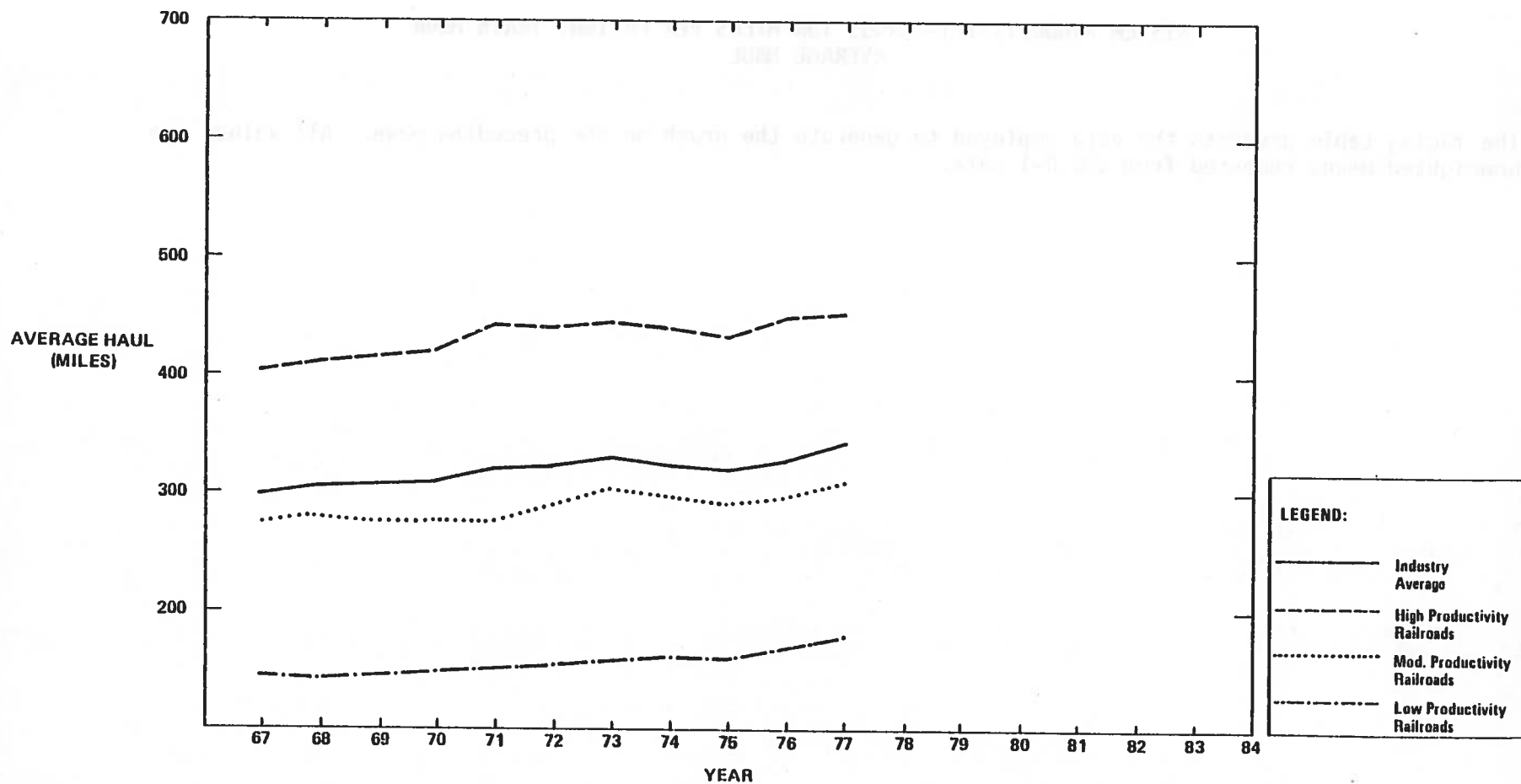
**SYSTEM PRODUCTIVITY--GROSS TON MILES PER FREIGHT TRAIN HOUR
AVERAGE HAUL**

Average haul represents the distance that a revenue ton is carried from an origin to a destination within a railroad. The index is computed by dividing revenue ton miles by revenue tons, using data from the ICC's R-1 reports.

Typically, railroads with longer average hauls have been more productive, since the time delays and associated costs of traversing yards are minimized. The facing graph portrays the differences in average haul for each productivity grouping and the industry aggregate.

The analysis of monitoring indices for detecting changes in productivity indicated that average haul is the strongest detector of changes in productivity. Furthermore, relatively small improvements in average haul are likely to have significant impacts on a railroad's productivity.

**DISCRIMINANT CATEGORY: GROSS TON MILES PER FREIGHT TRAIN HOUR
INDEX : AVERAGE HAUL**



ALF3241-1

**SYSTEM PRODUCTIVITY--GROSS TON MILES PER FREIGHT TRAIN HOUR
AVERAGE HAUL**

The facing table presents the data employed to generate the graph on the preceding page. All values are unweighted means computed from ICC R-1 data.

DISCRIMINANT CATEGORY: GROSS TON MILES PER FREIGHT TRAIN HOUR

INDEX: AVERAGE HAUL (MILES)

Year	Industry Average	High Productivity Railroads	Moderate Productivity Railroads	Low Productivity Railroads
67.	299.5475	405.4352	275.1179	144.7594
68.	304.1106	413.2918	279.2451	143.2727
69.	305.2573	415.0411	279.5181	146.7047
70.	306.3486	419.8691	278.4358	148.1306
71.	315.9790	437.2156	285.1812	151.4775
72.	318.5312	434.3534	290.1979	156.4510
73.	328.6401	438.5203	305.8458	156.2542
74.	323.9248	433.6111	299.1352	151.0327
75.	316.4955	427.5314	290.0972	157.5482
76.	325.5580	441.4984	295.7196	159.9797
77.	339.7318	454.6078	311.8393	178.0580

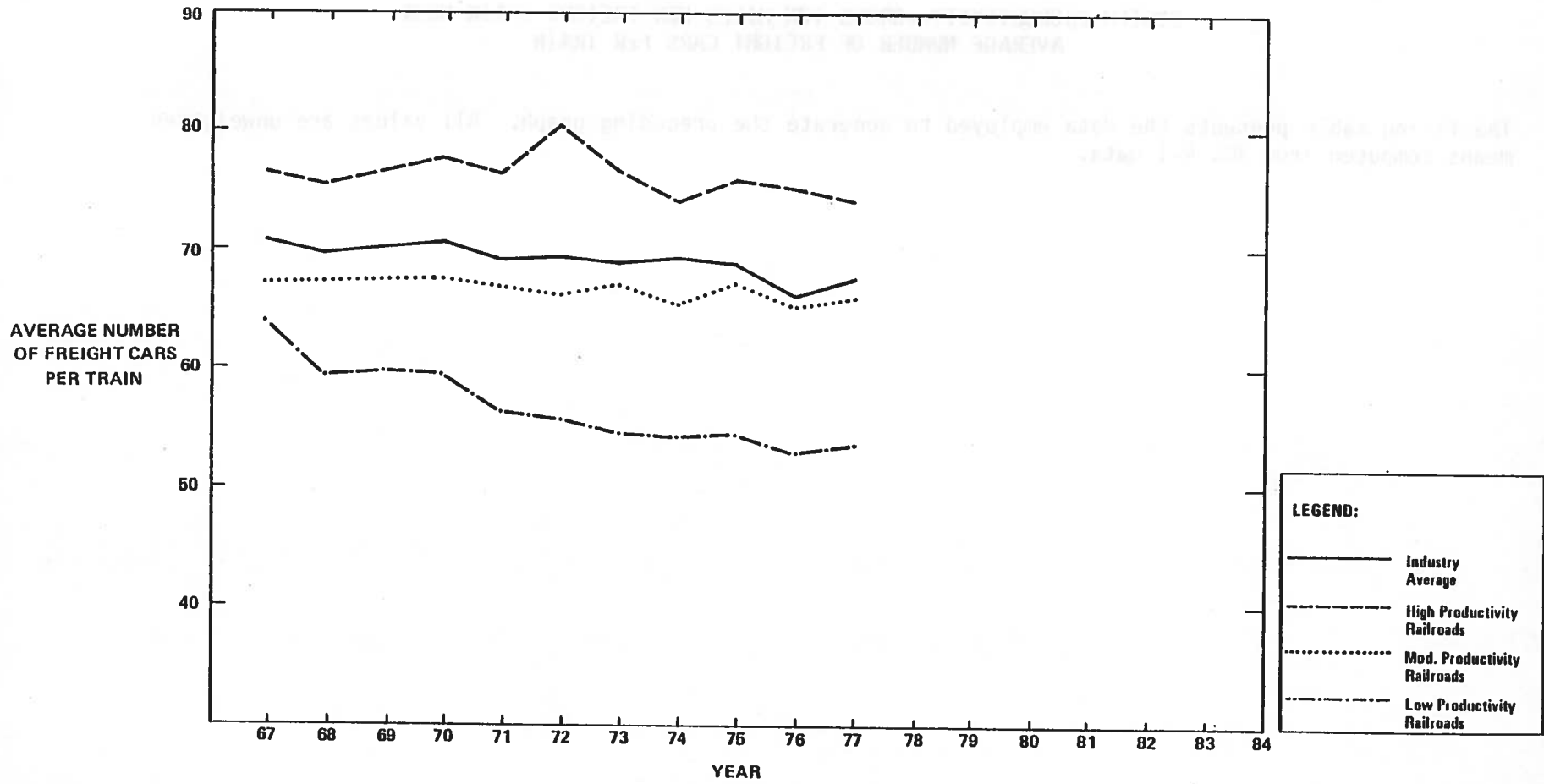
**SYSTEM PRODUCTIVITY--GROSS TON MILES PER FREIGHT TRAIN HOUR
AVERAGE NUMBER OF FREIGHT CARS PER TRAIN**

This monitoring index is computed by dividing freight car miles by freight train miles and affords a measure of average train length. Longer freight trains have been related to high productivity as the cost per car mile declines as train length increases.

Train length is of approximately equal importance to average haul in its ability to detect and measure changes in productivity. Furthermore, minor improvements in train length will usually result in detectable improvements in system productivity as measured by gross ton-miles per freight train hour.

The graph on the facing page illustrates the relative differences in train length between the three productivity groups as well as the industry average.

DISCRIMINANT CATEGORY: GROSS TON MILES PER FREIGHT TRAIN HOUR
 INDEX : AVERAGE NUMBER OF FREIGHT CARS PER TRAIN



ALF3241-2

**SYSTEM PRODUCTIVITY--GROSS TON MILES PER FREIGHT TRAIN HOUR
AVERAGE NUMBER OF FREIGHT CARS PER TRAIN**

The facing table presents the data employed to generate the preceding graph. All values are unweighted means computed from ICC R-1 data.

DISCRIMINANT CATEGORY: GROSS TON MILES PER FREIGHT TRAIN HOUR

INDEX: AVERAGE NUMBER OF FREIGHT CARS PER TRAIN

Year	Industry Average	High Productivity Railroads	Moderate Productivity Railroads	Low Productivity Railroads
67.	70.5512	77.4394	67.7110	64.3897
68.	69.8513	76.8874	67.7808	59.8190
69.	70.0427	77.3512	67.8375	59.8399
70.	70.3484	78.3054	68.0568	58.7537
71.	69.3457	77.2340	67.4075	56.3534
72.	69.7582	80.1578	66.5147	55.8379
73.	69.0799	77.0354	67.5343	54.9205
74.	67.3304	74.6138	65.6574	54.8291
75.	69.1805	76.7918	67.7113	54.8512
76.	66.9586	75.2437	65.0348	52.6380
77.	67.4343	74.4702	66.1721	53.7555

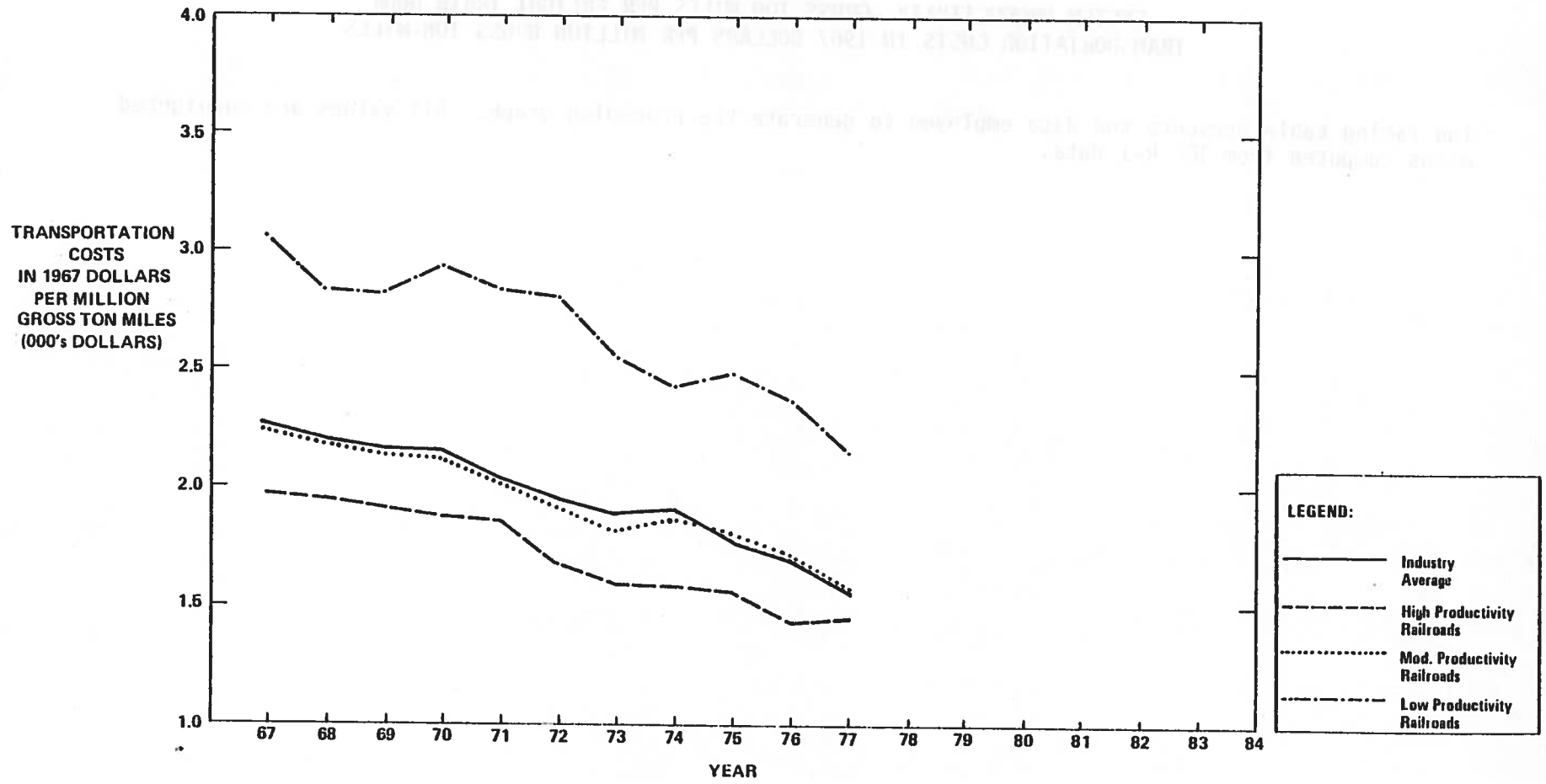
**SYSTEM PRODUCTIVITY--GROSS TON MILES PER FREIGHT TRAIN HOUR
TRANSPORTATION COSTS IN 1967 DOLLARS PER MILLION GROSS TON-MILES**

Transportation costs are divided by the number of million gross ton-miles of traffic to arrive at this monitoring index. The index, developed with ICC-R1 data, measures the average transportation cost of providing freight service.

Relatively small values of this monitoring index are usually indicative of relatively efficient operations. Therefore, as the value of this index decreases a railroad is in effect transporting freight at a lower cost as is illustrated on the facing graph.

Transportation costs per million gross ton-miles is approximately half as important as average haul and train length in its ability to detect and measure changes in system productivity. Hence, relatively large decreases in this index are required before a large impact in system productivity will be observable.

DISCRIMINANT CATEGORY: GROSS TON MILES PER FREIGHT TRAIN HOUR
INDEX : TRANSPORTATION COSTS IN 1967 DOLLARS PER MILLION GROSS TON MILES



ALF3241-5

**SYSTEM PRODUCTIVITY--GROSS TON MILES PER FREIGHT TRAIN HOUR
TRANSPORTATION COSTS IN 1967 DOLLARS PER MILLION GROSS TON-MILES**

The facing table presents the data employed to generate the preceding graph. All values are unweighted means computed from ICC R-1 data.

DISCRIMINANT CATEGORY: GROSS TON MILES PER FREIGHT TRAIN HOUR

INDEX: TRANSPORTATION COSTS IN 1967 DOLLARS PER MILLION GROSS TON-MILES
(In Thousands)

Year	Industry Average	High Productivity Railroads	Moderate Productivity Railroads	Low Productivity Railroads
67.	2.2500	1.9714	2.2396	3.0532
68.	2.1382	1.9509	2.1388	2.8579
69.	2.1490	1.9056	2.1492	2.8146
70.	2.1469	1.8305	2.1279	2.9550
71.	2.0535	1.8429	2.0273	2.8328
72.	1.9279	1.6325	1.9027	2.7157
73.	1.8235	1.5951	1.8022	2.5448
74.	1.8319	1.5311	1.8517	2.4326
75.	1.8030	1.5478	1.8053	2.4900
76.	1.7114	1.4551	1.7152	2.3550
77.	1.6527	1.4498	1.6339	2.1303

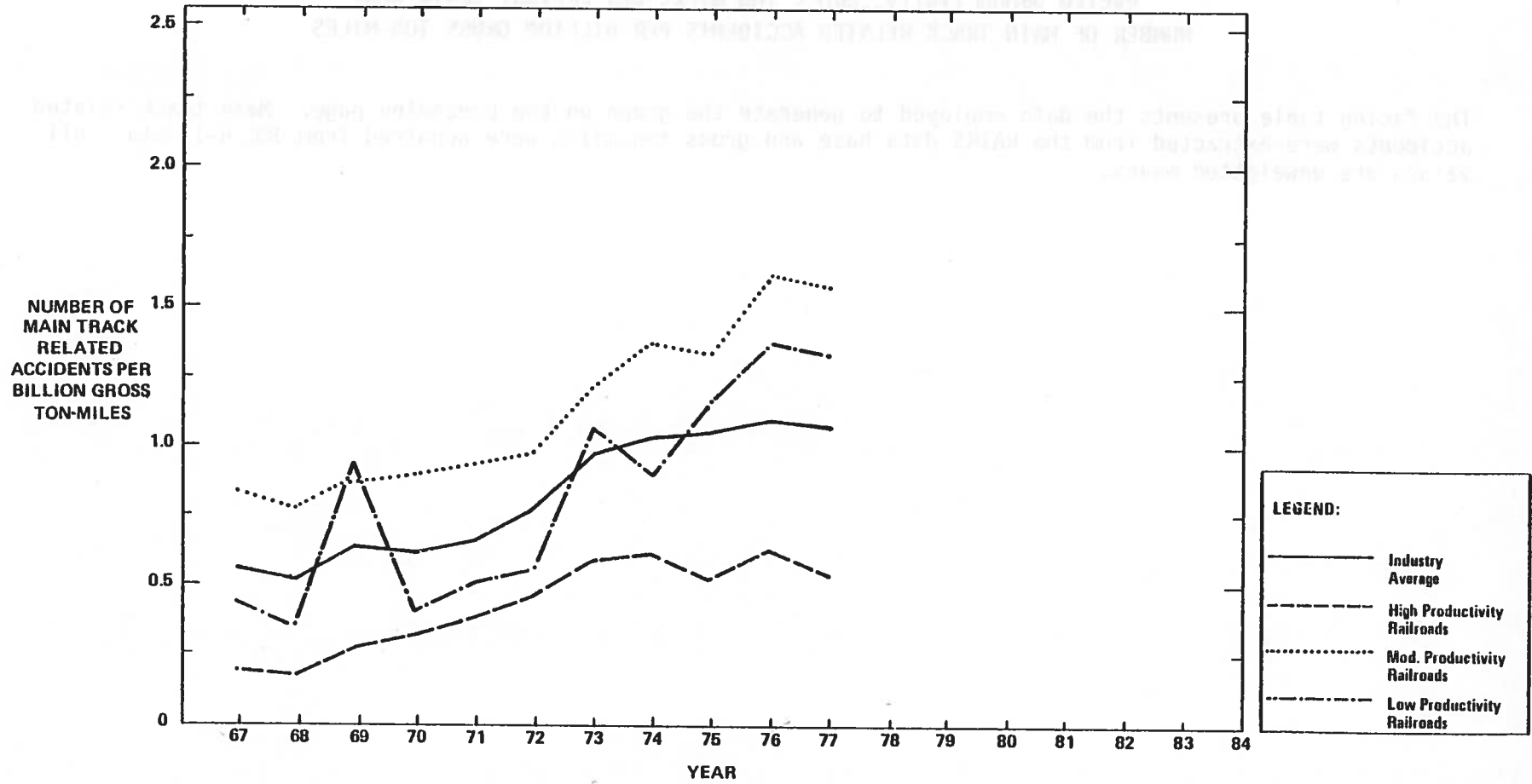
**SYSTEM PRODUCTIVITY--GROSS TON MILES PER FREIGHT TRAIN HOUR
NUMBER OF MAIN TRACK RELATED ACCIDENTS PER BILLION GROSS TON-MILES**

This index was derived by dividing the number of main track related accidents, as reported in the FRA's Railroad Accident Incident Reporting System, by billion gross ton-miles, available in the ICC's R-1 data base. The monitoring index measures the incidence of main line track related accidents.

Main line track related accidents impact system productivity in a number of ways. An increased incidence of main line track related accidents impairs the flow of traffic, removes equipment from revenue service, and/or requires an extraordinary level of effort to rectify the accident. The facing graph reveals that high productivity railroads typically have fewer main track related accidents than railroads with lower productivity levels.

This monitoring index is of approximately equal importance to transportation costs per million gross ton miles as an indicator of change in productivity. Relatively large changes in this index are necessary before any significant impacts in system productivity are experienced.

DISCRIMINANT CATEGORY: GROSS TON MILES PER FREIGHT TRAIN HOUR
INDEX : NUMBER OF MAIN TRACK RELATED ACCIDENTS PER BILLION GROSS TON-MILES



ALF3241-3

**SYSTEM PRODUCTIVITY--GROSS TON MILES PER FREIGHT TRAIN HOUR
NUMBER OF MAIN TRACK RELATED ACCIDENTS PER BILLION GROSS TON-MILES**

The facing table presents the data employed to generate the graph on the preceding page. Main track related accidents were extracted from the RAIRS data base and gross ton-miles were acquired from ICC R-1 data. All values are unweighted means.

DISCRIMINANT CATEGORY: GROSS TON MILES PER FREIGHT TRAIN HOUR

INDEX: NUMBER OF MAIN TRACK RELATED ACCIDENTS PER BILLION GROSS TON-MILES

Year	Industry Average	High Productivity Railroads	Moderate Productivity Railroads	Low Productivity Railroads
67.	0.5572	0.1981	0.8056	0.4268
68.	0.5174	0.1795	0.7737	0.2929
69.	0.6586	0.2598	0.8495	0.8960
70.	0.6430	0.3165	0.8946	0.4033
71.	0.6785	0.3308	0.9000	0.5004
72.	0.7523	0.4751	0.9577	0.5451
73.	0.9384	0.5412	1.2405	1.0840
74.	1.0301	0.5573	1.3550	0.8557
75.	1.0354	0.5024	1.3240	1.2021
76.	1.2652	0.5559	1.6517	1.4487
77.	1.2394	0.5299	1.6448	1.3565

A-14

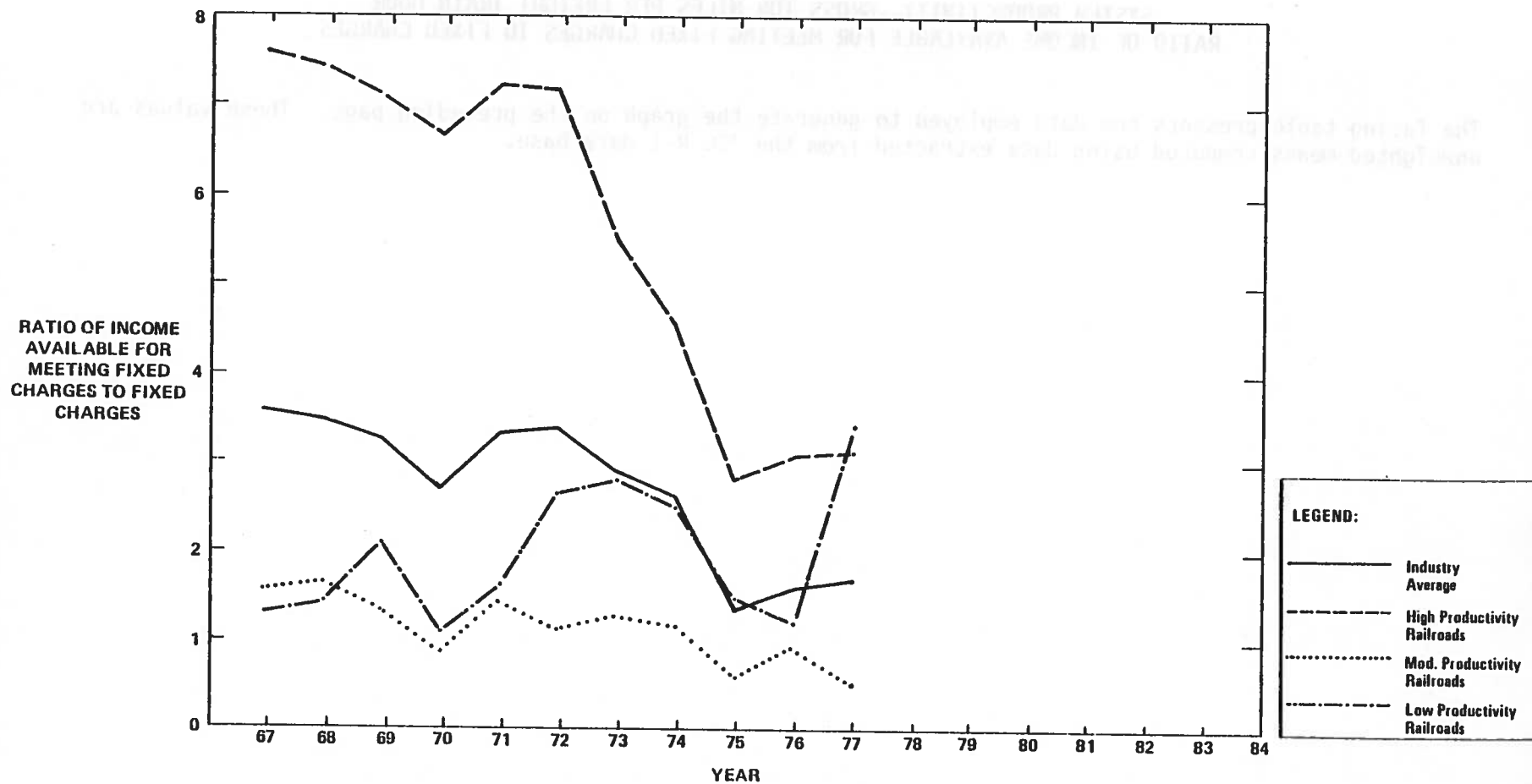
**SYSTEM PRODUCTIVITY--GROSS TON MILES PER FREIGHT TRAIN HOUR
RATIO OF INCOME AVAILABLE FOR MEETING FIXED CHARGES TO FIXED CHARGES**

Income available to meet fixed charges (as defined by the ICC Uniform System of Accounts), is divided by fixed charges to derive this monitoring index. The index measures a railroad's ability to meet its fixed obligations through operations.

Values of this index for each productivity group are plotted on the facing graph. High values on this index indicate a relatively sound and productive railroad.

This index is the weakest indicator of change in railroad productivity. In most cases, large changes in the value of this index are necessary for any significant changes in productivity to be observed.

DISCRIMINANT CATEGORY: GROSS TON MILES PER FREIGHT TRAIN HOUR
INDEX : RATIO OF INCOME AVAILABLE FOR MEETING FIXED CHARGES TO FIXED CHARGES



ALF3241-4

**SYSTEM PRODUCTIVITY--GROSS TON MILES PER FREIGHT TRAIN HOUR
RATIO OF INCOME AVAILABLE FOR MEETING FIXED CHARGES TO FIXED CHARGES**

The facing table presents the data employed to generate the graph on the preceding page. These values are unweighted means computed using data extracted from the ICC R-1 data base.

DISCRIMINANT CATEGORY: GROSS TON MILES PER FREIGHT TRAIN HOUR

INDEX: RATIO OF INCOME AVAILABLE FOR MEETING FIXED CHARGES TO FIXED CHARGES

Year	Industry Average	High Productivity Railroads	Moderate Productivity Railroads	Low Productivity Railroads
67.	3.5322	7.6348	1.5832	1.3505
68.	3.5770	7.4641	1.6743	1.4497
69.	3.3386	7.0335	1.3290	2.0797
70.	2.8496	6.7114	0.8890	1.0520
71.	3.4119	7.3148	1.4207	1.6393
72.	3.4382	7.2529	1.2520	2.7861
73.	2.9229	5.4571	1.3794	2.8991
74.	2.4936	4.5906	1.2264	2.4295
75.	1.4551	2.8379	0.6051	1.4728
76.	1.7194	3.1286	0.9895	1.1285
77.	1.7423	3.1541	0.5077	3.3881

HOLDING COMPANY STATUS

A holding company is a type of corporation which is formed when one (or more) of the owners of another firm in order to operate the business of the firm. This is done for a number of reasons. The most common is to separate the firm's operations from its ownership. This is done by having the holding company own the firm's stock and the firm's assets. The holding company is then responsible for the firm's operations and the firm's assets. This is done to protect the firm's assets from the firm's creditors and to protect the firm's assets from the firm's shareholders.

Under the laws of a number of states, a holding company is defined as a corporation which is formed for the purpose of owning and operating one or more other corporations. This is done to protect the holding company's assets from the assets of the other corporations. This is done to protect the holding company's assets from the assets of the other corporations.

The holding company is formed for the purpose of owning and operating one or more other corporations. This is done to protect the holding company's assets from the assets of the other corporations. This is done to protect the holding company's assets from the assets of the other corporations.

HOLDING COMPANY STATUS

SECTION 6.0

This section has been added to the holding company laws of a number of states. This is done to protect the holding company's assets from the assets of the other corporations. This is done to protect the holding company's assets from the assets of the other corporations.

A holding company is a type of corporation which is formed when one (or more) of the owners of another firm in order to operate the business of the firm. This is done for a number of reasons. The most common is to separate the firm's operations from its ownership. This is done by having the holding company own the firm's stock and the firm's assets. The holding company is then responsible for the firm's operations and the firm's assets. This is done to protect the firm's assets from the firm's creditors and to protect the firm's assets from the firm's shareholders.

This section has been added to the holding company laws of a number of states. This is done to protect the holding company's assets from the assets of the other corporations. This is done to protect the holding company's assets from the assets of the other corporations.

This section has been added to the holding company laws of a number of states. This is done to protect the holding company's assets from the assets of the other corporations. This is done to protect the holding company's assets from the assets of the other corporations.

HOLDING COMPANY STATUS

A holding company is a type of corporate structure which is produced when one firm buys all or a majority of the common stock of another firm in order to operate the acquired firm as a subsidiary.* Some of the benefits which have been attributed to holding companies include: the potential of controlling an acquired firm with a smaller investment than would be necessary in a merger; the functioning of each firm in a holding company as a separate legal entity with its separate obligations; and the lack of a requirement for stockholder approval before forming a holding company, as opposed to a merger.

Operation of a railroad as one entity of a holding company has received attention from government regulatory bodies. Concern has been focused particularly on the impact of key railroad resource allocation decisions under a holding company framework.

Railway Age magazine (February 28, 1977 p.12) identified groups of holding companies and rail subsidiaries. This list was employed to group the thirty-three Class I railroads in this effort according to their holding company status. This grouping is presented on the facing page.

Four indices have been analytically derived which can be monitored to detect changes in a railroad's corporate structure (holding vs. nonholding) including:

- o Miles of continuously welded rail to total track miles
- o Maintenance-of-equipment costs in 1967 dollars per unit of rolling stock
- o Ratio of earned surplus to total assets
- o Ratio of railway related taxes paid to net railway operating revenue

This evaluation spanned the time period 1974 to 1977 due to data requirements.

*Weston, J.F. and E.F. Brigham, Managerial Finance, Dryden Press, 1975 p.770.
+Deflation values can be found in the Appendix

HOLDING COMPANY STATUS

Roads Controlled by Holding Companies

Boston & Maine
Kansas City Southern
Missouri-Kansas-Texas
Missouri Pacific
Atchison, Topeka and Santa Fe
Detroit, Toledo & Ironton
Denver & Rio Grande Western
Delaware and Hudson
Seaboard Coastal Line
Louisville and Nashville
Clinchfield
Southern Pacific
St. Louis Southwestern
Union Pacific
Colorado & Southern
Fort Worth & Denver
Chicago, Milwaukee, St. Paul & Pacific
Western Pacific
Illinois Central Gulf
Baltimore and Ohio
Chesapeake and Ohio
Western Maryland

Roads Not Controlled by Holding Companies

Rock Island
Chicago & North Western
Pittsburgh & Lake Erie
Soo Line
Conrail
St. Louis-San Francisco
Grand Trunk Western
Southern System
Burlington Northern
Florida East Coast
Norfolk & Western

HOLDING COMPANY STATUS

Four indices have been analytically derived to assist analysts in discriminating between railroads with characteristics indicative of a railroad controlled by a holding company versus other types of railroad corporate structures. It should be noted that of the five indicator groups included in this handbook, this group has the weakest statistical basis. More extensive study into this subject area is recommended, prior to initiation of a monitoring program. Evaluating changes in the variables listed below in conjunction with the coefficient for each index will facilitate the identification of a railroad's "movement" toward one operating framework versus another:

Miles of continuously welded rail per total track mile	-6.573533
Maintenance-of-equipment costs in 1967 dollars per unit or rolling stock	2.684196
Ratio of earned surplus to total assets	1.735505
Ratio of railway related taxes paid to net railway operating revenue	- .926357
Constant	- .812549

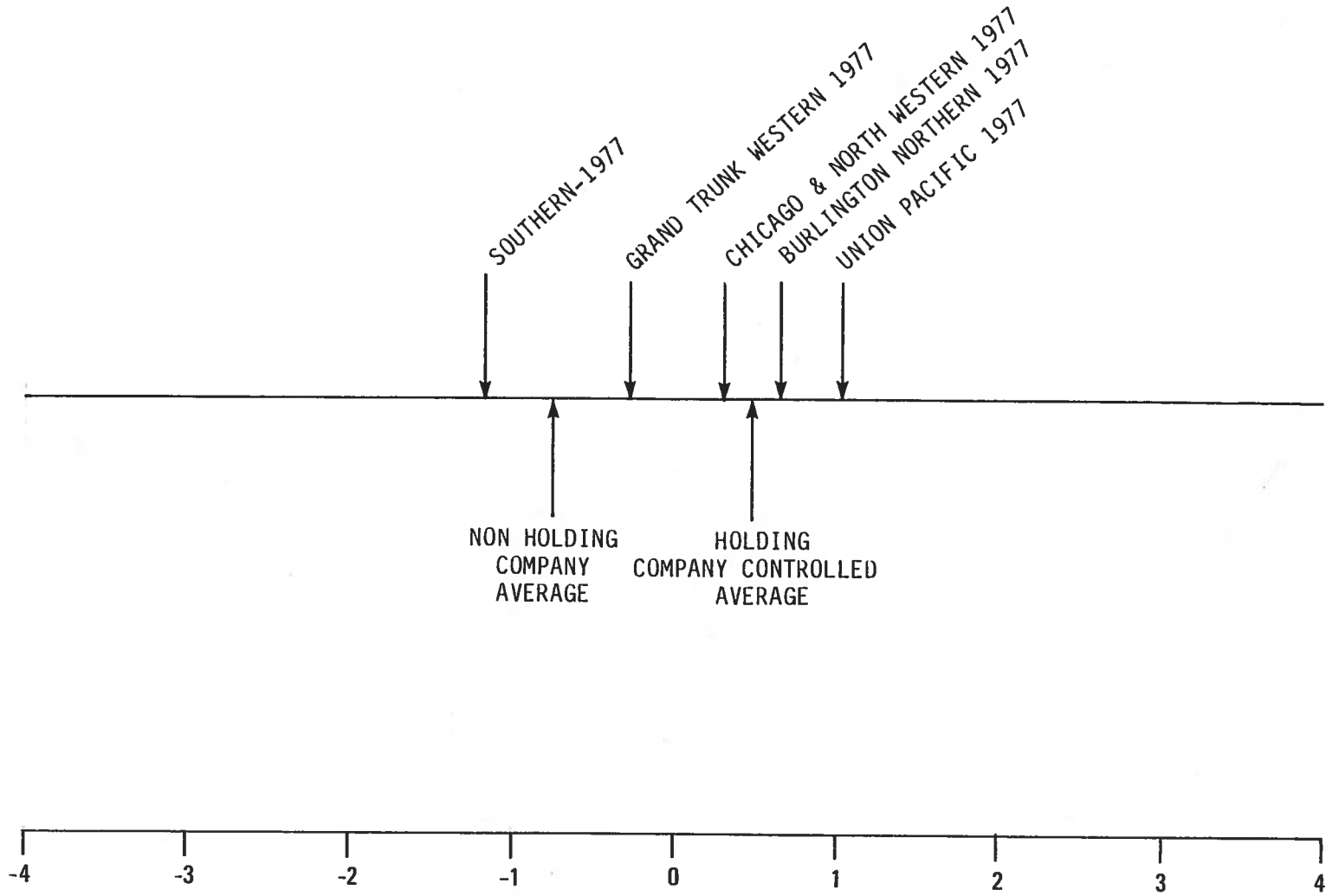
EXAMPLE

Summing the products of each index with its coefficient and adding the constant will result in a score which can be evaluated along the continuum on the facing page. The average scores of nonholding company railroads and holding company railroads are provided as reference points for interpreting the meaning of each score.

The scores for the Southern and Union Pacific railroads in 1977 are plotted on the facing graph. The U.P. has been operated under a holding company organization since 1969. Its position to the right of the holding company average indicates that it is firmly established as a holding company railroad on the basis of the key discriminating variables presented above. Conversely, the Southern located to the left of the nonholding company average has values on the key monitoring indices indicative of railroads operating as single corporate entities.

Several nonholding company railroads exhibited characteristics or movements in their composite scores which would have led an analyst to track their corporate policy. These roads included the Burlington Northern, Chicago & North Western, and the Grand Trunk Western. Railway Age of February 23, 1981 discussed Burlington Northern's plans for setting up a holding company.

HOLDING COMPANY STATUS



HOLDING COMPANY STATUS

The following worksheet can be used to derive a score for evaluation along the continuum on page 6-5.

Miles of continuously welded rail	[] ÷	=	[]	x	-6.573533	=	[]	
Total track miles	[] ÷	=	[]	x	2.684196	=	[]	+
MOE costs*	[] ÷	=	[]	x	1.735505	=	[]	+
Units of rolling stock	[] ÷	=	[]	x	-0.926357	=	[]	+
Earned surplus	[] ÷	=	[]	x	-6.573533	=	[]	+
Total assets	[] ÷	=	[]	x	2.684196	=	[]	+
Railway related taxes paid	[] ÷	=	[]	x	1.735505	=	[]	+
Net railway operating revenue	[] ÷	=	[]	x	-0.926357	=	[]	+
							-0.812549	
				RAILROAD SCORE			[]	

*Value should be deflated using deflation values in Appendix.

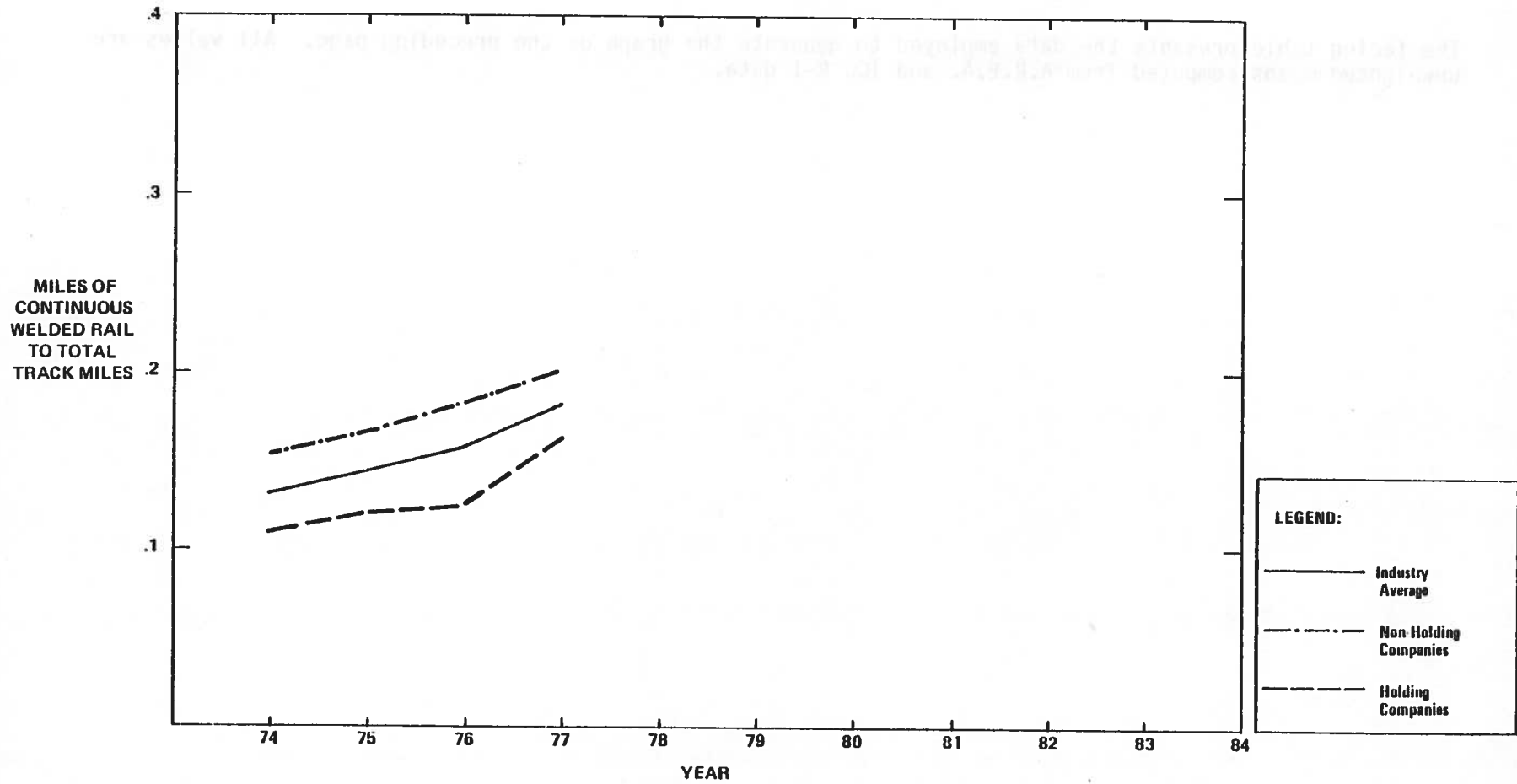
**HOLDING COMPANY STATUS
MILES OF CONTINUOUSLY WELDED RAIL TO TOTAL TRACK MILES**

This index is a measure of the quality of a railroad's track system. It is computed by dividing the total number of track miles of continuously welded rail as compiled by the A.R.E.A. by the total track miles of a railroad's system which is available from ICC R-1 reports.

Higher ratios of continuously welded rail to total track miles are usually an indicator of the level of investment being made by a railroad in its track system. Continuously welded rail is more expensive to install than jointed rail; however, it generally results in a superior track structure. Moreover, since most rail until fairly recently was bolted, this index identifies the level of reinvestment made by a railroad in its track system.

The analysis of this index relative to the holding company status of a railroad indicates that as the values of this index increase a railroad is more likely to be operated as a single entity versus as a subsidiary of a holding company. Therefore, in most situations, nonholding company railroads typically have more miles of CWR per total track miles than holding company railroads.

DISCRIMINANT CATEGORY: HOLDING COMPANY STATUS
INDEX: MILES OF CONTINUOUSLY WELDED RAIL TO TOTAL TRACK MILES



ALF3241-19

HOLDING COMPANY STATUS
MILES OF CONTINUOUSLY WELDED RAIL TO TOTAL TRACK MILES

The facing table presents the data employed to generate the graph on the preceding page. All values are unweighted means computed from A.R.E.A. and ICC R-1 data.

DISCRIMINANT CATEGORY: HOLDING COMPANY STATUS

INDEX: MILES OF CONTINUOUSLY WELDED RAIL TO TOTAL TRACK MILES

Year	Industry Average	Non-Holding Companies	Holding Companies
74.	0.1295	0.1563	0.1140
75.	0.1402	0.1715	0.1221
76.	0.1530	0.1877	0.1330
77.	0.1760	0.2208	0.1502

**HOLDING COMPANY STATUS
MOE COSTS IN 1967 DOLLARS PER UNIT OF ROLLING STOCK**

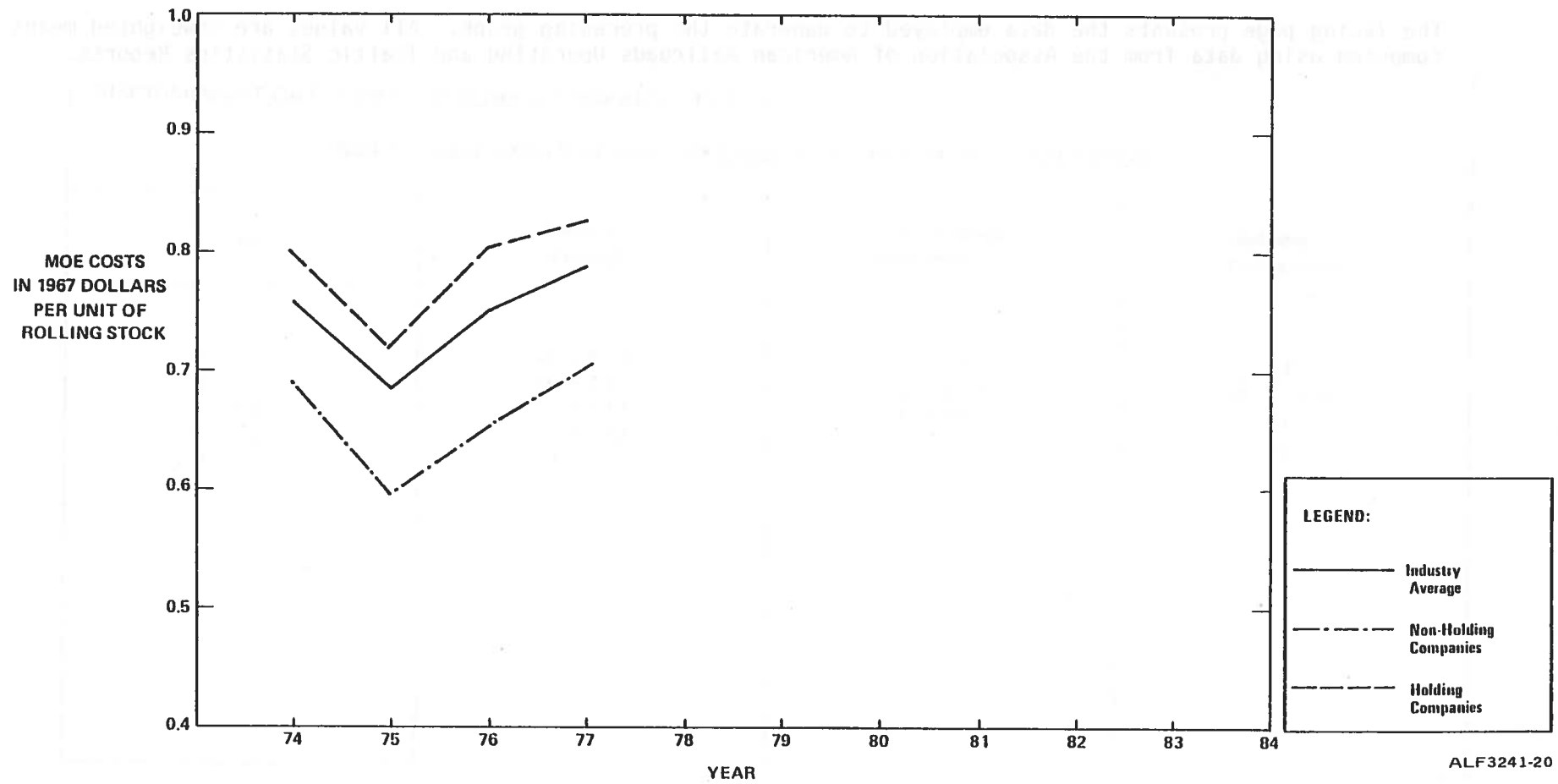
This monitoring index measures the level of equipment maintenance expenditures per unit of railroad rolling stock. Lower values on this index could be indicative of efficient maintenance operations and/or be reflective of a relatively new inventory of rolling stock.

The index is computed by dividing maintenance of equipment costs (in 1967 dollars*) by the number of units of active rolling stock which includes active locomotives and serviceable freight cars. The data to support development of this index can be found in A.A.R. Operating and Traffic Statistics Reports.

The index is a relatively important discriminator between holding company controlled and nonholding company controlled roads. Holding companies typically expend more dollars per unit of rolling stock for maintenance than nonholding company roads. Moreover, relatively small changes in the value of this index are likely to have detectable and measureable changes on a railroad's overall characteristics with respect to holding company status.

*Refer to appendix for deflation values.

DISCRIMINANT CATEGORY: HOLDING COMPANY STATUS
INDEX: MOE COSTS IN 1967 DOLLARS PER UNIT OF ROLLING STOCK



**HOLDING COMPANY STATUS
RATIO OF EARNED SURPLUS TO TOTAL ASSETS**

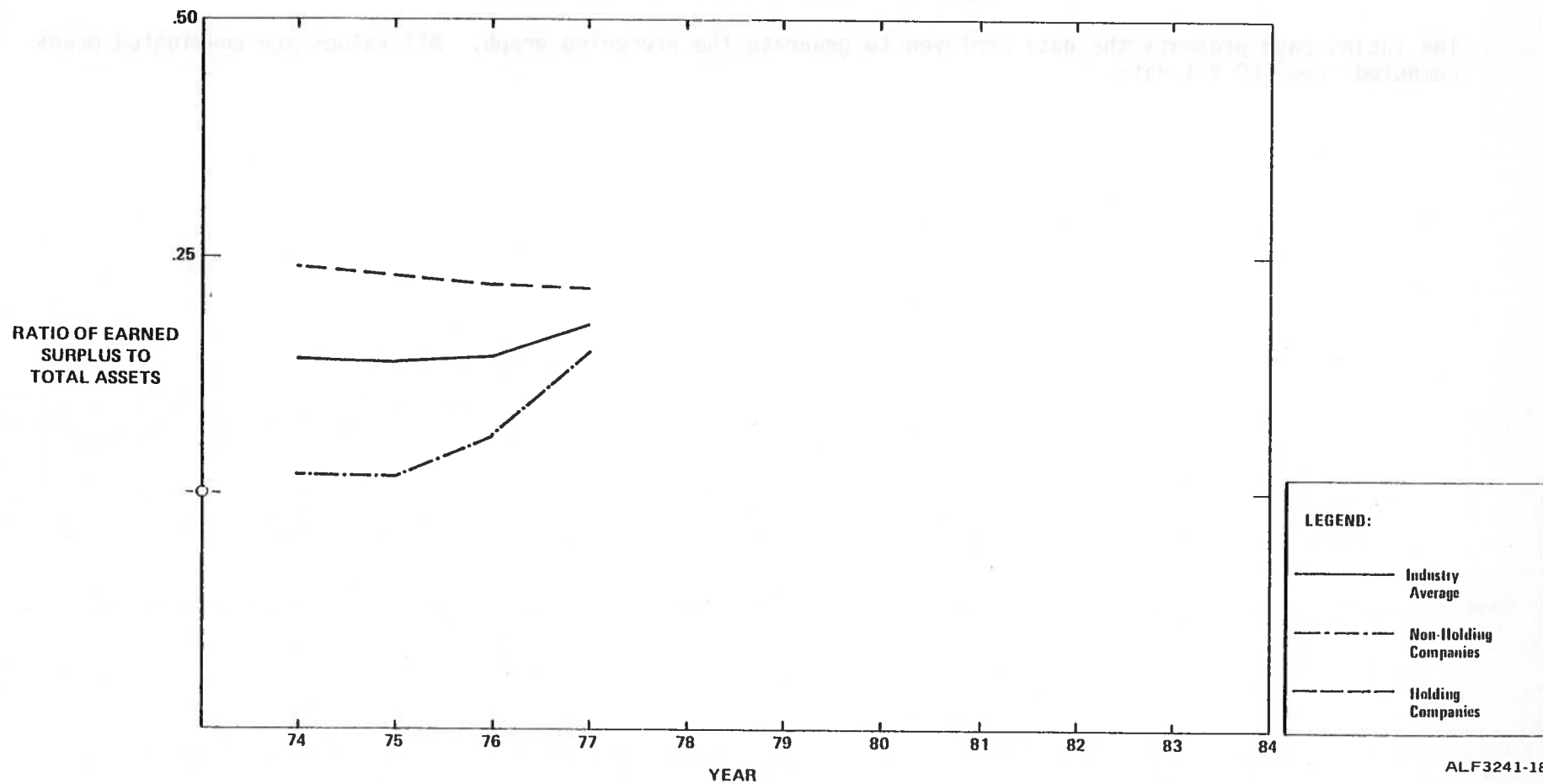
The level of total earned surplus from railroad operations is divided by total assets to arrive at this monitoring index. Both data elements are available in ICC R-1 reports.

This index is a measure of solvency which denotes the cumulative profitability of a railroad based solely on past performance. Note that when a railroad has gone through some type of reorganization, the earned surplus account may not reflect the true cumulative earning power of the road.

High values on this index are indicative of a railroad operation which has met basic expenses and still retained a surplus of funds which could be reinvested or used for other purposes. Railroads capable of generating an earned surplus are typically more financially stable.

The facing graph portrays the values of this index for holding company controlled roads and other railroads. As the value of the index increases, a railroad is more likely to assume holding company characteristics. This behavior supports previously stated hypotheses concerning the economic attributes of holding company railroads. Specifically, it has been postulated that holding company railroads seek to minimize operating expenditures in order to generate a pool of funds which can be transferred to the parent company. However, caution must be used in determining the cause of differences in earned surplus.

DISCRIMINANT CATEGORY: HOLDING COMPANY STATUS
INDEX: RATIO OF EARNED SURPLUS TO TOTAL ASSETS



**HOLDING COMPANY STATUS
RATIO OF EARNED SURPLUS TO TOTAL ASSETS**

The facing page presents the data employed to generate the preceding graph. All values are unweighted means computed from ICC R-1 data.

DISCRIMINANT CATEGORY: HOLDING COMPANY STATUS

INDEX: RATIO OF EARNED SURPLUS TO TOTAL ASSETS

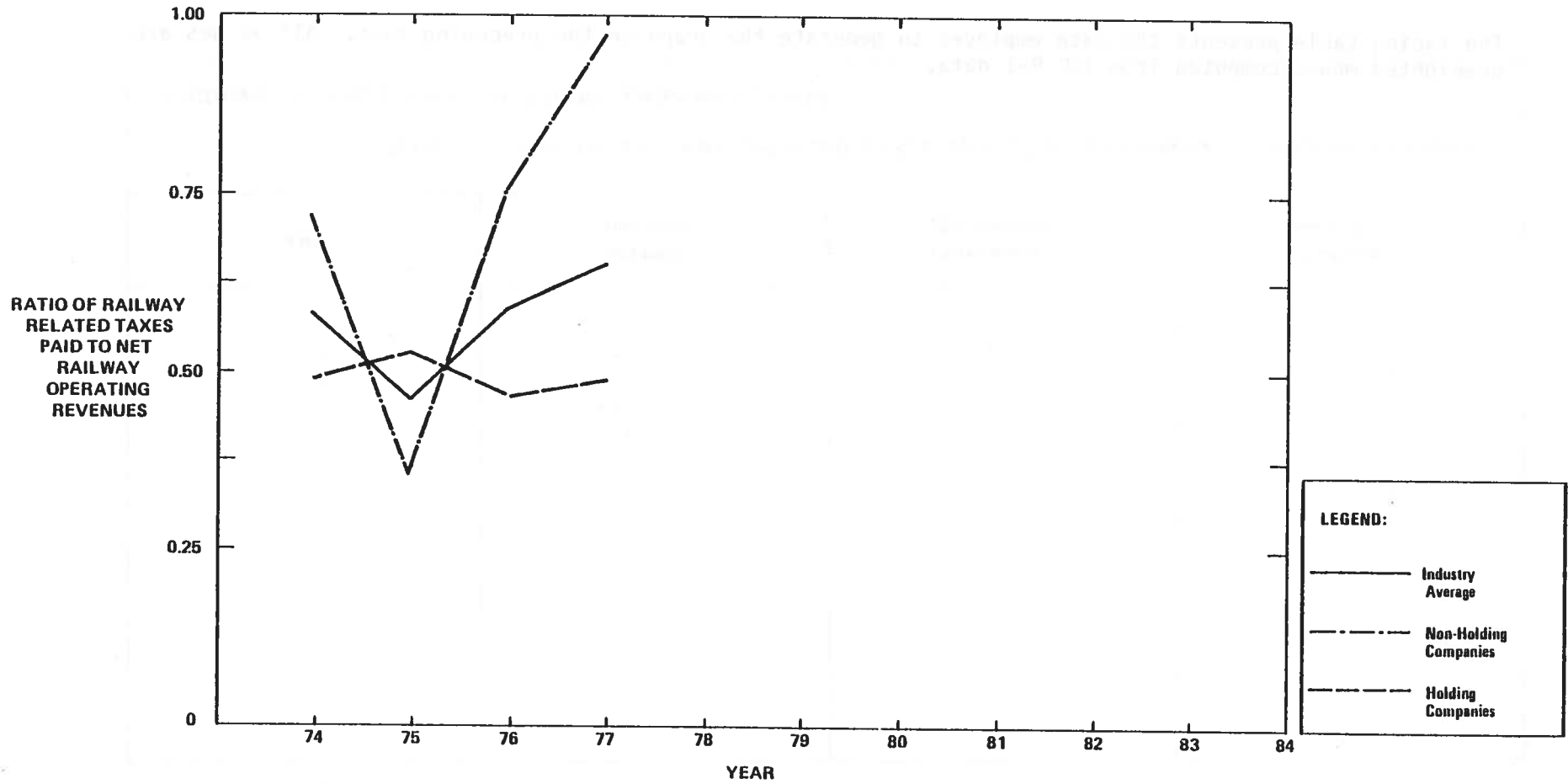
Year	Industry Average	Non-Holding Companies	Holding Companies
74.	0.1522	0.0220	0.2173
75.	0.1436	0.0205	0.2052
76.	0.1529	0.0596	0.1996
77.	0.1798	0.1563	0.1915

**HOLDING COMPANY STATUS
RATIO OF RAILWAY RELATED TAXES PAID TO NET RAILWAY OPERATING REVENUE**

This index is a measure of the relative burden of taxes on a railroad. It is computed by dividing total railway taxes paid by net railway operating revenue. Both data elements are available in ICC R-1 reports.

The facing graph portrays the behavior of this index for holding company controlled roads and roads operating under other corporate structures. Generally speaking, non-holding company controlled roads have carried a higher burden of taxes relative to their net revenue, which may indicate a large real estate tax burden for this group. Note that this index contributes the least to changes in a railroad's composite score along the continuum previously presented.

DISCRIMINANT CATEGORY: HOLDING COMPANY STATUS
INDEX: RATIO OF RAILWAY RELATED TAXES PAID TO NET RAILWAY OPERATING REVENUE



ALF3241-21

APPENDIX

DEFLATION FACTORS

DEFLATION FACTORS*

Divide the value of the variable for the year under investigation by the appropriate deflation factor:

1967	1.0
1968	1.057
1969	1.123
1970	1.233
1971	1.337
1972	1.456
1973	1.635
1974	1.868
1975	2.126
1976	2.354
1977	2.554
1978	2.774
1979	3.152

*Source: Yearbook of Railroad Facts 1980 Edition, Association of American Railroads Washington, D.C.

BIBLIOGRAPHY/REFERENCES

BIBLIOGRAPHY/REFERENCES

1. Altman, Edward I., "Predicting Railroad Bankruptcies in America", Bell Journal of Economics, Vol. 4, No. 1, Spring, 1973.
2. Altman, Edward I., "Financial Ratios, Discriminant Analysis and the Prediction of Corporate Bankruptcy", The Journal of Finance, September 1968, pg. 590-609.
3. Avery, Robert B., and R. A. Eisenbeis, Discriminant Analysis and Classification Procedures, Lexington Books.
4. Cochran, William G., "On the Performance of the Linear Discriminant Function", Technometrics, May 1964.
5. Cooley, W. W. and P. R. Lohnes., Multivariate Data Analysis, John Wiley & Sons, Inc., 1971.
6. Dam Bolena, Ismael G., and Sarkis J. Khoury, "Ratio Stability and Corporate Failure", The Journal of Finance, September 1980, pgs. 1017-1025.
7. Dillon, William R., "The Performance of the Linear Discriminant Function in Nonoptimal Situations and the Estimation of Classification Error Rates: A Review of Recent Findings", Journal of Marketing Research, August 1979, pgs. 370-382.
8. Dynatrend Inc., "Draft Report - Proposed Indices", Contract DTRS-57-80-C-00085 Technical Task Directive No. 2.
9. Dynatrend Inc., "Case Studies", Contract DTRS-57-80-C-00085 Technical Task Directive No. 2.
10. Dynatrend Inc., "Proposed Discriminant Groupings", Contract DTRS-57-80-C-00085 Technical Task Directive No. 4.
11. Edmister, Robert O., "An Empirical Test of Financial Ratio Analysis for Small Business Failure Prediction", Journal of Financial and Quantitative Analysis, March 1972.
12. Eisenbeis, Robert A., "Pitfalls in the Application of Discriminant Analysis in Business, Finance, and Economics", The Journal of Finance, June 1977, pgs. 875-957.

13. Frank, Ronald E., Massy, William F., Morrison Donald G., "Bias in Multiple Discriminant Analysis", Journal of Marketing Research, August 1965, pgs. 250-258.
14. Johnson, Rodney D., "The Performance of Bank Holding Company Acquisitions: A Multivariate Analysis", The Journal of Business, pgs. 204-213.
15. Klecka, William R., "Quantitative Applications in the Social Sciences", Discriminant Analysis, Sage University.
16. Klett, C. James and John E. Overall, Applied Multivariate Analysis, New York: McGraw-Hill Company, 1972.
17. Lachenbruch, Peter A., "An Almost Unbiased Method of Obtaining Confidence Intervals for the Probability of Misclassification in Discriminant Analysis", Biometrics, December, 1967, pgs. 639-645.
18. Morrison, Donald G., "On the Interpretation of Discriminant Analysis", Journal of Marketing Research, May 1979, pgs. 156-63.
19. Morrison, Donald G., "Discriminant Analysis", Handbook of Marketing Research, 1974.
20. Nie, Norman H., Hull, C. H. et. al., SPSS (Statistical Package for the Social Sciences) Second Edition, McGraw-Hill, Inc., 1975.
21. Nie, Norman H. & C. H. Hull, SPSS Update, McGraw-Hill Book Company, 1979.
22. Norton, Curtis L. and Ralph E. Smith, "A Comparison of General Price Level & Historical Cost Financial Statements in the Prediction of Bankruptcy", The Accounting Review, January 1979.
23. Norusis, M. J., SPSS Statistical Algorithms - Release 8.0, SPSS Inc., 1979.

RAILROAD DATA

INDEX: AVERAGE FREIGHT TRAIN SPEED

RR	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
ATSF	27.597	28.617	28.314	28.571	28.252	29.371	27.842	29.705	29.483	30.534	29.688
BM	15.584	14.882	14.141	13.719	13.668	13.601	13.993	14.190	14.499	14.116	14.267
BN	22.193	22.350	21.863	22.050	22.229	22.972	22.415	22.500	20.962	22.794	22.689
BO	18.099	18.818	18.177	18.137	18.635	19.476	17.002	15.324	15.999	15.190	15.742
CNW2	16.276	16.733	15.770	15.417	15.726	15.917	16.100	17.023	17.420	17.548	17.307
CO	17.214	18.048	17.365	16.602	17.429	17.948	15.930	16.351	16.073	15.566	14.593
CONR	17.510	17.178	17.412	18.849	20.856	15.940	17.396	16.900	16.658	15.245	15.029
CHR	18.543	19.132	19.227	17.738	17.721	17.901	18.446	17.681	18.590	18.127	15.969
CS	16.235	17.218	17.365	17.991	18.033	21.553	20.359	23.907	22.110	20.720	19.062
DH	20.544	19.877	17.271	16.329	17.843	19.378	19.550	18.143	16.643	17.594	16.044
DRGJ	26.061	26.585	26.369	25.987	26.625	26.947	25.253	25.977	26.197	26.081	26.199
DTIR	12.513	10.428	9.949	9.695	10.056	10.179	10.583	11.075	10.776	11.723	10.878
FEC	25.870	19.641	18.099	18.811	19.216	19.817	20.028	21.791	21.949	24.034	21.688
FWD	25.544	25.261	25.770	20.297	20.500	20.678	18.070	19.742	19.179	18.575	18.283
GTW	22.539	21.530	22.017	21.800	20.577	20.356	20.559	21.922	21.973	21.677	21.362
ICG	18.324	18.116	17.114	15.399	14.453	12.070	17.220	17.480	17.560	17.294	17.391
KCS	19.561	19.092	18.432	18.090	17.334	17.633	15.999	16.888	18.499	19.137	18.881
LM	16.705	16.358	16.117	15.675	15.932	16.152	15.894	15.871	16.165	15.853	15.966
MILW	21.912	22.608	21.420	21.286	21.551	21.875	22.051	21.432	21.297	21.872	20.766
MKT	18.978	19.071	19.915	19.227	19.416	18.824	17.755	17.949	16.549	16.760	16.974
MP	21.336	21.548	21.699	20.821	21.865	22.423	21.740	22.277	22.174	22.420	21.397
NW	18.289	18.499	18.333	18.028	19.216	19.345	19.280	18.546	18.419	18.574	17.614
PLE	13.712	13.595	12.627	13.470	13.480	14.887	15.563	14.742	15.800	14.824	14.805
RT	22.590	22.177	20.500	20.636	19.856	20.002	19.710	18.926	18.877	18.176	17.567
SCL	18.528	18.369	17.755	18.441	18.729	18.559	18.015	18.854	18.862	18.906	18.841
SLSF	24.013	24.297	24.414	22.946	21.326	21.556	20.113	21.075	21.821	22.056	21.408
SLSJ	25.187	24.180	24.017	22.541	21.927	22.459	22.634	23.909	23.067	23.297	23.750
SOU	20.549	21.750	19.003	20.338	20.880	20.201	20.546	20.622	20.574	21.417	20.799
SOU	17.203	17.421	17.933	19.580	20.627	20.270	20.140	20.452	17.672	19.732	19.387
SPT	26.240	25.416	24.940	24.427	23.222	23.723	22.879	22.718	22.771	23.175	22.457
JP	31.030	31.654	30.705	30.750	30.805	32.184	31.891	32.013	33.222	33.314	33.192
WM	13.308	13.623	13.915	13.736	12.950	13.921	13.669	12.748	9.809	10.097	10.525
WP	29.354	29.564	28.387	29.509	29.911	29.291	29.459	29.558	29.629	30.536	31.229

**** - DENOTES A MISSING VALUE

INDEX: MILFS OF TRACK MAINTAINED PER MOW LABOR HOUR

RR	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
ATSF	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001	0.002	0.002	0.001
BN	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.001
BN	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
BO	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
CNW2	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
CU	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
CONR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
CFR	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
CS	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
DH	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
DRGW	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
JTR	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
FEC	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
FWD	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
GTW	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
ICG	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
KCS	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
LN	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003	0.003
MILW	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
YKT	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
MP	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
NW	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
PLE	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
RI	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SCL	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SLSF	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SLSW	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002	0.002
SOU	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SOU	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004	0.004
SFT	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
JF	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
WM	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001
WF	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001	0.001

**** - DENOTES A MISSING VALUE

INDEX: RATIO OF TRANSPORTATION COST TO RAILWAY OPERATING REVENUE

RR	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
ATSF	0.388	0.385	0.380	0.373	0.355	0.353	0.391	0.403	0.398	0.390	0.384
BH	0.461	0.454	0.451	0.483	0.453	0.481	0.465	0.455	0.487	0.446	0.436
BN	0.410	0.400	0.412	0.419	0.406	0.407	0.415	0.407	0.400	0.390	0.385
BO	0.399	0.391	0.383	0.394	0.376	0.374	0.378	0.365	0.378	0.371	0.354
CNW2	0.438	0.426	0.448	0.424	0.419	0.423	0.424	0.441	0.459	0.427	0.420
CO	0.396	0.403	0.399	0.395	0.379	0.380	0.390	0.373	0.389	0.378	0.422
CUNR	0.472	0.476	0.479	0.503	0.469	0.471	0.471	0.463	0.496	0.490	0.474
CRR	0.274	0.277	0.263	0.272	0.280	0.279	0.294	0.293	0.293	0.283	0.297
CS	0.395	0.320	0.329	0.337	0.344	0.366	0.401	0.398	0.399	0.342	0.364
DH	0.362	0.377	0.369	0.398	0.386	0.381	0.377	0.379	0.406	0.419	0.435
DRGW	0.339	0.327	0.329	0.325	0.305	0.318	0.338	0.352	0.345	0.342	0.347
DTIR	0.353	0.356	0.354	0.381	0.359	0.369	0.396	0.379	0.389	0.397	0.374
FEC	0.327	0.240	0.237	0.259	0.218	0.238	0.218	0.249	0.272	0.271	0.267
FWD	0.416	0.423	0.456	0.477	0.452	0.456	0.455	0.508	0.397	0.420	0.378
STW	0.478	0.492	0.538	0.595	0.507	0.495	0.470	0.471	0.463	0.419	0.419
ICG	0.376	0.378	0.377	0.377	0.365	0.375	0.381	0.405	0.424	0.397	0.401
ICS	0.349	0.340	0.331	0.332	0.338	0.336	0.391	0.367	0.361	0.334	0.328
LN	0.385	0.374	0.373	0.368	0.360	0.378	0.381	0.384	0.402	0.391	0.397
MILW	0.417	0.419	0.432	0.437	0.401	0.412	0.415	0.424	0.450	0.438	0.449
MKT	0.398	0.381	0.386	0.385	0.362	0.390	0.400	0.422	0.411	0.389	0.386
MP	0.362	0.353	0.355	0.362	0.358	0.366	0.390	0.386	0.387	0.370	0.358
NW	0.371	0.355	0.359	0.367	0.359	0.343	0.359	0.358	0.348	0.327	0.340
PLE	0.373	0.390	0.372	0.401	0.383	0.402	0.395	0.358	0.407	0.380	0.377
RI	0.448	0.429	0.438	0.436	0.404	0.411	0.446	0.461	0.453	0.435	0.438
SCL	0.387	0.397	0.377	0.369	0.349	0.358	0.384	0.389	0.394	0.380	0.377
SLSF	0.369	0.371	0.383	0.401	0.369	0.377	0.402	0.393	0.404	0.396	0.388
SLSW	0.331	0.338	0.328	0.352	0.325	0.356	0.367	0.361	0.380	0.367	0.379
SNO	0.404	0.384	0.388	0.376	0.353	0.359	0.341	0.345	0.353	0.336	0.326
SCU	0.334	0.323	0.319	0.312	0.294	0.297	0.311	0.314	0.331	0.318	0.318
SFT	0.403	0.399	0.400	0.401	0.373	0.378	0.395	0.398	0.408	0.399	0.389
JP	0.364	0.370	0.367	0.360	0.339	0.344	0.353	0.354	0.361	0.347	0.345
JM	0.361	0.356	0.362	0.371	0.375	0.392	0.390	0.345	0.360	0.341	0.342
WF	0.378	0.370	0.414	0.431	0.394	0.388	0.403	0.423	0.436	0.441	0.428

**** - DENOTES A MISSING VALUE

INDEX: RATIO OF SWITCHING LOCOMOTIVE MILES TO THOUSANDS OF TOTAL FREIGHT CAR MILES

RR	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
ATSF	6.963	7.094	7.121	7.042	6.638	6.858	5.720	6.364	6.252	6.207	6.052
BN	12.559	13.329	14.281	15.694	15.021	14.256	13.431	13.172	13.598	12.950	12.878
BN	8.000	7.431	7.261	7.431	7.332	7.269	5.910	5.965	5.752	5.592	5.630
BO	10.501	10.039	10.372	10.197	10.235	9.853	9.703	10.481	40.406	12.209	11.900
CHW2	11.541	11.891	12.287	11.533	11.493	11.395	10.446	10.593	10.904	9.155	9.003
CO	10.147	10.025	10.513	9.960	11.451	12.138	11.925	11.894	12.128	11.383	9.312
CONR	13.254	13.996	14.260	14.115	13.399	13.087	13.251	13.449	12.524	12.281	13.116
CRR	5.537	5.389	5.189	5.259	5.640	6.129	5.903	6.100	6.095	6.337	6.207
CS	12.978	12.736	12.730	11.204	8.596	7.698	7.022	8.679	9.314	9.294	3.894
DH	7.908	8.073	9.045	9.815	9.867	9.621	9.085	7.762	7.554	5.494	4.933
DPGW	8.378	6.997	6.923	6.916	6.352	6.573	6.510	6.302	6.044	6.011	5.955
DTIR	18.948	16.137	15.531	16.105	15.765	15.648	17.212	15.725	14.128	13.727	12.343
FIC	14.329	9.776	9.474	10.175	9.264	8.935	9.755	9.260	8.389	7.711	7.266
FWD	7.735	7.571	8.048	7.660	4.559	4.616	5.739	6.720	7.493	7.485	4.733
GTW	19.110	19.083	19.729	19.537	18.814	17.292	16.536	16.088	15.559	16.530	17.314
ICG	10.701	10.905	10.499	9.989	9.176	8.332	8.500	8.877	9.225	9.246	9.368
ICS	12.323	12.877	12.932	10.539	12.148	11.528	10.651	11.936	11.444	10.905	9.699
LV	11.443	11.455	10.829	10.190	10.021	10.755	13.072	14.253	13.814	13.316	13.585
MILW	11.214	10.447	10.343	10.187	10.225	10.050	9.605	10.250	9.858	8.588	8.111
MKT	11.414	11.083	11.349	10.231	10.291	10.711	10.537	11.502	11.792	12.311	12.118
MP	9.080	9.156	9.187	9.480	9.461	9.295	8.593	8.656	8.670	8.611	8.507
NW	10.154	10.294	10.404	10.614	10.602	10.290	9.994	9.405	8.849	9.132	9.750
PLC	56.518	51.343	63.105	61.746	62.200	51.689	53.391	51.018	54.905	50.715	44.846
RI	8.262	7.736	7.511	7.576	7.569	7.410	7.369	7.517	7.571	7.559	7.734
SCL	9.417	9.744	9.817	9.228	8.784	8.982	9.521	9.469	9.113	8.671	8.681
SLSF	9.527	9.744	9.543	9.728	8.942	8.586	8.874	8.866	8.200	7.925	8.059
SLSW	5.106	4.985	4.814	4.751	4.378	4.493	4.273	4.316	4.178	4.111	3.569
SOO	11.497	11.517	9.611	9.611	9.290	9.412	9.109	8.265	9.319	9.202	8.897
SOU	9.056	9.149	8.027	7.957	7.915	7.517	7.442	7.149	7.243	7.652	8.102
SPT	7.377	7.117	7.206	7.066	6.894	6.745	5.875	6.838	6.497	6.464	6.776
UP	4.886	4.834	4.833	4.770	4.578	4.523	4.495	4.258	3.325	3.754	3.540
WM	10.968	11.195	10.989	11.189	12.320	11.496	11.430	9.829	10.052	10.620	10.625
WP	5.488	5.191	5.039	4.807	4.363	2.978	4.156	4.874	4.638	5.002	3.943

**** - DENOTES A MISSING VALUE

INDEX: RATIO OF RAILWAY OPERATING EXPENSES TO OPERATING REVENUES

RR	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
ATSF	0.821	0.826	0.801	0.800	0.778	0.778	0.791	0.806	0.815	0.820	0.820
BM	0.921	0.833	0.844	0.889	0.848	0.896	0.867	0.837	0.921	0.861	0.873
BN	0.926	0.817	0.830	0.843	0.828	0.827	0.826	0.795	0.807	0.814	0.832
BO	0.759	0.755	0.745	0.769	0.757	0.732	0.724	0.686	0.754	0.743	0.719
CND2	0.372	0.854	0.890	0.813	0.805	0.795	0.781	0.814	0.938	0.798	0.815
CO	0.742	0.794	0.809	0.788	0.807	0.762	0.770	0.731	0.771	0.759	0.846
CONR	0.936	0.845	0.849	0.904	0.869	0.851	0.834	0.817	0.888	0.946	0.574
CRR	0.595	0.613	0.562	0.571	0.635	0.617	0.633	0.617	0.652	0.628	0.635
CS	0.311	0.693	0.675	0.680	0.662	0.680	0.753	0.816	0.825	0.802	0.799
DH	0.308	0.817	0.754	0.820	0.830	0.796	0.800	0.789	0.911	0.859	0.902
DRGW	0.707	0.699	0.677	0.674	0.665	0.688	0.734	0.736	0.744	0.746	0.756
DTIR	0.750	0.717	0.731	0.774	0.743	0.739	0.803	0.754	0.776	0.798	0.755
FEC	0.811	0.824	0.737	0.814	0.734	0.590	0.580	0.644	0.690	0.789	0.742
FWD	0.943	0.815	0.850	0.838	0.782	0.831	0.745	0.857	0.729	0.758	0.720
GTW	0.332	0.825	0.895	1.051	0.903	0.892	0.822	0.802	0.810	0.798	0.773
ICG	0.766	0.783	0.781	0.783	0.776	0.790	0.752	0.777	0.818	0.797	0.822
KCS	0.697	0.693	0.685	0.707	0.699	0.731	0.773	0.756	0.784	0.767	0.761
LN	0.308	0.732	0.809	0.789	0.796	0.785	0.761	0.744	0.786	0.768	0.781
MILW	0.796	0.817	0.857	0.855	0.822	0.848	0.803	0.795	0.836	0.804	0.870
MKT	0.341	0.750	0.769	0.758	0.729	0.752	0.745	0.769	0.774	0.788	0.769
MP	0.753	0.767	0.755	0.751	0.751	0.769	0.755	0.734	0.733	0.722	0.715
NW	0.700	0.697	0.699	0.720	0.725	0.712	0.725	0.708	0.718	0.683	0.728
PLE	0.303	0.919	0.895	0.970	1.047	1.057	1.016	0.898	1.071	0.944	0.939
RI	0.960	0.821	0.814	0.811	0.796	0.807	0.819	0.829	0.843	0.820	0.851
SCL	0.791	0.793	0.755	0.758	0.744	0.747	0.768	0.770	0.782	0.754	0.748
SLSF	0.740	0.730	0.729	0.758	0.746	0.767	0.775	0.758	0.782	0.759	0.764
SLSW	0.639	0.660	0.637	0.703	0.677	0.766	0.754	0.758	0.794	0.778	0.786
SOD	0.303	0.754	0.756	0.730	0.741	0.728	0.683	0.695	0.712	0.691	0.690
SOJ	0.722	0.713	0.722	0.728	0.717	0.705	0.717	0.724	0.718	0.725	0.725
SPT	0.743	0.781	0.779	0.782	0.782	0.769	0.773	0.773	0.787	0.786	0.774
UP	0.747	0.756	0.757	0.751	0.747	0.737	0.741	0.736	0.767	0.754	0.747
WM	0.942	0.856	0.848	0.836	0.895	0.860	0.796	0.668	0.746	0.748	0.765
WT	0.366	0.810	0.923	0.941	0.845	0.822	0.831	0.829	0.856	0.847	0.852

**** - DENOTES A MISSING VALUE

INDEX: RATIO OF TOTAL DEBT TO TOTAL ASSETS

RR	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
ATSF	0.171	0.169	0.169	0.175	0.182	0.182	0.175	0.177	0.202	0.204	0.215
BM	0.336	0.328	0.365	0.322	0.316	0.328	0.310	0.303	0.327	0.350	0.354
BN	0.277	0.274	0.283	0.316	0.319	0.327	0.326	0.304	0.307	0.293	0.285
BO	0.332	0.346	0.333	0.338	0.342	0.333	0.317	0.283	0.310	0.334	0.311
CNW2	0.331	0.303	0.339	0.345	0.343	0.707	0.662	0.671	0.679	0.690	0.656
CO	0.588	0.356	0.352	0.360	0.344	0.312	0.293	0.238	0.236	0.258	0.249
CONR	0.389	0.443	0.446	0.461	0.491	0.491	0.494	0.476	0.445	0.449	0.697
CKR	0.752	0.746	0.714	0.686	0.734	0.716	0.715	0.696	0.738	0.671	0.638
CS	0.278	0.294	0.280	0.264	0.296	0.357	0.337	0.353	0.340	0.314	0.298
DH	0.390	0.403	0.385	0.371	0.373	0.352	0.320	0.283	0.259	0.370	0.403
DRGW	0.302	0.308	0.303	0.271	0.263	0.260	0.242	0.225	0.232	0.206	0.220
DTIR	0.368	0.334	0.301	0.272	0.266	0.259	0.239	0.222	0.234	0.191	0.166
FEC	0.502	0.495	0.224	0.228	0.205	0.190	0.173	0.159	0.148	0.142	0.131
FWD	0.255	0.256	0.248	0.246	0.251	0.245	0.213	0.253	0.251	0.229	0.222
GTW	1.546	1.617	1.693	1.871	1.965	2.020	1.958	1.947	2.141	1.851	0.761
ICG	0.281	0.298	0.295	0.282	0.268	0.291	0.301	0.314	0.305	0.310	0.310
KCS	0.364	0.368	0.348	0.348	0.338	0.343	0.355	0.350	0.324	0.295	0.351
LN	0.423	0.439	0.438	0.443	0.446	0.436	0.407	0.378	0.417	0.408	0.426
MILW	0.409	0.394	0.388	0.376	0.374	0.367	0.353	0.312	0.312	0.307	0.311
MKT	0.486	0.495	0.499	0.510	0.516	0.519	0.541	0.532	0.559	0.541	0.621
MP	0.511	0.508	0.497	0.490	0.482	0.479	0.461	0.423	0.415	0.407	0.440
NW	0.369	0.352	0.370	0.363	0.362	0.356	0.340	0.306	0.297	0.276	0.263
PLE	0.109	0.122	0.098	0.147	0.143	0.114	0.093	0.073	0.097	0.100	0.085
RI	0.288	0.278	0.271	0.265	0.259	0.255	0.252	0.252	0.243	0.264	0.285
SCL	0.336	0.319	0.300	0.296	0.282	0.266	0.314	0.283	0.270	0.250	0.260
SLSF	0.437	0.437	0.435	0.428	0.437	0.426	0.409	0.398	0.396	0.396	0.412
SLSW	0.087	0.079	0.073	0.065	0.058	0.057	0.112	0.155	0.212	0.219	0.214
SOD	0.346	0.345	0.340	0.325	0.326	0.335	0.322	0.318	0.318	0.314	0.313
SGU	0.301	0.304	0.310	0.303	0.312	0.309	0.306	0.259	0.257	0.273	0.262
SPT	0.317	0.311	0.315	0.310	0.308	0.317	0.311	0.288	0.276	0.278	0.261
JP	0.129	0.118	0.116	0.181	0.192	0.205	0.193	0.176	0.223	0.204	0.223
WM	0.404	0.400	0.388	0.379	0.393	0.376	0.343	0.293	0.308	0.282	0.268
WP	0.299	0.285	0.294	0.293	0.280	0.233	0.204	0.179	0.208	0.194	0.261

**** - DENOTES A MISSING VALUE

INDEX: NEW RAIL INSTALLED IN TONS PER MILE

RR	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
ATSF	1.371	3.311	3.150	2.465	2.507	2.522	3.427	2.494	1.171	2.900	2.928
BN	0.118	0.006	0.012	0.331	0.469	0.005	0.819	0.618	1.572	1.077	0.910
BN	1.306	1.211	1.290	1.315	1.018	1.225	1.849	1.742	1.883	1.987	3.337
BO	2.301	2.640	1.367	2.603	3.715	2.744	1.286	1.343	2.096	2.786	2.505
CNW2	0.426	0.500	0.392	0.503	0.467	0.064	0.001	0.764	0.426	0.079	1.060
CO	1.486	0.699	0.859	2.080	3.020	1.724	1.808	1.081	3.570	2.990	2.903
COVR	1.286	0.977	1.279	1.017	1.373	1.142	1.099	1.164	1.342	3.145	4.245
CRR	7.826	8.856	8.696	0.112	6.262	4.261	5.719	4.990	2.420	2.924	4.751
CS	0.009	0.276	0.419	0.900	0.229	0.151	1.453	12.563	3.897	4.393	9.627
DH	0.797	1.752	1.658	0.831	0.005	0.069	0.000	0.946	1.743	1.754	3.195
DRGW	2.734	2.030	1.017	1.027	2.387	1.992	4.590	5.230	2.496	2.984	4.744
JTIR	0.436	0.003	0.335	3.192	0.407	2.802	4.302	0.073	0.037	0.074	1.050
FLC	0.199	8.812	5.933	0.000	3.577	0.153	0.514	12.815	7.188	6.627	5.881
FWD	0.178	0.187	0.017	0.347	0.002	0.364	0.002	1.521	1.853	2.031	7.581
GTW	1.743	1.169	0.891	3.527	3.206	2.693	2.563	2.199	2.696	2.249	2.752
ICG	1.369	1.334	0.845	1.198	0.917	1.745	0.714	1.050	0.907	0.956	3.098
KCS	0.752	1.678	1.537	0.768	0.952	1.868	1.512	2.271	1.506	3.961	0.970
LN	2.138	2.453	3.053	3.924	4.365	2.193	2.355	2.477	0.632	2.286	2.615
MILW	0.430	0.498	0.784	0.562	0.457	0.485	0.398	0.583	0.290	0.219	0.364
MKT	1.012	0.012	0.436	0.024	0.133	0.202	0.387	0.000	0.000	5.196	3.998
MP	2.482	2.396	3.045	2.408	2.435	3.020	2.813	3.093	3.228	3.024	4.077
VW	1.010	1.661	3.041	1.645	2.634	2.398	2.439	2.446	2.588	3.893	4.294
PLE	0.284	3.231	3.528	4.000	3.001	3.169	3.526	3.790	1.885	1.960	1.399
RI	0.631	0.089	0.568	0.558	0.554	0.644	0.693	0.414	0.074	2.149	0.455
SCL	1.539	1.829	1.756	1.154	1.798	1.716	1.846	2.554	0.628	1.999	2.376
SLSF	2.509	2.016	1.889	2.615	2.650	3.534	3.837	3.370	1.521	2.474	2.784
SLSW	0.049	5.897	0.145	4.917	4.749	6.995	4.369	5.489	1.770	4.051	3.845
SOD	0.478	0.640	0.636	1.092	1.216	2.394	2.830	3.191	1.028	1.806	2.277
SOU	1.980	2.306	3.596	3.744	4.530	6.500	6.182	5.893	2.315	5.060	6.516
SFT	1.754	2.917	2.254	2.001	3.512	4.766	3.241	2.707	2.348	2.177	2.350
JP	2.178	3.243	3.540	3.662	3.991	3.931	5.599	5.754	4.722	5.092	5.313
WM	2.327	3.484	2.439	1.691	2.379	0.943	0.451	0.031	0.002	0.041	0.000
WIP	3.198	1.295	4.238	1.647	3.358	4.877	3.653	3.997	2.594	2.594	3.673

**** - DEKOTES A MISSING VALUE

INDEX: AVERAGE NUMBER OF TRIPS PER CAR

RR	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
ATSF	18.911	****	20.729	21.780	20.673	22.264	24.962	24.368	20.754	20.945	21.868
BM	54.399	53.302	47.793	43.077	50.228	46.729	49.781	54.762	40.760	42.335	44.251
BN	25.374	26.583	29.210	26.909	23.309	22.999	25.524	24.188	20.721	22.214	22.671
BO	38.445	40.804	40.570	35.083	29.837	31.658	31.451	31.180	26.398	25.702	27.005
CNW2	28.625	32.012	30.092	30.727	29.634	30.293	31.228	30.056	28.220	31.902	34.109
CO	29.728	28.994	29.491	28.127	24.545	30.561	29.739	28.813	25.717	24.369	23.467
CONR	25.356	24.557	25.095	25.712	26.096	26.034	27.036	27.181	27.981	22.813	27.399
CRR	68.337	77.299	65.893	45.105	29.064	57.818	70.105	79.707	69.178	59.950	65.811
CS	47.787	44.420	53.035	50.719	48.051	40.372	40.779	55.498	58.859	64.862	93.818
DM	59.444	61.867	67.803	73.591	63.619	49.660	70.727	59.688	46.268	37.868	36.560
DRGW	37.894	40.258	43.686	46.767	49.849	47.422	53.499	49.553	44.710	51.118	60.061
DTIR	19.255	21.336	20.373	21.151	24.568	25.831	29.613	26.242	20.813	21.920	22.008
FCC	52.224	46.450	46.847	45.759	49.175	53.774	65.204	****	69.809	66.220	68.176
FWD	42.528	39.541	41.063	44.229	44.778	33.626	25.292	35.061	32.740	60.904	61.501
GTW	38.223	38.395	37.501	32.546	33.777	37.830	34.941	31.786	31.002	31.782	****
ICG	32.350	36.364	31.280	32.523	32.334	32.573	30.903	31.670	25.475	25.119	29.245
ICS	41.950	45.403	36.084	35.050	54.003	49.980	49.836	51.075	59.411	66.762	46.202
LV	36.300	39.195	39.614	33.239	32.023	31.537	34.017	34.760	31.544	31.602	30.819
MILW	25.080	27.913	28.788	27.129	27.196	26.014	26.994	24.734	21.693	23.490	24.052
MKT	30.555	28.404	28.473	27.345	26.521	30.585	29.607	29.330	25.561	29.395	31.916
MP	45.795	49.817	50.835	41.346	36.740	40.867	40.203	41.523	38.100	29.363	28.711
NW	29.411	30.096	28.327	27.445	24.368	24.206	25.856	25.781	22.180	22.956	21.397
PLE	****	43.052	****	****	****	36.209	49.371	39.812	****	21.599	21.311
RI	36.309	35.450	38.137	36.378	33.655	31.013	29.219	29.643	25.063	24.139	26.007
SCL	****	42.263	47.469	36.191	36.052	36.163	36.166	36.495	31.173	32.959	34.234
SLSF	39.776	39.556	33.153	40.852	40.071	37.252	33.181	37.991	33.888	34.654	34.991
SLSW	58.336	55.452	58.017	56.594	49.697	53.951	56.691	58.617	47.223	58.010	52.039
SOD	30.209	31.538	30.527	30.596	28.220	31.679	34.883	32.096	27.716	28.298	29.684
SOU	24.421	34.196	38.245	28.695	24.992	26.896	36.017	34.934	29.910	31.573	32.859
SPT	30.783	32.031	30.949	28.263	26.235	28.529	29.143	28.004	23.617	25.791	25.384
UF	23.364	25.626	27.556	28.293	25.719	27.054	30.041	27.409	23.266	24.609	26.946
WM	44.973	75.934	86.065	74.015	59.378	63.516	73.271	58.436	54.441	53.745	58.265
WP	30.539	32.129	32.371	31.449	28.607	33.054	39.051	33.117	33.933	37.704	42.231

**** - DENOTES A MISSING VALUE

INDEX: RATIO OF NEW TO RELAY RAIL INSTALLED

RR	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
ATSF	1.018	2.086	1.286	0.941	1.593	1.037	1.466	0.814	0.477	1.382	1.265
BM	0.064	0.004	0.008	0.217	0.354	0.003	0.398	0.395	0.805	0.318	0.477
BN	0.352	0.957	0.887	1.127	1.010	1.197	1.361	0.682	0.626	0.538	0.829
BO	0.571	0.872	0.485	0.800	1.118	0.465	0.199	0.273	0.450	0.445	0.533
CNW2	0.510	0.549	0.760	0.858	0.531	0.037	0.000	0.342	0.183	0.037	0.439
CO	0.309	2.254	0.324	0.883	1.057	0.813	0.864	0.254	1.139	0.680	0.652
CONR	0.559	0.414	0.506	0.706	0.778	0.781	0.722	0.739	0.864	1.199	3.308
CRR	7.531	4.948	10.834	0.083	0.706	0.781	4.433	0.689	0.786	1.062	4.075
CS	0.317	0.412	0.695	1.074	0.267	1.572	0.609	10.985	2.060	2.245	1.894
DH	0.275	1.078	0.895	0.467	0.345	0.058	0.000	0.431	0.787	1.041	1.060
DPGW	1.309	0.767	0.381	0.345	0.972	0.085	1.255	1.467	1.342	0.996	0.546
DTIR	0.105	0.002	0.267	3.913	0.299	0.990	0.815	0.065	0.053	0.090	1.101
FEC	0.459	29.076	62.530	0.000	13.772	1.817	0.182	6.470	1.089	0.861	5.824
FWD	0.307	0.796	0.037	1.590	0.012	0.060	0.001	1.465	1.604	1.707	1.525
GTW	1.331	0.793	0.821	2.456	1.959	0.512	4.074	1.363	2.144	1.247	1.724
ICG	0.456	0.416	0.309	0.521	0.325	1.519	0.405	0.746	0.661	0.628	0.148
ICS	0.478	0.831	1.204	0.338	0.563	0.761	1.094	1.530	1.192	2.250	0.635
LN	0.727	0.549	0.446	1.186	0.979	0.988	0.875	0.858	0.244	0.909	0.528
MILW	0.599	0.746	1.039	0.655	0.460	0.671	0.617	0.617	0.386	0.283	5.368
MKT	0.579	0.005	0.314	0.020	0.121	0.517	0.449	0.449	0.000	7.002	1.132
MP	0.768	0.920	1.016	0.951	0.922	0.239	0.401	0.000	0.888	1.918	0.871
VW	0.352	1.184	1.246	1.066	1.030	1.204	1.152	0.698	1.918	0.606	1.640
PLE	0.343	2.112	0.926	1.244	0.350	0.726	0.771	0.802	0.453	0.351	1.330
RI	0.354	0.053	0.383	0.289	0.271	0.384	0.501	0.178	0.052	2.002	0.310
SCL	0.560	0.677	0.610	0.343	0.666	0.630	0.565	0.716	0.298	0.849	0.766
SLSF	0.568	1.033	1.414	1.561	1.078	1.067	1.697	1.092	0.716	0.669	1.330
SLSW	0.014	2.003	0.065	4.391	1.849	1.517	3.630	1.092	0.421	0.669	1.330
SOD	0.431	0.643	0.552	0.727	0.783	1.093	1.130	0.776	0.787	0.821	0.911
SOU	0.791	0.990	1.333	1.556	1.749	2.992	3.749	1.272	1.697	2.804	3.628
SPT	0.517	0.777	0.573	0.865	0.800	1.390	1.029	0.899	0.783	0.527	0.434
UP	0.799	1.288	1.238	1.306	0.755	0.959	1.126	1.130	1.425	1.072	1.303
WM	0.783	2.023	1.007	0.976	1.438	0.942	0.378	0.029	0.001	0.014	0.000
JP	1.368	0.531	2.067	0.954	3.837	11.653	70.024	4.493	13.387	13.387	2.557

**** - DENOTES A MISSING VALUE

INDEX: RATIO OF MANUFACTURED TONS TO RAW MATERIAL TONS CARRIED

RR	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
ATSF	2.068	2.091	2.186	1.768	1.931	1.830	1.552	1.662	1.470	1.759	1.929
BM	2.038	1.216	1.927	2.418	2.706	2.690	2.904	2.753	2.525	3.168	3.701
BN	0.944	1.035	0.960	0.749	0.739	0.760	0.726	0.709	0.635	0.629	0.592
BO	0.513	0.620	0.583	0.576	0.639	0.594	0.601	0.531	0.447	0.478	0.482
CNW2	0.905	1.400	1.181	0.953	0.963	0.908	0.826	0.826	0.719	0.811	0.952
CO	0.381	0.375	0.394	0.348	0.431	0.419	0.419	0.384	0.350	0.372	0.383
CONR	0.769	0.829	0.843	0.841	0.918	0.966	0.957	0.945	0.853	0.777	0.899
CHR	0.282	0.335	0.334	0.290	0.290	0.290	0.334	0.281	0.259	0.264	0.211
CS	1.106	1.109	1.095	1.053	1.244	1.231	0.921	0.789	0.790	0.647	0.535
DH	1.258	1.402	1.500	1.246	1.647	2.859	3.039	2.878	2.737	3.198	3.170
JRGW	0.317	0.901	0.792	0.698	0.746	0.717	0.625	0.581	0.474	0.480	0.449
OTIR	3.577	5.418	1.974	2.114	2.613	2.495	2.452	2.711	3.206	3.398	3.277
FEC	0.686	0.720	0.631	0.670	****	0.698	0.739	****	0.637	0.744	0.604
F&D	1.182	1.478	1.479	0.944	1.087	1.121	0.654	0.964	0.732	0.711	0.486
GTW	2.389	2.640	2.527	2.152	2.662	2.612	2.687	****	2.848	2.602	2.518
ICG	1.084	1.275	1.299	1.251	1.425	1.359	1.225	1.323	1.191	1.293	1.341
KCS	1.374	2.511	2.266	2.165	2.521	2.547	1.859	2.480	3.505	2.602	1.825
LN	0.696	0.771	0.765	0.657	0.687	0.731	0.725	0.699	0.600	0.633	0.621
MILW	1.322	1.701	1.543	1.442	1.686	1.642	1.528	1.405	1.229	1.270	1.388
MKT	1.581	1.675	1.469	1.189	1.240	1.282	0.925	1.027	0.895	0.910	0.761
MP	1.829	2.370	1.944	1.765	1.842	1.715	1.470	1.557	1.415	1.533	1.369
NW	0.472	0.508	0.504	0.488	0.565	0.559	0.554	0.532	0.454	0.488	0.504
PLE	0.369	0.377	****	****	****	0.468	****	0.440	****	0.354	0.340
RI	1.555	1.333	1.159	1.358	1.283	1.275	1.196	1.174	1.266	1.159	1.141
SCL	1.248	1.352	1.530	1.548	1.494	1.455	1.482	1.446	1.050	1.165	1.104
SLSF	3.132	3.338	3.283	3.017	3.187	3.703	3.325	3.506	3.207	3.555	3.831
SLSW	3.961	4.903	4.967	4.523	4.763	5.926	6.094	5.685	5.037	5.471	6.578
SOO	2.001	2.246	1.790	2.225	2.636	2.463	1.907	2.360	2.353	3.036	3.466
SOU	1.309	1.034	1.064	1.024	1.114	1.094	1.137	1.103	1.038	1.145	1.118
SPT	1.586	1.653	1.527	1.450	1.649	1.696	1.753	1.722	1.706	1.810	2.000
UP	1.184	1.288	1.209	1.084	1.174	1.090	0.937	0.921	0.830	0.874	0.843
WM	0.358	0.420	0.503	0.457	0.505	0.513	0.493	0.428	0.380	0.327	0.328
WP	4.250	4.105	4.427	****	****	****	4.773	5.412	5.303	4.662	5.250

**** - DENOTES A MISSING VALUE

INDEX: AVERAGE HAUL

RR	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
ATSF	612.391	599.618	597.215	583.806	611.424	624.182	640.029	625.590	595.762	605.179	655.125
BM	168.203	154.324	172.606	178.804	182.576	187.544	184.129	186.366	187.467	193.449	193.589
BN	371.397	388.862	387.515	419.043	463.319	475.890	495.593	521.000	545.885	569.695	605.265
BO	251.371	253.833	252.239	246.863	250.935	255.253	260.844	262.850	251.463	247.417	250.324
CNWX	253.223	261.214	278.149	281.084	279.933	280.835	302.422	308.868	286.292	290.355	297.309
CO	300.702	294.804	295.927	308.508	282.626	257.446	262.058	264.804	268.867	259.402	245.230
CONR	245.044	254.399	251.277	253.313	260.215	268.429	269.257	272.589	281.257	317.979	344.032
CRR	179.241	174.591	180.826	190.728	189.155	185.127	174.791	164.698	161.995	156.955	166.479
CS	197.376	195.550	206.653	208.156	235.719	239.710	246.191	242.901	204.856	186.081	249.812
DH	214.507	209.555	210.141	185.002	177.321	196.750	201.711	205.018	207.570	300.322	341.826
DRGW	314.147	334.557	325.257	322.840	336.177	324.219	315.125	321.608	313.498	300.211	306.738
JTIR	105.148	114.900	106.749	105.320	114.135	110.543	111.210	122.084	130.907	149.336	171.002
FCC	198.131	192.177	191.311	197.004	203.776	217.584	212.002	210.888	209.339	227.436	234.911
FWD	299.737	308.909	291.742	267.707	320.968	336.461	359.708	307.686	321.731	298.378	347.885
GTW	169.187	171.626	170.250	175.733	173.785	168.418	178.010	183.476	173.447	172.639	172.099
ICG	275.555	285.792	295.925	276.096	272.723	272.946	332.809	303.609	293.252	303.423	316.867
KCS	204.105	219.536	258.671	275.599	270.097	265.254	299.649	269.964	268.495	271.143	269.747
LN	261.788	256.463	264.871	261.738	265.099	278.178	285.569	295.832	295.684	310.310	314.381
MILW	383.007	384.496	377.040	393.647	398.573	415.586	422.212	413.424	407.605	406.172	413.929
MKT	314.510	329.876	311.211	314.318	312.446	319.717	371.279	365.430	334.458	324.618	320.862
MP	295.764	299.204	299.855	308.603	318.178	309.445	333.035	331.842	314.499	335.416	412.475
NW	303.807	310.861	312.871	321.939	317.936	326.061	331.802	334.090	336.309	340.566	341.355
PLE	56.386	53.933	51.639	53.751	53.045	53.837	50.918	55.171	55.565	54.158	59.640
RI	402.231	394.437	390.180	397.287	417.367	432.218	442.117	406.064	371.341	353.125	358.431
SCL	208.552	218.315	215.734	218.410	214.272	212.232	220.016	223.258	212.734	215.938	214.003
SLSF	353.785	355.603	353.495	344.148	355.589	365.526	389.982	375.642	374.593	361.541	369.622
SLSW	406.377	407.196	417.922	413.486	429.285	439.590	442.737	442.519	434.706	438.046	455.101
SUO	323.360	347.985	351.021	357.102	384.464	398.446	409.437	402.118	401.393	415.887	419.959
SOU	202.225	204.357	215.604	214.148	213.048	215.967	220.599	219.939	220.707	223.950	224.023
SPT	523.142	528.185	510.391	514.969	562.665	567.792	567.843	555.340	538.671	552.841	562.042
UP	619.898	640.958	646.592	639.517	659.329	661.280	655.226	624.876	621.766	641.881	661.108
WM	107.556	111.690	115.153	111.475	105.422	110.133	117.716	124.794	102.479	109.697	112.729
WP	520.156	527.635	513.151	516.765	532.768	474.241	463.429	476.426	458.827	539.468	523.118

**** - DENOTES A MISSING VALUE

INDEX: AVERAGE NUMBER OF FREIGHT CARS PER TRAIN

RR	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
ATSF	66.520	62.815	61.710	60.618	61.180	58.965	56.285	52.367	56.169	55.370	53.423
BN	57.563	57.502	59.979	57.387	56.672	52.991	55.203	57.021	57.188	58.124	55.912
BO	67.375	70.456	70.555	70.222	65.914	66.314	67.555	67.307	74.324	72.274	72.203
BO	67.008	67.470	77.715	76.220	73.666	74.684	74.090	79.747	73.893	72.815	67.398
CNWX	69.268	67.222	69.107	71.215	65.940	62.561	65.113	63.905	65.719	67.027	71.745
CO	83.588	86.491	83.522	88.077	78.000	77.846	71.633	77.147	81.194	75.127	73.752
CONR	75.014	73.256	70.384	66.916	63.447	63.333	61.905	62.612	65.953	54.533	68.299
CRR	83.963	82.507	87.060	88.542	88.919	94.250	89.019	86.364	87.807	89.054	86.353
CS	61.057	65.420	68.178	65.574	72.424	67.635	71.579	60.582	59.403	60.408	66.475
DN	74.185	75.686	75.417	73.196	69.981	64.804	70.773	71.235	64.747	58.593	64.149
DRGW	51.222	57.449	55.517	60.948	60.831	57.465	58.713	56.453	59.562	58.794	58.702
DIR	59.935	60.355	55.638	57.271	54.532	56.170	51.319	52.871	60.436	53.057	56.882
FE	71.307	53.078	56.209	52.480	52.360	52.840	50.321	43.564	42.298	44.846	50.254
FWD	50.159	51.821	47.596	53.093	63.345	57.793	63.086	45.135	50.116	47.780	53.912
GTW	58.769	58.225	52.667	56.556	57.999	63.995	62.079	65.897	67.125	62.627	62.305
ICG	73.902	70.973	74.328	70.311	67.976	68.416	72.448	65.312	66.121	65.545	65.546
ICS	103.231	98.573	97.315	98.852	101.501	101.399	100.050	89.254	82.893	84.777	81.751
LN	68.348	70.449	73.223	73.783	71.420	69.612	67.592	67.152	71.335	69.960	66.719
MILW	68.347	69.365	71.987	70.872	66.232	65.945	63.205	63.834	68.276	58.034	69.269
MKT	64.659	69.274	69.762	73.386	77.113	72.297	76.550	74.680	70.133	69.545	69.434
MP	72.538	71.951	70.140	72.444	68.844	67.051	69.517	65.116	67.058	64.461	66.553
NW	91.229	91.410	91.952	92.190	86.736	83.374	81.834	82.548	86.965	87.162	86.754
PLE	101.734	92.247	97.884	95.611	91.006	110.405	109.776	109.283	100.710	84.525	90.873
RJ	62.180	60.757	58.383	61.033	61.437	59.619	58.822	54.689	59.870	57.574	58.280
SCL	71.115	71.710	71.045	70.052	71.026	73.166	71.707	72.360	75.148	72.133	72.823
SLSF	61.732	60.401	59.140	60.114	58.717	58.572	59.511	58.883	61.039	61.120	59.718
SLSW	70.593	73.794	72.058	76.879	76.682	75.179	79.895	75.520	85.366	86.600	81.441
SOO	56.594	55.939	55.735	56.258	56.751	59.198	62.294	65.322	71.001	70.243	71.952
SOU	79.535	73.638	72.746	66.104	69.017	70.736	59.136	68.227	80.673	64.003	62.768
SPT	68.411	72.443	72.338	78.714	77.480	75.102	75.160	73.474	80.736	79.176	79.863
JP	76.332	76.042	77.946	79.551	80.810	78.129	74.259	72.333	72.775	72.085	71.888
JM	69.553	68.331	66.533	67.797	61.970	61.351	61.839	65.860	59.522	54.717	52.014
JP	70.224	68.025	56.638	59.233	58.516	81.153	57.382	55.849	57.404	57.862	55.922

**** - DENOTES A MISSING VALUE

INDEX: NUMBER OF MAIN TRACK RELATED ACCIDENTS PER BILLION GROSS TON-MILES

RR	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
ATSF	0.182	0.191	0.234	0.255	0.175	0.156	0.322	0.240	0.206	0.207	0.175
BN	1.154	0.538	1.552	1.063	0.608	1.336	1.458	1.153	0.821	1.454	2.121
BN	0.075	0.094	0.149	0.336	0.415	0.437	0.424	0.490	0.471	0.572	0.528
BO	0.498	0.635	0.637	0.697	0.716	1.011	0.895	1.229	1.154	1.803	1.744
CNW2	1.760	1.358	1.451	2.004	1.853	2.028	2.674	3.614	3.308	3.417	3.059
CO	0.288	0.256	0.268	0.400	0.446	0.817	0.653	0.720	0.822	1.000	1.076
CUNR	0.578	0.626	0.715	0.722	0.487	0.556	0.642	0.865	1.094	1.572	1.241
CRR	0.131	0.000	0.134	0.125	0.402	0.396	0.725	1.292	1.025	1.526	0.596
CS	0.738	0.000	0.309	0.000	0.744	0.224	0.389	0.201	0.832	1.702	1.835
DH	0.502	0.387	0.252	0.274	0.812	0.552	1.199	0.662	1.311	1.802	2.248
DRGW	0.327	0.206	0.155	0.112	0.052	0.370	0.151	0.245	0.296	0.195	0.236
JTIR	0.000	0.349	0.647	0.000	0.665	0.307	0.907	0.953	0.000	0.946	0.582
FCC	0.300	0.000	0.511	0.278	0.000	0.000	0.805	0.218	0.525	0.237	0.598
FWD	0.335	0.612	0.000	2.478	0.666	0.820	1.740	0.408	0.000	1.655	1.643
GTW	0.116	0.114	0.331	0.369	0.482	0.825	0.107	0.687	0.384	1.207	0.523
ICG	0.320	0.464	0.472	0.536	0.789	0.569	1.016	1.131	1.492	2.010	1.935
ICS	0.358	0.342	0.478	0.564	0.454	0.639	2.338	1.832	1.500	1.495	0.678
LV	1.146	1.147	1.017	1.351	1.290	1.251	1.350	1.380	1.143	1.293	1.590
MILW	0.490	0.495	0.786	0.740	0.739	1.209	1.465	2.952	2.987	3.115	3.629
MKT	4.686	4.014	4.413	3.004	2.462	2.829	2.683	2.503	2.394	1.905	1.869
MP	0.273	0.341	0.285	0.297	0.273	0.296	0.450	0.582	0.384	0.268	0.370
VW	0.214	0.201	0.171	0.173	0.098	0.208	0.182	0.272	0.257	0.209	0.198
PLE	0.257	0.000	1.092	1.446	2.347	2.171	1.305	0.989	1.209	1.450	2.757
RI	0.365	0.952	1.809	1.065	1.887	1.943	4.063	4.503	3.176	3.915	4.105
SCL	0.248	0.403	0.401	0.296	0.376	0.503	0.587	0.507	0.591	0.500	0.628
SLSF	0.359	0.551	0.337	0.547	0.873	0.558	1.073	0.823	1.284	1.098	0.661
SLSW	0.139	0.506	0.204	0.203	0.000	0.211	0.159	0.206	0.193	0.191	0.150
SOD	0.548	0.904	1.279	0.724	0.821	0.952	1.023	1.227	1.146	1.141	1.143
SOU	0.653	0.649	0.529	0.600	0.483	0.476	0.330	0.412	0.332	0.316	0.307
SPT	0.121	0.200	0.175	0.143	0.101	0.138	0.152	0.206	0.185	0.165	0.242
JP	0.389	0.024	0.023	0.015	0.033	0.059	0.080	0.151	0.062	0.094	0.053
JM	0.554	0.285	0.874	0.293	0.729	0.538	1.166	1.131	3.463	3.159	2.165
JP	0.285	0.212	0.053	0.110	0.111	0.441	0.105	0.207	0.122	0.122	0.216

**** - DENOTES A MISSING VALUE

INDEX: TRANSPORTATION COSTS IN 1967 DOLLARS PER MILLION GROSS TON-MILES

RR	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
ATSF	1.739	1.669	1.631	1.533	1.454	1.363	1.370	1.460	1.381	1.317	1.269
BM	4.162	3.952	4.023	4.212	3.941	3.793	3.433	3.288	3.330	3.053	2.385
BN	2.166	2.026	1.992	2.050	1.943	1.698	1.563	1.482	1.344	1.244	1.140
BO	2.404	2.356	2.224	2.278	2.175	2.005	1.899	1.854	1.909	1.888	1.843
BNW2	2.246	2.452	2.505	2.332	2.397	2.213	1.951	1.942	1.917	1.682	1.572
CO	2.158	2.174	2.183	2.007	2.127	2.091	2.006	1.949	1.952	1.894	2.089
CONR	3.110	3.158	3.120	3.171	3.016	2.724	2.573	2.572	2.097	3.252	2.392
CRR	1.093	1.132	1.052	1.019	1.065	1.018	0.989	1.123	1.054	1.023	1.037
CS	2.210	1.854	1.629	1.672	1.537	1.532	1.502	1.517	1.847	1.421	1.172
DH	1.390	1.912	1.868	2.038	2.098	2.016	1.756	1.768	1.811	1.672	1.711
DRGW	1.534	1.474	1.490	1.443	1.291	1.302	1.237	1.299	1.190	1.192	1.152
DTIR	3.565	3.348	3.271	3.479	3.314	3.243	3.310	3.126	2.911	2.895	2.642
FEC	2.173	1.637	1.643	1.763	1.498	1.466	1.275	1.378	1.411	1.340	1.266
FWD	2.443	2.241	2.097	2.079	1.757	1.579	1.487	1.949	1.563	1.572	1.154
GTW	3.711	3.762	3.993	4.178	3.892	3.602	3.360	3.252	3.348	2.992	3.019
ICG	2.041	1.955	1.909	1.864	1.827	1.576	1.684	1.817	1.849	1.681	1.647
ICS	1.820	1.732	1.683	1.596	1.668	1.569	1.533	1.640	1.563	1.422	1.293
LV	1.344	1.818	1.803	1.723	1.709	1.583	1.513	1.536	1.463	1.362	1.409
MILW	2.379	2.292	2.261	2.211	2.116	1.945	1.859	1.987	1.882	1.624	1.603
MKT	1.855	1.798	1.717	1.630	1.547	1.663	1.517	1.598	1.601	1.446	1.438
MP	1.347	1.918	1.800	1.725	1.711	1.592	1.484	1.521	1.502	1.388	1.315
NW	1.967	1.930	1.859	1.892	1.861	1.691	1.601	1.604	1.481	1.358	1.497
PLE	4.555	5.119	4.952	5.151	5.384	4.386	4.099	3.575	3.876	3.674	3.412
RI	2.132	2.033	2.056	1.876	1.808	1.707	1.719	1.928	1.829	1.817	1.776
SCL	1.307	1.920	1.919	1.802	1.681	1.618	1.629	1.633	1.551	1.472	1.447
SLSF	1.773	1.732	1.681	1.837	1.653	1.580	1.565	1.540	1.460	1.357	1.350
SLSW	1.488	1.454	1.396	1.427	1.278	1.310	1.242	1.220	1.201	1.143	1.202
SOD	2.371	2.206	2.225	2.087	1.931	1.833	1.631	1.630	1.614	1.469	1.321
SOU	1.950	1.819	1.638	1.791	1.511	1.390	1.307	1.338	1.319	0.913	1.153
SPT	2.169	2.032	1.981	1.748	1.616	1.540	1.508	1.526	1.491	1.414	1.373
UP	1.682	1.644	1.599	1.502	1.435	1.337	1.251	1.228	1.155	1.071	1.038
WM	2.352	2.365	2.322	2.406	2.578	2.361	2.162	1.939	2.308	2.162	2.228
WP	1.275	1.248	1.336	1.325	1.280	1.292	1.159	1.235	1.287	1.268	1.536

**** - DENOTES A MISSING VALUE

INDEX: MILES OF CONTINUOUSLY WELDED RAIL TO TOTAL TRACK MILES

RR	1967	1968	1969	1970	1971	1972	1973	1974	1975	1976	1977
ATSF	****	****	****	****	****	****	****	0.261	0.276	0.295	0.312
BH	****	****	****	****	****	****	****	0.016	0.026	0.047	0.050
BN	****	****	****	****	****	****	****	0.115	0.123	0.140	0.158
BO	****	****	****	****	****	****	****	****	****	****	****
CNW2	****	****	****	****	****	****	****	0.036	0.043	0.050	0.063
CO	****	****	****	****	****	****	****	****	****	****	****
CONR	****	****	****	****	****	****	****	0.105	0.114	0.140	0.170
CKR	****	****	****	****	****	****	****	0.233	0.233	0.233	0.243
CS	****	****	****	****	****	****	****	0.061	0.074	0.089	0.130
DH	****	****	****	****	****	****	****	0.146	0.160	0.165	0.166
DPGW	****	****	****	****	****	****	****	0.103	0.113	0.122	0.136
DTIR	****	****	****	****	****	****	****	0.000	0.000	0.000	0.009
FEC	****	****	****	****	****	****	****	0.243	0.283	0.299	0.452
FWD	****	****	****	****	****	****	****	0.005	0.016	0.022	0.044
GTW	****	****	****	****	****	****	****	0.077	0.093	0.104	0.133
ICG	****	****	****	****	****	****	****	0.130	0.140	0.148	0.151
ICS	****	****	****	****	****	****	****	0.012	0.016	0.031	0.047
LV	****	****	****	****	****	****	****	0.166	0.167	0.205	0.220
MILW	****	****	****	****	****	****	****	0.000	0.000	0.001	0.003
MKT	****	****	****	****	****	****	****	0.011	0.011	0.037	0.056
MP	****	****	****	****	****	****	****	0.196	0.211	0.197	0.265
NW	****	****	****	****	****	****	****	0.141	0.158	0.185	0.218
PLE	****	****	****	****	****	****	****	0.297	0.314	0.325	0.343
RI	****	****	****	****	****	****	****	0.086	0.090	0.104	0.112
SCL	****	****	****	****	****	****	****	0.162	0.166	0.177	0.190
SLSF	****	****	****	****	****	****	****	0.165	0.197	0.211	0.228
SLSW	****	****	****	****	****	****	****	0.244	0.252	0.260	0.286
SOD	****	****	****	****	****	****	****	0.124	0.131	0.144	0.163
SGU	****	****	****	****	****	****	****	0.330	0.341	0.360	0.389
SPT	****	****	****	****	****	****	****	0.227	0.239	0.253	0.280
UF	****	****	****	****	****	****	****	0.093	0.112	0.131	0.152
JM	****	****	****	****	****	****	****	****	****	****	****
JP	****	****	****	****	****	****	****	0.099	0.107	0.113	0.112

**** - DENOTES A MISSING VALUE