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**AN ECONOMIC ANALYSIS OF
IMPROVING THE VIABILITY OF RAIL LINES:
A MICHIGAN CASE STUDY**

By

John Michael Patrick

A DISSERTATION

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ABSTRACT

AN ECONOMIC ANALYSIS OF IMPROVING THE VIABILITY OF RAIL LINES: A MICHIGAN CASE STUDY

By

John Michael Patrick

In recent years, the status of Michigan's rail system has become a major concern for Michigan transportation officials. In 1973, nearly half of the Michigan Lower Peninsula rail system (2,200 miles) was operated by two bankrupted railroads--the Ann Arbor and the Penn Central. In addition, another 300 miles of rail line was pending service abandonment petitions before the Interstate Commerce Commission.

The general goal of this research effort has been to identify initiatives that Michigan transportation officials can consider for improving the long-term viability of three regional Michigan rail lines: the Ann Arbor, the Michigan Northern (formerly part of the Penn Central), and the C.O.-Northwest. To achieve this goal, three specific research tasks were undertaken: (1) Identification of factors that affect the viability of rail lines in general; (2) Determination of the financial and operating status of the Ann Arobr, the Michigan Northern, and the C.O.-Northwest, followed by evaluation of opportunities for improving the viability of the three Michigan rail lines; and (3) Specification of programs and policies that Michigan transportation officials can consider for improving the viability of the three Michigan rail lines.

Over the years, regulation has restricted the ability of railroads to remain competitive through rate and plant size adjustments in response to changing market conditions and demand for transportation services. Consequently, many railroads have adopted operating procedures that minimize their costs in the movement of freight. In terms of rail service quality, the operating procedures favor large volume rail users and heavy-density rail lines. For the light-density rail line composed primarily of small-volume rail users, the railroads' operating procedures often result in a vicious circle of poor service, decline in demand for rail service, loss of traffic, rising unit-costs, cost-saving practices, poor service, etc., that spirals relentlessly towards the point that the remaining traffic cannot cover the railroad's cost of operation and complete abandonment of service takes place.

The Ann Arbor, Michigan Northern, and C.O.-Northwest are presently caught-up in the vicious circle of deteriorating rail service. The future viability of the three Michigan rail lines depends upon reversing this downward spiral, improving the quality of rail service, increasing railroad operating revenues and/or decreasing railroad operating costs. Under existing federal and state rail reorganization legislation, Michigan transportation officials have the authority and resources to (1) encourage alternative railroad and rail user behavior, and (2) make changes in the configuration of Michigan's rail system that are likely to lead to improvements in the viability of the three Michigan rail lines.

Recommendations offered to Michigan transportation officials for their consideration as a result of this research include: (1) establishing rail user associations on the three Michigan lines to articulate and bargain effectively with railroads for improved rail service; (2) discontinuing rail service on portions of the Michigan Northern and linking the Michigan Northern and C.O.-Northwest into a regional rail subsystem; (3) establishing a transportation authority to articulate the option demand held by many individuals and communities for available rail service in the future; and (4) establishing a rail service contract and evaluation committee to promote improved rail service quality, increased use of rail service, and the adoption of cost-effective measures in the production and consumption of rail service.

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CHAPTER ONE

THE PROBLEM, SCOPE OF THE RESEARCH EFFORT, AND ANALYTICAL FRAMEWORK

The Problem

Decline in the U.S. Railroad Industry

Railroads played a key role in the rapid expansion and development of the United States during the 19th and early 20th centuries. Over the past 50 years, however, the U.S. railroad industry has experienced economic decline, stagnation and bankruptcy of major and minor roads; the recent Penn Central collapse being exemplary of the ill health of much of the railroad industry today.

At the time of its bankruptcy in June, 1970, the Penn Central employed 90,000 people, operated some 20,000 miles of track in 16 states, the District of Columbia, and two Canadian provinces. Its territory included 55 percent of the nation's manufacturing plants and 60 percent of its manufacturing employees. An integral part of the nation's transportation system, Penn Central handled more than 20 percent of all the freight cars loaded in the U.S.; over 80 percent of its traffic interchanged with other railroads.¹

Review of a few intercity freight statistics illustrates the decline of U.S. railroads vis-a-vis other transportation modes.

¹United States Railway Association, Preliminary System Plan, Volume 1, February 26, 1975, p. i.

In 1947, railroads accounted for 65 percent of the intercity freight ton-miles in the U.S.; by 1973, the railroads' share had dropped to 38 percent. During the same period, trucks increased their share of total intercity freight ton-miles from 10 percent to 23 percent; oil pipelines increased their share from 10 percent to 22 percent; inland waterways increased their share from 14 percent to 16 percent.²

When changes in the composition of the intercity freight market are accounted for, we find that the railroads' relative position has deteriorated more than the intercity freight ton-mile figures suggest. In 1940, railroads earned 55 percent of the intercity freight revenues; by 1973, their share had fallen to 23 percent.

An indication of the U.S. railroad industry's ill-health is its chronically poor and declining rate of return on investment in transportation property; rate of return on investments for the U.S. railroad industry was 3.44 percent in 1947 and 2.95 percent in 1972. For railroads in the Eastern District, including Northeast and Midwest railroads, the rate of return on investment was 3.02 percent in 1947 and 0.44 percent in 1972.³

Causes. No single cause can be attributed to the railroads' ills. Many complex and interrelated factors have contributed to

²Task Force on Railroad Productivity, Improving Railroad Productivity, A Report to the National Commission on Productivity and the Council of Economic Advisors, Washington, D.C., 1973, p. 3.

³Ibid., pp. 31-32, 91.

the current situation. Among the more important factors are:

1. rapid development of competing technologies since the 1920's, including the automobile, truck, barge, pipeline, and airplane.
2. massive public support for competing transportation modes through the provision of public funds for construction and maintenance of ground facilities and rights-of-way.
3. basic changes in underlying market conditions, including shifts in population centers, location of industry and traffic flows.
4. the inability of the railroad industry to adjust to changing market conditions because of fixed facilities, and a regulatory climate that constrains management's flexibility and options to adjust through price changes, mergers, and abandonment of obsolete properties and line.
5. restrictive work rules that create serious barriers to efficient use of labor in the railroad industry.
6. insufficient internal funds to maintain and upgrade railroad facilities, resulting in the adoption of deferred maintenance practices that in turn, lead to the further weakening of marginal lines and operations involved.
7. inability of the railroads to cooperate effectively in plant and equipment utilization, and the interlining of freight.
8. operating procedures that result in unreliable rail service, leading to the loss of traffic to more reliable modes, particularly trucks.

Federal Legislation and the Northeast and Midwest Railroad Problem

The bankruptcy of the Penn Central and seven other railroads in the Northeast and Midwest in the early 1970's spawned major federal legislation aimed at making fundamental changes in the configuration and operation of the U.S. railroad system. With growing conviction that ordinary reorganization procedures were inadequate to assure a viable rail system in the Northeast and Midwest, Congress passed the Regional Rail Reorganization Act of 1973 (RRR Act), and later amended it with the Railroad Revitalization and Regulatory Reform Act of 1976 (RRRR Act). The basic

legislative goal was the rationalization and reorganization of the several bankrupt railroads into a financially self-sustaining regional rail system. To achieve this goal, Congress directed the U.S. Department of Transportation to identify those rail properties "essential for the preservation of transportation services in the Northeast." Further, Congress created the United States Railway Association (USRA) and charged it with reviewing the Department of Transportation findings and developing a "Final System Plan." Rail properties included in the "Final System Plan" would be operated by a quasi-private, for-profit corporation, called Consolidated Rail Corporation (ConRail), another entity created as part of the RRR Act.

For those lines found to be "nonessential" to the organization of a viable Northeast-Midwest regional rail system, the RRR and RRRR Acts established a five-year rail freight assistance program. The purpose of the program is to afford states and localities time to evaluate their particular situations and facilitate necessary adjustments. After the five-year assistance period, states and localities are to assume full financial responsibility for further necessary adjustments.⁴

⁴The RRRR Act of 1976 provides for a five-year federal-state matching rail freight assistance program with the federal share being 100 percent the first year, 90 percent the second, 80 percent the third, and 70 percent for each of the fourth and fifth years. To be eligible to receive federal assistance funds, a state must submit an acceptable state railroad plan to USRA, and give evidence of financial ability to pay their share of the assistance program. (10 percent the second year, 20 percent the third year, and 30 percent the fourth and fifth years.)

In addition to the short-term rail freight assistance program, the RRR and RRRR Acts provide financial help for the rehabilitation, modernization, and acquisition of railroad plant and facilities. Government assistance is also pledged to meet labor adjustment costs. The Acts also provide for a degree of rate-making flexibility not previously available to railroads.

Michigan's Rail System

In 1973, total railroad mileage in Michigan stood at approximately 6,000 miles; 4,700 miles in the Lower Peninsula and 1,300 miles in the Upper Peninsula. In the Lower Peninsula, 2,200 miles of the total 4,700 miles were operated by solvent railroads. An additional 2,200 miles were operated by two bankrupted railroads--the Ann Arbor and the Penn Central. The final 300 miles, though operated by solvent railroads, were pending service abandonment petitions before the Interstate Commerce Commission (ICC).

Under the provisions of the RRR and RRRR Acts, 1,000 miles of the 2,200 miles of Michigan bankrupted rail line was included in ConRail. Of the remaining 1,200 miles of bankrupted line, state transportation officials decided to continue service on 1,000 miles with funds from the federal-state rail freight assistance program, discontinuing service on the remaining 200 miles. The right-of-ways and track were placed in a rail "land bank" pending further study for alternative uses.

Michigan officials have indicated the state's intention to take advantage of the five-year federal rail freight assistance program to

"more adequately" evaluate its present rail system in light of Michigan's long-term, state-wide transportation system goals.

The financial magnitude of Michigan's rail "problem" is conveyed, in part, by a recent R.L. Banks and Associates study completed for the Michigan Department of State Highways and Transportation.⁵ Banks and Associates examined available operating revenue and cost information for the 1,200 miles of Michigan rail line left out of the ConRail system. Their conclusions concerning the financial condition of the lines in question are sobering, if not shocking at first blush. For example, Banks estimated subsidies between \$10 to \$11 million would be necessary in 1976 to operate the 1,200 miles of Michigan rail line left out of the ConRail system.⁶ Based on Banks' line segmentation, subsidies per carload needed to break-even ranged from a high of \$1,084 to a low of \$31 with an average subsidy per carload of \$330.⁷

Continuing service on much of the 1,200 miles of line would not seem justified based on present traffic levels. In addition, trends

⁵R.L. Banks and Associates, Inc., Michigan Segmented Line Analyses: Traffic, Revenue, Cost, and Community Impact, Agreement No. 75-1603, Washington, D.C., October 20, 1975.

⁶Subsidies would be required to pay operating costs beyond those covered by operating revenues, an 8.3 percent return on investment and 10 percent of rehabilitation costs necessary to get the lines up to minimum (Class I) federal operating standards.

⁷The financial condition of a "line" will depend upon how it is defined, that is how it is segmented. Had Banks segmented the 1,200 miles differently, his conclusions might have been different. The line segmentation used by Banks for his study was given to him by Michigan transportation officials.

in population growth, consumption patterns, and levels of economic activity in areas served by many of the rail lines in question, do not indicate things will get better in the future. Nevertheless, there is considerable agreement, and some supporting evidence, that increases in traffic levels on some of the lines in question can be realized if the quality and frequency of rail service is improved and increased. Further, it is felt that changes in present railroad operating procedures, including the combining of several lines into a regional rail system, can lead to better plant and equipment utilization, increased labor productivity, and lower operating costs.

Scope of The Research Effort

The loss of rail service on any line may have important economic consequences for businesses and communities that use it; therefore, the loss of rail service deserves careful consideration. Of particular concern are those lines that presently, or in the future, may contribute to regional economic development activities.

Three regional rail lines of particular concern to Michigan transportation officials are the Ann Arbor, the Michigan Northern (formerly part of Penn Central), and a branch of the Chesapeake and Ohio system. Two of the lines, the Ann Arbor and the Michigan Northern, are presently being operated under the federal-state subsidy program. The third line, the branch of the Chesapeake and Ohio, although presently receiving service, is under petition for abandonment with the Interstate Commerce Commission.⁸

The Ann Arbor railroad runs northwest from Toledo, Ohio, across Michigan to Frankfort. From Frankfort, the railroad operates car ferries to the ports of Kewaunee and Manitowoc, Wisconsin. The Michigan Northern railroad runs north from Grand Rapids to Mackinaw City and includes the line between Walton Jct. and Traverse City. The third line is part of the Chesapeake and Ohio system in the northwestern corner of the lower peninsula. It runs northeast from Manistee, through Traverse City to Petoskey, and will be referred as C. & O. - Northwest hereafter. (See Figure 1-1)

⁸Interstate Commerce Docket No. AB-18 (Sub-No. 19).

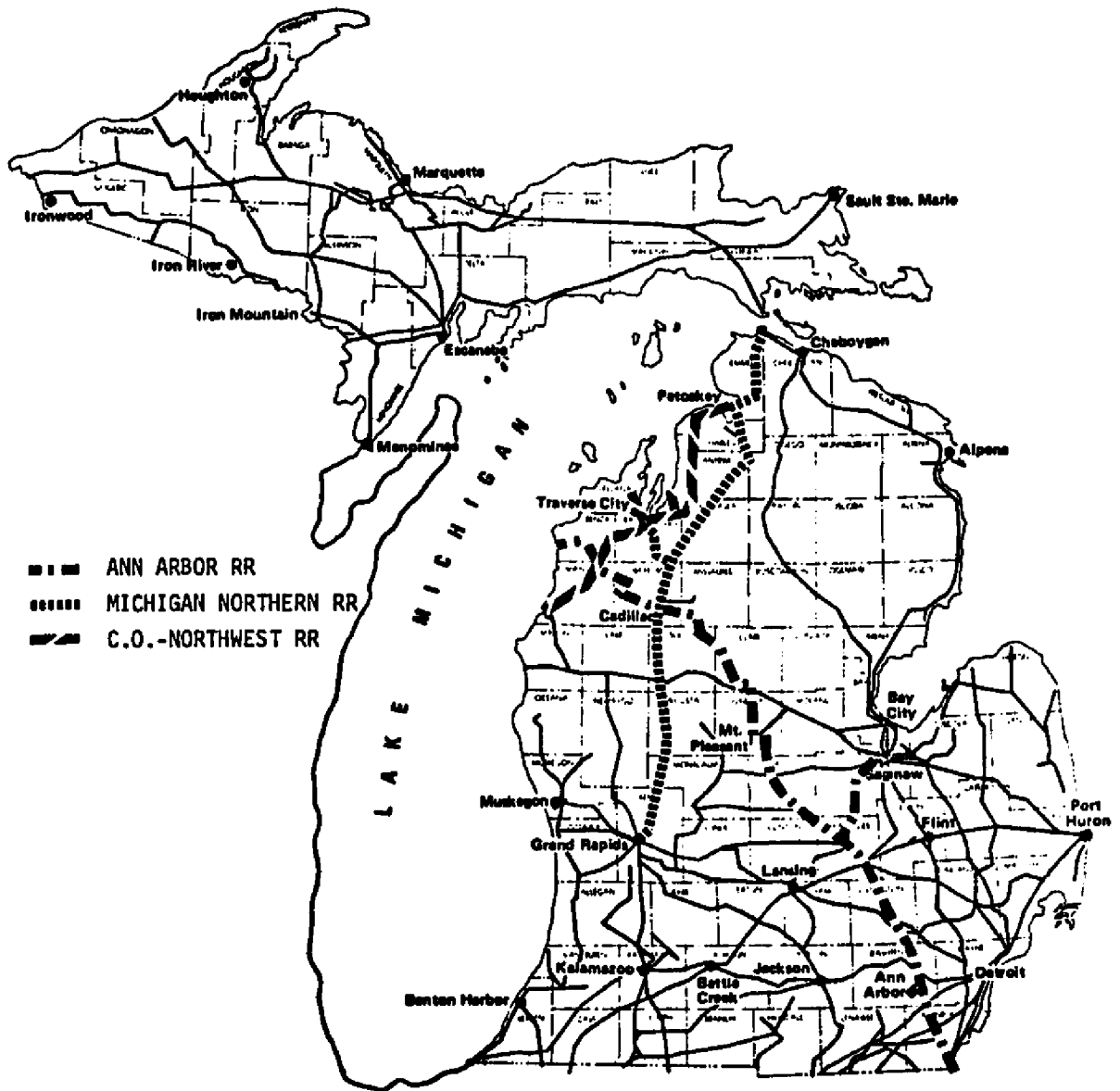


FIGURE 1-1

MICHIGAN'S RAILROAD NETWORK

Michigan officials have expressed special interest in these lines. Even though the Ann Arbor is bankrupt and incapable of reorganization, according to its trustee, Michigan officials feel otherwise.⁹ In a recent letter to the Federal Railway Administration, Governor Milliken stated that:

The Ann Arbor railroad is a key element of (Michigan's) system plan. (We) intend to use the Ann Arbor railroad as the backbone of the state supported system, with additions to the key carrier portions of the Penn Central connecting at Owosso and Cadillac, and possible future additions of Chessie system lines at Alma and Tompsonville.

The fact that Michigan has purchased portions of the Ann Arbor line between Toledo, Ohio and Frankfort from the Ann Arbor Trustees during the past year supports the Governor's position. Both the Michigan Northern and C.O.-Northwest are regarded as necessary for development of natural resources and industrial expansion in the northwestern portion of Michigan's lower peninsula.

The general goal of this research effort is to identify initiatives that Michigan transportation planners and officials can consider for improving the long-term financial viability of the Ann Arbor, the Michigan Northern, and the C.O.-Northwest railroads.

Research Objectives

The specific objectives of this research effort are threefold.

1. Identify factors that affect the financial viability of rail lines, in general.
2. Determine the present financial and operating status of three Michigan rail lines--the Ann Arbor, the Michigan

⁹Report to Mr. John N. Chase, Jr., Trustee Ann Arbor Railroad, April 1, 1974. Report submitted by Peat, Marwick, Mitchell and Co., Washington, D.C.

Northern, and the C. & O. - Northwest. Analyze opportunities for improving the financial viability of these lines.

3. Suggest programs and policies that Michigan transportation planners and officials might consider for improving the financial viability of the Ann Arbor, Michigan Northern, and C. & O. - Northwest rail lines.

Research Procedure

The procedure for accomplishing the research objectives begins with a presentation and discussion, in this chapter, of the analytical framework employed. Identification and analysis of major factors affecting the viability of rail operations and rail lines, in general, is the subject of Chapter Two. Factors considered include changing demand for transportation services, regulation, inter-modal competition, the interdependent nature of mainline and branch line operations, and intra- and inter-railroad policies and procedures used in the provision of rail services.

Analysis of opportunities for improving the viability of the Ann Arbor, the Michigan Northern, and the C. & O. - Northwest rail lines is the subject of Chapters Three and Four. Opportunities for increasing the demand for rail service on the three Michigan lines, in the present and the future, is the focus of Chapter Three. Financial analysis of alternative configurations of the three Michigan rail lines into a regional rail subsystem is the topic of Chapter Four. A summary of the research findings and suggested policies and programs for improving the viability of the three Michigan rail lines is presented in Chapters Five and Six.

Analytical Framework

An institutions, behavior, and performance (IBP) framework of analysis is used in this research effort. For purposes of clarification, the analytical framework is first presented in its general form. This is followed by a brief discussion of (1) the relationship between institutions and physical and technological characteristics of goods and services and its impact on behavior and performance; and (2) the effect of alternative modes of behavior on performance. Finally, the IBP framework is discussed in the context of the provision of rail service.

IBP Framework - General Form

Institutions. Institutions are the rules and regulations adopted by participants in a system to structure their relationships. Institutions establish the structure of opportunity sets (range of choices) defining the bounds of individual and group action. The structure of opportunity sets represent a system of human interaction and interdependence. The choices made by individuals and groups are both dependent and independent of the choices of other participants. They affect the range of choices available to others.

System's performance is the collective outcome of individuals and groups choosing between alternative courses of action within their opportunity sets. Institutions establish sets of reinforcement contingencies (rewards and sanctions) to elicit and guide individual and group behavior.

Behavior. Behavior is the choices individuals and groups make within their opportunity sets. The fact that individuals and

groups have a choice between alternative courses of action indicates that more than one collective outcome (i.e., system's performance) is possible. Predicting and modifying the outcome of alternative institutions requires understanding of the forces that influence choice-making by the individuals and groups in the system.

Uncertainty and limited information characterize individual and group decision-making. Uncertainty exists because man's knowledge of the real state of affairs is limited by his ability to (1) acquire and (2) assimilate information. Man has finite mental capacity for organizing and assimilating information. Consequently, man cannot know all possible outcomes of his choices. Uncertainty is made greater, secondly, by the costs of acquiring information. An individual or group attempting to reduce uncertainty will actively seek information, but the process involves real and direct costs. Available resources and expected net benefits will determine how much information an individual or group will obtain. Therefore, in most cases, the amount of information it is rational for an individual or group to acquire is even less than the amount they are capable of absorbing.

Given uncertainty and limited information, individuals and groups employ decision rules--techniques and standard operating procedures (SOPs)--to achieve their objectives. Techniques are employed by individuals, and SOPs by groups, to carry out daily activities, respond to problems and handle new situations. In addition, where the success of an individual or group to achieve its objectives depends on the actions of others, efforts will be made to

establish coordinating mechanisms for sharing information and making and carrying out decisions.

Techniques, SOPs, and coordinating mechanisms are learned modes of behavior maintained, modified, or discarded on the basis of how well they serve individuals and groups in pursuit of their objectives. Outside forces, due to a change in the environment, can reduce the effectiveness of existing techniques, SOPs and coordinating mechanisms, signaling a need for their modification. Or, given environmental conditions, the availability of new information can lead to the adoption of new techniques, SOPs and coordinating mechanisms.

In general, two thresholds characterize the use and modification of techniques, SOPs and coordinating mechanisms--a perceptual threshold and a reaction threshold. Because individuals and groups are limited in time, energy and ability to analyze and interpret new situations, prevailing techniques, SOPs and coordinating mechanisms will continue in use, even though they may no longer be appropriate (i.e., the prevailing techniques, SOPs and coordinating mechanisms are no longer the most efficient means for achieving a specified set of objectives, or they may produce undesirable outcomes). Eventually, however, a perceptual threshold is reached when the appropriateness of techniques, SOPs, and coordinating mechanisms are questioned. Modification and change do not occur, however, until a reaction threshold is reached. The period of time separating the two thresholds is a function of the perceptions of costs and benefits associated with change. Not until the perceived

benefits from adopting new techniques, SOPs and coordinating mechanisms are greater than the perceived costs of staying with the prevailing techniques (SOPs and coordinating mechanisms) will individuals and groups move from perceptual thresholds to reaction thresholds and change becomes possible.

In many situations awareness of the potential net benefits of change may not be enough to bring about change. This is particularly true where change in the behavior of two or more individuals or groups is required in some systematic way. The failure of one individual or group to alter its behavior can deny all individuals and groups the benefits of change. In such situations, special incentives may be needed to encourage the appropriate behavior. This may mean modification of the existing institutions (i.e., rules, regulations and sets of reinforcement contingencies) or the creation of new institutions.

Performance. System performance is the flow of consequences from the structure of institutions. Individuals and groups have performance objectives. Whether these objectives are achieved depends upon the structure of institutions that determine the structure of opportunity sets and incentive systems that motivate individual and group behavior.

By system performance we mean dynamic interaction in which performance in period one feeds back and shapes performance in period two. In addition, within the system (structure of institution) a number of subsystems may exist. The performance of the larger system is determined, in part, by the performance of the subsystems, and vice versa.

Institutions and Physical and Technical Characteristics of
Goods and Services¹⁰

Predicting the consequences of alternative opportunity sets requires an understanding of the specific variety of human interdependence raised by particular goods, services, or situations. Various physical and technological characteristics of goods and services affect interdependence.

High Exclusion Cost Goods and Services. Many goods and services, once produced, can be consumed by all whether they contribute to their production costs or not. In such situations, if the costs of producing the good or service must be paid for by consumers on a voluntary basis, production might not take place. As more and more consumers prefer a "free ride" rather than pay their share, the greater the burden that falls on the few who are willing to pay, and the payments of a few may not be enough to justify committing resources to production of the good or service.

Production and maintenance of high exclusion cost goods and services occurs in three situations: (1) where a sense of community and individual expectation prevents consumers from being "free riders"; (2) where consumers turn to government to collect taxes and purchase the good or service because sense of community is not strong enough to prevent "free rider" behavior; (3) where a group

¹⁰A. Alan Schmid, The Economics of Property, Power and Public Choice: Consequences of Institutional Alternatives, Unpublished Manuscript, Department of Agricultural Economics, Michigan State University, 1974.

of consumers, willing to share the production costs of the good or service but unable to organize their contribution due to high organization costs, turn to government to bear the initial organizational costs.

A number of variations of the high exclusion cost good or service exist. One variation related to this research effort is the individual consumption (private) good or service that also possesses characteristics of a collective-consumption (public) good or service.¹¹ For example, consider a good or service that possesses a number of characteristics, including different levels of quality. The initial purchase of the good or service is limited to those who pay a users fee. Those who do not pay cannot consume the good or service--hence the good or service can be considered private. However, for those who do purchase the good or service, the quality of the good or service is consumed by all. Changes in the quality of the good or service become part of the good or service and are consumed equally by all--hence the private good or service is also, in part, a public (collective-consumption) good or service. Efforts to improve the quality of an individual-collective consumption good or service may face problems similar to those involved in the production of high exclusion cost goods and services.

¹¹For discussion on this point see: Burton A. Weisbrod, "Collective-Consumption Services of Individual-Consumption Goods," Quarterly Journal of Economics, LXXVIII (August 1964), 471-477.

Goods and Services with Lumpy and Indivisible Cost Structures.

The production of some goods and services involve large initial investments before the first units can be produced, with the costs of producing subsequent units declining over a broad range of output. The cost to the consumer is a function of the demand of other consumers. The larger the number of consumers, the lower the per unit cost to each consumer, as the firm can spread its large fixed costs over more units of output. Consumers recognizing this, and being uncertain as to the behavior of others, may decide to withhold their purchases in hopes others will purchase first, thereby lowering the cost to them. If all or the majority of consumers take this attitude, the per unit costs will remain high and the firm may eventually go out of business.

Similar to the case of the high exclusion cost good or service, some mechanism is needed to articulate individual demand for the good or service.

Investment Coordination. The problems of uncertainty and fixed assets go beyond the individual firm when coordination of investments in a number of interdependent production steps are required to produce a good or service. In such situations, a sequence of investments, each representing a sizeable investment and minimum operating level to be efficient are involved. Interdependence between production units as well as consumers are involved; the decisions of one firm impact on the decisions of other firms, and eventually are felt by the consumers in terms of price and quality of goods and services available. In a like manner, the decisions

of consumers to be "free riders" or not, to coordinate their demand, etc., will affect the price and quality of goods and services produced.

Option Demand and Contigent Claims. Many consumers would like the option to consume certain goods or services in the future, whether they do or not. Consumers may value the option-demand goods and services as a hedge against unlikely and unexpected changes in the environment. The production of option-demand goods and services can create problems for producers. Firms may be unwilling to undertake investments today based on uncertain knowledge of future demand. The firm needs some guarantee of a minimum level of compensation or return to justify its investment in the production and maintenance of option-demand goods and services.

Markets in "contingent claims" (option-demand) for the right to consume a good or service in the future, under specified conditions, do exist; insurance is one common example of this. For option-demand goods and services that are also high exclusion cost goods and services, markets for that particular contingent claim may not exist. An alternative may be for government to purchase the option-demand good or service and provide it free of direct charge to all members of the collective group. Tax payments to the governmental unit would be substituted for direct payment to the producer.

Summary. Predicting the consequences of alternative institutions (i.e., a change in rules, regulations and reinforcement contingencies) requires an understanding of the factors and forces that

affect human interdependence and behavior. Human interdependence and behavior vary with different goods, services, and situations. Also, when an individual's or group's action (behavior) depends on the actions of others, information and perceptions play a key role in determining performance.

Alternative Modes of Behavior and Performance

System's performance is the collective outcome of individuals and groups choosing between alternative courses of action (behavior) within their opportunity sets. This implies that different outcomes (performance) can be achieved by encouraging the adoption of alternative individual and group behavior.

Recent works by Albert O. Hirschman¹² and Mancur Olson¹³ in the area of individual (firm) and group (organization) behavior and performance are relevant to this discussion.

Exit, Voice, and Loyalty. According to Hirschman, all firms and organizations experience deterioration in performance from time to time. That is, they experience absolute or comparative deterioration in the quality of the product or service they provide. Recuperation (improved performance) usually occurs with management responding to customer-member exit or voice or some combination of

¹² Albert O. Hirschman, Exit, Voice and Loyalty: Response to Decline in Firms, Organizations and States, (Harvard University Press, 1970).

¹³ Mancur Olson, The Logic of Collective Action: Public Goods and the Theory of Groups, (Harvard University Press, 1965).

the two. Exit occurs when the customers stop buying the firm's product (service) or members leave the organization. Exit results in a drop in revenues, decline in membership, and management is impelled to find ways to correct its faults. Voice occurs when customers-members express their dissatisfaction directly to management, through general protest or political action. Management responds once again, in the search for ways to correct its faults, and recapture lost revenue or membership.

Hirschman notes that in our economy, few situations will exist where recuperation (or improvement) of firm performance can be achieved through the use of exit or voice alone. Instead, he argues, success will most likely come through the artful balancing of the two, and, that the degree of recuperation (improved performance) and speed with which it occurs will depend on the interaction of some exit-voice combination and the reaction function of management.

Improved Performance. Hirschman makes two important observations regarding opportunities for improved performance vis-a-vis the interaction between customer-member exit and/or voice and management's reaction function.

1. Management's reaction function can be visualized as a discontinuous three-value function. No management reaction occurs for small decreases in revenue or increases in protest; full recovery in performance occurs for intermediate size decreases in revenue or increases in protest; and, no recovery occurs if large decreases in revenue or increases in protest occur. Too large a

drop in revenues may bankrupt the firm before it can respond; or too much protest may be so harassing that the firm will not be able to respond.

Hirschman's management reaction function can be described in terms of perception and reaction thresholds. To improve performance, a "minimum" level of revenue loss and/or protest is needed before the firm perceives something is wrong; an "optimum" level of revenue loss and/or protest is needed to encourage the firm to react in a positive way--improving performance. But, "too large" of a drop in revenues and/or protest can cause the firm to react in a negative way--the firm may go out of business or adopt behavior that causes performance to deteriorate even more. What constitutes "minimum", "optimum" and "too large" will vary with firms and situations.

2. Customers (members) may resort to exit in response to the deterioration in the quality of a good or service. The firm (organization) may not be sensitive to exit, in which case performance will not be improved. On the other hand, had the customers (members) protested (voice) the decline in the quality of the good or service improved performance may have resulted. Consequently, the choice of mechanisms (exit, voice, or some combination) is just as important to achieve improved performance as is the strength with which they are employed. The following example, discussed by Hirschman, may provide some insight into how the concepts of exit and voice might be related to this research effort and the importance behavior plays in efforts to improve performance.

In a recent book,¹⁴ I tried to explain why the Nigerian railways had performed so poorly in the face of competition from trucks, even for such long-haul, bulky cargo as peanuts...Specific economic, socio-political, and organizational reasons could be found for the exceptional ability of the trucks to get the better of the railroads in the Nigerian environment; but having done so I still had to account for the prolonged incapacity of the railroad administration to correct some of its more glaring inefficiencies, in spite of active competition, and proposed the following explanation:

The presence of a ready alternative to rail transport makes it less, rather than more, likely that the weaknesses of the railways will be fought rather than indulged. With truck and bus transportation available, a deterioration in rail service is not nearly so serious a matter as if the railways held a monopoly for long-distance transport--it can be lived with for a long time without arousing strong public pressures for the basic and politically difficult or even explosive reforms in administration and management that would be required. This may be the reason public enterprise, not only in Nigeria but in many other countries, has strangely been at its weakest in sectors such as transportation and education where it is subjected to competition: instead of stimulating improved or top performance, the presence of a ready and satisfactory substitute for the services public enterprise offers merely deprives it of a precious feedback mechanism that operates at its best when the customers are securely locked in. For the management of the public enterprise, always fairly confident that it will not be let down by the national treasury, may be less sensitive to the loss of revenue due to the switch of customers to a competing mode than to the protests of an aroused public that has a vital stake in the service, has no alternative, and will therefore "raise hell".

In Nigeria, then, I had encountered a situation where the combination of exit and voice was particularly noxious for any recovery: exit did not have its usual attention-focusing effect because the loss of revenue was not a matter of the utmost gravity for management, while voice did not work as long as the most aroused and therefore the potentially most vocal customers were the first ones to abandon the railroads for the trucks. It is particularly this last phenomenon that must be looked at more closely, for if it has any generality, then the chances that voice will ever act in conjunction with exit would be poor and voice would

¹⁴Albert O. Hirschman, Development Projects Observed, (The Brookings Institution, 1967), pp. 146-147.

be an effective recuperation mechanism only in conditions of full monopoly when the customers are securely locked in. ¹⁵

Willingness to Use Voice. The decision to exit or not will often depend on the prospects for the effective use of voice. If customer-members believe that voice will be effective, exit may be postponed. The decision not to exit in the face of a clearly better buy (or organization) will be made by customers (members) based on expected complaints and protests of others, and the likelihood of success. The effort customers-members make to put their case before management will be in proportion to the advantage to be gained from a favorable outcome multiplied by the probability of influencing management decisions.

The probability of influencing management decisions will depend, in large part, on the bargaining power customers-members have vis-a-vis firms-organizations. In general, the larger the percent of total firm sales a customer (or group of customers) represent, the greater their bargaining power; and the more likely the firm will be responsive to their protests and threats of exit. Smaller customers (in terms of total sales) may be able to improve substantially their bargaining position through collective action. Individual and collective use of voice entails a number of costs, however, that must be weighed against the expected benefits of voice. Customers must consider the opportunity cost of voice (forgoing the exit option). They must also bear the direct costs

¹⁵ Albert O. Hirschman, Exit, Voice, and Loyalty: Response to Decline in Firms, Organizations and States, Op. Cit., pp. 44-45.

of money and time (transaction costs) spent trying to change the firm's behavior. Although collective action may result in lower individual transaction costs and increased bargaining power, individuals may fail to organize because of high initial organizational costs.

Hirschman argues, however, that once voice is recognized as a useful mechanism for improving and maintaining firm (organization) performance, institutions can be designed in such a way that the cost of individual and collective action would be decreased. A major advantage of voice over exit is the information conveyed to the firm. While exit of customers is evidence to the firm that it is doing something wrong, it doesn't (necessarily) indicate what it is doing wrong. Voice, on the other hand, can be used to communicate to the firm what is wrong, e.g., in what ways product or service quality has deteriorated. Firms, in turn, may communicate to customers changes in customer behavior that would facilitate improvement in the quality of the products and services they produce.

Exit: Not Too Easy or Too Attractive. According to Hirschman, the willingness to develop and use voice is reduced by the opportunity for exit. But the ability to use voice with effect is increased by the potential for exit. Consequently, there should be a possibility for exit, but it should not be too easy or too attractive. This may sound like a contradiction, but it is a very important point. We will attempt to develop this point in the following paragraphs.

For any individual, a quality change in a product or service can be translated into an equivalent price change. But this

equivalence will normally vary from individual to individual due to the different values placed on product and service quality. Some individuals may stop purchasing the good or service immediately if quality deteriorates, provided an acceptable competing product or service is available, even if it is at a much higher price. Their exit reduces the chances that voice will be used in the future.

...the consumers who drop out when quality declines are not necessarily the marginal consumers who would drop out if price increased, but may be intramarginal consumers with considerable consumer surplus; or, put more simply, the consumer who is rather insensitive to price increases is often likely to be highly sensitive to quality declines.

At the same time, consumers with a high consumer surplus are, for that very reason, those who have most to lose through a deterioration of the product's quality. Therefore, they are the ones who are most likely to make a fuss in case of deterioration until such time as they do exit. 16

To prevent deterioration in product and service quality from becoming cumulative, Hirschman argues:

Specific institutional barriers to exit can often be justified on the grounds that they serve to stimulate voice in deteriorating, yet recuperable organizations which would be prematurely destroyed through free exit. 17

In addition, loyalty can provide the needed balance between exit and voice. Loyalty, according to Hirschman, can "hold exit at bay" while it "activates voice". The importance of loyalty is that it can neutralize within certain limits the tendency of the most quality-conscious customers to exit first.

¹⁶Albert O. Hirschman, Exit, Voice, and Loyalty, Op. Cit., p. 49.

¹⁷Ibid., p. 79.

Loyalty...helps to redress the balance by raising the cost to exit. It thereby pushes men into the alternative, creativity-requiring course of action from which they normally recoil and perform a function similar to the underestimate of the prospective task's difficulties.¹⁸

Summary. Hirschman's work illustrates the importance that alternative behavior can have on performance. Improving performance in many situations will require modification of existing institutions or the creation of new institutions to encourage and reward alternative behavior.

Logic of Collective Action

Individual Behavior and Collective Goods and Services. Oftentimes individuals can achieve their objectives through individual, unorganized action. Frequently, however, individuals share certain common interests that can only be provided through some type of organized, collective action. Many common interest goods or services, however, possess characteristics that make them difficult to provide through volunteer forms of collective action.

Olson, for example, observes that it is not always true that individuals with common interests will attempt to further those interests through group action.

...It does not follow, because all the individuals in the group would gain if they achieved their group objective that they would act to achieve that objective even if they were all rational and self-interested. Indeed, unless the number of individuals in a group is quite small, or unless

¹⁸ Albert O. Hirschman, Exit, Voice and Loyalty, Op. Cit. p. 80.

there is coercion or some other special device to make individuals act in their common interest, rational, self-interested individuals will not act to achieve their common or group interests. ¹⁹

A rational, self-interested individual is expected to adopt behavior that will maximize his welfare subject to the constraints of his opportunity set; an individual is acting rationally when he seeks to acquire benefits and avoid costs. In the case of a high exclusion cost good or service, rational individual behavior would suggest the good or service may not be produced if collective action is required.

Even though a large number of individuals may have a common interest in obtaining the collective good or service, they do not have a common interest in paying the cost of providing the good or service. Each individual would prefer that the others pay the entire cost, since it would be difficult to exclude him from any benefits whether he paid his share of the cost or not.

Group Size, Organization Costs and Selective Incentives. Whether the collective good or service is provided or not will depend upon the number of individuals involved and/or the presence of special incentives. If a few individuals stand to receive a large share of the benefits, they may decide to bear the entire cost of providing the collective good or service. A group agreement for sharing costs is not needed.

If, however, the benefits are widely dispersed over a large number of individuals, the collective good or service will not be

¹⁹ Mancur Olson, The Logic Of Collective Action, Op. Cit., pp. 1-2.

obtained without some group agreement for sharing costs. In such situations, individuals may lack the incentive to cooperate because they feel their contributions, relative to the total needed, would not make much difference. They also know that if the collective good or service is provided, they benefit without bearing their portion of the cost. This type of behavior may lead to the non-provision of the collective good or service.

The larger the group, moreover, the greater the costs of organization and obtaining agreement. Where there is no pre-existing organization, certain minimum costs must be borne to establish an organization. For example, there are the costs involved in providing information, communication and decision-making. There are also costs of staffing and maintaining the operations of the organization on a day-to-day basis. These costs make the first unit of the collective good or service quite expensive in relation to subsequent units. And according to Olson:

...However immense the benefits of the collective good, the higher the absolute total costs of getting any amount of that good, the less likely it is that even a minimal amount of that good could be obtained without coercion or separate, outside incentives. 20

Incentives to encourage individuals to contribute to the costs of obtaining the collective good or service must be "selective" if they are to be effective; they must allow those who do not belong to the organization or otherwise contribute to the collective good to be treated differently from those that do. According to Olson, these "selective incentives" can be either negative or positive in

²⁰ Mancur Olson, The Logic of Collective Action, Op. Cit., pp. 47-8.

that they coerce by punishment those who fail to bear an allocated share of the costs of group action, or they can be positive inducements offered to those who act in the group interest.²¹

"Selective incentives" can be social in nature as well as economic. Friendship, respect and prestige can be strong motivating factors. Oftentimes social incentives can substitute for economic incentives, or they can compliment economic incentives. Olson notes that in general, social pressure and social incentives operate best in small groups, where members can have face-to-face contact with one another.

One way to operationalize social incentives in the large group context is to divide the group into a number of smaller federated groups. Through the use of economic incentives (e.g., provision of services) the federated organization could encourage the "federal" groups to use their social incentives to get individual members to contribute to the collective interests of the whole group.

Selective Incentives: A Few Examples. Olson argues that the common characteristic which distinguishes all of the large economic groups with significant lobbying activities for collective goods is that they are organized for some other purpose. For example, the provision of private or noncollective products, or social and recreational benefits are used as a source of positive inducement to attract and to maintain membership.

1. American Medical Association obtains its membership partly through the use of subtle coercion, and partly by providing

²¹ Mancur Olson, The Logic of Collective Action, Op. Cit., p. 51.

noncollective benefits. Members benefit from mal-practice defense, and technical information through medical journals and conventions.

2. Trade Associations distribute statistics, provide credit references on customers, help collect bills, and provide technical research and advisory services.
3. Farmer Cooperatives provide members with technical assistance market information, marketing and farm supply services, credit, and various types of insurance.

The ability of some organizations and groups to attract and maintain members requires legislation. For example, the Wagner Act made organizing a union with compulsory membership much easier. Also, many state legislatures have required by law that every practicing lawyer must be a member of the state bar association.

Summary. Many goods and services require collective action if they are to be provided. Special incentives may be needed to encourage group-oriented behavior.

Provision of Rail Service in the IBP Framework

The following is a brief outline of the IBP variables involved in the provision of rail service. The various relationships between these variables and subsequent consequences on the viability of selected Michigan rail lines is the subject of the following chapters.

Institutional Variables. Federal legislation listed below has defined what railroads can do, can not do, and must do when tendering rail service.

1. Granger Laws, late 1800's,
2. Act to Regulate Commerce, 1887,
3. establishment of Interstate Commerce Commission, 1887,
4. Transportation Act of 1920,
5. Railway Labor Act of 1926,
6. Emergency Transportation Act of 1933,
7. Transportation Act of 1940,
8. Transportation Act of 1958,
9. Department of Transportation Act of 1966,
10. Regional Rail Reorganization Act of 1973, and
11. Railroad Revitalization and Regulatory Reform Act of 1976.

The rules and regulations provided by the above legislation are broad and far ranging with respect to railroad behavior. Included are rules and regulations pertaining to:

1. rate-making by railroads, individually and jointly;
2. establishment of routes, individually and jointly;
3. division of revenues by railroads participating in joint movement of traffic;
4. joint use of equipment and facilities, including cars, trucks, terminal and classification yards;
5. new rail line constructions;
6. rail service abandonments;
7. railroad consolidations and mergers;
8. settlement of labor disputes;
9. minimum safety standards for track, grade crossings, signal equipment, over-passes, and rolling stock;
10. records and accounting procedures; and
11. intermodal operations.

In addition to federal rules and regulations pertaining to interstate railroad freight movements, most states have specific laws and regulations governing intrastate railroad operations.

Behavioral Variables: Techniques, SOPs and Coordinating Agreements. Within the allowable range of action established by federal and state laws (rules) and regulations, railroads' management and operators have developed a set of techniques, SOPs, and coordinating agreements for providing rail service; these procedures and agreements govern intra-railroad and inter-railroad behavior as well as railroad-rail user relationships.

The following presents a brief outline of the major procedures and agreements; the list is not meant to be exhaustive.

1. rate bureaus for setting through rates, joint rates and determination of revenue divisions between railroads involved in the movement of freight over the lines of two or more railroads;
2. agreements, including car-service, per-diem and demurrage rules, to improve the utilization of rolling stock and other equipment;
3. reciprocal switching and interchange agreements to move freight through terminal and classification yards and between intermediate yards.
4. negotiated labor contracts specifying wage levels, work rules and seniority privileges;
5. established through routes, in-transit and stop-off privileges;
6. arrangements with rail users for special handling, construction of spurs, sidings, loading-unloading facilities, storage facilities and use of intermodal ("Piggyback"-TOFC, COFC) services;
7. procedures for handling damage claims, tracing cars, routing cars, and soliciting new business;
8. maintenance, rehabilitation, and modernization programs and policies, vis-a-vis plant facilities, rolling stock and other equipment;
9. policies determining train-unit size (locomotive power, cars per train) and frequency of service; and
10. methods of response to dissatisfied rail users.

Performance. Performance consequences in the context of railroad operations can be considered at three levels--the railroads, the rail users, and the community.

Railroads are concerned with maintaining sufficient revenue levels to cover their costs, plus earning a reasonable rate of return on their investment.

Rail Users are concerned with receiving reliable, economical rail service. Rail service is a factor of production to the rail user (firm); the effective cost of rail service will affect the firm's position in the marketplace.

Communities can be considered at two levels: The local rail-using community and the larger, less well-defined community of regional and state rail interests. Local communities are concerned about receiving reliable, economical rail service because it affects employment, business activity, and potential growth opportunities. Regional and state communities of interest are concerned about reliable, economical rail service as it affects future opportunities to develop natural resources, expand and diversify economic activity and promote desired settlement patterns.

Major factors determining the performance consequences of railroad operations vis-a-vis railroad, rail user, and community interests are railroad operating revenues and costs. Railroad operating revenues and costs are determined by supply and demand forces including:

1. train-unit operating capacity and frequency of service;
2. maintenance, rehabilitation, and modernization of railroad properties--track, roadbeds, switches, signal equipment, other structures, and rolling stock;
3. rail freight rates;
4. rail service quality--transit time, variance in transit time, rail user contact with railroad personnel, availability of cars and other equipment, etc; and
5. freight rates and quality of service provided by competing modes of transportation.

CHAPTER TWO

SOME FACTORS INFLUENCING THE VIABILITY OF RAILROAD OPERATIONS

The viability of a railroad and the lines it serves depends upon the revenues and costs generated by the provision of rail service; in turn, railroad revenues and costs are determined by forces shaping the supply and demand of rail services.

Transportation service is a factor of production to the firm. The demand for rail service vis-a-vis other transportation modes will be based upon the comparative rate and service characteristics of the available modes. A number of factors determine the rate and service characteristics of the different modes of transportation, including technology, regulation, and the extent of intra- and inter-modal competition and cooperation.

The rate and service characteristics of rail service, in particular, depend upon coordination and cooperation among railroads. Intra- and inter-railroad procedures and policies affect railroad operating costs as well as rail service characteristics. Also, the viability of many branch lines depends upon the performance of the interline carriers as much as they do on the performance of the originating or terminating branch line carrier.

Finally, railroad behavior in the short run designed to reduce the pressures of a deteriorating financial situation often trigger rail user counter-behavior that leads to the abandonment of

rail service. On many rail lines, an alternative structure of incentives could discourage such self-defeating railroad-rail user behavior, and, instead, promote the adoption of new behavior that would improve the viability of rail operations.

The purpose of this chapter is to consider the above points in greater detail. Insight into the dynamics of major factors determining the viability of rail operations will serve as a basis for evaluating the circumstances of Michigan rail lines, and for making recommendations for improvements.

Demand for Transportation Services and Regulation

Derived Demand. Demand for freight transportation service is a derived demand and can be considered in the same way as demand for any other factor of production. In general, the demand for a factor of production will be less elastic (sensitive to price changes): (1) the less elastic the demand for the commodity using the factor; (2) the less important the price of the factor in the cost of producing the commodity; (3) the less factor substitution is possible in the production process; and (4) the less willing other factory owners are to match reductions in the cost of a given factor.

The demand for general transportation services is probably quite inelastic in the short run. Once the firm's locational decision has been made, its transportation needs are more or less fixed. In the long run, however, locations become flexible and the firm

could alter its overall dependence on transportation services. Also, transportation accounts for a small percentage of the final-goods price for most commodities.²²

Although the overall elasticity of demand for transportation is probably low, cross elasticities between modes are probably high. The demand for a given transport mode will depend on the rate and service characteristics (speed, reliability, shipment size, etc.) offered by that mode and all competing modes. The nature of demand will be influenced by the type of commodity being shipped. Since commodities possess different characteristics, they are often sensitive to different aspects of transport costs. For example, a particular commodity's elasticity of demand with respect to price and service characteristics will vary according to the value, density, volume, fragility, or perishability of the commodity.

Friedlaender presents a good discussion of this point:

Density should primarily affect the shipment costs per ton. Since the unit of supply is the truck or box car instead of the ton, the greater the density, the greater the possible load per vehicle mile; hence, the lower the cost per vehicle mile. This implies that dense commodities

²²Friedlaender reports, for most commodities, transportation accounts for no more than 2 percent of the final-goods price. Transportation costs are the highest in ferrous mining (9.1 percent of the final-goods price), chemical and fertilizer mineral mining (6.4 percent of the final-goods price), lumber and wood products (5.1 percent of the final-goods price), stone and clay products (6.0 percent of the final-goods price), and primary iron and steel products (5.3 percent of the final-goods price).

Ann F. Friedlaender, The Dilemma of Freight Transport Regulation, (The Brookings Institution, 1969), p. 52.

should have a relatively lower percentage of transport costs embodied in their final-goods price. Thus, the elasticity of demand with respect to rates should be rather low for dense commodities. This is not true with respect to other determinants of demand, however. Since a given transport vehicle (barge, box car, or truck) can transport a large tonnage of a dense commodity, the value of the shipment will be greater than that for a less dense commodity. This will increase inventory costs associated with a shipment. Hence for dense commodities, the elasticity of demand with respect to speed, minimum shipment volume, and reliability should be rather high.

Value affects transport demand in a fashion similar to density. Since high-value commodities usually have a low percentage of transport costs in their final-goods price, their elasticity with respect to rates should be fairly low. Similarly, because any given shipment will incur higher inventory costs as the value of the commodity rises, high-value goods should have a relatively high elasticity with respect to speed, minimum shipment volume, and reliability.

Volume refers to quantity shipped per unit of time. Therefore, the larger the volume to be shipped the more sensitive should shippers be to rate differentials and the greater should be the elasticity of demand with respect to rates. Large-volume shippers would probably not be very sensitive to other elements of transport demand. Since a large volume implies a relatively constant throughput, speed or reliability should not affect the transport demand of high-volume shippers very much.

Fragility should make a commodity sensitive to such factors as speed and reliability. Moreover, since the minimum shipment size will determine the amount of loss in case of accident, fragile commodities should be sensitive to minimum shipment size. It is likely that fragile commodities will be more sensitive to these characteristics than rate differentials.

To recapitulate, low-value, average-density commodities with a large annual shipment should be sensitive to rates and not particularly sensitive to the inventory costs associated with speed, minimum shipment size, and reliability. High-value, dense or fragile commodities should be relatively insensitive to rates, but sensitive to the factors affecting inventory cost.²³

²³Ann A. Friedlaender, The Dilemma of Freight Transport Regulation, Op. Cit., pp. 54-55.

Assuming a competitive market for transportation services, and given knowledge of firms' transportation service requirements and the technical capabilities of the different carriers, one would expect freight traffic to be allocated between the different modes according to relative cost; carriers would be expected to carry freight traffic for which they have lower total marginal costs. However, to the extent that regulation of transportation service pricing exists, the distribution of freight traffic will not occur on the basis of the lowest total marginal cost. In addition, to the extent that regulation affects, directly or indirectly, the character of transportation services, the distribution of freight traffic among the competing modes will also be affected.

In the following paragraphs, an effort will be made to analyze the dual effects of a changing intercity freight market and a regulated transportation industry on the present and future viability of railroad operations. A detailed analysis of the impact of regulation on economic efficiency in the transportation industry is beyond the scope of this research effort. The reader is referred to the work done by Friedlaender, Meyer, and others for empirical investigations of this question. ²⁴

Railroads: The Early Years. From the first days of the Republic, transportation has been aided and promoted at various governmental

²⁴Ann F. Friedlaender, The Dilemma of Freight Transportation Regulation, (The Brookings Institution, 1969); John R. Meyer, et. al., The Economics of Competition in the Transportation Industries, (Harvard University Press, 1959); Robert A. Nelson and William R. Greiner, "The Relevance of the Common Carrier Under Modern Economic Conditions", in Transportation Economics, (Columbia University Press, 1965), pp. 351-74.

levels in our society. Improved transportation systems were essential to developing the nation's physical resources and physically settling the continent. It was recognized that even in a country committed to private enterprise, governmental assistance was needed to create an environment conducive to economic development.

Social and economic development goals and economic characteristics of establishing and operating transportation systems led to public policies that gave railroads broad powers. Public land-grant policy ²⁵ and free entry led to a flurry of rail-building activity in the mid- and late 1800's. ²⁶ In 1860, total miles of railway operated in the U.S. was 30,626. Forty years later (1900) it was 192,556 miles, a 529 percent increase. Total miles of railway operated in the U.S. reached its peak of 260,440 miles in 1930, a 35 percent increase over the same figure for 1900. Early rail line construction was local in character with lines seldom connecting--hardly what could be called a system.

Public support for the promotion of railroads began to wane in the years following the 1860's, however. There were several reasons for this: political, social and economic. ²⁷ Excesses in

²⁵ Railroads were given condemnation powers for obtaining right-of-way; the cost of piecing together rights-of-way through individual land parcel purchases would have been prohibitive.

²⁶ Roy J. Sampson and Martin T. Farris, Domestic Transportation: Practice, Theory, and Policy, (New York: Houghton Mifflin Co., 1966), p. 25.

²⁷ For elaboration of these views see: Frank Norris, The Octopus, (New York: Doubleday and Company, Inc., Bantam Books, 1958); Cornelius Cotter, Government and Private Enterprise (New York: Holt, Rinehart & Winston, 1960); Gabriel Kallo, Railroads and Regulation, (Princeton University Press, 1965); Solum Justus Buck, The Granger Movement, 1870-1880 (Harvard University Press, 1913).

railroad promotion and construction were common. Railroads frequently built duplicating lines in their efforts to tap lucrative areas; this resulted in substantial excess plant capacity. Exploitation of individual rail users and communities was common as railroads sought to adjust. Given their high fixed costs and low variable cost structure, railroads engaged in drastic rate competition for traffic and revenues. The result was volatile prices and uncertain service for rail users and "ruinous competition" for the railroads. An alternative for many railroads was collusion and discrimination against shippers or areas that had few options--predominantly farmers and farming communities.

Agrarian discontent towards the railroad reached a peak in the early 1870's with the passage of Granger Laws. A number of mid-western states passed laws forbidding rate discrimination and established maximum rates. But because these were state laws, they were not applicable to the interstate business of the railroads. Consequently, the railroads (through their control over route, service, and price dimensions of interstate movements) maintained control over the economic fate of communities, states, and regions.

Regulation of Railroads. The Interstate Commerce Act of 1887 was enacted by Congress in order to extend the provisions of the state Granger Laws to interstate commerce. The lawmakers' intent was two-fold. First of all, the lawmakers sought to curb the monopoly power railroads held over small agricultural shippers and western communities. To achieve this, the Interstate Commerce Act required that railroads' rates be just and reasonable (Section 1), by explicitly prohibiting personal discrimination (Section 2),

undue preference between persons, localities and types of traffic (Section 3), and by prohibiting the practice of charging more for a short haul than a long haul over a common line (Section 4).

Secondly, the federal government wanted to insure relatively low freight rates from the west to encourage the continued settlement and development of that region. At the same time, the railroads had to be able to charge rates high enough to stay in business. The mechanism for achieving these dual goals was the implicit legalization of the most prevalent type of price discrimination used by the railroads at that time--the practice of value of service pricing.

The value of service pricing structure is based upon the fact that different commodities have different price elasticities of demand for transportation services. During the late 1800's and early 1900's, bulk commodities (agricultural products and raw materials) were subject to considerable competitive pressure because of water competition, alternative sources of supply, and the high proportion of freight costs in the final-goods price, which insured that an increase would be reflected in it. Thus, these commodities had a high elasticity of demand for rail services; any rate change would lead to a more than proportional change in traffic (in the opposite direction of the price change). Consequently, to capture as much of this traffic as possible, railroads maintained low rates on these commodities.

What the railroads lost through low prices in agricultural products and raw materials they made up with high prices on manufactured goods. At the turn of the century, railroads had little

competition for high valued manufactured goods and an inelastic demand for rail services, meaning any rate change would lead to less than a proportional change in traffic. Railroads, in effect, charged the manufacturers what the "traffic would bear". This form of commodity price discrimination encouraged the development of the west and also maximized the railroads' profits.

During the same period, the ICC adopted an orientation towards branch abandonment that resulted in railroads providing service even where it was unprofitable to do so. The Commission's orientation in branch line abandonment cases stressed the potential harm to local shipper, community and area economies. This orientation inevitably led to the principle that states:

...marginal or money-losing services should not be abandoned, but rather cross-subsidized by profitable services as long as the subsidy is less than the total loss to the community losing service.²⁸

The principles of value-of-service pricing and line cross-subsidization were established in the late 19th and early 20th centuries. Existing technology and market conditions gave railroads a virtual transportation monopoly. Since then, population shifts, changing economic activity in form and place, plus the development

²⁸For further discussion on cross-subsidization, see: Ernest W. Williams, Jr., ed., The Future of American Transportation, (Prentice-Hall, Inc., 1971).

of other modes of transport-motor carrier, barges, pipelines and air carriers, have rendered these principles less effective and often harmful to the financial health of railroads. Many railroads have responded by adopting behavior that leads to unreliable rail service and subsequent declines in the demand for rail service.

Changing Market and Demand for Freight Transportation. As the U.S. economy has matured, changes in the location of population, economic activity, technology, and consumption patterns have reduced the relative importance of heavy materials in the economy. Since this is the type of materials railroads are best suited to move, the railroad industry is participating in what is inherently a slow growth market.²⁹ Commodities that traditionally move by rail are expanding in output less rapidly than others. For example, coal, iron ore, lumber, and grains are expanding less rapidly than such substitutes as petroleum and natural gas,³⁰ non-ferrous metals, plastics, and meat, respectively.³¹ These commodities tend to move by non-rail modes.

In contrast to bulk commodities, traffic in manufacturers is growing. Rising per capita income is, in part, responsible for this

²⁹Task Force on Railroad Productivity, Improving Railroad Productivity, A Report to the National Commission on Productivity and Council of Economic Advisors, Washington, D.C., 1973.

³⁰The current energy situation and government plans to encourage the substitution of coal for petroleum and natural gas should favor railroads.

³¹Task Force on Rail Productivity, Op. Cit., pp. 13-16.

growth; as per capita income rises there is a shift in consumer expenditures toward more highly fabricated products. The production of manufactured goods requires the passing-through of a number of fabrication or production stages. Increasing specialization in the manufacturers industry means that a manufactured good will, most likely, be involved in a number of interplant shipments before it is finally completed and ready to market. Although the railroads have already lost much traffic in manufactures to trucks, this traffic still accounts for 25 percent to 40 percent of railroad ton-miles (depending on one's definition) and a still larger proportion of revenues and profits.³²

Railroads have lost manufactures traffic to trucks because they have not provided the standard of freight service firms need and are willing to pay for. The reasons for this will be discussed later in this chapter. The value of manufactures per unit of weight is, in general, greater than that for non-manufactured goods because of greater amounts of labor and capital inputs used in their production. As the amount of working capital tied-up in manufactured goods rises, there is a strong tendency for firms to opt for speedier, more reliable delivery as a way to control carrying costs.

Increasingly, products are competing in the market place on the basis of quality of service. Consequently, the demand for freight transportation has become more service-elastic and less price-elastic.

³²Task Force on Rail Productivity, Op. Cit., p. 21. .

Population shifts have also affected the demand for rail freight service and the viability of many rail lines. The rural population of the U.S. has declined as a percentage of the population (from 85 percent in 1850 to 60 percent in 1900; 36 percent in 1950; and 25 percent today).³³ As the population has migrated to the cities, the flow of manufactures to rural areas has diminished or been diverted to truck. In the past, railroads would move agricultural products and raw materials from rural areas to manufacturing points and handle manufactures as back haul on their return trip. Today, however, the decline in bulk commodity consumption, together with the loss of manufactures to truck, has rendered much of the rural rail network superfluous and expensive to operate.

Regulation of Intermodal Competition. Congressional desire to insure low freight rates on agricultural and bulk commodities led to the passage of the Motor Carriage Act of 1935; this Act gives the ICC regulatory power over carriers operating for-hire in interstate commerce (with a few exceptions). Motor carriers engaged in the interstate transportation of "unmanufactured agricultural products" were exempt, as were private not-for-hire carriers. Barge and other water carriers were brought under ICC regulation with the passage of the Transportation Act of 1940.

Within the scope of its regulatory powers, the ICC has sought to limit competition between modes. The prevailing belief was that financially strong railroads were necessary to maintain the

³³Source: Statistical Abstracts of the U.S. (1976), rural population defined as that outside of SMSA.

traditional rate structure, and that this was not possible if large segments of the transportation industry (i.e., trucks and barges) were undermining their competitive position. ³⁴

According to Friedlaender, the ICC regulation of rates has placed railroads at a competitive disadvantage, particularly in the manufactures market.

(Following World War II) the railroads have consistently pushed for reduced rates to compete more effectively with the water and motor carriers. The ICC has been apparently inconsistent in granting these. On the one hand, it has recognized that lower rates on bulk commodities are desirable and has thus permitted the railroads to cut rates down to out-of-pocket costs to meet barge competition. On the other hand, it has generally been unwilling to grant rate reductions on high-value goods. Because of this, it has often been accused of preventing railroads from exploiting their true competitive position. If truck and railroad rates are kept at comparable levels, the traffic will usually go by the trucks, which offer better service at the same cost. Thus in its unwillingness to permit rate reductions, the ICC has prevented the railroads from exercising their only means of competition. ³⁵

It would appear that one effect of ICC rate-making policies and practices has been to dull price competition between rail and motor carriers for traffic in manufacturers, promoting competition on the basis of service differentials rather than rate differentials. Statistical analysis of commodity data from the 1963 Census of Transportation supports this contention. Results from one study

³⁴For elaboration on this point see: Ann F. Friedlaender, Op. Cit., Cit., Chapter 2; Robert A. Nelson and William R. Greiner, Op. Cit., pp. 351-74; Earnest W. Williams, Jr., The Regulation of Rail-Motor Competition, (Harper and Bros., 1958).

³⁵Ann F. Friedlander, Op. Cit., p. 24.

show that transportation demand of manufactured goods was more sensitive to relative inventory costs (a function of rail service quality) than to rates.³⁶

Although available data is incomplete and imprecise due to its general nature, indications are that the railroads are not faring well in the competition for intercity manufactures traffic. Over the three year period from 1967 to 1970, railroads lost traffic in six major manufactures groups and gained in two (see Table 2-1). Trucks were the primary beneficiary although water carriers made large gains in the movement of lumber.

Rail Service Quality as Rail Users View It. The argument has been made that demand for freight transportation has become more service-elastic and less price-elastic. The purpose of this section is to clarify what constitutes "rail service quality" from the firms' perspective and how this perspective affects their choice of transportation modes.

Public testimony given by rail users at a recent ICC hearing is suggestive of the rail users' view of rail service quality:

Ranking high on many rail customers' list of concerns is the matter of rail service reliability...inefficient, unreliable, erratic, haphazard rail service leads to poor car utilization (and demurrage charges against the shipper)...Numerous complaints of poor rail service were laid to "reduction in service schedules, inconsistent transit time, unreliable and deficient switching service and bunching of cars. In the words of a shipper: ...we are willing to pay complete and compensatory demurrage

³⁶Ann F. Freidlaender, Op. Cit., p. 60.

TABLE 2-1

MANUFACTURERS INTERCITY FREIGHT TONNAGE
Modal Share of Traffic for Selected
Commodities: 1967, 1970

Commodities	Railroads (Percent)		Private and For-Hire Trucks (Percent)		Water Carriers (Percent)	
	1967	1970	1967	1970	1967	1970
Food and Drugs*	56.1	33.4	40.9	62.8	2.8	3.6
Textiles	9.1	6.7	79.6	92.4	0.3	0.1
Lumber	53.5	46.9	41.4	18.5	5.0	34.5
Paper Products	55.5	56.6	42.8	39.1	1.4	4.1
Chemicals	52.4	43.1	35.8	44.0	11.3	12.7
Stone, Clay, Glass	35.7	36.0	62.2	62.3	1.8	1.6
Fabricated Metal Products	23.0	22.9	74.4	74.8	1.7	0.8
Motor Vehicles & Equipment	57.6	32.5	41.8	65.6	0.1	1.6

Source: Table constructed from data reported in Alexander L. Morton, "Intermodal Competition for Intercity Transport of Manufacturers," Land Economics, Vol. 48, November 1972, p. 361. United States Railway Association, Preliminary System Plan, February 1976, p. 121.

*The percentage figures for this group are not completely comparable since the 1967 figures represent freight movement of food only, drugs are not included.

rates, but we don't think we should pay anything when the detention is caused by inconsistent service. We are already paying enough... 37

Surveys of shippers indicate that profit maximization does not simply imply the minimization of costs, i.e., the selection of the least cost mode. While cost is consistently one of the most important factors in mode selection, so also are transit time and transit time reliability... while the freight rate will have importance to the freight budgetary department, the mode transit time will help to determine necessary inventory and storage requirements, and the mode reliability will be important in reducing inventory costs through lowering of the size of safety stocks needed to protect the firm against a stock out. By using a more reliable mode, a firm should be able to lower warehousing costs since less variability would be expected in the distribution line from factory or distributor to the retail store. Quicker modal service would also reduce the need for warehousing capacity, it could improve the ability of the firm to market their product and service their customers as well. 38

In terms of service characteristics, the highest pay-off (to the carrier) is likely to come from increases in reliability, which influence shipper mode choice behavior considerably more than the reduction of in-transit time. 39

In a recent survey, 323 major eastern shippers were asked to check the factors that caused them to shift from rail to truck. 40

³⁷Based on public testimony given at ICC I and S Docket No. 8577: Demurrage Rule Changes Nationwide, reported in Don P. Ainsworth, "Implications of Inconsistent Railroad Service", Canadian Transportation Research Forum, (May 1972), 489.

³⁸Ibid., 143.

³⁹Peter L. Watson, et. al. "Factors Influencing Shipping Modal Choice for Intercity Freight: A Disaggregate Approach," Canadian Research Forum, 1974, p. 139.

⁴⁰United Research, Inc., The Freight Potential of the New York, New Haven and Hartford Railroad 1965-1970, reported in Douglas W. Woods, et. al., "Competition between Rail and Truck in Intercity Freight Transportation," Op. Cit., p. 268.

The percentage distribution of responses was: (1) Faster Transit Time, 24.7 percent; (2) Dependable Transit Time, 12.5 percent; (3) Convenient Frequency, 12.5 percent; (4) Equipment Available when needed, 12.1 percent; (5) Minimum Weights, 9.0 percent; (6) Lower Rates, 8.7 percent; (7) Specialized Equipment, 6.5 percent; (8) Equipment Conditions, 4.1 percent; (9) Proper Car Handling, 3.6 percent; (10) Traffic Solicitation, 2.7 percent; (11) Delay Notification 2.2 percent; and, (12) Better Bill Procedure, 1.4 percent.

In 1975, the U.S. Department of Transportation conducted a survey of 198 randomly selected manufacturing establishments (in SMSAs) employing 100 or more individuals.⁴¹ As part of the survey, plant traffic managers were asked to evaluate the quality of service extended to their plants by rail and motor carriers. Four specific measures of transport service were used to test carrier performance: (1) on-time pickup, (2) on-time delivery, (3) loss and damage, and (4) equipment availability. Survey results indicated the following:

1. On-Time Pickup

Motor Carrier	- 89 percent of time
Rail	- 81 percent of time

2. On-Time Delivery

Motor Carrier	- 84 percent of time
Rail	- 70 percent of time

⁴¹U.S. Department of Transportation, Office of Transportation Planning Analysis, Industrial Shipper Survey--Plant Level, Washington, D.C., 1975.

3. Loss and Damage (Without)

Motor Carrier - 94 percent
 Rail - 89 percent

4. Equipment Availability (Within a reasonable time period)

Motor Carrier - 90 percent
 Rail - 63 percent

On the question of point-to-point delivery performance between rail and motor carriers, two distinctions were made. Motor carriers were separated on the basis of for-hire and private status; and motor and rail carriers were separated on the basis of truckload (carload) and less-than-truckload (TOFC/COFC). The results are provided below:

Percent of Shipments On-Time		
	Truckload (Carload)	Less than Truckload (TOFC/COFC)
Motor Carrier For-Hire	89	82
Private	96	97
Rail	65	70

The studies cited above define rail service quality primarily in terms of reliability (e.g., reliability of transit time and on-time pickup and delivery). Available rail cars on a timely basis and shipment loss and damage are also cited as important dimensions of rail service quality. ⁴²

⁴²Modal selection studies conducted in other countries confirm the importance shippers attach to transit time, variance in transit time, availability of equipment and loss and damage. See: B.T. Bayliss, Demand for Freight Transport--Practical Results of Studies on Market Operations, Paris: European Conference of Ministers of

Unreliable rail transit time can create a number of problems for rail users. Inconsistent transit time can result in lost sales or production slow downs due to stock-outs, lower revenues, higher costs, and declining profits. The firm can also experience short-term material handling problems. Since most firms, particularly smaller ones, do not maintain specialized shipping and receiving crews, late (or early) freight shipments may cause the firm to incur additional costs, either through payment of overtime rates or through the hiring of additional help.

Trade-Off between Transportation Costs, Inventory Costs, and Customer Sales. Physical distribution activities constitute a major part of the firm's production cost; transportation costs (freight rates) are but one part of the firm's total physical distribution costs. Purchasing, inventory control, production scheduling, warehousing, internal materials handling, packaging, and other functions are also part of the firm's physical distribution activities; and their costs are determined partially by the reliability of transportation services the firm uses.

The firm's inventory costs, for example, are affected by transit time reliability. The greater the variance in transit time on a particular shipment, the greater the chances the firm will run out of inventory. In order to reduce the probability of stock-out and subsequent production slow-downs or lost sales, or both, the firm must carry larger inventories.

Transport, 1973); H.M. Kolsen, The Economics of Control of Road-Rail Competition: A Critical Study of Theory and Practices in the United States of America, Great Britain, and Australia, (Sydney: Sydney University Press, 1968).

Larger inventories may result in higher costs to a firm in a number of ways. To begin with, additional inventory requires tying-up more working capital. In addition, the firm may find it necessary to invest in more warehouse space. Also, as inventory levels increase, the firm will experience changes in costs for insurance, product obsolescence, product deterioration, and state and local inventory taxes.

Today, more firms are adopting a total cost approach towards physical distribution management; many firms are realizing that minimizing direct transportation costs is not necessarily the way to minimize physical distribution costs. Instead there is a growing awareness of the possible trade-offs between the different physical distribution functions. Many firms, for example, are finding that a higher priced mode of transportation can be justified because it reduces other physical distribution costs, particularly inventory costs, more than the increase in direct transportation costs. In addition, some firms are finding that the speed and dependability of premium transportation service more than pays for itself through better customer service and increased business volume.⁴³

The relationship between transportation costs, inventory costs, and total cost is illustrated in Figure 2-1. The relationship

⁴³For a fuller discussion of physical distribution management see: Ronald H. Ballou, Business Logistics Management, (Prentice-Hall, Inc., 1973); and Ray J. Sampson and Martin T. Farris, Domestic Transportation: Practice, Theory and Policy (Houghton Mifflin Company, 1966).

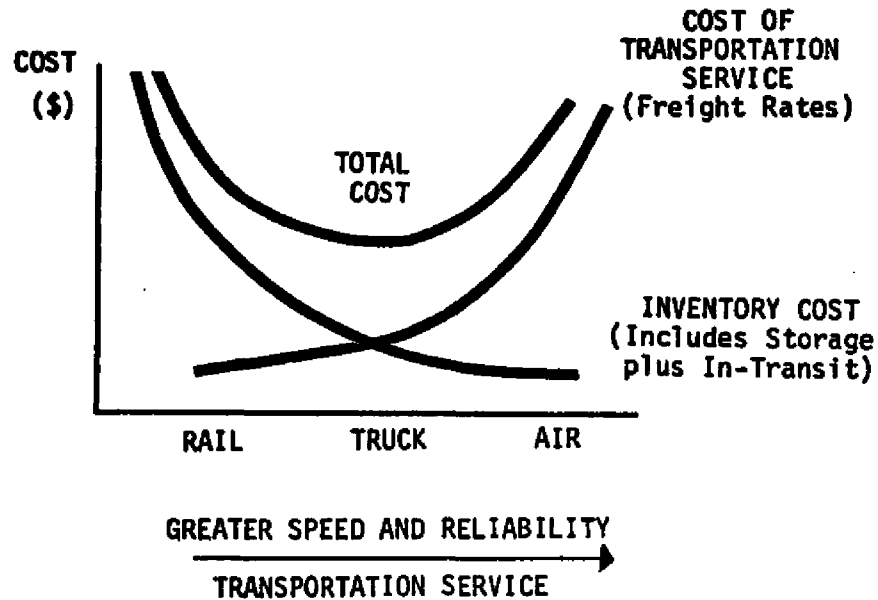


FIGURE 2-1
RELATIONSHIP BETWEEN TRANSPORTATION
COSTS, INVENTORY COSTS, AND TOTAL COST

between physical distribution costs and the costs of customer service are illustrated Figure 2-2. Consider first Figure 2-1. Consider a midwestern retailer that must choose between available transport modes to deliver a recent commodity purchase from a west coast manufacturer. Suppose that rail, truck, and air are the transport modes he has to choose from. Suppose also that the quality of transport service (speed and reliability) and its cost are positively related: the more quality desired, the higher the transportation cost. Each mode--rail, truck and air--has unique price and service characteristics. The firm might initially choose rail because of its low transportation cost, but when the inventory costs of rail are considered the firm finds the effective price (total cost) of rail service to be fairly high. Air freight, on the other hand, would reduce inventory costs substantially; but air freight rates are high, again the effective price is high. Consequently, in

this example, truck offers the best balance between inventory and transportation costs (i.e., lowest total cost). It should be noted that trucks are not always the least cost mode as Figure 2-1 suggests. The least cost mode will vary with commodity and the particular transportation needs of the firm. In addition, the shape of the total cost curve is determined by the shape of the transportation cost curve and the inventory cost curve. The transportation cost curve reflects, more or less, the regulated rate structure of the transportation industry. The inventory cost curve reflects the technology and operating procedures of the various modes. New technology or new operating procedures adopted by one of the transport modes will alter the shape of the inventory cost curve and that mode's effective price (total cost) relative to the other carriers. Also, changes in the regulated rate structure will alter the shape of the transportation cost curve and the relative position of the various transportation modes.

Figure 2-2 illustrates the firm's cost trade-offs in setting customer service levels. As the customer receives a higher level of service, fewer of them are lost due to out-of-stock situations, and slow, unreliable service. To say it another way, the cost due to lost sales decreases with improved customer service. Counterbalancing lost-sales is the cost of maintaining the level of service. Improved service usually means more must be paid for transportation, order processing, inventory management, and so on.

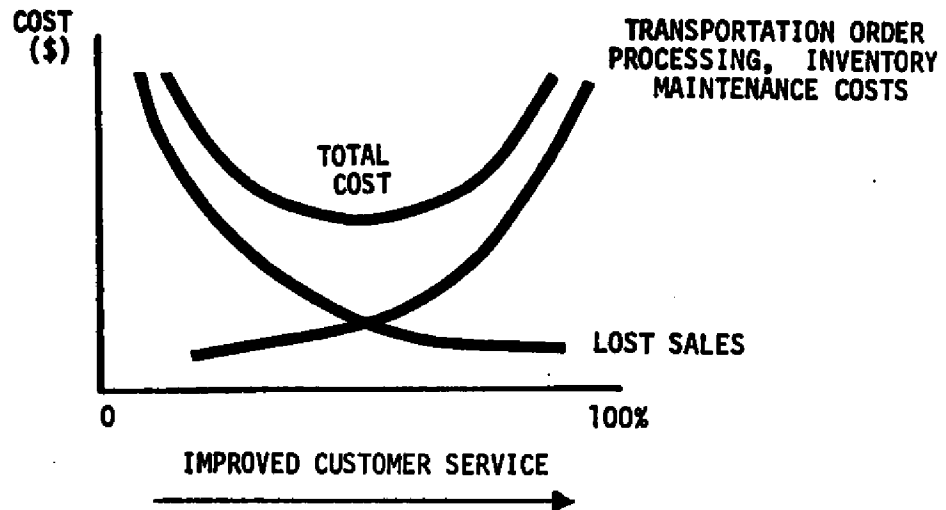


FIGURE 2-2
RELATIONSHIP BETWEEN PHYSICAL DISTRIBUTION
COSTS AND COSTS OF CONSUMER SERVICE

Summary. The composition of the intercity freight market is shifting rapidly from low-valued raw and bulky materials to high-valued manufactures. With this change, the demand for freight transportation has become more service-elastic and less price-elastic. If railroads are to increase their share of the intercity freight market in manufactures, they will have to improve the reliability of the service they provide. The next section of this chapter considers some of the forces that affect the ability of railroads to improve rail service quality.

Factors Influencing the Viability of Rail Operations and The Quality of Rail Service

The purpose of this section is to examine some key carrier-rail user economic and organizational relationships that determine rail service quality, and contribute to the viability of rail operations.

Railroad Cost-Output Relationships. Every production operation entails costs. And it is common for economists to analyze production costs by classifying them into two categories: fixed and variable. The fixed costs are those which are not related to output in a direct fashion; they remain independent of output throughout a given range of output changes. Variable costs, on the other hand, relate directly to output in a manner determined by the technical input-output relationship.

Railroad fixed costs can be divided into three groups--ownership, maintenance, and administrative costs. Ownership costs include interest and taxes paid on investments--land, track, building, rolling stock (locomotives, freight cars), and other equipment. Maintenance costs pertain to track, roadbed, grade crossings, signal equipment, bridges, tunnels, buildings, etc. Finally, administrative costs include management and office personal, salaries, and fringe benefits, etc. Railroad variable costs can also be considered in three categories--locomotive, crew, and other. Variable locomotive costs include fuel and operating maintenance, crew costs are primarily wages and fringe benefits. And, other variable costs include operating maintenance of way costs, car rentals (per diem on "foreign" cars), and car and train inspections.

The distinction between fixed and variable is usually made on the basis of time. The long-run is a period of time sufficient to enable the producer to make basic changes in the plant. In the case of railroads, the long-run usually refers to the time required to

alter the productive capacity of plant (i.e., construction of new lines and complementary facilities and equipment.

Railroads, in general, have high fixed costs. To provide service to one rail user or many requires a large investment in physical facilities which must be provided and maintained, often without reference to the level of day-to-day operations. Interest on investment and maintenance of tracks, roadbeds, grade crossings, bridges, tunnels, buildings, and other physical facilities continues with little regard to the number of trains operated in a given period. In addition, the train-unit (i.e., locomotive unit and crew) represents a fixed cost to the railroad, although its period of fixity is less than that associated with the physical plant (i.e., track and structures).

For example, the productive capacity represented by a particular train-unit may be 100 freight cars; train-unit costs are basically fixed over the relevant range of output (1 - 100 cars). Consequently, the incremental costs of handling an additional car, up to the point train-unit capacity is relatively small; also, the savings in operating costs from handling one less car are minimal.

Railroad productive capacity can, therefore, be discussed at two levels. First, there is the productive capacity of the physical plant; that is, the number of train-units that can utilize track and complementary equipment and facilities within a given time period. And secondly, the productive capacity of a particular train-unit. Unused railroad productive capacity can exist at both levels, simultaneously, or independently of one another.

Because of its large fixed costs in physical facilities, a railroad will have an incentive to continue any operations even though fixed costs may not be entirely covered. This is true because ceasing to operate will mean only a modest reduction in operating cost and a complete loss of income from such operations. Under such circumstances, the railroad has no income with which to cover fixed costs.

In situations where unused train-unit capacity exists, a railroad may feel it can lower its total costs by reducing the number of train-units it has in operation and by altering their service schedule. The outcome of such adjustments, however, can only be determined after consideration has been given to their impact on the demand for rail service. Changes in existing train-unit operating procedures, for example, will affect freight shipment transit time as well as pick-up and delivery dates; these factors influence the demand for rail service.

Fluctuating Revenues, Cash-Flow Problems, and Branch Line Operations⁴⁴

Due to their large fixed cost component, railroad costs do not vary much over broad ranges of change in traffic levels; railroad revenues, in contrast, do vary with changes in traffic levels. One consequence of this is that fluctuations in the economy often create

⁴⁴Branch lines, in contrast to main lines ("trunk" lines) primarily originate and terminate freight shipments. Although branch lines handle some "bridge" (interline) traffic, their primary function is "local". Branch lines are like fingers reaching out from the core of the rail system's mainlines. They perform a gathering, dispersing function for the mainlines that connect major production and consumption areas in the country.

cash-flow problems for railroads. Figure 2-3 on the following page illustrates for Class I railroads ⁴⁵ the tendency for fixed costs to remain fairly stable, even though net operating revenues fluctuate widely.

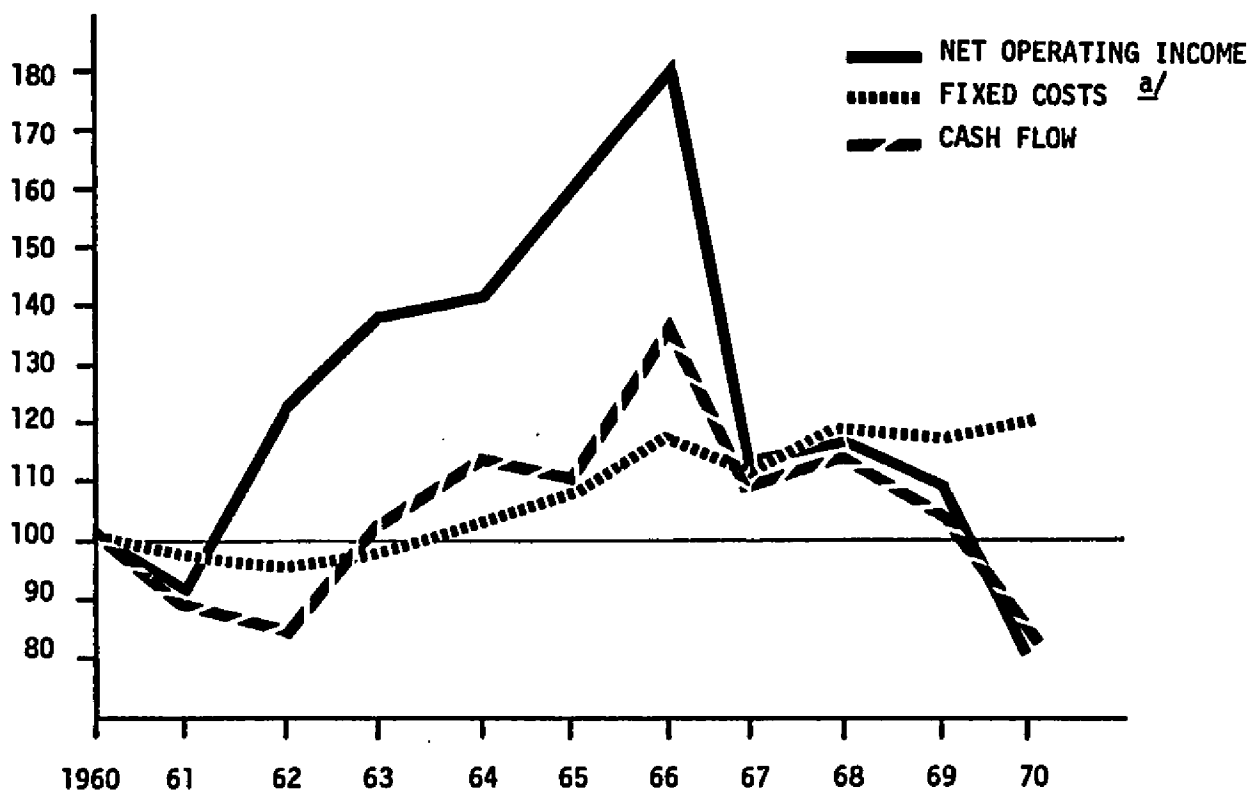
It is common practice in the industry for railroads to postpone costs in the short-run to stabilize their cash-flow position when revenues fluctuate widely. Deferring maintenance and rehabilitation of track, roadbeds, other structures, and equipment in the lean years and playing catch-up in the good years is a procedure used by many railroads to stabilize their cash-flow.

Net railway operating income...reflects the maintenance policies of the railroad industry. There is persuasive evidence that maintenance levels in the railroad industry are varied over the business cycle to coincide better with availability of internal funds and ...to improve stability of earnings. ⁴⁶

In general, railroads must rely upon internally generated funds for maintenance and modernization of track, roadbed, and other structures. External funds are used to invest in rolling stock--locomotives and freight cars.

⁴⁵The U.S. railroad industry is dominated by approximately 70 large "trunk line" systems. Most of these carriers are designated by the Interstate Commerce Commission as Class I railroads, i.e., those having gross operating revenues of \$10 million or more annually (averaged over three years). Although Class I railroads make up only about one-third of the total, they are the most important part of the industry, accounting for over 99 percent of the industry's ton-miles. Class I railroads range in size from over 10,000 miles to under 100 miles, with the average between 2,000 to 5,000 miles.

⁴⁶Improving Railroad Productivity, Op. Cit., p. 94.



SOURCE: THE PENN CENTRAL AND OTHER RAILROADS, A REPORT TO THE SENATE COMMITTEE ON COMMERCE, DECEMBER 1972, PP. 433-434.

FIGURE 2-3

TRENDS IN NET OPERATING INCOME,
FIXED COSTS, CASH-FLOWS - CLASS I RAILROADS
1960 - 1970

^aThe climb in fixed charges owes to a combination of factors--higher interest rates plus increased debt. "The fact that gross capital expenditures have been on the rise does not necessarily imply that real net investment is increasing. Real capital stock of railroads evaluated in constant dollars has been roughly the same from 1947 to 1972". (Improving Railroad Productivity, Op. Cit, p. 112).

From the standpoint of legal security for lenders, it is often much easier to obtain funds for some types of investment than others. A locomotive or freight car is portable and in the event of default on required payments, rolling stock can be transferred to another railroad. This is not the case with investment in track, terminals and yards, or even in computer or telecommunication facilities. While such fixed investments might add greatly to railroad operating efficiency, they tend to be under-financed except for railroads which can generate the necessary capital internally.⁴⁷

For railroads experiencing financial difficulties, main line operations, in most cases, take priority over branch line operations; deferred maintenance and rehabilitation occurs first on branch lines. Only if the railroad's financial problems continue will the cost-saving practices be used on main lines, too. While these cost-saving practices may improve the railroad's financial position in the short-run, their long-run consequences can be quite the opposite.

Postponing rehabilitation and maintenance of branch line facilities often results in substandard track and equipment conditions; this leads to higher operating costs and a loss of revenues as demand for rail service falls off. Substandard track and equipment results in slow transit time, derailments, shipment damages, and generally unreliable rail service. Reducing train speed due to poor track conditions means higher labor and fuel costs. Faced with higher operating costs, the next step for many railroads is to reduce the frequency of service offered. The number of train-units in operation are reduced, say from five per week to two per week, thereby reducing operating costs.

⁴⁷The Penn Central and Other Railroads, Op. Cit., p. 252.

From the (branch line) rail user's point of view, the result of such railroad behavior is a significant decline in rail service quality. Rail service has become unreliable and the firm may give serious consideration to using another mode of transportation. Should the firm shift, say to truck service,⁴⁸ the railroad would experience a reduction in revenues with almost no reduction in costs due to its cost structure (of high fixed costs and relatively small variable costs). The decrease in revenues may encourage the railroad to pursue additional cost-saving behavior (e.g., reducing the frequency of train service even more or cutting overhead costs by reducing the number of freight agents on the line. The branch line becomes enmeshed in a vicious circle of poor service, declining traffic, rising unit costs, cost-saving practices, poor

⁴⁸When a firm makes the decision to shift from rail service to truck service, it may have to physically alter its plant facility and even its production procedures. The firm may have to invest in loading and unloading docks and specialized equipment for handling truck shipments. And, plant facilities may have to be modified to handle smaller inventories. The firm may also change its markets.

To the extent a firm invests in new equipment and facilities, the more difficult it will be for the railroad to get its business back. Such investments represent fixed inputs (assets); and their economic value to the firm will be realized over a number of production periods. The firm can only justify, economically, reverting to rail service if the expected benefits (lower transportation costs, access to new markets, etc.) outweigh the costs.

service, etc., that spirals relentlessly toward the point that the remaining traffic cannot cover the railroad's cost of operation and complete abandonment of service takes place.

This sequence of railroad/rail user behavior and counter-behavior can have an affect on the welfare of local and regional economics as well as affecting the railroad and rail users. Consider the following example:

Assume a Class I railroad has recently purchased 200 covered hopper cars to compete for the substantial increase in grain traffic moving to the gulf ports; expectations are for a strong and growing grain export market, as Russia, China, and developing countries are not expected to produce enough to meet their growing domestic demands. Assume also that the U.S. economy has just experienced a downturn and the railroad is faced with cash-flow problems. In order to meet the payments on its recently purchased fleet of covered hoppers, the railroad decides to forego scheduled maintenance and rehabilitation on a number of branch lines. This improves its financial position somewhat, although it causes a number of branch line firms to complain of poor rail service. A few even decide to shift over to trucks.

Included in these costs are any losses the firm would sustain by shifting specialized equipment and facilities, designed for truck service, from their present use to their next best use (alternative). The alternative uses available must provide the firm with returns equal to or greater than those they are now earning in their present use to justify shifting them on economic grounds. Other costs would include necessary investments required to use rail service again--sidings, spurs, unloading-loading facilities, etc. Also, to be included, are any costs associated with modifications in plant facilities and production processes.

A few years later, national attention focuses on the energy crisis. The rising cost of oil signals a potentially strong demand for other energy sources in the future (coal in particular). The railroad decides to invest in a new fleet of rail cars to move coal. To finance the purchase the railroad postpones, once again, needed maintenance and rehabilitation of its branch lines. After four years of neglect, the branch lines are in terrible condition and more and more firms are abandoning rail service for other modes. The loss of rail users on one branch has reduced operating revenues to the point that the railroad cannot cover its operating costs, let alone its fixed costs. The railroad petitions the ICC to abandon service on the line.

Ironically, the line serves an area with large coal deposits. With reliable rail service it would be economical to mine. The railroad has the rail cars to move coal but not the finances to rehabilitate and modernize the line. Consequently, the coal is not mined, the regional economy does not benefit, nor does the railroad.

Rather than lose rail service entirely, a few rail users attempted to work out a joint financing agreement with the railroad for rehabilitating the branch line. An agreement was never reached, however, because the initiating rail users were unable to convince the other rail users on the line to contribute to the rehabilitation project. Many of the rail users were hesitant to contribute without guarantees that the other rail users on the line would contribute also. A few rail users took the attitude, why contribute when you can enjoy the benefits, whether you pay your share or not?

To summarize, Class I railroads often turn to cost-saving practices (e.g., deferring maintenance and rehabilitation of branch line track and facilities, and reducing frequency of service) to improve their cash-flow positions. These practices, however, contribute to poor rail service. And a sequence of railroad-rail user behavior and counter behavior follows, often leading to complete abandonment of rail service on the branch line. The absence of mechanisms to facilitate collective rail user action frequently prevents railroads and rail users from undertaking activities that would be of mutual benefit.

Some Strategies for Retaining and Improving Branch Line Service

Over the past two or three decades, a combination of factors have rendered thousands of branch line miles uneconomical to operate, and the viability of many more branch lines is in doubt. Many branch lines were originally constructed to tap areas rich in natural resources (e.g., minerals, timber, and agricultural products); as the resources of these areas have been depleted, many railroads have found it uneconomical to continue to operate. In addition, population shifts from rural to urban areas, changing consumption patterns, and the rise of intermodal competition, particularly truck, have combined to reduce the demand for rail freight service by 60 to 70 percent in many rural areas. ⁴⁹ Also, a decline in demand

⁴⁹Improving Railroad Productivity, Op. Cit.

for rail freight service has occurred on many branches because of poor service.

On some branch lines, rail users have provided railroads with operating subsidies to retain service and have, on occasion, also helped finance branch line rehabilitation and modernization projects. On other branch lines, government acting alone or in cooperation with rail users and the railroad has financed operating subsidies and rehabilitation projects.

Why is government assistance required on some branch lines and not others? In other words, why can't the rail users and railroads be relied upon to work out agreements for retaining and improving rail service? The character of rail service provides part of the answer. We recall that certain goods and services of a pure individual consumption (private) variety also possess characteristics of a pure collective-consumption (public) good or service. Since it may be difficult to exclude non-contributors from consuming the collective-consumption aspect of such a good or service, individuals frequently have the incentive to be "free riders". Where a sense of community does not exist to prevent free rider behavior, some type of administrative action (government) or special incentive may be needed to articulate demand.

Under a different set of circumstances high organizational costs may prevent a group of consumers from effectively expressing their demand for the collective-consumption good or service. Government can facilitate articulation of consumer demand in such situations by

bearing the initial organizational costs. Finally, government may act to express option-demand for the taxpayers right to consume the good or service at some future date.

Rail service can be considered a private good with collective-consumption service attributes. The quality of rail service on a branch line, for example, is consumed by all rail users. When the railroad defers maintenance on the line and transit time becomes unreliable, all rail users suffer; likewise, when investments in the line are undertaken and service improves all rail users benefit. Consequently, when the railroad seeks financial help (e.g., loans) from the users to modernize the line, the users might decide it is to their advantage not to volunteer their help since they cannot be excluded from the benefits anyway. The same situation is likely to prevail where a subsidy is needed to retain service. That is, once someone bears the necessary costs to retain rail service on the line, the service becomes available to any user willing to pay a small fee (freight charge).

In this section a few strategies, private and public, for retaining, and in some cases improving, branch line rail service will be briefly considered.

Private and Public/Private Efforts to Retain and Improve Rail Service. Examples of two programs, one private and the other a joint public-private effort, to retain and to improve rail service are briefly described below. Both programs occurred recently in Iowa.

(1) In the early 1970's a group of farmers built a major grain elevator on a branch line.⁵⁰ The condition of the branch line did not permit the use of the new "jumbo" grain hopper cars, however. Also, shortly after the new elevator was completed, the railroad cut back the frequency of rail service on the line. The net effect was to put the farmers at a competitive disadvantage in marketing their grain vis-a-vis elevators on main lines. Subsequently, the group of shippers negotiated with the branch line carrier to rehabilitate the line virtually to main line standards and to increase the frequency of service. Under agreement with the railroad, the shippers (through their farmers' cooperative) raised the money to rebuild the line and loaned it to the railroad free of interest. In return, the railroad would credit the cooperative for every carload of freight originated or terminated on the line. The credits ranged from \$10 to \$50, averaging \$40 per carload. The credits were based on the revenue received by the railroad for each carload handled. At the end of the year, the cooperative received a check for the total of the year's accumulated credits. This refund was the way the railroad repaid its loan. The loan period was established for 10 years.

(2) Iowa has recently initiated a railroad rehabilitation program to upgrade selected branch lines in the State.⁵¹ The

⁵⁰ This example is taken from: Edwin P. Patton and C. John Langley, Jr., Handbook for Preservation of Local Railroad Service, U.S. Department of Transportation, July 1976, pp. 25-27.

⁵¹ For a fuller description of the program see: The Council of State Governments, Railroad Rehabilitation: A Program to Upgrade Selected Branch Lines in Iowa, (Lexington, Kentucky, 1976).

program involves a three-way commitment between the railroads, the shippers and the state. The program is outlined below.

The Iowa Legislature created a railroad assistance fund, specifying that "moneys in this fund shall be expended for providing assistance to railroads for upgrading railroad roadbeds, track, track structures, and other appurtenances of railroad right-of-way of railroad branch lines."⁵² The enabling legislation also required railroads benefitting from the program (i.e., increase in revenues due to the improved condition of the branches) to maintain a fund for improving branch lines in Iowa.

State funds were made available for rehabilitation of only those branch lines for which both the shippers and railroads were willing to participate financially. The State would contribute approximately one-third of the project costs with the shippers and railroads paying the remainder. The actual work was to be done by the railroads. The program is similar to the grain elevator example described earlier in that the funds made available to the railroad are treated as a loan. Funds advanced by shippers are repaid by the railroad according to a formula based upon the number of carloads shipped and/or the revenues produced.

Shipper contributions have varied in their form. On several branch lines, the overall shipper financial requirement has been met by a large grain elevator. There have been instances where certain smaller rail users have not contributed at all. Although the

⁵²Railroad Rehabilitation: A Program to Upgrade Selected Branch Lines in Iowa, Op. Cit., pp. 4-5.

nonparticipating shippers benefit from improved rail service, they do not receive any of the payback allowance. Many shippers formed "rail improvement corporations" and borrowed money from the Farmers' Home Administration (FHA), which was then used by the shippers to pay their contribution. The FHA repayment schedule was tied to the payments by the railroad to the shippers.

The repayment schedule to the State of Iowa is slightly more complex. ⁵³

...If rail traffic does not increase in the five-year period after rail line improvement, no state funds are repaid by the railroad. Payback procedures are implemented when traffic increases. If the State's contribution is one-third of the total cost of branch line repaid, railroads rebate to the State on the same basis as shippers, that is, usually a flat \$25 per car. However, this money is not returned to the State but held by the railroad in a special account for future branch line projects agreed upon by the railroad and the State.

...If the State's contribution is more than one-third of the repair cost, the first one-third (of total project cost) rebate will be held in railroad accounts as noted above. The funds which are in excess of the one-third contribution will be rebated by the railroads (to the State) for future branch line projects.

It is interesting to note in these two examples that rail users, for the most part, made financial contributions to the rehabilitation of their lines through some type of organization--farmers' cooperative or "rail improvement corporations". Although the original source documents for these two examples were not clear on the motivating factors for group action, two reasonable explanations can be suggested: (1) to reduce individual transaction costs

⁵³ Railroad Rehabilitation: A Program to Upgrade Selected Branch Lines in Iowa, Op. Cit., pp. 13-14.

(e.g., information and bargaining costs) with railroads, state officials and others, rail users turned to group action; and (2) with state contributions to rehabilitation of the line contingent on a minimum rail user contribution, group action was necessary to raise the rail users' share.

Public Ownership and Operation, Public Ownership and Private Operation of Branch Lines. Some states and municipalities have purchased branch line properties about to be abandoned to preserve the right-of-way and retain the option for rail service in the future. After purchase has been made, the governmental unit either becomes the operator or leases the railroad properties to an independent railroad. The independent railroad provides rail service in accordance with terms set out in the lease. Although the specifics of such arrangements differ from case to case, they seem to have two common objectives: (1) stabilizing the railroad's cash flow position to minimize the amount of deferred maintenance; and (2) improving the general quality of rail service.

The City of Prineville Railway is an example of public ownership and public operation of a branch line. It is a railroad that has been developed by and is wholly owned and operated by a municipality.⁵⁴ According to John Due:

The experience with the (City of Prineville) railway is an excellent illustration of the ability of a government to undertake and sustain a long-range investment project which

⁵⁴John F. Due, "The City of Prineville Railway--A Case Study in Government Enterprise", Quarterly Review of Economics and Business, Vol. 5 (Winter, 1965), 63-81.

is of great significance for economic development of an area, yet with prospective returns too uncertain and too remote in the future for private enterprise to be willing to make the investment. ⁵⁵

In the early 1900's, Prineville was a major commercial center in central Oregon. Nevertheless, community efforts to persuade the (nearest) railroad 20 miles away to provide a branch line to Prineville failed. The railroad felt the traffic prospects were far too limited. The residents felt that the community's economic survival depended upon it. After much deliberation the community decided to construct the branch line themselves. Prior to the depression, traffic density was light and inbound traffic fell as motor carriers increased their share of merchandise for local stores (traffic they particularly were well-suited for). During the depression years the city was forced to default on the bond interest and was barely able to meet operating deficits. Maintenance of the track and roadbed was cut back sharply.

The railroad began to turn around financially in the late 1930's and early 1940's with the growth of the industry in the area.

...The problems were not all over, however. The road was ill-prepared to handle the increased (lumber) traffic...maintenance of track and equipment had been so long neglected that, despite the acquisition of three more locomotives, it was virtually impossible to keep the traffic moving. The road was tied up for days at a time by derailments...⁵⁶

⁵⁵ John F. Due, "The City of Prineville Railway--A Case Study in Government Enterprise", Op. Cit., p. 181.

⁵⁶ Ibid., p. 66.

The lumber industry, requiring a cheap, reliable mode of transportation, encouraged the City of Prineville to modernize branch line operations. The city did; the line was rebuilt with heavier rail and ballast and obsolete steam engines were replaced with modern diesel locomotives.

...By 1965 the railroad was in first-class physical condition, with well-maintained track, modern equipment, well-trained personnel, two-way radio communication and--from all indications--highly efficient operations. All debt had been paid off...⁵⁷

A few observations can be made regarding the City of Prineville Railway experience. One fairly obvious, although very important, point is that there is no substitute for traffic. A railroad, branch line, or main line cannot operate profitably without traffic irrespective of how modernized and efficient its operations are.

Secondly, government, with access to a variety of financial instruments (taxing and bond-issuing powers), can sustain a faltering branch line operation in the short-run if prospects for the long-run look good. Government can also subsidize, in part or whole, a branch line operation deemed important to long-run economic development needs of the community and area; or for social reasons, such as maintaining a particular settlement pattern.

The willingness of residents of (the City of) Prineville to support temporary railroad deficits by taxation was a decisive factor in keeping the enterprise in operation on the basis of long-range interests of the community.

⁵⁷John F. Due, "The City of Prineville Railway--A Case Study in Government Enterprise", Op. Cit., p. 66.

...The city was correct in its expectations that ultimately the undertaking would be justified...The enterprise has, in the last two decades, been of great help to the municipality in allowing higher levels of municipal activities and lower levels of taxes than would otherwise have been possible, both of which should stimulate economic growth of the area... 58

One final point, shippers are sensitive to the quality of rail service, independent of the type of ownership of the railroad providing rail service. Due asked the question:

Do shippers use the railroad to a greater extent than they would if it were not municipally owned, either as a matter of principle in terms of community pride or to increase the profits of and thus aid the city financially? 59

Due found the general answer to this question to be negative. For most of the traffic handled by rail (lumber, wood chips, potatoes), the attitude of shippers was that truck transport is not feasible in terms of cost and availability of service. But greater use of trucks would occur if rail service did not remain satisfactory.

The Vermont Railway is an example of public ownership and private operation of a branch line. The Vermont Railway is operated by a private railroad company under contract with the State of Vermont. The State owns the railroad properties; the railroad is 130 miles long, running nearly the entire length of Vermont. The Vermont Railway was formerly part of the Rutland Railroad that

⁵⁸ John F. Due, "The City of Prineville Railway--A Case Study in Government Enterprise", Op. Cit., p. 81.

⁵⁹ Ibid., p. 79.

abandoned operations in 1961. In response to state-wide concern over the loss of rail service, the Vermont legislature authorized the state to purchase the line. The State of Vermont, in turn, leased the line to a newly formed short line--the Vermont Railway. ⁶⁰

The decision to have the State of Vermont buy the railroad was founded on the belief that the capital requirements (Vermont paid 2.6 million dollars for the line) would be beyond the means of a short line railroad. Vermont wanted to retain rail service, but it also did not want to burden state government with added administrative responsibilities. The decision was to lease the properties to a private railroad company. A sliding scale of lease payments was arranged to enable the state to share in the profits earned on its investment.

The lease covers a 10-year period with renewal options for three successive 10-year periods for the Vermont Railway. ⁶¹ As a rental fee, the Vermont Railway agreed to pay 7 percent of their railway operating revenues for the first seven years. During the next three years (of the 10-year lease period) agreed to pay a sliding scale of rental fees (7 percent, 9 percent, 11 percent, 13 percent) based on the level of railway operating revenues.

⁶⁰ For a more complete historical description see: Robert Roberts, "Small Railroad Thinks Big," Modern Railroad, June 1969, p. 61; and R.L. Banks and Associates, Short Line Techniques to Improve Financial Viability of Light Density Lines--Major Railroads, Op. Cit., pp. 20-30.

⁶¹ The lease contract is included as an appendix in R.L. Banks and Associates, Short Line Techniques to Improve Financial Viability of Light Density Lines--Major Railroads, Op. Cit.

The contract obligates the Vermont Railway to maintain the physical plant in good operating condition. And, the railroad must maintain a minimum service schedule specified in the contract. In return, the state agrees not to collect property tax from the railroad; and the railroad can keep any rents earned from the sublease of railroad properties involved in the promotion of industrial development in the area served by the railroad. The State is under obligation to maintain all highways at railroad grade crossings as well as bridges that carry traffic over the railroad. The State will reimburse the Vermont Railway for installation, but not maintenance or repair, of all signal equipment and warning devices at grade crossings.

In contrast to normal branch line operations, the Vermont Railway is relieved of a portion of its fixed costs, i.e., ownership costs and taxes. Although the Vermont Railway must pay a rental fee, it is considerably less than what they would have to pay in ownership costs (interest and principal) and taxes if they owned the railroad properties. The Vermont Railway also benefits by the state assuming part of the costs associated with installation of signal equipment and maintenance of grade crossings. Normally, these costs are the sole responsibility of the railroad.

The State of Vermont benefits from this arrangement, also. In bearing these costs, the State insures that the condition of the railroad's physical plant will not deteriorate, leading to a decline in rail service quality and demand for rail services, and subsequently the need for larger operating subsidies.

Short Line Railroads. Many people argue that where a Class I railroad cannot operate a branch line profitably, a short line railroad may be able to do so. There are a variety of definitions as to what constitutes a "short line" railroad; they range from the Interstate Commerce Commission's definition of Class II railroads--"full-service common carriers by rail which have operating revenues of less than \$10,000,000 per year"--to the widely used layman definition of "any railroad less than 100 miles in length."

A recent study, by R.L. Banks and Associates, comparing methods of operation and other financial characteristics of short line railroads to their Class I branch line counterparts concluded that the short line operations possess many advantages and few disadvantages vis-a-vis their Class I branch line counterparts; this gives short line railroads a definite economic edge.⁶² The short line operating advantages discussed in the Banks study include:⁶³

- (a) ability to utilize labor more effectively,
- (b) ability to pay prevailing local wage scale,
- (c) reduction of overhead expenses and inertia of a large organization,
- (d) closer relations with shippers and communities, and
- (e) local management team.

⁶²R.L. Banks and Associates, Inc., Short Line Techniques to Improve Financial Viability of Light Density Lines--Major Railroads, Op. Cit.

⁶³Ibid., p. 112.

According to the study, short lines experience operating disadvantages vis-a-vis their Class I branch line counterparts in the areas of:

- (a) access to freight cars,
- (b) maintenance of equipment (locomotives and freight cars) and maintenance of way (track, roadbed, switches, and other structures),
- (c) skilled operators, trained auditors, and data processing facilities.

On the whole, however, the study concluded that short lines are able to operate branch lines at lower total cost than are their Class I railroad counterparts. First of all, the non-union status of most short lines often leads to higher labor productivity, as workers can be employed in a variety of jobs. Class I branch line crew duties, for example, are limited to those specified in the labor contracts, and almost without exception, they are restricted to train and engine crew services. Crew members are paid for a minimum number of working hours per day (usually 8 hours). When they finish with their assigned duties, they are not required (or allowed by union contract) to do any additional work--even though sections of track are in need of repair or cars need switching from spurs and sidings to branch lines. Furthermore, any task performed on the branch line beyond the normal territory of the particular crew on duty, even though it may fall within the realm of train and engine crew service, cannot be accomplished without an extra day's pay.

Short line crews, in contrast, frequently perform other jobs limited only by the time available to perform the work. If a short line is providing service every other day, on off days train crew members often help with repairs on equipment, track, roadbeds, and

so on. Short line management personnel frequently relieve train crews when they cannot bring the train into the terminal within the federally specified crew operating time limits. In addition, many short lines are able to pay local wage rates. In general, flexible work rules and payment of wages in line with local wage rates allow short lines to operate at lower total costs than their Class I counterparts.

Many short lines are also able to reduce their fixed costs through contracting for various services. For example, contracting with a Class I railroad for locomotive, rolling stock, and maintenance of way services reduces necessary fixed costs associated with ownership of equipment and tools. Likewise, contracting for legal services, financial audits, and data processing reduces the short line's overhead costs.

Finally, the Banks study suggested that generally superior short line employee attitudes contribute to the overall high level of labor productivity enjoyed by short line operations. Factors believed to contribute to superior short line employee attitudes include the following:

1. Most short line employees have been born and reared in rural areas. They tend to share the expectations and values held by those that provide rail service as well as the community at large.
2. Because short line employees generally have a wide variety of duties to perform they tend to participate informally in management decisions. Employees are encouraged to find ways to improve the overall operations of the railroad.
3. Local management can respond quickly to correct operating deficiencies. Management's commitment to improving railroad performance enhances the employee's sense of job security and consequently their attitudes toward their jobs.

The Banks study was based on field investigations of six short line railroads and six corresponding branch lines of Class I railroads. The field investigations included actual observations of short line and branch line operations, discussions with officers and employees, and examination of accounting and operating data for the respective operations. Tables 2-2 and 2-3 on the following pages summarize the study results. The tables compare and contrast economic and operating characteristics for the six short lines and six Class I branch lines.

Table 2-2 presents basic data (geographic location, number of shippers, commodities, carloads, revenues, etc.) for the Class I branch (listed first in the pairing) and short line railroad (listed second in the pairing) operations studied. Table 2-3 provides a comparison of selected economic indicators for the two groups of lines. The economic indicators were constructed by taking the simple group averages for the six Class I branch and six Class II short line railroads. To the extent large differences exist between lines within each group, the (average) numbers tend to become less meaningful.

Comparison of economic indicators suggests that the short lines enjoy an economic advantage. Even though on the average the short lines require more man hours to move cars over the line and to maintain track, roadbed, switches and other structures, their costs per hour are considerably less (see Table 2-3). One needs to be careful about generalizing from these results, however. As Banks indicates, the lines studied represent only a small

TABLE 2-2

TRAFFIC DATA FOR COMPARABLE CLASS I - BRANCH LINE AND
CLASS II - SHORT LINE RAILROAD OPERATIONS, 1972

RAILROAD	NUMBER OF SHIPPERS	ROAD MILES	CARLOADS	FREIGHT REVENUE	PRINCIPLE COMMODITIES	
					INBOUND	OUTBOUND
MAINE CENTRAL RR-CALAIS BR. (MAINE)	30	158	10,104	N.A.	PULPMOOD, FUEL	BLUEBERRIES
VERMONT RAILWAY (VERMONT)	75	129	9,668	1,125,146	LUMBER, FEED, FERTILIZER PAPER CHEMICALS	BAGGED LIMESTONE
MONTPELLER & BARRE RAILWAY (VERMONT)	25	14	1,833	174,233	STONE, BEER, WINE	STONE PRODUCTS
BOSTON & MAINE RR-ASHUELOT BR (N.H.)	40	22	3,647	N.A.	LUMBER, NEWSPRINT, FEED, ROOFING MATERIAL	PAPER PRODUCTS
PENN CENTRAL RR-MECHANICSBURG BR. (OHIO)	5	17	1,676	N.A.	FEED, FERTILIZER	GRAIN
CADIZ RAILROAD (KENTUCKY)	7	10	1,909	105,456	FEED, FERTILIZER, BUILDING MATERIALS	AUTO PARTS
UNION PACIFIC RR-MT. HOOD (OREGON)	15	21	3,485	N.A.	FERTILIZER	FRESH FRUIT, LUMBER PRODUCTS
CITY OF PRINEVILLE RR (OREGON)	12	18	9,400	678,640	FEED, FERTILIZER, FUEL	LUMBER PRODUCTS
SOUTHERN PACIFIC RR-SANTA PAULA BR. (CALIF)	60	28	4,010	N.A.	LUMBER, SAND	FRESH FRUIT
SAN LOUIS CENTRAL RAILWAY (COLORADO)	25	16	746	51,813	FERTILIZER, COAL	POTATOES, LETTUCE
LAURINBURY & SOUTHERN RAILWAY (N.C.)	24	28	7,832	353,659	CHEMICAL, FERTILIZER	COTTON, LUMBER, WOOD PRODUCTS
SEABOARD COASTLINE RR-ALOMA SUB. (FLA.)	16	28	7,232	N.A.	LUMBER, SAND, GRAVEL, FERTILIZER	METAL PRODUCTS, WOOD PRODUCTS

N.A. - NOT AVAILABLE

SOURCE: TABLE CONSTRUCTED FROM INFORMATION PROVIDED IN SHORT LINE TECHNIQUES TO IMPROVE FINANCIAL VIABILITY OF LIGHT DENSITY LINES--MAJOR RAILROADS, A REPORT TO THE FEDERAL RAILROAD ADMINISTRATION, R.L. BANKS AND ASSOCIATES, INC., WASHINGTON, D.C., MAY 1974.

TABLE 2-3
SUMMARY AND COMPARISON OF ECONOMIC INDICATORS
FOR CLASS I BRANCH - AND CLASS II - SHORT LINE
RAILROAD OPERATIONS, 1972

ECONOMIC INDICATORS	SIMPLE AVERAGE OF SIX STUDIED LINES	
	BRANCH	SHORT
MILES OF ROAD	46	36
CARLOADS	5,036	5,231
FREIGHT REVENUE	N.A.	\$414,825.00
TRAIN AND ENGINE CREW MAN HOURS PER CARLOAD	2.77	3.21
TRAIN AND ENGINE CREW MAN HOURS PER REVENUE CAR-MILE	0.16	0.29
MAINTENANCE OF WAY MAN HOURS PER MILE OF ROAD	469	592
TRAIN AND ENGINE CREW WAGES, ROAD AND YARD PER CARLOAD	\$21.98	\$11.50
TRAIN AND ENGINE CREW WAGES, ROAD AND YARD PER REVENUE (AR-MILE)	\$ 1.28	\$ 1.01
MAINTENANCE OF WAY WAGES PER MILE OF ROAD	\$2,084.00	\$1,814.00
MAINTENANCE OF WAY EXPENSES PER MILE OF ROAD	\$3,242.00	\$3,178.00
MAINTENANCE OF WAY EXPENSES PER REVENUE CAR-MILE	\$ 1.40	\$ 1.40
TRAIN AND ENGINE CREW AVERAGE WAGE PER MAN HOUR	\$ 7.22 ^{a/}	\$ 3.64
MAINTENANCE OF WAY AVERAGE HOURLY WAGE	\$ 4.38 ^{a/}	\$ 3.00

N.A. - NOT AVAILABLE

^{a/} INCLUDES ARBITRARIES AND PENALTY PAYMENTS

SOURCE: TABLE CONSTRUCTED FROM INFORMATION PROVIDED IN SHORT LINE TECHNIQUES TO IMPROVE FINANCIAL VIABILITY OF LIGHT DENSITY LINES--MAJOR RAILROADS, A REPORT TO THE FEDERAL RAILROAD ADMINISTRATION, R.C. BANKS AND ASSOCIATES, INC., WASHINGTON, D.C. MAY 1974.

fraction of all U.S. branch and short lines. "While the (study) lines assessed may be indicative of other lines they are not necessarily typical." ⁶⁴

Even though short lines, in many cases, may enjoy cost advantages over their branch line counterparts, there is no guarantee that the short line will succeed. Short lines must have a reasonable level of traffic to survive, just like any other railroad. Short lines are just as secure as the industry they serve. When a big shipper closes an obsolete plant or a mining company abandons a played-out mine, the short line often has no alternative but to shut down as well. Those short lines that survive and prosper do so because they have diversified their operations. They have attracted off-line business or have provided special services to shippers--such as consolidation, storage, and breakdown services. Three brief examples will help illustrate the broad range of activities and services provided by short line railroads.

(1) The Vermont Railway, discussed earlier, has found a profitable diversification--piggyback operations. ⁶⁵ The railroad owns 300 piggyback trailers and leases an additional 5,000. To develop a solid off-line industry demand for its piggyback (TOFC--Trailer On Flatbed Car) operations, the Vermont Railway promoted the formation

⁶⁴R.L. Banks and Associates, Inc., Short Line Techniques to Improve Financial Viability of Light Density Lines--Major Railroads, Op. Cit., p. 112.

⁶⁵Robert Roberts, "Small Railroad Thinks Big," Modern Railroads, (June, 1969), 61.

of a TOFC shipper association. The association provides pick-up and delivery truck service between the TOFC ramp and the member's place of business. The Vermont Railway's piggyback operations have paid off. In 1972, Vermont's net railway operating income, excluding its piggyback operations, was a negative \$106,478. On the other hand, its net income from piggyback operations was \$239,598, giving the Vermont Railway positive earnings for the year.⁶⁶

(2) Providing services to rail users beyond the normal pick-up and delivery of rail cars can turn a marginal short line railroad into a sound financial venture. For example, in 1958 the Stockton Terminal and Eastern Railroad (ST&E) handled 3,119 carloads. By 1970, the railroad was handling 16,744 carloads annually. The reason--ST&E established a food consolidation warehouse on its line.⁶⁷ Californian, Hawaiian and Pacific Northwest canners benefited immediately from the consolidation of services offered by the ST&E (located in Stockton, California). Previously, to accomodate eastern buyers, western distributors had to use high-priced transportation (truck and air freight) for many small shipments of a particular item. No one (eastern) store could use a carload of canned salmon, for example. By establishing a consolidation point on the ST&E, a canner could ship in-volume to Stockton where the products could be consolidated with other products and shipped

⁶⁶R.L. Banks and Associates, Inc., Short Line Techniques to Improve Financial Viability of Light Density Lines--Major Railroads, Op. Cit., p. 28.

⁶⁷Robert Roberts, "Short Line is Key Link in Food Distribution Chain," Modern Railroads (April, 1972), 70.

east at low cost in carload amounts. This method eliminated costly warehousing for canners 2,000 to 3,000 miles away from their eastern markets and kept western canners competitive in the midwest and the east. ⁶⁸

(3) Car supply can be a specific problem for short line railroads. Short lines, for the most part, depend on their Class I connecting carriers to provide them with rail cars. Consequently, many short lines have difficulty in providing firms rail cars when they would like them; and, failure to provide firms with clean rail cars on a timely and reliable basis can mean the permanent loss of their business. To solve their car supply problem, many short lines have either purchased or leased rail cars. For a few short lines their investments have paid-off; not only have they been able to attract new business by being able to provide rail cars when they were needed, they also have benefited from substantial car rentals (per diem) paid by other railroads.

The San Luis Central Railroad (SLC) in Colorado illustrates this point. The primary function of the SLC is to transport potatoes, and to a lesser extent lettuce, twelve miles from their production area to the interchange point with the Denver and Rio Grande Western Railroad (D&RGW). The SLC depended upon D&RGW for its supply of refrigerated rail cars. The D&RGW provided small 30-foot ice refrigerator cars, for the most part. ⁶⁹ The freight

⁶⁸Robert Roberts, "Short Line is Key Link in Food Distribution Chain," Op. Cit., 70.

⁶⁹R.L. Banks and Associates, Inc., Short Line Techniques to Improve Financial Viability of Light Density Lines, Op. Cit., pp. 78-86.

rates on the smaller cars were not competitive with the truck rates, so most of the farmers in the area were shipping by truck.

SLC began to compete effectively with trucks in 1972. SLC purchased 302 ex-REA Express refrigerator cars, larger than the 30-foot ice refrigerator cars. The larger cars allowed SLC and its connecting carriers to publish reduced (truck competitive) rates to major markets. Producers in the region responded to SLC's lower rates by increasing their use of rail service. While in 1971 SLC carried only 8 percent of the potatoes exported from the area, their market share was 15 percent in 1972 and was 25 percent in 1973. At the same time SLC was earning higher revenues through increased carloadings, it also was earning substantial car rental (per diem) fees from railroads handling their cars.

In 1972, SLC had a net railway operating income of \$140,021 (up from a negative \$11,136 in 1971). By owning its own cars SLC was able to provide its shippers a sure car supply at favorable rates; it also reduced SLC's car-hire expenses by about \$1,000. But more importantly, SLC earned \$185,790 in car rentals from the off-line movement of traffic it originated in its own cars.⁷⁰

Although our discussion of short line railroads has been brief, it illustrates a number of points regarding the future viability of many branch lines.⁷¹

⁷⁰R.L. Banks and Associates, Inc., Short Line Techniques to Improve Financial Viability of Light Density Lines--Major Railroads, pp. Cit., pp. 84-85.

⁷¹For an excellent discussion of what to consider when setting up a short line railroad see: Edwin P. Patton and C. John Langley, Jr., Handbook for Preservation of Local Railroad Service, U.S. Department of Transportation, (July, 1976).

1. Changes in intra-railroad operating procedures, such as the adoption of flexible work rules, can lead to lower railroad operating costs and improved rail service.
2. Branch line railroads need to be flexible and innovative in their approach to providing rail service.
3. There is no magic formula for success. Even with flexible work rules and innovative management, the absence of minimal levels of traffic will doom any railroad operation to failure.

Branch Line Rationalization. Many rural areas today are served by one or more branch lines. Due to factors discussed earlier in this chapter, the demand for rail service in many rural areas has declined substantially in the last two or three decades; it has also become more irregular as those still using rail service use it less frequently and often on short notice. For a large number of branch line railroads the decline in demand for rail service and its irregular nature has meant inadequate revenues to cover their operating costs, much less their fixed costs. This has led many branch line railroads to adopt cost-saving procedures (i.e., deferred maintenance, less frequent service, and so on) that eventually result in poor rail service and in the loss of business.

As a result, many states are faced with a situation today where the productive base of its rural rail system--the physical plant--is in need of major rehabilitation and modernization. If firms on the

Also, rail users, communities, and public officials desiring a procedure to help them decide whether to invest or disinvest in a branch line should see: Marc A. Johnson, Community Evaluation of Railroad Branch Lines: Principles and Procedures, Report No. 38, Center for Rural Manpower and Public Affairs, Department of Agricultural Economics, Michigan State University, April 1975.

branch lines are going to use rail service and remain competitive, they must be able to take advantage of the latest technology--larger freight cars and the preferential volume freight rates that accompany them. This means branch lines with heavier gauge rail and in some cases larger loading and unloading facilities, are required to make economical use of the larger cars.

Where investment in rehabilitation and modernization of two or three branch lines in a given area cannot be justified, it may be justified for one. Consolidation of traffic from two or three lines on one line may allow the branch line railroad to realize the scale economies inherent in its operation; the consolidation of traffic lowers the railroad's operating costs, improves its financial position, and makes it unnecessary to adopt cost-saving procedures that led to poor rail service.

The rationalization or re-configuration of branch lines in an area does not necessarily mean former rail users will lose service. It does mean that adjustments will have to be made, however. A number of complementary changes with rationalization may in fact result in improved transportation service for many firms. The establishment of rail sub-terminals, for example, with pick-up and delivery truck service may make it possible for firms located 15 to 20 miles away to use rail service. Firms that formerly relied upon truck service would now have access to rail service and perhaps new markets for their products and their purchases.

Few studies of the consequences of alternative branch line rationalization plans have been made. This is due, in part, to the line by line abandonment procedure followed by the ICC. With the

passage of the RRR and RRRR Acts, however, reorganization of branch line systems on a regional basis is likely to occur.

Summary. In this section, a brief review of a few strategies used to retain and to improve rail service have been considered. Increasing the viability of a branch line requires increasing the level of demand (and revenues) for rail service, as well as decreasing costs. As we have indicated in this section and others, the demand for rail service is sensitive to the quality or reliability of rail service. Thus far we have considered the behavior of the branch line railroad and its affect on rail service quality; we have not considered the behavior of the off-branch railroads that is also a determinant in the quality of service the branch line rail user receives. In the next section of this chapter, consideration is given to the behavior of interline carriers (off-branch railroads) and the reliability of rail service.

Intra- and Inter-Railroad Operating Procedures, Interlining of Rail Shipments, and Rail Service Quality

The purpose of this section is to examine how procedures established by railroads for interchange and movement of freight shipments over their lines affects the quality of rail service branch line firms receive. We begin by defining a few terms. "Intra-railroad operating procedures" refers to individual railroad policies on train length, service schedules, "blocking" (i.e., grouping cars for a common destination), car and equipment supply, handling of damage claims, monitoring freight shipments while in transit, and maintenance and rehabilitation of track, switches, signal equipment and other structures. "Inter-railroad operating procedures" refer

to agreements railroads have established for the interchange and movement of interline traffic (e.g., joint rates and routes), including agreements on joint facilities and equipment use.

Interlining occurs when freight shipments must pass over the lines of two or more railroads before reaching their final destination. The behavior of interline carriers has direct bearing on shipment transit time and variance in transit time as well as freight car utilization.

Interlining: An Example. The following description for the movement of a typical freight shipment is provided to facilitate discussion of the factors that determine transit time, variance in transit time, and so on.⁷² Figure 2-4 identifies the important events associated with movement of a carload shipment between its points of origin and destination.

Assume a firm located on a Michigan branch line places an order for a carload of a certain commodity with a west coast manufacturer. Railroad responsibility for the shipment begins when the manufacturer notifies the originating railroad that the car is ready to be picked-up (pulled). Sometime later, a local switch engine pulls the car and brings it to a railroad classification yard where it is assembled into a group or "block" of cars having the same immediate destination (intermediate classification yard).

⁷²This example is based on a similar one provided by C.D. Martland and J.M. Sussman, "Rail Service Time Reliability--An Analysis of Operating Data," Canadian Transportation Research Forum (May, 1972), 527-528.

Event	Trip Segment			
RELEASE				
PULL	INDUSTRY SIDING			LOCAL MOVE
ARRIVE AT FIRST YARD	LOCAL SWITCH RUN			
DEPART FIRST YARD	ORIGIN YARD		TOTAL LINE HAUL	PORTION OF TOTAL HAUL BY 1ST RAILROAD
ARRIVE INTERMEDIATE YARD	LINE HAUL			
DEPART INTERMEDIATE YARD	INTERMEDIATE YARD			
ARRIVE INTERCHANGE	.			
DEPART INTERCHANGE (DELIVERY)	DESTINATION YARD		TOTAL LINE HAUL	PORTION OF TOTAL HAUL BY 2ND RAILROAD
DEPART INTERCHANGE	ORIGIN YARD			
ARRIVE INTERMEDIATE YARD	LINE HAUL			
DEPART INTERMEDIATE YARD	INTERMEDIATE YARD			
ARRIVE FINAL YARD	.		TOTAL LINE HAUL	PORTION OF TOTAL HAUL BY 2ND RAILROAD
DEPART FINAL YARD	DESTINATION YARD			
PLACEMENT BRANCH LINE FIRM'S SIDING	LOCAL SWITCH RUN			LOCAL MOVE
TOTAL HAUL - FROM CONSIGNOR TO CONSIGNEE				

FIGURE 2-4
HYPOTHETICAL CARLOAD SHIPMENT

Once blocked with other cars, the shipment then proceeds to its destination in a series of line haul trips between classification yard and interchanges. When it arrives at the destination yard, the branch line railroad contacts the firm which is to receive the shipment (consignee) for delivery instructions. The consignee may ask that the car be delivered immediately or that it be held in the yard at his expense until he is ready to receive it.

As this hypothetical example suggests, the nature of railroad operations causes a shipment (car) to encounter numerous opportunities for delay as it moves from its point of origin to final destination. Sussman notes:

...At each yard, cars moving to common intermediate or final destinations are consolidated into "blocks," placed in a train consisting of one or more blocks, and handled together to another yard which may be twenty or more than a thousand miles distant. Whenever a car is set off from a train or the train reaches its destination, the car is reswitched and consolidated with other traffic into a new block and a new train. This procedure is repeated until the car reaches its final destination....This process of switching and consolidation necessarily results in longer transit time than would be required for the direct movement (such as by unit train). Equally as important, this procedure is unreliable. That is, each time a car is switched, the potential for a missed connection at that yard exists. ⁷³

According to Sussman, ⁷⁴ missed connections are the cause of large variations in transit time. Car delays of 12 to 24 hours

⁷³ Joseph M. Sussman, "Research Needs and Priorities in Rail Service Reliability," Railroad Research Study Background Papers, Transportation Research Board, (July, 1975), p. 220.

⁷⁴ Ibid.

(the time until the next appropriate outbound train) are common with missed connections. Among the causes for missed connections are outbound train cancellations, train length/weight constraints, and late arrival of an inbound car. The late arrival of an inbound car is particularly an important factor.

...if a car arrives late by some "threshold" time, its connection with the outbound is often missed. Of course, the outbound could be held for the car allowing the connection to be made despite the lateness of the arrival. However, this may well lead to further problems.

...(it has been shown ⁷⁵) that the primary cause of late arrivals at a yard is late departure from the preceding yard. Hence, holding trains to allow particular connections to be made may well lead to inbound lateness at succeeding ⁷⁶ yards and the possibility of other missed connections.

Based on a case study of Southern Railway, Sussman and Martland concluded that potential for improvement in rail service existed through operating strategies that would either avoid intermediate yarding of cars (i.e., run-through trains) or improve the probability of making connections when yardings were necessary.⁷⁷ They found that variability in total transit time for a car increased with the number of intermediate (classification) yards it had to pass through.

⁷⁵K. Belovarac and J.T. Kneafsey, Determinants of Line Haul Reliability, (Studies in Railroad Operations and Economics), Vol. 3, M.I.T., Report R72-40, 1972.

⁷⁶Joseph M. Sussman, "Research Needs and Priorities in Rail Service Reliability," Op. Cit., p. 222.

⁷⁷Joseph M. Sussman and Carl D. Martland, Improving Railroad Reliability: A Case Study of Southern Railway, (Studies in Railroad Operations and Economics), Vol. 5, M.I.T., Report R74-20, 1974.

Classification Yards. Classification yards are a cause of unreliable rail service in two respects; they contribute to (1) unreliable transit time (discussed above), and (2) low rates of equipment utilization, particularly freight cars. A recent Federal Railroad Administration (FRA) study of carloading cycles found the average rail car (in its sample ⁷⁸) spent 62 percent of its load-to-load cycle in classification yards, 24 percent under shipper control, and 14 percent in-transit.

Railroad Cooperation and Competition. The quality of rail service that branch line firms receive depends upon the performance of interline carriers as well as the branch line railroad. Reliability of transit time, for example, is determined by how well interline railroad operating procedures dovetail. On this point, many students ⁷⁹ of the U.S. rail industry argue that railroad operating policies do not dovetail well at all; and, that the current structure of the rail industry promotes disincentives rather than incentives for coordination and cooperation. Morton notes:⁸⁰

⁷⁸The Federal Railroad Administration study was based on a 15,000 car national sample. For further details see: Reebie Associates, Toward and Effective Demurrage System, Final Report to the Federal Railroad Administration, July, 1972.

⁷⁹Alexander L. Morton, "Balkanization in the Railroad Industry," Canadian Transportation Research Forum, October 1974, 14-17; Task Force on Railroad Productivity, Improving Railroad Productivity, Op. Cit., pp. 240-245.

⁸⁰Alexander L. Morton, Op. Cit., pp. 14-15.

...one-half of all rail shipments, accounting for seventy percent of revenue ton-miles, travel over two or more railroads to reach their destination. This interline traffic, crucial to the welfare of virtually every railroad, creates a high level of interdependence within the industry and demands a high degree of cooperation and coordination among rail carriers...the large volume of interline traffic might be thought sufficient to stimulate whatever cooperation and coordination is necessary. In fact, however, railroads do not share common motivations.

...The situation is vastly complicated by the fact that railroads also compete intensely with one another. They compete both to originate traffic and to share in interline traffic exchanged at rail junction points. This competition undermines the cooperation and coordination which their interdependence requires...Because of the high degree of interdependence there are many opportunities for one railroad to promote its welfare at the expense of other railroads and the system as a whole (i.e., the suboptimization problem).

The suboptimization that Morton refers to occurs when each railroad attempts to minimize its own costs via its control over train schedules and operating policies (e.g., blocking, train length/weight constraints, through-trains, train cancellations, and so on). According to the Task Force on Railroad Productivity:

(since) individual lines receive the same division (proportion of revenues) regardless of the time they take in completing their portion of the movement...The profit motive impels individual lines to perform their part of the movement in whatever way minimizes the cost to themselves, with only slight regard for the effect on the quality of service to the shipper...Not only does this suboptimizing behavior of individual lines degrade service quality, it inflates costs. Individual carriers minimize cost to themselves with only slight regard to⁸¹ any higher costs imposed on the connecting carriers.

The long-run consequences of such railroad behavior is the deterioration in the quality of rail service offered and higher

⁸¹Task Force on Railroad Productivity, Op. Cit., p. 241.

railroad operating costs; factors which determine the viability of railroad operations.

Rail User Size, Routing, and Rail Service Quality

Large volume rail users tend to have fewer problems with slow and unreliable rail service than do the smaller rail users. There are two reasons for this: (1) large volume rail users tend to use rail service on a fairly constant and predictable basis, and (2) large volume rail users often represent a substantial portion of the railroads' operating revenue.

As noted earlier in this section, railroads have adopted operating procedures (car classification, blocking, scheduling, routing, handling, interchanging, and so on) designed to reduce their per-unit (ton-mile) costs for handling shipments--interline and local. The fairly constant and predictable demand of large volume rail users allows the railroads to plan their service activities so as to achieve economies of scale in handling and in equipment use. In contrast, small volume rail users with infrequent demand for rail service can be a source of expense to the railroads. To accomodate the service desires of small, infrequent rail users (e.g. faster transit time, increased frequency of service), often-times requires that railroads operate train-units substantially below their capacity; this results in high per-unit operating costs. Railroads avoid such situations whenever possible.

The Importance of Routing. By tradition and law,⁸² a rail user has the right to route his shipments. Large volume rail users, in contrast to small volume rail users, can use their routing rights as a bargaining tool in obtaining more favorable services or rates from railroads. "A carrier who knows that a substantial volume of business can be diverted from his own lines to a rival carrier is likely to listen to the rail users' views or grievances with considerable respect."⁸³

Even though the bargaining power of a small volume rail user may be minimal, he may still derive considerable economic benefit by specifying the routing of his shipments; the service and reliability features of certain railroads may be generally better than others. If the rail user decides not to exercise his legal right to route his shipment, the railroads must move the shipment over the lowest-priced route. From the rail user's perspective, the lowest-priced route may turn out to be quite expensive when such factors as inventory costs are considered. Given a choice, the rail user might prefer a longer, higher priced (i.e. higher freight charge) route if it means reducing transit time by two or three days.

To a small rail user, however, the cost of gathering and analyzing information on the service characteristics of different

⁸²Rail users are given the legal right to route their shipments under Part I of the Interstate Commerce Act.

⁸³Roy J. Sampson and Martin T. Farris, Domestic Transportation: Practice, Theory and Policy, (Boston: Houghton Mifflin Co., 1966), p. 405.

railroads and alternative routes may be prohibitive. For example, between New York City and El Paso, Texas, rail tariffs show 240 different routings.⁸⁴ According to Sampson:

...There may be as many as two million different kinds of commodities subject to transportation (regulation) in the United States, and every one of these items conceivably is subject to transportation between any two of thousands of origin and destination points. Further, in moving from origin to destination, an exceedingly large number of alternative routes may be used...there are more than 4,700,000 possible rail routes between Dallas, Texas and Detroit, Michigan.⁸⁵

Given the complexity of evaluating alternative carriers and routes, many large rail using firms employ traffic managers. They are specialists in the area of rates and routes, and are very knowledgeable about service features of different railroads. Although it may not be economical for a small rail user to hire a traffic manager, it may be economical for a group of rail users to do so. Some of the benefits small rail users may be able to capture through group action (e.g., rail users association) will be discussed in the next section of this chapter.

Rail Users' Association, Quality of Rail Service, and Branch Line Viability

In this section a general argument will be made for the establishment of rail users' associations on branch lines. Rail

⁸⁴Thomas Coneybeer, "Rail Car Routing Policies and Practices," Transportation Journal, (Summer 1976), 29-38.

⁸⁵Roy J. Sampson, Domestic Transportation: Practice, Theory and Policy, Op. Cit., p. 155. Although there are more than 4,700,000 possible rail routes between Dallas and Detroit, there are only a few hundred for which tariffs presently exist.

users' associations, it will be argued, may be able to (1) improve the quality of rail service received by its members, and (2) work with the branch line railroad to increase the financial viability of the line. Brief review will be given to the legal constraints placed on rail users' associations by the Interstate Commerce Commission. And, consideration will also be given to some potential problems in organizing a rail users' association.

Rail Users' Association: What It Can Do. A rail users' association can contribute to the increased viability of their branch line by (1) maintaining close communications with the branch line railroad over problems of mutual concern (e.g., frequency of train service, provision of freight cars, maintenance and rehabilitation of track and other structures, and so on); and (2) by entering into agreements with the branch line railroad for the provision of short-term revenue supplement payments, rehabilitation loans, and joint financing of rail sidings and loading/unloading facilities.

The importance of the rail users' association is that it can mobilize the efforts of a large number, if not all, of the rail users on the line. In most cases this is critical, for the actions of one or a few rail users on a branch line are usually not enough to achieve the changes that are needed to improve the quality of rail service and increase the financial viability of the branch line.

To reduce individual member transaction costs in dealing with the branch line railroads and vice versa, the rail users' association would hire a traffic manager and perhaps a small staff. Besides representing the association members in dealings with the branch

line railroad, the traffic manager would provide members with information on alternative rates, routes, and interline railroads. The traffic manager would also represent association members in negotiations with interline railroads on the specification of rates and service levels on different shipments. In contrast to the small branch line firm (rail user), the ability of the rail users' association to route the shipments of many rail users over the lines of its choice should improve its members' bargaining position with the railroads substantially.

The value of a traffic manager to one firm is illustrated in the following example.

What level of service can you realistically expect to get from a railroad? Georgia-Pacific found that hiring a veteran railroad man to monitor its shipments brought out the best in the railroads. ⁸⁶

When Georgia Pacific hired their traffic manager, it was shipping its products by rail (50 percent) and truck (50 percent); two years later the ratio was 90:10 in favor of rail. According to the newly hired traffic manager:

If you're going to get service, you have to find out what service you need and how the railroad is going to provide it. Once service is established, see to it they (the railroads) provide it. And if they don't, you always have leverage...you can take business away from them and force them to pay attention.

You just can't look at the shippers' problems, you have to look at the railroads' problems, too...What I do is set up a pattern of how the car should be handled...not the best of all possible schedules, but what is the most reasonable way those cars should be handled.

⁸⁶"Speaking of Service," Transportation and Distribution Management, (October 1973), 21.

After we establish that, we monitor the cars to see that they're handled that way. And when they're not handled that way, we tell the railroads.

I am (traffic manager) convinced if you communicate with the railroads there are many problems you can work out to the satisfaction of the railroad and the shipper...I personally think a lot of industries are missing a good bet by not having a position similar to mine, somebody who understands the railroad business, understands transportation and at the same time can work for the interests of the shippers.⁸⁷

This example illustrates how a rail users' association, through its traffic manager, can combine voice and exit to improve the quality of rail service. The traffic manager articulates (voice) the service preferences of the association's members, at the same time he indicates the members will take their business to another railroad or shift to trucks (exit) if they are not satisfied with the service provided.

Rail Users' Associations and the Interstate Commerce Commission.

The content of bargained agreements between rail users' associations and railroads is subject to the approval of the Interstate Commerce Commission (ICC). To examine this point, consideration will first be given to the ICC's definition of a rail users' (shippers') association. Following this, aspects of rail service that the ICC permits rail users' associations and railroads to bargain over will be considered.

According to the Interstate Commerce Commission, a true shippers' cooperative (rail users' association) is a legally

⁸⁷Speaking of Service", Op. Cit., 21-22.

unregulated organization (either incorporated or unincorporated) composed of shippers who are "desirous of participation in mutual non-profit pool car or pool truck activities and securing for themselves the benefits of carload, truckload and other volume rates." ⁸⁸ This exemption is provided by Section 402 (c)(1) of the Interstate Commerce Act as follows:

The provisions of this part shall not be construed to apply (1) to the operations of a shipper, or a group or association of shippers, in consolidating or distributing freight for themselves or for members thereof, on a non-profit basis, for the purpose of securing the benefits of a carload, truckload, or other volume rates, or (2) to the operations of a warehouseman or other shippers' agent, in consolidating or distributing pool cars, whose services and responsibilities to shippers in connection with such operations are confined to the terminal area in which such operations are performed.

Technically, a rail users' association can perform the same functions as a freight forwarder, but not be subject to the rate regulations of the Interstate Commerce Commission. Freight forwarders are considered indirect modes of transportation, competing with direct modes for traffic. Since freight forwarders perform transportation services for-hire, they are regulated as common carriers in ways similar (i.e. entry, rates and service) to railroads, motor carriers, pipelines, and domestic water carriers under the Interstate Commerce Act. According to Sampson:

⁸⁸Atlanta Shippers Association, Inc.,--Investigations of Operations (FF-C-7), 322 I.C.C. 273-300, cited in Bill C. Smith, "What Constitutes a Bona Fide Shippers' Cooperative", Transportation Journal, (Winter 1969).

The primary function of forwarders is the consolidation of small shipments of several or numerous shippers into large shipments which move at lower rates.

The forwarder sells his transportation services directly to a shipper. Then, in turn, he buys line-haul services from the basic modes (in effect, to use an analogy, he subcontracts a part of the movement). His operating expenses and profits are covered by the spread between rates on small shipments and rates on large shipments. The shipper pays no more (or perhaps less) than he otherwise would have to pay on a small-lot movement. In addition, he is relieved of the chores of dealing directly with the basic or primary carriers and may receive better pickup and delivery services, a faster line-haul movement and even other services related to distribution.⁸⁹

What then distinguishes a rail users' cooperative or association from a freight forwarder? According to Smith,⁹⁰ the Interstate Commerce Commission has adopted the following guidelines for determining whether or not a rail users' association is operated legally:

1. The association must serve its own members and only those members. That is a bona fide cooperative must be distinguishable from a "for hire carrier" and must stand aloof to temptations to serve non-members.
2. The association must serve on a nonprofit basis.
3. The association must be controlled by the members who assume the risk of business.

Although the Commission has not clearly stated what is meant by risk:

...they imply that a member of a shippers' cooperative must assume some risk and this would prescribe

⁸⁹Roy J. Sampson and Martin T. Farris, Domestic Transportation: Practice, Theory, and Policy, Op. Cit., pp. 71-72.

⁹⁰Bill C. Smith, "What Constitutes a Bona Fide Shippers' Cooperative," Op. Cit., 23-24.

that sufficient fees should be charged to constitute such a risk, in relation to the scope of operation anticipated, and to serve as a deterrent to membership being construed to be open to the general public for a token fee.⁹¹

Membership fees are often used by rail users' associations for employing a small managerial and clerical staff to provide various services to its members, including traffic management services.

The Interstate Commerce Commission permits rail users and carriers to establish agreed rates, sometimes referred to as loyalty-incentive rates, for certain freight movements. Under agreed rates, a rail user enters into a formal agreement with a railroad or a group of railroads to ship a certain volume, over a specified period of time, by the particular railroad or group of railroads. In return, the rail user pays less than the standard published rate or receives a refund from the railroad for differences between the standard rate at the end of the named period of time. Under such agreements, the rail user normally is not under an absolute obligation to use the services of the given railroad or group of railroads; but if he fails to live-up to the agreed volume, the rail user must pay the standard rate of all his shipments.⁹²

In general, the Interstate Commerce Commission does not favor agreed rates because it is felt that this may be a form of

⁹¹Bill C. Smith, "What Constitutes a Bona Fide Shippers' Cooperative," Op. Cit., 23-24.

⁹²Roy J. Sampson and Martin T. Farris, Domestic Transportation: Practice, Theory and Policy, Op. Cit., p. 175.

discrimination between rail users who may be able to negotiate favorable agreements and smaller rail users who do not have as much bargaining power. The railroads have argued that such agreements, in addition to reducing the rail users' costs, allow them to do better planning for utilization of their equipment and provide better service at lower railroad cost. Accepting the railroads' argument on occasion, the Interstate Commerce Commission has authorized agreed rates based on specific guaranteed amounts of aggregate tonnage to be transported with a specified time period.⁹³ The primary commodities moving under agreed rates today are such high volume, low-unit value commodities as coal, grain, minerals, ores, chemicals, pulp, and so forth.

The Interstate Commerce Commission has prohibited agreed rates based on a guaranteed percentage of the total traffic of a rail user between two or more origins and destinations over a specified period of time. In addition, the Commission rarely approves contracts calling for specific service levels (transit time guarantees, for example) or tariffs and rates which contain such minimum service level agreements.⁹⁴ The Commission's rationale is that if such service arrangements are not available to all rail users, they discriminate between rail users; this is explicitly prohibited by the Interstate Commerce Act. Although

⁹³Kennthe R. DeJarnett, "Regulatory Policy and Decision Relating to Rail Contract Rates," Transportation Journal, (Winter, 1973), 23.

⁹⁴Ibid.

formal agreements on minimum service levels may be difficult to find in writing, they are very much a part of railroad/rail user relations. John Lloyd, President of the Missouri Pacific Railroad, had this to say about one of its largest rail users--General Motors: "They don't come on our lines to get fire engine service."⁹⁵ Lloyd indicated that if Missouri Pacific cannot guarantee General Motors that a railcar will be alongside its Kansas City assembly plant every second morning out of Chicago, General Motors will take its business to another railroad that can.

This brief consideration of Interstate Commerce Commission policy toward rail service agreements between rail users' associations and railroads indicates some of the legal constraints on branch line rail user efforts to improve rail service quality through group action.

Organizational Costs. Even though individual rail users may benefit from rail user group action, there is no guarantee that group action will occur, i.e., a rail users' association will be formed. In previous sections of this chapter, discussion was devoted to the problem that initial organizational costs (e.g., communication, information processing, decision-making, staffing, and so on) pose for group action.

In situations where the number of potential group participants is large, the amount of time and money any one participant

⁹⁵"Railroading's Rising Star," Forbes, (April 1, 1976), 30.

is willing to devote to organizing the group may be small relative to the total effort required. And, when the perceived benefits a potential participant expects to receive from group action are less than the costs he would have to bear to make group action possible, the less likely he will be to contribute at all. This attitude may be reinforced by the knowledge that non-contribution to initial organizational costs will not necessarily preclude him from later membership in the group.

In the case of a rail users' association, the larger its membership, the greater its potential bargaining power with railroads in the determination of rates and other characteristics of rail service.

On branch lines where the formation of a rail users' association is likely to contribute to the financial viability of the line, arguments for government to bear the initial organizational costs can be made. If discontinuing rail service on a branch is likely to have broad economic consequences, government action may be justified.

Summary

The purpose of this chapter has been to consider some of the important factors that influence the character of railroad operations. Particular attention has been given to dynamics of railroad-rail user behavior and its impact on the viability of branch lines. The following points serve to highlight the major relationships discussed in this chapter.

1. The viability of a branch line depends principally on the relationship between the railroad's long-run operating revenues and costs. Although the railroad may adopt cost-saving strategies in the short-run to improve its financial position, these strategies may affect long-run revenues and costs negatively. A railroad may continue to operate in the long-run even though its costs exceed revenues if its losses are covered by a subsidy. The subsidy may come from a rail user, government, or a rail user-government combination. Unprofitable branch line rail operations can also be continued through cross-subsidization by profitable operations elsewhere in the rail system.
2. A railroad's operating revenues and costs are a function of the demand for its service. Demand for rail service, in turn, is a function of the price and service characteristics of available rail service, given the price and service characteristics of other transportation modes (for example, truck, barge, pipeline, and air). The price (freight rates) and service characteristics of rail service are determined by regulation, technology, inter-railroad cooperation and competition, intra- and inter-railroad operating procedures, and railroad-rail user relations.
3. Intra- and inter-railroad operating procedures and policies play a major role in determining the quality of rail service. From the rail users' perspective, key elements of rail service quality include transit time, variance in transit time, car and equipment supply, shipment damage and loss, and communication with railroad personnel responsible for service. Intra- and

inter-railroad operating procedures and policies determining the quality of rail service include train-unit size (length and weight restrictions), service schedules, car and equipment supply, maintenance and rehabilitation of track, switches, signal equipment and other structures, "blocking", routing, car rental rules ("per diem"), and many more.

4. Rail service quality is important to rail users because it affects their production costs. Unreliable transit time, for example, affects the firm's inventory costs. The greater the variance in transit time on a particular shipment, the greater the chances the firm (rail user) will run out of inventory. To reduce the probability of stock-out and subsequent production slow downs or lost sales, or both, the firm must carry larger inventories. Larger inventories may result in higher costs to the firm in a number of ways. To begin with, additional inventory requires tying-up more working capital. In addition, the firm may find it necessary to invest in more warehouse space. Finally, as inventory levels increase, the firm may experience changes in cost for insurance, product obsolescence, product deterioration and state and local inventory taxes.
5. Unreliable rail service causes the effective price (cost) of rail service to rise vis-a-vis other transportation modes. As the costs of rail service increase, many firms find it more economical to shift to truck or other modes. Due to its large fixed costs, the railroad will experience a proportionately larger drop in revenues than costs when firms shift to other modes. The loss of firms (rail users) on a particular line may place the railroad in a cost-revenue squeeze. The railroad may adopt short-run cost-saving strategies, such as deferring maintenance and rehabilitation projects on track and related structures, and/or reducing the frequency of rail service on the line. The net effect of these cost-saving procedures, however, may turn out to be self defeating in the long-run.
6. The effect of deferring maintenance and rehabilitation of track and related structures can be two-fold. The general effect of such policies is substandard track and structures that result in poor rail service and high operating costs. Substandard track leads to slower, less reliable transit time, an increase in derailments, and shipment damage. Operating costs will rise as it may require two train crews to complete a run that was previously handled by one train crew. Locomotive operating and maintenance costs will likely increase, as will daily track maintenance and repair costs.

The decline in rail service reliability may cause firms to abandon rail service for another mode. In addition, railroads that attempt to reduce their costs by providing service less frequently (e.g., twice a week, rather than daily) may find their loss in revenues to be greater than their cost-savings. Many rail users may feel that more frequent service is needed and will shift to another mode accordingly.

7. Large volume rail users tend to get better service from railroads (branch line and interline) than do small rail users. Large volume rail users, in contrast to small rail users, tend to have a fairly constant and predictable demand for rail service. This improves the railroad's ability to plan service activities so as to achieve economies of scale in handling and equipment use. Large volume rail users usually represent a substantial portion of the railroad's operating revenue, consequently the railroad has an incentive to provide the type of service the (large) rail user desires. The rail user's right to choose the routing of his traffic improves his bargaining position with railroads when it comes to establishing and maintaining desirable service standards.
8. Branch line rail users, cooperating through a rail users' association, may be able to achieve many of their commonly shared transportation needs, that are difficult to secure by individual action alone. A rail users' association may be able to work effectively with their branch line railroad to retain and improve rail service; this may be done, for example, by halting the vicious circle of poor service, declining revenues, rising costs, railroad cost-saving efforts, poor service, and so forth. The association may also be able to bargain effectively with interline railroads for improved service by offering to route its members' shipments over their lines.
9. High initial organizational costs, plus the difficulty of excluding non-contributors from some of the benefits, may frustrate rail user efforts to organize a rail users' association. In such cases, rail users may turn to government for help in becoming organized.
10. Many rural areas today are served by more than one branch line. The decline in demand for rail service in many of these areas raises serious questions about the viability of continued rail operations. Retaining rail service may require rationalization and re-configuration of branch line systems on a regional basis.

11. On branch lines where current rail shipment levels do not justify continued rail operations, government may preserve the option for future use of rail service by providing operating subsidies. The option to make use of rail service in the future may be valued by communities for the added flexibility it provides on questions concerning future economic development activities and human settlement patterns; it may also be valued as a hedge against rising fuel and energy costs.

The understanding that this chapter has provided of the forces and processes that determine branch line viability will be drawn upon in the analysis of the operations of selected Michigan rail lines. It is also anticipated that the insights that this chapter have provided into the dynamic railroad-rail user relationships will aid in making program and policy recommendations for improving the viability of the Michigan rail lines studied.

CHAPTER THREE

THE CURRENT FINANCIAL AND OPERATING STATUS OF THE ANN ARBOR, MICHIGAN NOERTHERN, AND THE C.O.-NORTHWEST RAIL LINES

In 1973, total railroad mileage in Michigan stood at approximately 6,000 miles--4,700 miles in the Lower Peninsula and 1,300 miles in the Upper Peninsula. In the Lower Peninsula, 2,200 miles of the total 4,700 miles of rail line were operated by two bankrupt railroads--the Ann Arbor and the Penn Central. In addition, approximately 300 miles of rail were pending service abandonment petition before the Interstate Commerce Commission. The remaining 2,200 miles of Lower Peninsula rail line was operated by solvent railroads.

Under the provisions of the RRR and RRRR Acts, 1,000 miles of 2,200 miles of Michigan bankrupted line were included in ConRail. Of the remaining 1,200 miles of bankrupted line, state transportation officials decided to continue service on 1,000 miles with funds from the federal-state rail freight assistance program.

The loss of rail service to an area may have important economic and social consequences for businesses and communities that depend upon it. Three regional rail lines of particular concern to Michigan transportation officials are the Ann Arbor, the Michigan Northern (formerly part of Penn Central, and a branch of the Chesapeake Ohio (C.O.) system. Two of the lines, the Ann Arbor and the Michigan Northern are presently being operated under the federal-state

subsidy program. The third line, the branch of the Chesapeake and Ohio (hereafter referred to as C.O.-Northwest), is under petition for abandonment with the Interstate Commerce Commission.

The purpose of this chapter is to establish the current financial and operating status of these three Michigan lines. This information will provide the necessary background needed to analyze opportunities (in Chapters Four and Five) for improving the financial viability of the three lines.

The procedure followed in this chapter is as follows. First, brief consideration is given to available data and information on the three Michigan rail lines and the limitations this has placed on efforts to achieve the research objectives. This discussion is followed by analysis of the financial and operating status of the three lines separately. The chapter concludes with a brief comparison of selected financial and operating characteristics of the three lines.

Information and Data Constraints

Most research efforts are constrained, to one degree or another, by the availability of information and data on a problem and the researcher's access to it. This research effort, also, has been hampered by a number of information and data problems.

The value of information on the present financial status of railroad operations of a particular rail line is increased if it can be placed in historical perspective. For example, a person concerned about the future of a particular rail line may want to know how present railroad revenue and cost figures compare with

past revenue and cost figures. What are the trends? Has the financial position of the line improved relative to last year, to ten years ago? Has the mix in freight shipments, originating or terminating on the line, changed in the past few years? If so, which commodities and how has this affected the railroad's revenues and costs? In short, a researcher needs fairly detailed time-series data on a railroad's revenues, costs, commodity mixes, and the like in order to analyze and interpret the significance of a railroad's present financial position. Failure to understand the railroad's present position in a historical perspective may lead to poor policy and program recommendations.

Unfortunately, for the purposes of this research effort, time-series data on the three Michigan lines are not available. Although the Interstate Commerce Commission publishes data and statistics on U.S. railroads, they are too aggregated and incomplete to be useful. For example, the Interstate Commerce Commission groups railroads together by regions (railroad rate territories) and publishes a one percent sample of the railroads' freight movements on a regional basis. Consequently, to the extent that railroads differ in the type of freight (i.e., commodities, size, tons, and value) they handle, the aggregate ICC figures do not reflect what is happening on an individual railroad basis. Furthermore, the aggregate figures are of no help to researchers wanting to focus on a particular branch line of a large railroad. The one percent Waybill sample may be a source of trouble also, even if it was available on an individual railroad (and branch line) basis; depending upon how the

one percent sample is drawn, seasonality of freight shipments may not be reflected, thereby increasing the possibility of distortion.

This research effort focuses on the operations of individual railroads and on particular rail lines. Consequently, the Interstate Commerce Commission data is of little value and will not be used.

The Michigan Public Service Commission has had ⁹⁶ responsibility for enforcing railroad operating safety standards in the state. In the course of their work, they have evaluated the condition of track and railroad structures in Michigan; they have made estimates of the amount of rehabilitation required to upgrade the facilities to different minimum safety standard levels. The Public Service Commission estimates are used in the analysis of the three Michigan lines. The Commission, however, does not collect time-series data on Michigan railroad operations such as commodities, tons, revenues, and costs.

Therefore, due to the absence of time-series data, cross-sectional information from a number of sources will be used to establish the current financial status of the three Michigan lines. The 1973 (100 percent) Waybill records for the Ann Arbor, Michigan Northern, and C.O.-Northwest railroad operations are used to estimate the commodity mix, carloads, tons, and carrier gross revenues for the three lines. Sources of information on railroad costs vary and will be discussed for each rail line separately later in this chapter.

⁹⁶The responsibility for enforcing railroad operating safety standards has been moved to the Michigan Department of State Highways and Transportation.

The Ann Arbor Rail Line

Background. The Ann Arbor railroad runs northwest, 292 miles from Toledo, Ohio across Michigan to Frankfort. From Frankfort, the railroad operates car ferries to the ports of Kewaunee and Manitowoc, Wisconsin.

From its beginning, in 1892, the financial health of the Ann Arbor railroad has been tied to its cross-lake ferry service and the revenue earned from bridge traffic routed over it. In the 1950's and early 1960's, the Ann Arbor and its ferry service provided a valuable Chicago bypass route to eastern and western bound rail shipments. In recent testimony before the Interstate Commerce Commission, Burlington-Northern railroad officials indicated that the Kewaunee-Frankfort ferry connection provided savings of three to five days in transit time on freight shipments which would otherwise move through the congested Chicago classification yards.⁹⁷

The Ann Arbor began to have financial trouble in the mid-1960's as westbound automobile movements began deserting the cross-lake ferry for all-rail routings via Chicago. In addition, Penn Central⁹⁸ operating problems in the late 1960's caused many east coast firms to opt for other eastern railroads. The eastern railroads routed the western-bound shipments through Chicago, Peoria, and

⁹⁷Reported in An Evaluation of the United States Railway Association Preliminary System Plan as It Pertains to the Ann Arbor Railroad, A Report done for the Michigan Department of State Highways and Transportation by Vincent M. Malanaphy and Associates, Inc., (April, 10 1975), p. 11.

⁹⁸The Pennsylvania Central and New York railroads merged in 1968 to form the Penn Central railroad.

St. Louis, rather than interchanging with the Ann Arbor. This gave them the long-haul and higher revenues.⁹⁹

The profitability of the Ann Arbor Railroad company took a turn for the worse in the late 1960's. According to one report, the company's net income plunged from a positive \$204,000 in 1962 to a negative \$756,000 in 1966.¹⁰⁰ For the same period, the Ann Arbor railroad's net operating income fell from a positive \$404,000 (in 1962) to a negative \$288,000 (in 1966). By 1973, the Ann Arbor Railroad company's net income had declined to a negative \$4,312,000.

On October 15, 1973, the Ann Arbor Railroad company applied for reorganization under Section 77 of the Interstate Commerce Act. When a study conducted by the court appointed trustee concluded that the Ann Arbor railroad was not reorganizable, the judge recommended that the Ann Arbor be included in the ConRail system. It was not included and Michigan has taken over responsibility for the Ann Arbor to insure continued rail service.

Although the Ann Arbor's railroad operations continue without much visible change, it has been broken into several pieces on the basis of ownership. Presently, the state of Michigan owns the portion of the Ann Arbor line between Toledo and Ann Arbor--the Saline branch and the portion of line between Ashley and Cadillac.

⁹⁹George W. Hitton, "Great Lakes Car Ferries: An Endangered Species," Trains, (January, 1975), 47-48.

¹⁰⁰An Evaluation of the United States Railway Association Preliminary System Plan as It Pertains to the Ann Arbor Railroad, Op. Cit. Reasons for the fall in income were not given.

The State is leasing the Cadillac to Frankfort and Durand to Ann Arbor portions of the line from the Ann Arbor trustee; the remaining portion of the line from Durand to Ashley is being leased from the Grand Trunk Western Railroad. Finally, the state of Michigan is leasing the Owosso to Saginaw branch from the Penn Central trustees. Rail service on the Ann Arbor is being provided by subsidy under the federal-state freight assistance program.

Importance of the Ann Arbor Car Ferry and Bridge Traffic. In 1973, the Ann Arbor railroad's operating (gross) revenues were approximately \$10.5 million. Of this, \$6.5 million was attributed to bridge traffic and \$4.0 million to freight shipments that either originated or terminated at stations on the Ann Arbor line. The \$6.5 million in bridge traffic can be broken down into bridge traffic using the car ferry (\$5.1 million) and bridge traffic not using the car ferry (\$1.4 million). The importance of the car ferry to the Ann Arbor railroad is evident: It is responsible for nearly 50 percent of the railroad's operating revenue.

As was noted earlier in this chapter, car ferry traffic has been declining since the mid-1960's. Between 1972 and 1973 car ferry traffic dropped 22 percent after the crank shaft on one of the two car ferries broke and service between Frankfort and Manitowoc was discontinued. The impact that the loss of ferry service over the Frankfort-Manitowoc route has had on Ann Arbor operations is partially illustrated in Tables 3-1 and 3-2 on the following pages.

TABLE 3-1

**ANN ARBOR CARFERRY TO/FROM KEWANUEE
AND MANITOWAC, 1972, 1973, 1974**

CARLOADS

YEAR	LOAD STATUS	PORT		TOTAL
		KEWAUNEE	MANITOWOC	
1972	LOADED	18312	14894	33206
	EMPTY	9636	8115	17751
	<u>TOTAL</u>	<u>27948</u>	<u>23009</u>	<u>50957</u>
1973	LOADED	26424	0	26424
	EMPTY	13245	0	13245
	<u>TOTAL</u>	<u>39669</u>	<u>0</u>	<u>39669</u>
1974	LOADED	25520	0	25520
	EMPTY	14528	0	14528
	<u>TOTAL</u>	<u>40048</u>	<u>0</u>	<u>40048</u>

Source: Table constructed from data provided in Analysis of Railroad Operating Ferry and Lighterage Operations. United States Railway Association, A.T. Kearney, Inc., 1975.

TABLE 3-2

SELECTED ANN ARBOR RAILROAD REVENUES,
COSTS, AND PROFITS FIGURES, 1972, 1973, 1974

YEAR	OPERATING REVENUES	OPERATING EXPENSES	NET EQUIPMENT AND JOINT FACILITY RENTS	TAXES-PAYROLL AND OTHER	NET RAILROAD OPERATING INCOME
---	---	---	--- DOLLARS ---	---	---
1972	11,002,965	10,239,935	(1,044,973)	822,825	(1,104,768)
1973	10,542,199	10,318,553	(1,185,899)	904,719	(1,866,972)
1974	9,477,000	10,492,000	(1,162,000)	1,082,000	(3,259,000)
PERCENT CHANGE 1972- 1974	(14)	2.5	11.0	31.0	(195)

(NEGATIVE)

Source: Moody's Transportation Manual, 1975.

In 1972, the Ann Arbor car ferries moved a total of 50,957 rail cars across Lake Michigan. About 65 percent, or 33,206 cars, were loaded while the remaining 17,751 (35 percent) of the cars were moved empty. With service terminated to Manitowoc in 1973, total carloadings for the year fell to 39,666 (a decline of 11,291 cars and a 22 percent decrease over 1972). The distribution of cars between loaded and empty remained comparable to 1972--67 percent loaded and 33 percent empty. Consequently, discontinuing ferry service between Frankfort and Manitowoc resulted in the Ann Arbor losing 7,400 revenue producing carloads (65 percent of 11,291) for 1973. The financial implications of this lost traffic is partially reflected in Table 3-2.

Operating revenues for the Ann Arbor railroad fell \$460,766 between 1972 and 1973. The loss would have been higher if originating and terminating carloads on the line in 1973 had not increased by 2,830 over the 1972 levels (see Table 3-3).

Ann Arbor railroad operating revenues fell by \$1,065,199 from 1973 to 1974. During the same period, originating and terminating traffic on the line declined by nearly 2,700 carloads. And although car ferry traffic increased in 1974 by 394, when the loaded to unloaded ratio is examined we find that the number of loaded (revenue-producing) carloads actually dropped by 1,283.

Not all Ann Arbor bridge traffic is cross-lake ferry traffic. In the early 1970's, for example, the Ann Arbor was moving four to five 100-car unit trains of coal a week between Toledo and Owosso. The cars were switched at Owosso to Penn Central for delivery to

TABLE 3-3
ANN ARBOR RAILROAD
ORIGINATING AND TERMINATING TRAFFIC
1972, 1973, 1974
CARLOADS

RAIL STATIONS	YEARS					
	1969	1970	1971	1972	1973	1974
Frankfort-Owosso	3,937	3,635	3,104	3,504	4,463	5,521
Owosso-Toledo	16,441	19,566	18,456	21,079	22,950	19,199
Total	20,378	23,201	21,506	24,583	27,413	24,720
Percent Traffic Owosso-Toledo	80.7	84.3	85.6	85.7	83.7	77.7

Source: Table constructed from data presented in V.M. Malanaphy and Associates, Inc.,
An Evaluation of the United States Railway Association Preliminary Plan
As it Pertains to the Ann Arbor Railroad, 1975.

Saginaw. The bankruptcy of the Ann Arbor and the Penn Central and the uncertainty of future rail service has caused the coal traffic to be re-routed over lines of solvent carriers. The coal traffic represented about 22,000 to 26,000 revenue-producing carloads to the Ann Arbor. Michigan transportation officials believe that chances are not good for the Ann Arbor to recapture this traffic.

It is beyond the scope of this research effort to analyze, in detail, the car ferry and bridge traffic aspects of the Ann Arbor railroad operations. This brief analysis, however, has attempted to indicate the importance of the cross-lake ferry operations and bridge traffic to the financial health of the Ann Arbor railroad. For example, in 1973, ferry and bridge traffic was responsible for about 62 percent of the Ann Arbor railroad's gross operating revenues. Clearly, policy aimed at increasing the viability of the Ann Arbor will have to give careful consideration to these two aspects of the railroad operation.

Distribution of Originating and Terminating Freight Shipments.

Rail freight shipments originating or terminating on the Ann Arbor line are also an important source of railroad operating revenue. In 1973, originating and terminating shipments on the line account for nearly 40 percent (\$4 million) of the Ann Arbor's gross operating revenues.

Originating and terminating rail shipments, however, are not evenly dispersed over the Ann Arbor line. A significant portion of this traffic occurs between Owosso and Toledo (see Table 3-3).

Over a six year period, 1969 to 1974, 83 percent of the originating

and terminating shipments on the Ann Arbor line occurred between these two stations, which is 37 percent of the miles for the line as a whole. The concentration of traffic on the southern end has financial implications for the operation of the Ann Arbor.

A recent study of the financial and operating condition of the Ann Arbor found that (excluding car ferry traffic) only those stations from Owosso south to Toledo generated enough traffic and revenues to cover the railroad's costs in providing service.¹⁰¹

The growth of traffic north of Owosso in 1973 and 1974 (see Table 3-3) is due to the development of sand deposits at Yuma. The importance of the sand traffic to the northern two-thirds of the Ann Arbor can be noted in the following changes. In 1973, 3,068 cars (excluding the sand traffic) were either originated or terminated on the Ann Arbor line north of Owosso. The number fell to 2,510 in 1974--a decrease in traffic of 18 percent. For the same period, the number of sand carloads increased by 116 percent--from 1,395 cars in 1973 to 3,011 cars in 1974. The sand traffic represented 31 percent of the total traffic on the Ann Arbor, north of Owosso, in 1973 and 54 percent in 1974.

¹⁰¹ Reorganization Study of the Ann Arbor Railroad, A Report to Mr. John N. Chase, Jr., Trustee, Ann Arbor Railroad Company, by Peat, Marwick, Mitchell and Co., Washington, D.C., (April 1, 1974.

Many people argue that sand is one of the few rail using commodities north of Owosso that has growth potential. Results from a rail users survey, conducted as part of this research effort and discussed in Chapter Four, indicate that sand is a commodity with growth potential, but not the only one. A recent report predicts the growth in sand traffic on the Ann Arbor will be significant in the next few years.

...Testimony before the Rail Service Planning Office indicates that this traffic (sand) should reach 10,000 cars per year in the near future. The sand presently moves to a (Ford Motor Company) casting plant at Cleveland, Ohio and is being considered for use at a plant in the Detroit area. Other markets for sand are apparently being developed and negotiations for the return movement of spent sand in the same cars that move the sharp sand down to Cleveland appear promising. Another sand plant has been constructed at Harlan, Michigan (just north of Yuma) and is scheduled to go into operation this year (1975). The sand deposits on the Ann Arbor are the first inland deposits of this magnitude developed to date. Most sand of this type has been mined from dunes along the shores of Lake Michigan and there is a movement by environmental groups to put an end to this practice. This could lead to further development of these deposits so that the growth in this segment of the line (north of Owosso) would appear assured. ¹⁰²

The growth in sand traffic has not reached its predicted levels yet, however. And whether it does or not will depend largely upon the outcome of the Interstate Commerce Commission's current investigation of the "reasonableness" of the sand rate. When agreement

¹⁰²Vincent M. Malanaphy and Associates, Inc., An Evaluation of the United States Railway Association Preliminary Plan As It Pertains to the Ann Arbor Railroad, Op. Cit., p. 19.

was reached between the Ann Arbor and the Ford Motor Company for delivery of the sand to Cleveland, they settled on a rate (\$3.10 a ton) that was protested by the present supplier of sand (located in Ohio) as non-competitive. If the Interstate Commerce Commission finds the Ann Arbor rate to be too low and requires that it be raised, a large portion of the sand market will probably be recaptured by Ann Arbor's competitor.

Although sand carries a low rate, the Ann Arbor earns nearly 100 percent of the freight revenues since it moves the sand almost the entire distance. Consequently, revenues on the sand traffic compare favorably with other higher rate traffic since the Ann Arbor earns a smaller portion of those total freight revenues paid.

Analysis of Originating and Terminating Freight Shipments in 1973. Table 3-4, on the next page, summarizes information on freight shipments (commodities, carloads, tons, and gross revenues) that originated or terminated on the Ann Arbor line in 1973. In terms of aggregate numbers, 23,608 ¹⁰³ carloads originated or terminated on the Ann Arbor line in 1973. The 23,608 carloads represent over 1.3 million tons of freight and approximately \$3.6 million in gross revenues to the Ann Arbor. Originating carloads

¹⁰³This figure differs from the one presented in Table 3-3 because the line has been defined differently. The figures in Table 3-4 have been adjusted to reflect the present configuration of the Ann Arbor. Traffic between Durand and Ashley has been dropped while traffic between Owosso and Saginaw has been added. These changes have not been made for the figures reported in Table 3-3, hence the difference.

TABLE 3-4

ANN ARBOR RAIL LINE
(FRANKFORT TO TOLEDO, OWOSSO TO SAGINAW)

1973

<u>Commodity</u>	<u>Carloads</u> <u>(Number)</u>	<u>Tons</u> <u>(Metric)</u>	<u>Gross</u> <u>Revenue</u> <u>(Dollars)</u>
Farm Products	1,125	87,572	297,484
Forest Products	202	2,752	31,168
Fresh Fish or Other Marine Products	6	175	529
Metallic Ores	8	537	1,764
Coal	2,917	199,187	395,275
Crude Petroleum, Natural Gas, or Gasoline	--	--	--
Nonmetallic Minerals	1,813	164,536	421,552
Ordinance or Accessories	--	--	--
Food or Kindred Products	369	16,733	84,202
Tobacco Products	--	--	--
Basic Textiles	107	1,097	13,089
Apparel	1	40	139
Lumber or Wood Products	1,268	52,140	248,050
Furniture or Fixtures	1,158	11,382	93,042
Pulp, Paper, or Allied Products	296	18,414	68,083
Printed Matter	--	--	--
Chemicals or Allied Products	901	69,747	224,724
Petroleum or Coal Products	630	31,768	85,866
Rubber or Misc. Plastic Products	104	1,617	8,811
Leather or Leather Products	0	7	37
Stone, Clay, or Glass Products	7,564	560,791	1,024,498
Primary Metal Products	81	4,595	23,423
Fabricated Metal Products	54	1,477	8,828
Machinery	47	1,031	9,505
Electrical Machinery	8	271	905
Transportation Equipment	4,632	105,935	554,345
Misc. Products of Manufacturing	--	--	--
Waste or Scrap Materials	191	11,100	37,865
Misc. Freight Shipments	67	897	5,575
Containers, Shipping	56	720	5,278
Shipper Association or Similar Traffic	--	--	--
Misc. Mixed Shipments	1	24	240
Small Packaged Freight Shipments	2	160	2,623
TOTAL	23,608	1,344,704	3,645,995

accounted for 66 percent of the total carloads on the Ann Arbor in 1973 while terminating carloads accounted for 34 percent (see Table 3-5).

TABLE 3-5
ANN ARBOR RAIL LINE
DISTRIBUTION OF CARLOADS BY
ORIGIN AND TERMINATION
1973

CARLOADS - 1973		
STATUS	NUMBER	PERCENT
Originating	15,556	66
Terminating	8,052	34
Total	23,608	100

Although the Ann Arbor railroad originated or terminated freight in 35 different commodity groups in 1973, seven (7) commodity groups accounted for 87 percent, 88 percent, and 83 percent of the carloads, tons, and gross revenues, respectively. (see Table 3-6) Commodity groups--Stone, Clay and Glass Products and Transportation Equipment--accounted for over 50 percent of the carloads and tons and for over 40 percent of the gross revenues. Two major firms located south of Owosso are responsible for this traffic.

TABLE 3-6
ANN ARBOR RAIL LINE
DISTRIBUTION OF TRAFFIC BY
MAJOR COMMODITY GROUPS
1973

Commodity Group	Carloads (Number)	Cumulative Distribution (Percent)	Tons (Number)	Cumulative Distribution (Percent)	Gross Revenue (Dollars)	Cumulative Distribution (Percent)
Stone, Clay or Glass Products	7,564	32	560,791	42	1,024,498	28
Transportation Equipment	4,632	52	105,935	50	554,345	43
Coal	2,917	64	199,187	65	395,275	54
Non-Metallic Minerals	1,813	72	164,536	77	421,552	65
Lumber or Wood Products	1,268	77	52,140	81	248,050	72
Furniture or Fixtures	1,158	82	11,382	82	93,042	75
Farm Products	1,125	87	85,572	88	297,484	83
Others	3,131	100	165,161	100	611,749	100
Total	23,608		1,344,704		3,645,995	

Carloads originating and terminating on the Ann Arbor line can be classified according to their terminating and originating points off the Ann Arbor line. Table 3-7 indicates which regions of the U.S. (west, midwest, east and south-southwest) and Canada terminate carloads originating on the Ann Arbor line. In turn, Table 3-8 indicates which regions of the U.S. and Canada originate carloads that terminate on the Ann Arbor line. With reference to originating and terminating points off the Ann Arbor line, the following states have been grouped together to form the U.S. regions--west, midwest, east, and south-southwest:

West: Montana, Wyoming, Colorado, Utah, New Mexico, Arizona, Idaho, Washington, Oregon, Nevada, and California.

Midwest: Kansas, Missouri, Nebraska, Iowa, South Dakota, North Dakota, Minnesota, Illinois, Indiana, Ohio, Wisconsin, and Michigan.

East: Maine, New Hampshire, Vermont, Massachusetts, Rhode Island, Connecticut, New York, New Jersey, Pennsylvania, Delaware, Maryland, District of Columbia, Virginia, West Virginia, and Kentucky.

South-Southwest: Florida, Mississippi, Georgia, South Carolina, North Carolina, Tennessee, Arkansas, Oklahoma, Louisiana, and Texas.

The midwest and east constitute the major markets for rail shipments originating or terminating on the Ann Arbor line. The midwest receives more shipments from Ann Arbor rail users than all the other U.S. regions and Canada combined (53 percent for the midwest and 47 percent for all other regions). In contrast, the east originates over 40 percent of the shipments bound for Ann Arbor rail users. Although the south-southwest region receives 26 percent

TABLE 3-7

ANN ARBOR RAIL LINE
 DISTRIBUTION OF 1973 CARLOADS ORIGINATING ON THE
 ANN ARBOR AND TERMINATING ELSEWHERE IN THE
 U.S. AND CANADA, BY REGION

TERMINATING REGION	CARLOADS	
	NUMBER	PERCENT
East	2275	15
Midwest	8325	53
South-Southwest	4064	26
West	459	3
Canada	433	3
Total	15,556	100

TABLE 3-8

ANN ARBOR RAIL LINE
 DISTRIBUTION OF 1973 CARLOADS TERMINATING ON
 THE ANN ARBOR AND ORIGINATING ELSEWHERE IN
 THE U.S. AND CANADA, BY REGION

ORIGINATING REGION	CARLOADS	
	NUMBER	PERCENT
East	3224	41
Midwest	2586	32
South-Southwest	941	11
West	750	9
Canada	551	7
Total	8052	100

of shipments originating on the Ann Arbor, it originates only 11 percent. The west and Canada do not appear to be important markets for Ann Arbor rail users on the basis of carloads.

From a freight revenue point of view, the importance of the various regions (markets) to the Ann Arbor railroad cannot be determined on the basis of carload numbers alone. Commodities will generate different revenues for the railroads participating in their movement depending upon their size, value, and special equipment requirements. Also, the division of revenue agreements the railroads have established will affect each railroad's earnings. Unfortunately, this information for the freight shipments originating or terminating on the Ann Arbor line in 1973 was not available. Therefore, the precise value (in terms of freight revenue) each region holds for the Ann Arbor railroad could not be determined.

Analysis of Rail Service Operating Revenues and Expenses for Originating and Terminating Freight Shipments in 1973. Determining the Ann Arbor operating costs for that portion of its rail service associated with originating and terminating freight shipments posed a number of problems. To analyze operating costs associated with originating and terminating rail shipments requires (1) separation of line-haul operating costs from car ferry operating costs, and then (2) separation of line-haul bridge traffic costs from line-

haul costs associated with originating and terminating traffic. This is not an easy task.

We could start by identifying those costs that pertain to the car ferry operation only. But even this may not be easy. What portion of the line-haul expenses are attributable to the car ferry operation? If the ferry operation was discontinued tomorrow, would the line-haul operating expenses decline accordingly? The line-haul costs might decline, but under certain circumstances they might not decline at all. Consider the following example:

Assume for the moment that a northbound train-unit of 50 cars is made-up in Toledo. Twenty cars will be dropped-off at stations along the way as the train moves north, 10 cars will be switched to another carrier at Owosso, and the remaining 20 cars will be delivered for ferry service across Lake Michigan. Now assume ferry service is discontinued; what savings result? The railroad will avoid the costs of the ferry operation; but as long as the northbound train-unit continues to operate as scheduled, line-haul costs will not change appreciably. Operation of the train-unit represents a fixed cost in terms of locomotive power and crew size that will not vary much even though 20 fewer cars are being moved (those bound for the ferry). Adjusting line-haul operating costs to reflect the loss of non-ferry bridge traffic possesses similar problems.

The most likely Ann Arbor management response to the loss of its ferry and bridge traffic would be to alter the number of

train-units it operates in the short-term and adjust the overall size of its physical plant in the long-term. Consequently, without making some rather arbitrary judgments about the assignment of joint costs and operating adjustments likely to be made by railroad management, it is very difficult to say what the operating costs associated with originating and terminating freight shipments are.

Furthermore, if one is interested in operating revenues as well as costs associated with originating and terminating traffic, additional problems arise. If we assume the car ferry service has been discontinued so that we can eliminate these costs from the analysis, we have to allow for adjustments in revenues, too. What happens, for example, to originating and terminating shipments that presently use the car ferry? In most cases, the shipments will probably be routed through Chicago and Toledo. Even though this may cause the Ann Arbor to lose some revenue due to changes in its revenue divisions, it will still retain the shipments. On the other hand, if the cross-lake route is favored by the Ann Arbor rail users because it bypasses Chicago, saving 3 to 5 days in transit time on their shipments, they may decide to relocate or truck to and from the C. & O. or Grand Trunk Western railroads; both of these railroads have cross-lake ferry operations. And the loss of originating and terminating shipments may affect the Ann Arbor's operating costs.

The main point of this discussion has been to illustrate the difficulties involved in isolating those costs that can be attributed to originating and terminating freight shipments on the Ann

Arbor. Since it is beyond the scope of this research effort to undertake a detailed study to determine these costs, the work of others will be relied upon.

Perhaps the "best" cost figures for the operations of the Ann Arbor railroad are contained in a recent study conducted for the Trustee of the Ann Arbor Railroad Company.¹⁰⁴ The study evaluated the potential of several reorganization strategies for the Ann Arbor, including rail operations without ferry service and bridge traffic. The costs used for the various strategies were developed from Ann Arbor's annual reports submitted to the Interstate Commerce Commission for the years 1969 through 1972, working papers for the 1973 annual report, and other accounting and statistical data supplied by Ann Arbor personnel.

Table 3-9 on the following page presents estimates of 1973 operating revenues, operating expenses, and net operating income figures for the Ann Arbor railroad. The operating revenue and expense figures are for rail service associated with originating and terminating freight shipments (carloads) only. Revenues and costs associated with the car ferry and bridge traffic have been excluded. Other sources of railroad revenues, such as switching fees and demurrage have not been estimated. According to the study done for the Ann Arbor Trustee, they represent less than

¹⁰⁴Reorganization Study of the Ann Arbor Railroad, A Report to Mr. John N. Chase, Jr., Trustee, Ann Arbor Railroad Company, by Peat, Marwick, Mitchell and Co., Washington, D.C., April 1, 1974.

TABLE 3-9
ANN ARBOR RAIL LINE
(FRANKFORT TO TOLEDO, OWOSSO TO SAGINAW)
1973 FINANCIAL STATUS
(In Dollars)

Operating Revenues		\$3,645,995
Operating Expenses ^{1/}		\$7,004,082
Transportation ^{a/}	\$2,475,498	
Maintenance of Equipment ^{b/}	724,885	
Maintenance of Way & Structures ^{c/}	2,323,200	
Traffic ^{d/}	55,391	
General ^{e/}	323,608	
Net Equipment and Joint Facilities Rents ^{f/}	(254,800)	
Railroad Property Tax	233,100	
Railroad Payroll Tax	613,600	
Net Operating Income		\$(3,358,087)

(negative)

^{1/}According to the Interstate Commerce Commission's Uniform System of Accounts-Railroad Companies, the various expenses included in the operating expense are the following:

^{a/}Transportation: expenses incurred for transporting the materials of others, including the expenses associated with stations, trains, yards, and terminal service. Compensation for train and yard employees are the most important component cost in this category. Also included are expenses for superintendence, train dispatching, fuel and special grade sand for traction.

^{b/}Maintenance of Equipment: expenses incurred for maintenance of locomotives, freight-train cars, shop and power plant machinery and other indirect maintenance of equipment expenses such as insurance and employees health and welfare benefits. Also included in account are expenses for superintendence and depreciation of equipment.

^{c/}Maintenance of Way and Structures: expenses incurred to keep road properties in good condition. This includes those related to right-of-way; track structure, signals and communication systems; appurtenant structures such as bridges, tunnels, and buildings; and other road property facilities such as yards and stations. Major components of cost are superintendence roadway maintenance and maintaining structures. Also included in this account are indirect maintenance of way expenses such as insurance and employee's health and welfare benefits.

TABLE 3-9 Continued

d/Traffic: expenses incurred for such activities as advertising, soliciting, securing traffic for the carrier's line and preparation and distribution of tariffs governing such traffic.

e/General: expenses incurred for administration including: salaries and expenses of general officers, clerk, and attendants; general office supplies, and legal expenses. Also included in this account are insurance and other general expenses such as employee's health and welfare benefits, pensions, stationery, and printing.

f/Net Equipment and Joint Facilities Rents: expense incurred is determined by subtracting rent income from rents payable. The types of rent which are of the most importance are: (1) hire of freight cars (per diem); and (2) locomotive, work equipment, and joint-facility rents.

2 percent (1.6 percent) of total operating income.¹⁰⁵ Nor has non-railroad operating income been estimated. Again, according to the Trustee's report, non-railroad operating revenues represent less than one percent (0.6 percent) of total operating income. Based on the figures presented in Table 3-9, the Ann Arbor lost over \$3 million in 1973 on rail service associated with the originating and termination of freight shipments for rail users located on its line. The average loss per carload to the Ann Arbor was \$142.

One measure of the relative accuracy of these figures is how well they compare with State revenue and cost figures used to determine the amount of subsidy required to operate the land portion of the Ann Arbor system. The comparison is quite good. The subsidy contract numbers were: (1) expected operation revenues--\$3.9 million, (2) expected operating expenses--\$7.3 million, and (3) negotiated subsidy--\$3.4 million.¹⁰⁶

Using a similar format to the one used for the Ann Arbor we will now turn to an analysis of the financial and operating status of the Michigan Northern and C.O.-Northwest railroad operations. Following this, a brief comparison of the three lines will be made.

¹⁰⁵Reorganization Study of the Ann Arbor Railroad, Peat, Marwick, Mitchell and Co., Op. Cit.

¹⁰⁶Michigan Railroad Plan: Annual Update, Michigan Department of State Highways and Transportation, August, 1976, pp. 14-15. The reported contract costs and revenues for the Ann Arbor land system included on-branch and off-branch revenues and costs, revenues and costs associated with bridge traffic, and programmed rehabilitation. After talking with Michigan transportation officials, the contract figures were adjusted to reflect revenues and costs for originating and terminating traffic only.

Michigan Northern Rail Line

Background. The Michigan Northern railroad ¹⁰⁷ runs north from Grand Rapids, 247 miles to Mackinaw City and includes the branch between Walton Jct. and Traverse City. The Michigan Northern rail line origin dates from the early 1800's when the lumber industry in northern Michigan was flourishing. Passenger service, however, made the line famous as thousands of wealthy tourists rode the train from the cities of the eastern midwest to fashionable fishing and vacation resorts in Traverse City, Petoskey, Harbor Springs, and Mackinaw City. ¹⁰⁸

The exhaustion of commercial forest reserves in the early 1900's and the general decline in agricultural product traffic after World War II put a financial squeeze on the Michigan Northern line that could not be compensated for by passenger service. Passenger traffic fell considerably in the late 1930's and early 1940's as the automobile became the predominant mode of passenger transportation.

In 1961, passenger service was discontinued and efforts were made by Penn Central to disinvest in the line. Freight service was reduced from three times a week and maintenance of track and other structures was cut back sharply. Since the mid-1960's, Penn Central repeatedly petitioned the Interstate Commerce Commission to

¹⁰⁷ The Michigan Northern is a new short line railroad established to operate the line, which was formerly part of the Penn Central System.

¹⁰⁸ Kevin P. Deefe, "How Michigan Got into the Railroad Business," Trains, (October, 1976), 47-48.

discontinue service. The petitions were opposed by rail users and communities on the line; they argued that the loss of rail service to the northern half of the lower Peninsula would have severe consequences on economic development and growth of the area. Rather than let rail service to the area terminate with the bankruptcy of the Penn Central, the State of Michigan has contracted with the Michigan Northern to provide service. The contract is being funded under the federal-state rail freight assistance program established by the RRR and RRRR Acts.

Around the turn of the century, mining and forest products moved from the Upper Peninsula, across Lake Michigan by car ferry at the Straits of Mackinaw and down the Michigan Northern line to the Chicago gateway. This traffic represented a significant source of bridge traffic and freight revenue. With the decline in mining and timber activities during the mid-1900's and the growth in truck competition in the 1940's and 1950's, bridge traffic on the Michigan Northern virtually disappeared. Consequently, the Michigan Northern's primary source of revenue is from its originating and terminating shipments.

Analysis of Originating and Terminating Freight Shipments in 1973. In 1973, 2,411 carloads originated and terminated on the Michigan Northern line (see Table 3-10). The 2,441 carload represented 100,000 tons and generated gross operating revenues close to \$400,000. ¹⁰⁹

¹⁰⁹ Gross revenue figures taken from the Penn Central (100 percent) waybill tape have been adjusted to reflect Michigan Northern's share.

TABLE 3-10

MICHIGAN NORTHERN RAIL LINE
GRAND RAPIDS TO MACKINAW CITY,
WALTON JCT. TO TRAVERSE CITY
1973

<u>Commodity</u>	<u>Carloads</u> <u>(Number)</u>	<u>Tons</u> <u>(Metric)</u>	<u>Gross</u> <u>Revenue</u> <u>(Dollars)</u>
Farm Products	12	316	1,223
Forest Products	235	3,124	25,850
Fresh Fish or Other Marine Products	4	120	775
Metallic Ores	1	60	223
Coal	93	5,590	9,907
Crude Petroleum, Natural Gas, or Gasoline	-	-	-
Nonmetallic Minerals	360	22,928	39,174
Ordinance or Accessories	-	-	-
Food or Kindred Products	134	4,773	20,245
Tobacco Products	-	-	-
Basic Textiles	6	61	318
Apparel	-	-	-
Lumber or Wood Products	451	19,077	64,538
Furniture or Fixtures	33	210	4,026
Pulp, Paper or Allied Products	97	2,074	6,890
Printed Matter	-	-	-
Chemicals or Allied Products	63	2,698	8,763
Petroleum or Coal Products	168	9,323	20,852
Rubber or Misc. Plastic Products	9	129	922
Leather or Leather Products	-	-	-
Stone, Clay, or Glass Products	224	9,593	31,977
Primary Metal Products	149	7,412	32,605
Fabricated Metal Products	81	3,556	35,712
Machinery	37	1,382	7,585
Electrical Machinery	17	475	2,380
Transportation Equipment	39	1,251	3,833
Misc. Products of Manufacturing	2	27	251
Waste or Scrap Materials	202	10,309	72,949
Misc. Freight Shipments	20	242	2,265
Containers, Shipping	1	17	305
Shipper Association or Similar Traffic	1	55	200
Misc. Mixed Shipments	-	-	-
Small Packaged Freight Shipments	2	7	111
TOTAL	2,441	104,709	393,879

In a fashion similar to the Ann Arbor, freight shipments on the Michigan Northern are fairly concentrated in a few commodities. Although shipments in 26 different commodity groups were originated or terminated on the Michigan Northern line in 1973, eight commodity groups accounted for 79 percent of the carload, 89 percent of the ton, and 78 percent of the gross revenues. Table 3-12 on the following page displays this information.

In contrast to the Ann Arbor, the Michigan Northern railroad primarily terminated freight shipments in 1973 rather than originating them. Terminating carloads accounted for 79 percent of the total while originating carloads made up the rest (21 percent). Table 3-12 presents this information below.

TABLE 3-11

MICHIGAN NORTHERN RAIL LINE
DISTRIBUTION OF CARLOADS
BY ORIGIN AND TERMINATION
1973

CARLOADS - 1973		
STATUS	NUMBER	PERCENT
Originating	503	21
Terminating	1938	79
Total	2441	100

Michigan Northern's freight patterns are similar to the Ann Arbor's patterns in one respect. The midwest is an important market for Michigan Northern rail users.

TABLE 3-12

MICHIGAN NORTHERN RAIL LINE
DISTRIBUTION OF 1973 TRAFFIC
BY MAJOR COMMODITY GROUPS

COMMODITY GROUP	CARLOADS (NUMBER)	CUMULATIVE DISTRIBUTION (PERCENT)	METRIC TONS (NUMBER)	CUMULATIVE DISTRIBUTION (PERCENT)	GROSS REVENUE (DOLLARS)	CUMULATIVE DISTRIBUTION (PERCENT)
Lumber or Wood Products	451	18	19,077	18	64,538	16
Non-Metallic Minerals	360	33	22,928	40	39,174	26
Forest Products	235	43	3,124	43	25,850	33
Stone, Clay, or Glass Products	224	52	9,593	52	31,977	41
Waste or Scrap Material	202	60	10,309	61	72,949	60
Petroleum or coal products	168	67	9,323	70	20,852	65
Primary Metal Products	149	73	7,412	77	32,605	73
Food or Kindred Products	134	79	4,773	83	20,245	78
Others	518	100	18,170	100	85,689	100
TOTAL	2,441		104,709		393,879	

The midwest originated 41 percent of the shipments (carloads) received by Michigan Northern rail users in 1973. Table 3-13 displays this information below. At the same time, Michigan

TABLE 3-13

MICHIGAN NORTHERN RAIL LINE
DISTRIBUTION OF 1973 CARLOADS ORIGINATING
ON THE MICHIGAN NORTHERN AND
TERMINATING ELSEWHERE IN THE U.S.
AND CANADA, BY REGION

TERMINATING REGION	CARLOADS	
	NUMBER	PERCENT
East	65	14
Midwest	205	41
South-Southwest	162	30
West	71	15
Canada	0	0
Total	503	100

Northern rail users shipped 49 percent of their total carloads to the midwest. Table 3-14 presents this information.

Next to the midwest, the south-southwest region is an important market for shipments originating with Michigan Northern rail users (30 percent of the total, Table 3-13 above). The east, south-southwest, west, and Canada are fairly equal (14 percent, 15 percent, 13 percent, and 9 percent, respectively) in the percentage of

TABLE 3-14

**MICHIGAN NORTHERN RAIL LINE
DISTRIBUTION OF 1973 CARLOADS TERMINATING
ON THE MICHIGAN NORTHERN AND ORIGINATING ELSEWHERE
IN THE U.S. AND CANADA, BY REGION**

ORIGINATING REGION	CARLOADS	
	NUMBER	PERCENT
East	256	14
Midwest	959	49
South-Southwest	290	15
West	264	13
Canada	169	9
Total	1938	100

carloads they originate bound for Michigan Northern firms (see Table 3-14 above).

As we noted in our discussion of the Ann Arbor traffic flow patterns, the importance of the originating and terminating regions (markets) to the Michigan Northern railroad can only be determined after we examine the freight revenues associated with the different carload types. Such information was not available at the time of this research effort.

Analysis of Rail Service Operating Revenues and Expenses for Originating and Terminating Freight Shipments. The United States Railway Association (USRA),¹¹⁰ a consultant¹¹¹ to the Michigan Department of State Highways and Transportation, and the Michigan Northern railroad have estimated the operating costs for the Michigan Northern line. For a number of reasons the estimates provided by the Michigan Northern railroad will be used in this research effort.

As was noted earlier, the Michigan Northern line was a branch line in the Penn Central railroad system. Consequently, separate operating cost information for the branch line is not available. The USRA attempted to determine from Penn Central system-wide operating cost records which costs might reasonably be attributed to the Michigan Northern branch line operation. Running into difficulties, USRA decided to use Penn Central system average operating costs as the measure of Michigan Northern branch line operating costs.

Michigan transportation officials, upset with USRA procedures and numbers, hired a consultant to determine "more accurately" what the operating costs on the Michigan Northern really are. Ironically,

¹¹⁰United States Railway Association, Preliminary System Plan, Vol. II, Washington, D.C., February 26, 1975.

¹¹¹R.L. Banks and Associates, Inc., Michigan Segmented Line Analysis: Traffic, Revenue, Cost and Community Impact, A Report to the Michigan Department of State Highways and Transportation, October 20, 1975.

the consultant ended-up using the USRA's operating cost figures after deflating them in a few categories.

A convincing argument can be made that system-wide operating cost figures do not accurately reflect what the cost of a single line in that system is, particularly a branch line. This would certainly seem to be the case with the Michigan Northern being such a small part of what was the nation's largest Class I railroad-- the Penn Central.

In addition, in the future the Michigan Northern line will probably be operated as a short line rather than as a branch line of a Class I railroad; and, its operating costs will likely be lower for reasons discussed in Chapter Two. Consequently, for the purposes of this research effort, Michigan Northern's operating costs for 1976-77 will be used in the analysis.

Table 3-15 illustrates the various operating costs associated with the provision of rail service on the Michigan Northern line .

Estimation of operating revenues, operating costs, and net operating income for the Michigan Northern are also provided in Table 3-15. Net operating income is estimated to be a negative \$666,535. Again, as in the case of the Ann Arbor railroad, one measure of the relative accuracy of these figures is to compare them with the figures used to determine the size of the subsidy payment the Michigan Northern would receive for providing rail service on the

line for one year. The contract figures included (1) expected operating revenues--\$450,000; (2) expected operating costs--\$1.1 million; and (3) negotiated subsidy--\$640,000. ¹¹²

TABLE 3-15

MICHIGAN NORTHERN RAIL LINE
(GRAND RAPIDS TO MACKINAW CITY,
WALTON JCT. TO TRAVERSE CITY)
1973 FINANCIAL STATUS

Operating Revenues	Dollars	Dollars 393,879
Operating Costs ^{a/}		1,064,414
Transportation	187,895	
Maintenance of Equipment	44,506	
Maintenance of Way and Structures	448,928	
Traffic	29,111	
General	117,074	
Net Equipment and Joint Facilities Rents ^{b/}	-	
Railroad Property Tax	172,900	
Railroad Payroll Tax ^{c/}	-	
Net Operating Income		(666,535)

(negative)

^{a/} See footnote to Table 3-9 for explanation of the component costs of operating costs.

^{b/}, ^{c/} Not presented separately; included in other operating component costs.

¹¹² Source: Michigan Railroad Plan: Annual Update, Michigan Department of State Highways and Transportation, August, 1976, pp. 14-15. Michigan Northern contract figures were adjusted to reflect operating costs associated with rail service to originating and terminating traffic.

C.O.-Northwest Rail Line

Background. The C.O.-Northwest line runs northeast from Manistee, 133 miles, through Traverse City to Petoskey. Although the C.& O. railroad officials claim this branch line is unprofitable and are seeking to abandon it, many people feel it can be operated profitably.

Analysis of C.O.-Northwest operating revenues and costs will be made in the same manner used for the Ann Arbor and Michigan Northern railroads. Operating revenues are taken from the 1973 C.& O. waybill (100 percent).¹¹³ As a branch line of a major Class I railroad, the operating revenues and costs, if calculated, have never been made public for the C.O.-Northwest line separate from its parent system. The abandonment petition (before the Interstate Commerce Commission) does not separate operating revenues from non-operating, nor does it break operating cost down into the component costs we have been working with (i.e., transportation, maintenance of way and structure, and so on). Since the C.O.-Northwest branch is part of a solvent railroad it is not part of the federal reorganization effort. Therefore, USRA did not try to estimate operating revenues and costs for the line; nor did the State of Michigan. Michigan Northern railroad, however,

¹¹³The gross revenues reported on the C.& O. waybill tape were adjusted to reflect operating revenues that would accrue to the branch if operated as a short line railroad. The appropriate divisions of revenue were provided by Michigan Northern officials.

has estimated the costs of operating the C.O.-Northwest.¹¹⁴ For this reason, Michigan Northern's operating cost estimates will be used for the purposes of this study.

Analysis of Originating and Terminating Freight Shipments in 1973. Although the C.O.-Northwest line is shorter than the Michigan Northern by about 110 miles, it originated and terminated nearly twice the number of carloads. In 1973, the C.O.-Northwest carriers handled 4,253 carloads. The carloads represented about 200,000 tons of freight, generating gross revenues of nearly \$750,000 (see Table 3-16).

The concentration of traffic on the C.O.-Northwest in a few commodities was just as great as it was on the Ann Arbor and the Michigan Northern. Although shipment in 33 different commodity groups were originated or terminated on the C.O.-Northwest line in 1973, six commodity groups accounted for 88 percent, 90 percent, and 87 percent of the carloads, tons, and gross revenues, respectively (see Table 3-17).

¹¹⁴Michigan Northern has become very knowledgeable on the C.O.-Northwest operations since it might be abandoned and they (Michigan Northern) may be interested in integrating the C.O.-Northwest line into their present system.

TABLE 3-16

C.O.-NORTHWEST RAIL LINE
(MANISTEE TO PETOSKEY)

1973

<u>Commodities</u>	<u>Carloads</u> (Number)	<u>Tons</u> (Metric)	<u>Gross</u> <u>Revenue</u> (Dollars)
Farm Products	10	600	1,500
Forest Products	52	780	9,620
Fresh Fish or Other Marine Products	10	300	1,851
Metallic Ores	-	-	-
Coal	15	960	1,829
Crude Petroleum, Natural Gas, or Gasoline	-	-	-
Nonmetallic Minerals	55	2,667	8,655
Ordnance Accessories	-	-	-
Food or Kindred Products	555	23,321	166,500
Tobacco Products	-	-	-
Basic Textiles	14	154	836
Apparel	-	-	-
Lumber or Wood Products	938	40,111	187,600
Furniture or Fixtures	370	2,359	48,110
Pulp, Paper or Allied Products	76	2,888	14,250
Printed Matter	-	-	-
Chemicals or Allied Products	84	4,620	20,321
Petroleum or Coal Products	517	30,503	81,556
Rubber or Misc. Plastic Products	79	1,185	13,042
Leather or Leather Products	-	-	-
Stone, Clay, or Glass Products	1,078	79,772	116,017
Primary Metal Products	27	1,404	6,032
Fabricated Metal Products	267	11,782	48,951
Machinery	10	398	3,117
Electrical Machinery	4	145	1,033
Transportation Equipment	12	960	2,713
Misc. Products of Manufacturing	-	-	-
Waste or Scrap Materials	70	4,760	13,086
Misc. Freight Shipments	-	-	-
Containers, Shipping	4	68	548
Shipper Association or Similar Traffic	-	-	-
Misc. Mixed Shipments	6	138	702
Small Packaged Freight Shipments	-	-	-
TOTAL	4,253	209,875	747,869

TABLE 3-17

**C.O.-NORTHWEST RAIL LINE
DISTRIBUTION OF TRAFFIC BY
BY MAJOR COMMODITY GROUPS**

1973

COMMODITY GROUP	CARLOADS (NUMBER)	CUMULATIVE DISTRIBUTION (PERCENT)	METRIC TONS (NUMBER)	CUMULATIVE DISTRIBUTION (PERCENT)	GROSS REVENUE (DOLLARS)	CUMULATIVE DISTRIBUTION (PERCENT)
Stone, Clay, or Glass Products	1,078	25	79,772	38	116,017	16
Lumber or Wood Products	938	47	40,111	57	187,600	41
Food or Kindred Products	555	60	23,321	68	166,500	63
Petroleum or coal products	517	72	30,503	83	81,556	74
Furniture or fixtures	370	81	2,359	84	48,110	80
Fabricated metal products	267	88	11,782	90	48,951	87
Others	528	100	22,027	100	99,135	100
Total	4,253		209,875		747,869	

Freight shipments are more evenly balanced on the C.O.-Northwest line in contrast to those on the Ann Arbor and Michigan Northern. Terminating carloads accounted for 54 percent of the total carloads while originating carloads made up the rest--46 percent (see Table 3-18).

TABLE 3-18

C.O.-NORTHWEST RAIL LINE
DISTRIBUTION OF CARLOADS BY
ORIGIN AND TERMINATION

1973

CARLOADS - 1973		
STATUS	NUMBER	PERCENT
Originating	1941	46
Terminating	2312	54
Total	4253	100

For the rail users on the C.O.-Northwest, like their counterparts on the Ann Arbor and Michigan Northern, the midwest is by far the most important region (market) for their freight shipments. Seventy-five percent of all the carloads originated by C.O.-Northwest shippers in 1973 were bound for the midwest (see Table 3-19). In turn, the midwest originated 45 percent of the freight shipments bound for C.O.-Northwest rail users (see Table 3-20).

TABLE 3-19

C.O.-NORTHWEST RAIL LINE
DISTRIBUTION OF CARLOADS ORIGINATING
ON THE C.O.-NORTHWEST AND TERMINATING
ELSEWHERE IN THE U.S. AND CANADA, BY REGION
1973

Terminating Region	Carloads	
	Number	Percent
East	204	11
Midwest	1462	75
South-Southwest	193	10
West	82	4
Canada	0	0
TOTAL	1941	100

TABLE 3-20

C.O.-NORTHWEST RAIL LINE
DISTRIBUTION OF CARLOADS TERMINATING
ON THE C.O.-NORTHWEST AND ORIGINATING
ELSEWHERE IN THE U.S. AND CANADA, BY REGIONS
1973

Originating Region	Carloads	
	Number	Percent
East	160	7
Midwest	1045	45
South-Southwest	255	11
West	552	24
Canada	290	13
TOTAL	2312	100

Analysis of Rail Service Operating Revenues and Expenses for Originating and Terminating Freight Shipments. In contrast to the Ann Arbor and the Michigan Northern railroads, the C.O.-Northwest railroad operation nearly breaks even (see Table 21). On a per carload basis the C.O.-Northwest operation lost only \$13. This compares to \$273 per Michigan Northern carload and \$142 per Ann Arbor carload.

TABLE 3-21
C.O.-NORTHWEST RAIL LINE
(MANISTEE TO PETOSKEY)
1973 FINANCIAL STATUS

	DOLLARS	DOLLARS
Operating Revenues		747,869
Operating Costs ^{a/}		803,339
Transportation	249,320	
Maintenance of Equipment	75,270	
Maintenance of Way and Structures	239,714	
Traffic	30,435	
General	115,500	
Net Equipment and Joint Facilities Rents ^{b/}	-	
Railroad Property Tax	93,100	
Railroad Payroll Tax ^{c/}	-	
Net Operating Income		(55,470)

(Negative)

^{a/} See footnote to Table 3-9 for explanation of the component costs of operating costs.

^{b/} ^{c/} Not presented separately, included in other component costs.

Summary

In this chapter the current financial and operating status of the Ann Arbor, Michigan Northern, and C.O.-Northwest rail lines have been briefly examined. Attention was given to the on-line operations of the three railroads.

The Ann Arbor was found to be primarily an originator of freight traffic; the Michigan Northern a terminator of freight traffic; and, the C.O.-Northwest split between originating and terminating freight shipments. For the rail users on the three lines, the midwest constituted the primary market for their freight shipment--inbound and outbound.

And, even though the three railroads originated and terminated freight shipments in a broad range of commodity groups less than 25 percent of the commodity groups accounted for over 80 percent of total carloads, tons, and gross freight revenue.

Based on the most recent set of operating revenue and cost data available, none of the three railroads showed a positive net operating income position. The Ann Arbor had net operating income of negative \$3,358,087; the Michigan Northern net operating income was negative \$666,535; while the C.O.-Northwest fared considerably better with a net operating income of negative \$55,470. Table 3-22 summarizes a few of the financial indicators for the three railroads.

TABLE 3-22
ANN ARBOR, MICHIGAN NORTHERN,
C.O.-NORTHWEST RAIL LINE
FINANCIAL INDICATORS
(1973)

	ANN ARBOR	MICHIGAN NORTHERN	C.O.- NORTHWEST
MILES	333	247	133
CARLOADS	23,608	2,441	4,253
OPERATING REVENUE	\$ 3,645,995	\$ 398,879	\$ 747,869
OPERATING EXPENSE	\$ 7,004,082	\$ 1,064,414	\$ 803,339
NET OPERATING INCOME	\$ (3,358,087)	\$ (666,535)	\$ (55,470)
NET OPERATING INCOME PER MILE	\$ (10,084)	\$ (2,698)	\$ (417)
NET OPERATING INCOME PER CARLOAD	\$ (142)	\$ (273)	\$ (13)

(Negative)

CHAPTER FOUR

PRESENT AND FUTURE OPPORTUNITIES FOR INCREASING RAIL USE LEVELS ON THE ANN ARBOR, MICHIGAN NORTHERN, AND C.O.-NORTHWEST RAIL LINES

In Chapter Three, using the best data available, evidence was found to suggest that the Ann Arbor, Michigan Northern, and the C.O.-Northwest railroads were sustaining operating losses. The purpose of this Chapter is to determine if opportunities exist for increasing the use of rail service (i.e., carloads and revenues) on these lines; and, what impact these increases would have on the financial viability of the lines.

To achieve this objective, our analysis will take place on two levels. First, consideration will be given to opportunities for increasing the present levels of rail use on the three Michigan lines. Secondly, an effort will be made to determine what the potential demand for rail service on these lines might be in the future.

Opportunities for Increasing the Present Level of Rail Use on the Ann Arbor and Michigan Northern Rail Lines

Demand for Rail Service and Rail Service Quality. In Chapter Two the importance of rail service quality from the rail users' perspective was discussed. The frequent claim made by rail users that they would increase their use of rail service, if it was more reliable was also noted.

To date, the body of empirical work on freight transportation demand is small relative to the work that has been done on transportation production and cost relationships. There has been, however, a growing interest in the sensitivity of transportation demand to variation in service quality. Recent studies in several European countries reveal that rail users do recognize relative service quality attributes between modes.¹¹⁵ Recently in Michigan, Johnson developed an empirical procedure for estimating the response of demand and modal selection probability to changes in service quality.¹¹⁶ The procedure was used to estimate service quality elasticities for outbound railroad shipments of grain from county elevators and inbound railroad shipments of fertilizer and feed.

Johnson found that the quantity of railroad services demanded by grain shippers is significantly influenced by firm size, the delay in the delivery of railroad cars, and the magnitude of damage and loss in transit.

An increase (decrease) in elevator size by 10,000 bushels of storage capacity results in a 1.3% increase (decrease) in the quantity of railroad service demanded annually, ceteris paribus. Each day added to

¹¹⁵B.T. Bayliss, Demand for Freight Transport--Practical Results of Studies on Market Operation, (Paris: European Conference of Ministers of Transport, 1973).

¹¹⁶Marc A. Johnson, Market and Social Investment and Disinvestment in Railroad Branch Lines: Evaluation Procedures and Decision Criteria, PhD Thesis, Michigan State University, 1975; Marc A. Johnson, "Service Quality and Transportation Demand", American Journal of Agricultural Economics, Vol. 53, No. 3, (August, 1976), 496-503.

the average delay in receiving railroad cars causes grain shippers to demand 5.6% less railroad service annually, holding other influences constant. The isolated effect of an increase in railroad freight damage of \$1 per \$1,000 of shipment value is a decline of annual rail usage by 1.25%. ¹¹⁷

With respect to modal split between rail and motor carriers, Johnson found that a number of movement and firm characteristics as well as service quality characteristics appear to influence the proportionate use of transport modes in the shipment of grain.

For an increase (decrease) in the average distance to market by one hundred miles, the proportion of rail to truck shipment increases (decreases) by 29% ceteris paribus.

Firm size and truck ownership affect the proportion of modal services used. Larger firms tend to place proportionally greater reliance upon motor carriage than do smaller grain handlers. As the elevator storage capacity increases by 10,000 bushels, the ratio of rail to truck decrease by 3.7% ceteris paribus...Truck ownership by grain handling firms reduces proportionate use of rail transportation.

Promotional effort by transportation companies appears to be important in selecting transportation modes. An additional contact by a trucking firm decreases the ratio of rail to motor usage by 6.7%, holding other influences constant. An additional contact by a railroad company will increase the ratio by 55%, ceteris paribus. Promotional contacts by railroad firms are few, and there may exist diminishing returns at higher levels of effort. However, at existing low levels of promotional effort, personalizing railroading may have high payoff from grain elevators. ¹¹⁸

Inbound shipments of fertilizer were found to be sensitive to rail transit time due to the nature of its seasonal use. The less

¹¹⁷Marc A. Johnson, "Service Quality and Transportation Demand," Op. Cit., pp. 501-502.

¹¹⁸Ibid., 502.

reliable rail transit time, the greater the likelihood the fertilizer will move by truck. Inbound shipments of feed were found to be sensitive to transit time, but less so than fertilizer. Because a large percentage of feed entering Michigan is in bags, damage and loss associated with rail and truck service was found to affect the quantity of service demanded from those modes. ¹¹⁹

Johnson concludes that the results of his regression analysis support the notion that service quality does tend to affect railroad service demand but not to the extent suggested by the testimony of many rail users before the Interstate Commerce Commission. Johnson suggests that the difference between vocal complaint and action can be explained by the concept of economic action thresholds. While a rail user may be inconvenienced by the relatively poor service of the railroad, operating costs associated with the poor service may not exceed the difference between the published railroad and motor carrier freight rates. Consequently, the railroad may decrease service quality until effective price of consuming rail services equals the effective price of the next least mode. Only at this level of service deterioration will the rail user have reached an economic action threshold which causes him to change modes. ¹²⁰

Demand for Rail Service by Rail Users on the Ann Arbor and Michigan Northern Rail Lines. Are rail users on the Ann Arbor and the Michigan Northern sensitive to changes in rail service quality?

¹¹⁹ Marc A. Johnson, Market and Social Investment and Disinvestment in Railroad Branch Lines: Evaluation Procedures and Decision Criteria, Op. Cit., pp. 150-156.

¹²⁰ Ibid., p. 155.

What dimensions of rail service quality are they sensitive to?

If rail service was improved, how would rail users on the Ann Arbor and Michigan Northern respond; that is, how many more carloads per year would they move by rail?

In an attempt to answer these questions, and others, interviews with rail users on the two lines were conducted as part of this research effort. Time did not permit interviews with rail users on the C.O.-Northwest.

Interview Procedure

Between July and October, 1976, 76 rail users on the Ann Arbor and 68 rail users on the Michigan Northern rail lines were interviewed. The objectives of the interviews included the following:

1. To estimate the level of rail use by rail users on the two lines in 1975 and 1976. Rail use is measured in terms of carloads, tons, and railroad gross revenues, by type of commodity.
2. To identify the dimensions of rail service quality that rail users on the two lines consider to be important.
3. To estimate the rail user's probable response to improvements in rail service quality. Rail user response is measured in terms of carloads, tons, and railroad gross revenues by type of commodity.
4. To determine the extent to which rail users route their shipments, engage in pooling of their shipments, and participate in other cooperative arrangements.

5. To determine rail user's attitudes on the need to rehabilitate their rail lines.

Interviews were completed with all known (current) rail users on the Ann Arbor and the Michigan Northern lines (with a few exceptions that will be discussed). Initial determination of names and locations of the 144 rail users was made through a cross-reference check with officials in the Rail Freight and Port Authority Section, Michigan Department of State Highways and Transportation and the Michigan Department of Commerce.

Rail users located on the Ann Arbor line between Durand and Ashley were not interviewed because they receive their rail service from the Grand Trunk Western (GTW) railroad. Also, rail users located between Owosso and Saginaw were not interviewed because time did not permit. Based upon a review of past freight shipment data, it was estimated that rail users on this branch (Owosso to Saginaw) originated or terminated less than 5 percent of the total traffic on the Ann Arbor in 1973.¹²¹ Finally, efforts were not made to interview off-line Ann Arbor rail users who might be trucking a short distance between their place of business and a

¹²¹The Owosso to Saginaw branch line was formerly part of Penn Central's (PC) operations in Michigan. A review of the PC 1973 (100 percent) waybill for stations on this branch line indicated originating and terminating, when added to the Ann Arbor, represented approximately 4.7 percent of total carloads on the Ann Arbor line. The State of Michigan's interest in this branch line is not for the local traffic it generates, but for the potential bridge traffic it might generate. In past years, unit coal trains moved to Saginaw-Bay City-Midland area over this branch line.

rail station. Discussions with Michigan transportation officials suggested that these rail users do not (presently) constitute a significant percent of the freight shipments originated or terminated on the Ann Arbor line.

Efforts were not made to interview Michigan Northern off-line rail users. Again, Michigan transportation officials indicated there were very few off-line rail users using Michigan Northern service. Later discussions with Michigan Northern railroad officials, however, revealed their belief that significant off-line traffic could be developed--particularly if a TOFC (trailer-on-flat-car, "piggyback") operation were established either in Cadillac, Traverse City, and perhaps Petoskey. Nevertheless, time did not permit interviewing off-line firms with respect to their interest in using "piggyback" service.

The survey questionnaire (Appendix A) was designed to supply information that would permit regression analysis (similar to that used by Johnson) to measure the sensitivity of transportation demand to variations in service quality. Rail users responses were inadequate, however, to permit the use of regression analysis. Part of the problem was due to the large number of commodities involved--sixteen commodities. Only four commodities--lumber, grain, fertilizer, and feed--had ten or more rail users. Consequently, for twelve of the sixteen commodities, the number of observations were too few to permit the use of regression. In addition, the responses were incomplete. Nearly all of the rail users interviewed said they had been asked similar questions at least three times in the past year. They could not understand why "government people" kept

asking the same questions. As one rail user put it, "don't you government people share information?" Many of the rail users interviewed did not answer questions that required them to review their records. They said they had already provided the information to other interviewers and they did not have the time to look for it again. ¹²²

The interview results, however, did permit the identification of dimensions of rail service quality and rough estimates of rail user response to improvements in rail service were obtained.

Discussion of Interview Results

Tables summarizing freight shipment information--commodities, carloads, tons, railroad gross revenue, and key rail service quality dimensions--on an individual rail user basis are provided in Appendix B. In this Chapter, rail user interview results will be grouped in a number of ways for comparative purposes.

There are many ways to group and analyze the responses given by the rail users. We begin by classifying rail users on the basis of whether they originated or terminated freight shipments or both. Using this initial break down, rail users are next classified according to whether or not they would increase their use of rail service if service was improved. The areas of needed rail service improvements are also identified.

¹²²Efforts to determine which State government units have been surveying rail users in the State were largely unsuccessful.

Rail User Classification by Origination and Termination of Freight Shipments. Of the 76 Ann Arbor rail users interviewed, 53 (70 percent) terminated carloads, 9 (12 percent) originated carloads, and 14 (18 percent) both terminated and originated carloads in 1976. A similar pattern was found for the 68 Michigan Northern rail users interviewed; 58 (85 percent) of the rail users indicated that they terminated carloads, 6 (9 percent) originated, and 4 (6 percent) both terminated and originated carloads (see Table 4-1).

TABLE 4-1

CLASSIFICATION OF ANN ARBOR
AND MICHIGAN NORTHERN RAIL USERS
BY ORIGINATION AND TERMINATION
OF CARLOADS

Status of Rail Shipments	Ann Arbor		Michigan Northern	
	Shippers		Shippers	
	Number	Percent	Number	Percent
Originating	53	70	58	85
Terminating	9	12	6	9
Originating and Terminating	14	18	4	6
TOTAL	76	100	68	100

Rail Users' Sensitivity to Rail Service Quality. Forty-four rail users (58 percent) and 42 rail users (62 percent) interviewed on the Ann Arbor and Michigan Northern lines, respectively, said they would increase their rail shipments if rail service was improved (see Table 4-2 below).

TABLE 4-2

CLASSIFICATION OF ANN ARBOR AND
MICHIGAN NORTHERN RAIL USERS BY WILLINGNESS
TO INCREASE THEIR USE OF RAIL SERVICE

Rail Line	Increase Rail Shipments if Rail Service Improved?					
	Yes		No		Total	
	Number	Percent	Number	Percent	Number	Percent
Ann Arbor	44	58	32	42	76	100
Michigan Northern	42	62	26	38	68	100

Of the 44 Ann Arbor rail users indicating they would respond to improvements in rail service, 29 (66 percent) terminated carloads; 6 (14 percent) originated carloads. For the 42 Michigan Northern rail users indicating a positive response to improved rail service, 33 (79 percent) terminated carloads; 6 (14 percent) originated carloads; and 3 (7 percent) both terminated and originated carloads (see Table 4-3).

TABLE 4-3

CLASSIFICATION OF ANN ARBOR AND
MICHIGAN NORTHERN RAIL USERS BY ORIGATION
AND TERMINATION OF CARLOADS AND RESPONSIVENESS
TO IMPROVEMENTS IN RAIL SERVICE QUALITY

Status of Rail Shipments	Increase Rail Shipments			
	Ann Arbor		Michigan Northern	
	Rail Users		Rail Users	
	Number	Percent	Number	Percent
Terminating	29	66	33	79
Originating	6	14	6	14
Terminating & Originating	9	20	3	7
TOTAL	44	100	42	100

Dimensions of Rail Service Quality. A large number of the rail users on the Ann Arbor and Michigan Northern indicated that rail service can be improved. Tables 4-4, 4-5, 4-6, and 4-7 illustrate the areas of rail service that need improvement according to the rail users interviewed on the two lines. For Ann Arbor rail users terminating freight shipment, consistent transit (42 percent), faster transit time (19 percent), and reduced rail rates (17 percent) were the dimensions of rail service mentioned most frequently (see Table 4-4).

TABLE 4-4

ANN ARBOR RAIL USERS' TERMINATING
CARLOADS, NEEDED AREAS OF RAIL
SERVICE IMPROVEMENT

Needed Rail Service Improvements	Rail Users	
	Number	Percent
Consistent Transit Time	15	42
Faster Transit Time	7	19
Reduced Rail Rates	6	17
Available Unloading Fac.	4	12
Increased Service Freq.	2	5
Reduced Damages In-Transit	1	3
Add. Storage Facilities	1	2
TOTAL	36	100

On the other hand, available rail cars (55 percent) and faster transit time (23 percent) were the rail service problem areas mentioned most frequently by Ann Arbor rail users that originated freight shipments (see Table 4-5).

TABLE 4-5

ANN ARBOR RAIL USER ORIGINATING
CARLOADS, NEEDED AREAS OF RAIL
SERVICE IMPROVEMENT

Needed Rail Service Improvements	Shippers	
	Number	Percent
Available Rail Cars	8	55
Faster Transit Time	3	23
Consistent Transit Time	2	14
Reduced Rail Rates	1	4
Reduced Damages In-Transit	1	44
TOTAL	15	100

For rail users on the Michigan Northern terminating freight shipments, consistent transit time (33 percent) was the dimension of rail service quality of greatest concern. Increased service frequency (30 percent) and faster transit time (12 percent) were also considered important (see Table 4-6).

TABLE 4-6

MICHIGAN NORTHERN RAIL USERS'
TERMINATING CARLOADS, NEEDED AREAS
OF RAIL SERVICE IMPROVEMENT

Needed Rail Service Improvements	Shippers	
	Number	Percent
Consistent Transit Time	12	33
Increased Service Frequency	11	30
Faster Transit Time	4	12
Available Unloading Fac.	3	8
Required Damages In-Transit	3	8
Reduced Rail Rates	2	7
Improved Car Spotting	1	2
TOTAL	36	100

Like their Ann Arbor counterparts, Michigan Northern rail users originating freight shipments indicated that available rail cars (80 percent) and faster transit time (20 percent) were the areas of greatest service concern (see Table 4-7).

TABLE 4-7

**MICHIGAN NORTHERN SHIPPERS'
ORIGINATING CARLOADS, NEEDED
AREAS OF RAIL SERVICE IMPROVEMENT**

Needed Rail Service Improvements	Shippers	
	Number	Percent
Available Rail Cars	6	80
Faster Transit Time	2	20
TOTAL	8	100

Rail User Responsiveness to Improvements in Rail Service--

Aggregate Measures. Based upon interview results, the aggregate response of rail users to improved service would appear to be fairly large. For the Ann Arbor, improved service would result in total carloads, tons, and carrier gross revenues increasing by 16, 24, and 23 percent, respectively. The increases are even larger for the Michigan Northern; total carloads, tons, and carrier gross revenues would increase by 27, 22, and 38 percent, respectively (see Table 4-8 on the following page).

TABLE 4-8

CARLOADS, TONS, CARRIER GROSS REVENUE
FOR ANN ARBOR AND MICHIGAN NORTHERN
RAIL LINES UNDER PRESENT RAIL SERVICE
QUALITY AND IMPROVED RAIL SERVICE QUALITY

Carloads, Tons Carrier Gross Revenues	Ann Arbor			Michigan Northern		
	Present Rail Serv. 1976* ^{a/}	Improved Rail Serv. 1976** ^{b/}	Percent Change 1976*-1976**	Present Rail Serv. 1976*	Improved Rail Serv. 1976**	Percent Change 1976*-1976**
Carloads	19,689	22,878	16.2	2,014	2,566	27.4
Tons (Metric)	1,122,620	1,394,202	24.2	120,315	146,897	22.1
Carrier Gross Revenues (Dollars)	3,352,628	4,116,703	22.7	241,621	333,927	38.2

^{a/} 1976* carloads, tons, carrier gross revenues are shipper estimates based on present rail service quality characteristics, i.e., transit time, variance in transit time, frequency of service, car supply, and so on.

^{b/} 1976** carloads, tons, carrier gross revenues are shipper estimates based on improved rail service.

Distribution of Freight Shipments by Stations. The aggregate freight figures (carloads, tons and carrier gross revenues) for the Ann Arbor and Michigan Northern lines presented in Table 4-8 do not convey the distribution of traffic on the two lines.

A rail line can be thought of as a series of links (or segments) between traffic generating points (stations). Each segment represents a set of incremental revenues and costs to the railroad. If the railroad provides service over more than one segment, the sum of the incremental revenues and costs constitute the railroad's total operating revenues and costs for providing service on the line. A railroad may find that it can improve its net operating income position by modifying its operations through segment adjustments. In Chapter Five, the sequential segment approach will be used to evaluate the financial status of the Ann Arbor, Michigan Northern, and C.O.-Northwest rail lines under alternative segment configuration.

In this section, the Ann Arbor and Michigan Northern lines are segmented and freight figures (carloads, tons, carrier gross revenues) are assigned. Tables 4-9 and 4-10 present 1976 freight figures for the Ann Arbor and Michigan Northern, respectively, based on present rail service (quality). Tables 4-11 and 4-12 present 1976 freight figures for the Ann Arbor and Michigan Northern, respectively, based on improved rail service (quality). The purpose for separating the 1976 freight figures in this manner is to show which segments of the two lines are likely to gain the most from improved rail service.

Response to improved rail service on the Ann Arbor is greatest on that segment of the line north of Cadillac, between Copemish and Frankfort. The primary reason for this is the sand traffic at Yuma. Improved service on the Ann Arbor will result in an increase of 3,189 carloads for the line as a whole--2,000 of these carloads are sand. Excluding the sand traffic, the greatest gains in rail use from improved service are likely to occur between North Star and Cadillac (Table 4-10). For determination of the traffic increases on a station-by-station and commodity-by-commodity basis, the reader is referred to Appendix B.

On the Michigan Northern, the greatest increase in rail use is likely to occur between Cadillac and Petoskey (Table 4-12). Again, the reader is referred to Appendix B for a more detailed analysis of rail user response to improved rail service.

In the next section of this Chapter, discussion will center on dimensions of rail service quality and how they affect the demand for rail service on the Ann Arbor and Michigan Northern lines.

TABLE 4-9

ANN ARBOR RAIL LINE 1976 CARLOADS
 TONS, GROSS REVENUES BY LINE SEGMENT
 (Present Rail Service)

Rail Stations	Carloads	Percent	Metric Tons	Percent	Gross Revenues	Percent
TOLEDO-BYRON	12,950	66%	622,393	55%	\$1,678,458	50%
NORTH STAR-CADILLAC	2,614	13	96,433	9	577,110	17
COPEMISH-FRANKFORT	4,125	21	403,794	36	1,097,060	33
TOTAL	19,689	100%	1,122,620	100%	\$3,352,628	100%

TABLE 4-10

ANN ARBOR RAIL LINE INCREASES IN 1976 CARLOADS,
TONS, GROSS REVENUES, BY LINE SEGMENT
(IMPROVED RAIL SERVICE)

Rail Stations	Carloads	Percent	Metric Tons	Percent	Gross Revenues (Dollars)	Percent
TOLEDO-BYRON	457	13%	33,620	12%	82,940	11%
NORTH STAR-CADILLAC	755	24	38,564	14	146,710	19
COPEMISH-FRANKFORT	2,007	63	200,280	74	534,425	70
TOTAL	3,189	100%	272,464	100%	764,075	100%

TABLE 4-11
MICHIGAN NORTHERN RAIL LINE
1976 CARLOADS, TONS, GROSS REVENUE
BY LINE SEGMENT
(PRESENT RAIL SERVICE)

Rail Stations	Carloads	Percent	Metric Tons	Percent	Gross Revenues	Percent
GRAND RAPID-CEDAR SPRINGS	980	49	60,171	50%	\$ 87,623	36%
HOWARD CITY-TUSTIN	205	10	11,719	10	26,333	11
CADILLAC-PETOSKEY	706	35	42,324	35	116,126	48
KINGSLEY-TRAVERSE CITY	104	5	5,761	4.8	9,721	4
PELLSTON-MACKINAW CITY	19	1	340	.2	1,818	1
TOTAL	2,014	100%	120,315	100%	\$241,621	100%

TABLE 4-12

MICHIGAN NORTHERN RAIL LINE
 INCREASES IN 1976 CARLOADS, TONS, CROSS
 REVENUES BY LINE SEGMENT
 (IMPROVED RAIL SERVICE)

Rail Stations	Carloads	Percent	Metric Tons	Percent	Gross Revenues	Percent
GRAND RAPIDS-CEDAR SPRINGS	84	15%	4,050	15%	\$ 8,690	9%
HOWARD CITY-TUSTIN	101	18	6,019	22	14,271	15
CADILLAC-PETOSKEY	346	63	15,313	58	66,099	72
KINGSLEY-TRAVERSE CITY	18	3.5	1,040	4	2,320	3
PELLSTON-MACKINAW CITY	3	.5	160	1	926	1
TOTAL	552	100%	26,582	100%	\$92,306	100%

Commodity Types and Sensitivity to Dimensions of Rail Service Quality. In examining the rail users' responses in greater detail, we find that a broad range of commodities are sensitive to changes in rail service on both lines. Two or three commodities on each line, however, constitute a very large percentage of the potential freight increases (see Tables 4-13 and 4-14).

On the Ann Arbor, although 23 commodities would appear to be responsive to various improvements in rail service, two commodities, sand and grain, constitute the major source of potential increase in freight shipments. Sand and grain together account for 73 percent, 84 percent, and 83 percent of the potential increases in carloads, tons, and carrier gross revenue, respectively, on the Ann Arbor. (see Table 4-13). The major shipper of sand on the Ann Arbor indicated that the lack of rail cars (approximately 7 per day) prevents him from shipping 2,000 additional carloads of sand a year. This problem may be solved soon, however; the firm's manager is optimistic that the Interstate Commerce Commission would rule that the present Ann Arbor sand rate is "reasonable". Such a ruling would likely encourage private investment in additional rail cars to move the sand.

TABLE 4-13

ANN ARBOR RAIL LINE
SHIPPER RESPONSE TO IMPROVEMENTS IN RAIL SERVICE QUALITY--INCREASES IN CARLOADS,
TONS, AND GROSS REVENUES, BY COMMODITY AND KEY RAIL SERVICE QUALITY ELEMENTS

COMMODITY	INBOUND (IB) OUTBOUND (OB)	CARS (NUMBER)	TONS (NUMBERS)	GROSS REVENUE (DOLLARS)	CARS (PERCENT)	TONS (PERCENT)	GROSS REVENUE (PERCENT)	KEY RAIL SERVICE QUALITY ELEMENT
SAND	OB	2,000	200,090	532,000	62.7	75.9	70.3	AVAILABLE RAIL CARS
GRAIN	OB	330	31,970	92,170	10.3	8.7	12.2	AVAILABLE RAIL CARS
DIMENSION LUMBER	IB	140	5,650	29,828	4.4	2.1	4.0	CONSISTENT TRANSIT TIME, REDUCED RAIL RATES
FEED	IB	128	5,807	20,970	4.0	2.2	2.8	CONSISTENT TRANSIT TIME, FASTER TRANSIT TIME, INCR. SER. FREQ.
FERTILIZER	IB	99	5,933	18,534	3.1	2.3	2.4	CONSISTENT TRANSIT TIME, FASTER TRANSIT TIME, UNLOADING FAC.
COKE	IB	82	5,760	10,640	2.6	2.2	1.4	CONSISTENT TRANSIT TIME, REDUCED RAIL RATES
CARBON BLACK	IB	72	4,880		2.2	1.9		UNLOADING FACILITIES
ROOFING SHINGLES	IB	59	2,280	9,390	1.9	0.9	1.2	CONSISTENT TRANSIT TIME, FASTER TRANSIT TIME, RED. RAIL RATES
AUTO PARTS	OB	50	1,500	4,500	1.7	0.6	0.6	AVAILABLE RAIL CARS, FASTER
CHRISTMAS TREES	OB	47	570	7,050	1.5	0.2	1.0	AVAILABLE RAIL CARS, FASTER TRANSIT TIME
FROZEN FOOD	IB	35	850	9,425	1.1	0.3	1.2	INCREASED SERVICE FREQUENCY
BRICK	IB	33	1,620	4,505	1.0	0.6	0.6	CONSISTENT TRANSIT TIME, FASTER TIME, RED. DAMAGES IN TRANSIT
PAPER MATERIAL	IB	25	1,500	4,500	0.8	0.6	0.6	CONSISTENT TRANSIT TIME
SCRAP METAL	OB	18	900	3,000	0.6	0.3	0.4	AVAILABLE RAIL CARS, FASTER TRANSIT TIME
CRUDE RUBBER	IB	14	950	2,590	0.5	0.4	0.3	REDUCED RAIL RATES
BEER & WINE	IB	12	600	2,100	0.4	0.2	0.3	INCREASED SERVICE FREQUENCY
OIL	IB	10	300	1,650	0.3	0.1	0.2	STORAGE FACILITIES
ALUMINUM	IB	10	500		0.3	0.2		UNLOADING FACILITIES
FARM EQUIPMENT	IB	7	124	630	0.2	0.05	0.1	FASTER TRANSIT TIME, UNLOADING FACILITIES
STEEL BEAMS	IB	5	250	925	0.1	0.07	0.1	FASTER TRANSIT TIME
SHEET METAL	IB	5	250	1,000	0.1	0.07	0.15	REDUCED RAIL RATES
POLES	IB	5	150	310	0.1	0.06	0.05	FASTER TRANSIT TIME
DOG FOOD	IB	3	120	600	0.1	0.05	0.10	FASTER TRANSIT TIME
TOTAL		3,189	272,464	\$ 756,317	100%	100%	100%	

TABLE 4-14

MICHIGAN NORTHERN RAILROAD
SHIPPER RESPONSE TO IMPROVEMENTS IN RAIL SERVICE QUALITY--INCREASES IN CARLOADS,
TONS, AND GROSS REVENUES, BY COMMODITY AND KEY RAIL SERVICE QUALITY ELEMENTS

COMMODITY	INBOUND (IB) OUTBOUND (OB)	CARS (NUMBER)	TONS (NUMBERS)	GROSS REVENUE		CARS (PERCENT)	TONS (PERCENT)	GROSS REVENUE (PERCENT)	KEY RAIL SERVICE QUALITY ELEMENT
				(DOLLARS)	(PERCENT)				
DIMENSION LUMBER	IB	157	6,934	20,685	28.4	26.0	22.4	22.4	CONSISTENT TRANSIT TIME, INCR. SERV. FREQ.
PIPE	IB	115	4,775	33,000	26.8	18.0	36.0	36.0	STORAGE FACILITY, REDUCED RAIL RATES
COAL	IB	40	2,000	4,100	7.2	7.5	4.4	4.4	CONSISTENT TRANSIT TIME, INCR. SERV. FREQ.
FEED	IB	35	2,312	5,294	6.3	8.6	5.7	5.7	CONSISTENT TRANSIT TIME, FASTER TRANS. TIME
CHRISTMAS TREES	OB	20	445	2,375	3.6	1.6	2.5	2.5	AVAILABLE RAIL CARS, FASTER TRANSIT TIME
SCRAP CABLE	OB	20	1,000	3,640	3.6	3.8	4.0	4.0	AVAILABLE RAIL CARS, INCR. SERV. FREQ.
PIG SKINS	IB	20	800	1,650	3.6	3.0	1.7	1.7	INCREASED SERVICE FREQUENCY
BRICK	IB	18	980	3,092	3.2	3.6	3.3	3.3	CONSISTENT TRANSIT TIME, REDUCED DAMAGES
SCRAP LEATHER	OB	15	900	1,200	2.7	3.3	1.3	1.3	AVAILABLE RAIL CARS
GRAIN	OB	15	1,200	2,250	2.7	4.5	2.4	2.4	AVAILABLE RAIL CARS
TIMBER	OB	14	630	2,144	2.5	2.3	2.3	2.3	AVAILABLE RAIL CARS, FASTER TRANSIT TIME
L.P. GAS	IB	13	946	1,260	2.3	3.5	1.3	1.3	FASTER TRANS. TIME, INCR. SERV. FREQ.
ASPHALT ROOFING PRODUCTS	IB	13	590	1,760	2.3	2.2	2.0	2.0	INCR. SERV. FREQ., UNLOADING FACILITY, REDUCED RATES
FERTILIZER	IB	10	820	1,771	1.8	3.1	2.0	2.0	CONSISTENT TRANSIT TIME, CAR SPOTTING
PAPER PRODUCTS	IB	10	200	720	1.8	1.0	1.0	1.0	UNLOADING FACILITIES
PIPE	OB	7	420	2,450	1.2	1.6	2.6	2.6	FASTER TRANSIT TIME, REDUCED RAIL RATES
WINE	IB	6	300	1,050	1.1	1.1	1.0	1.0	CONSISTENT TRANSIT TIME, FASTER TRANS. TIME
FARM EQUIPMENT	IB	4	200	1,040	0.7	1.0	1.0	1.0	CONSISTENT TRANSIT TIME, INCR. SERV. FREQ.
SOYBEAN MEAL	IB	4	320	720	0.7	1.2	1.0	1.0	CONSISTENT TRANSIT TIME, INCR. SERV. FREQ.
BEANS	OB	3	300	450	0.7	1.1	0.5	0.5	AVAILABLE RAIL CARS
SEA ANIMAL OIL	IB	3	90	450	0.5	0.3	0.5	0.5	FASTER TRANSIT TIME
ASBESTOS	IB	3	60	300	0.5	0.3	0.3	0.3	UNLOADING FACILITIES
TANNING OIL	IB	2	60	300	0.5	0.3	0.3	0.3	CONSISTENT TRANSIT TIME
POLES	IB	5	300	500	6.9	1.1	0.5	0.5	CONSISTENT TRANSIT TIME
TOTAL		552	26,582	\$ 92,201	100%	100%	100%	100%	

Inadequate car supply has also been reported as a major problem by grain shippers. Nearly every grain elevator (7 out of 8) surveyed on the Ann Arbor indicated that late arrival of cars forced them to ship substantial amounts of grain by truck. In 1976, for example, elevators moved the equivalent of 330 (100 ton) hopper cars of grain by truck because rail cars were not available when the shipper needed them. The average number of days for late delivery on rail cars (to the grain shippers surveyed) ranged from 5 days to 42 days (see Table 4-15).

Another common problem experienced by grain elevators is the arrival of rail cars in a non-useable condition. Rail cars frequently are delivered dirty and the shipper must either invest his own time and money to clean them or not accept them and send them back. In any case, the grain shipper incurs the added expense of not having a useable rail car when he needs one.

Although the data in Table 4-15 does not strongly support the contention that larger grain shippers have an easier time in obtaining rail cars, other evidence suggests that this is the case. For example, most Michigan grain elevators shipping by rail ship multi-car units directly to the east coast. A few of the smaller elevators, however, ship single cars to subterminals in the Toledo area.

Interviews with grain elevator managers indicated that the smaller elevators (under 100,000 bushel capacity) had a harder time obtaining cars than did the larger elevators (over 100,000 bushel capacity). One reason for this, according to personnel in

TABLE 4-15

ANN ARBOR RAIL LINE
GRAIN SHIPMENTS 1976,
IMPACT OF CAR SHORTAGE

SHIPPER- COMMODITY	DESTINATION	NUMBER OF CARLOADS SHIPPED BY RAIL-1976	AVERAGE NUMBER DAYS RAIL CARS DELIVERED LATE	CARLOADS MOVED BY TRUCK DUE LATE CAR DELIVERY
Grain	E. Coast	30	11	45
Grain	E. Coast	400	5	112
Grain	E. Coast	40	27	20
Grain	E. Coast	20	42	40
Grain	E. Coast	16	6	8
Grain	South	4	6	2
Grain	Midwest	12	12	8
Beans	S. West	35	27	30
Beans	S. West	20	23	40
Beans	South	10	23	25

charge of ConRail's Ann Arbor operations (located in Owosso) is that "everybody wants a rail car at harvest time, causing car shortages. To maximize the utilization of available cars, and earn the highest possible return for the railroad, our (ConRail's policy)

is to meet demands for unit-trains first. A shipper who wants a single car every now and then will just have to wait." ¹²³

According to the executive secretary for the Michigan Grain and Agri-Dealers' Association, technological changes in the railroad industry over the past 25 years has favored the large grain shipper when it comes to obtaining rail cars. ¹²⁴ In the past, grain moved in 50 ton box cars; today it moves primarily in 100 ton covered hopper cars. In addition, the railroads use lower rates to encourage shipments in three-car units. The three-car rate per bushel is around 6¢ to 8¢ cheaper than the single 100 ton car rate and 10¢ to 12¢ cheaper per bushel than truck.

To take advantage of the lower three-car rate requires an elevator to have minimum storage and blending capacity. Since each 100 ton hopper holds approximately 3,500 bushels, 10,500 bushels are required for a three-car unit. To blend effectively on a three-car basis requires minimum storage capacity of 50,000 bushels. ¹²⁵ Consequently, the chances that an elevator will get rail cars on or near the date ordered will improve if the elevator is large enough to ship in three-car units.

A recent study of the modal split of 1973 grain shipments by Michigan grain elevators indicates that larger elevators (bushel

¹²³Information supplied by a ConRail official during a telephone conversation, August, 1976.

¹²⁴Conversation with Stan Sherman, Executive Secretary, Michigan Grain and Agri-Dealers' Association, Saginaw, Michigan, April 1, 1977.

¹²⁵Ibid.

capacity) ship a higher percentage of their grain by rail than do smaller elevators.¹²⁶ The study results are summarized in Table 4-16 below. The smaller elevators definitely utilized rail service less than the medium-sized and large elevators in 1973.

TABLE 4-16
GRAIN SHIPMENTS BY
MICHIGAN ELEVATORS, BY
MODE, 1973

Elevator Storage Capacity (Bushels)	Rail		Truck	
	Tons	Percent	Tons	Percent
1-24,999	45,833	6	769,584	94
25,000-199,999	383,402	42	523,419	58
200,000-499,999	385,801	48	413,102	52
500,000-larger	387,609	51	274,330	49

Source: Michigan Freight Transportation Survey, p. 33.

These figures do not convey the full story, however. The difficulty in obtaining useable railroad equipment, according to the report, caused nearly half (45.5 percent) of grain volume intended for rail shipment to move by truck in 1973. When percent diverted

¹²⁶Marc A. Johnson, The Michigan Freight Transportation Survey: An Empirical Investigation of Modal Choice, A Report to the Michigan Department of State Highways and Transportation, 1975.

is classified according to elevator size, we find that the small elevators were at a substantial disadvantage in obtaining rail cars vis-a-vis the medium sized and large elevators (Table 4-17). Eighty-four percent of the smaller elevators, in contrast to only 10 percent of the largest elevators, had to divert grain intended for rail shipment to truck shipment due to unavailable rail cars in 1973.

TABLE 4-17

GRAIN SHIPMENTS BY MICHIGAN ELEVATORS
INTENDED FOR RAIL, BUT DIVERTED TO
TRUCKS FOR LACK OF CARS

1973

Elevator Storage Capacity (Bushels)	Percent Diverted From Rail to Truck
1-24,999	84
25,000-199,999	56
200,000-499,999	27
500,000-larger	10

Source: Michigan Freight Transportation Survey, p. 34.

There are various reasons for larger elevators obtaining better equipment service. Perhaps the most important one from the railroad's perspective is that larger elevators tend to have a fairly stable, constant demand for rail cars. In addition, larger elevators tend to order multiple car units which generate more revenue for

the railroad than single car orders; this also facilitates better equipment utilization. Leasing hopper cars and putting them in captive service ¹²⁷ is one option smaller elevators have for securing rail cars. This may not be economical, however, if the cars are not used in productive service year around.

Another option would be for a group of small elevators to invest in a larger elevator giving it the technical ability to ship grain in multi-car units.

Besides unavailable rail cars, inconsistent transit time was also a problem for many rail users on the Ann Arbor. For example, unreliable delivery times caused Ann Arbor rail users to divert 140, 128, and 99 carloads of lumber, feed and fertilizer, respectively, from rail to truck in 1976 (Table 4-13).

According to many of the Ann Arbor rail users interviewed, unreliable transit time not only caused many of them to sustain higher inventory costs, but it also put them at a competitive disadvantage. A large feed dealer, who buys his feed grain for blending from a wholesaler in Illinois, gave the following example:

Week One: Early Monday morning feed dealer "A" buys 2,000 bushels of feed grain from a wholesaler in Illinois. He makes arrangements to have the grain delivered by rail

¹²⁷ The owner or leasor of a rail car can specify that his cars be returned empty by the most direct route. This improves his chances of having a car available when he needs it.

on Thursday. But his shipment does not arrive until late Saturday. Consequently, he has to pay over-time to his employees to work on Sunday, blending the grain into the proper mixes so that it can be sold on Monday (of the second week).

In the meantime, feed dealer A's competitor, feed dealer "B", purchases 2,000 bushels of grain from the same wholesaler on Thursday (of the first week) at 4¢ less per bushel; wholesale grain prices had fallen. Rather than use rail service, feed dealer B hires a motor carrier to deliver his feed Friday morning. The cost per bushel of grain delivered by truck is 3¢ higher than rail. Feed dealer B receives his grain Friday morning, and blends that afternoon.

Week Two: Monday morning feed dealer A finds that he is selling his feed mix at a price 1¢ to 2¢ higher than his competitor. Since both dealers are basing their selling price on their buying price, plus processing costs, feed dealer A finds himself at a competitive disadvantage because of unreliable rail service.

The feed dealer who provided this example indicated that he was considering investment in his own trucks because he could not remain competitive if he had to depend upon unreliable rail service.

One wholesale food distributor that was interviewed indicated that late rail deliveries increased his handling costs significantly; late deliveries also caused him to duplicate delivery "runs" to his retail buyers. In another interview, the manager of a building supplies store said that erratic rail deliveries forced him to buy "locally" at higher prices to prevent stock-outs and loss of sales.

The situation on the Michigan Northern is similar, in many respects, to the Ann Arbor. Although 24 commodities on the Michigan Northern appear to be sensitive to changes in rail service quality, two commodities, lumber and pipe, constitute the major source of

potential increases in freight traffic (Table 4-14). For example, in 1976, Michigan Northern lumber dealers indicated that they moved 157 carloads of lumber by truck because they could not rely on rail service.

A number of the lumber dealers interviewed on the Michigan Northern felt the Chicago Yards were a major cause of unreliable transit time. One lumber dealer indicated that on more than one occasion his shipments were delayed in the Chicago Yards for two weeks before they were finally placed on a train bound for Michigan. Many lumber dealers indicated that rather than put up with the uncertainties of unreliable rail service, they were going to purchase lumber from wholesalers in Grand Rapids or Lansing. They can phone their order in that afternoon and take delivery the following morning or afternoon. Although they pay a higher freight rate for truck service than they would for rail, they reduce the costs of maintaining inventories against uncertain rail service. In the long run many of the dealers felt they would be better-off.

Presently a number of oil and natural gas exploration activities are underway in areas of northern Michigan served by the Michigan Northern railroad. Pipe, drilling mud, and other exploration materials are delivered to firms by rail on a weekly basis. One company surveyed claimed that it would ship approximately 115 carloads of drilling pipe by rail annually if a spur was built from the mainline to their storage area--a distance of approximately 1,000 feet. Without the spur, the company would have to double-handle the pipe at the rail siding and the firm's storage area.

The firm indicated interest in a joint financing effort with Michigan Northern to build the spur.

Feed shipments represent another source of potential traffic for the Michigan Northern Railroad. Six feed dealers interviewed indicated they would increase their total use of rail service by 35 carloads annually if delivery times were more consistent.

A paper mill plant indicated that it would resume its use of rail service if Michigan Northern could guarantee reasonable delivery times. According to the manager, power to operate the plant is generated by burning of coal. In the past years the firm received its coal shipments by rail. But Penn Central's service was so erratic, often forcing plant shut-downs, the firm discontinued its use of rail service and is now receiving coal by truck on a daily basis. The manager seemed certain that rail service, if reliable, would be more economical.

Summary. Discussion in this section illustrated the sensitivity of a number of commodities to different dimensions of rail service quality. Although elasticities for the different dimensions of rail service quality were not estimated, rough measures of the potential response of rail users to improved service have been noted.

What difference would it make to the viability of the Ann Arbor and Michigan Northern rail lines if rail service was improved? Would the increase in carloads, in response to improved rail service, generate enough revenue to put the two lines on sound financial footing? This question is discussed in the next section.

Impact of Improved Rail Service on the Financial Position of the Ann Arbor and Michigan Northern Lines. In Chapter Three, it was determined that the Ann Arbor and Michigan Northern railroads sustained sizeable operating losses in 1973 (see Table 3-22). Table 4-18 on the following page provides a comparison of Ann Arbor and Michigan Northern freight shipment data for 1973 and 1976. Two sets of 1976 figures are used in the comparison; one set of figures corresponds with the demand for rail service, given present service quality; and, the second set of figures corresponds with demand for rail service, given improved service quality.

TABLE 4-18

COMPARISON OF ANN ARBOR AND MICHIGAN NORTHERN
FREIGHT SHIPMENT DATA FOR 1973 AND 1976
CARLOADS, TONS, OPERATING REVENUE,
EXPENSES, NET OPERATING INCOME

Freight Shipment Data	ANN ARBOR			MICHIGAN NORTHERN		
	1973	1976 ^{a/}	1976 ^{**b/}	1973	1976 [*]	1976 ^{**}
CARLOADS	23,608	19,689	22,878	2,441	2,014	2,566
TONS (METRIC)	1,344,704	1,222,620	1,394,202	104,709	120,315	146,897
OPERATING REVENUE (DOLLARS)	3,645,704	3,352,628	4,116,703	393,879	241,621	333,927
OPERATING EXPENSES ^{c/} (DOLLARS)	7,004,082	7,004,082	7,004,082	1,064,414	1,064,414	1,064,414
NET OPERATING INCOME (DOLLARS)	(3,358,087)	(3,651,454)	(2,887,379)	(666,535)	(822,793)	(730,487)

^{a/} 1976 ^{*} carload, ton, and carrier gross revenue figures are rail user estimates based on present rail service quality characteristics--transit time, variance in transit time, frequency of service, availability of rail cars, and so on.

^{b/} 1976 ^{**} carload, ton, and carrier gross revenue figures are rail user estimates based on improved rail service.

^{c/} The precise effect of changing carload levels on operating costs was not estimated. It is assumed that operating costs will change very little with small changes in carload levels.

The importance of rail service quality to the financial viability of the Ann Arbor and the Michigan Northern is illustrated by comparing the railroads' 1973 and 1976 operating revenues. Between 1973 and 1976, operating revenues for the Ann Arbor and Michigan Northern declined by \$302,867 (8 percent) and \$152,258 (38 percent), respectively.

Interviews with rail users on the two lines indicate the declines in operating revenue are due to deterioration in rail service quality between 1973 and 1976. Further, the rail users surveyed indicated that improvement in the quality of rail service led to an increase in demand for rail service on the two lines; increases in 1976 operating revenues on the Ann Arbor and Michigan Northern with improved service were estimated to be \$764,075 and \$92,306, respectively.

For the Ann Arbor, the 1976 estimated operating revenue with improved rail service represents an increase of \$470,999 over its 1973 operating revenues. For the Michigan Northern, 1976 estimated operating revenues with improved rail service represent an improvement over the 1976 figures without improved rail service, but operating revenues fail to reach their previous 1973 level. This failure occurs despite an increase in total carloads (125) on the Michigan Northern between 1973 and 1976.

The changes in carloads and operating revenues on the Michigan Northern (and Ann Arbor) suggest that the composition of freight shipments as well as the absolute number of carloads determine the railroad's gross operating revenues. The Michigan Northern figures

suggest the loss of high revenue-producing traffic between 1973 and 1976. A detailed analysis of composition of freight on the Michigan Northern between 1973 and 1976 would be required to determine what changes have taken place. Available data, however, did not permit such an analysis.

One might speculate, however, as to what happened. A number of rail using firms may have gone out-of-business or relocated. Or, perhaps unreliable rail service encouraged firms sensitive to inventory costs, etc., to shift to trucks. Interviews with Michigan Northern rail users suggest that the latter may be the case.

Based on analysis thus far, one can draw the tentative conclusion that improving rail service is necessary for increasing railroad operating revenues. But given the present financial positions of the Ann Arbor ¹²⁸ and the Michigan Northern, an increase in rail use by present rail users is not enough; the railroads will still be left with large operating deficits (see Table 4-18). Before examining what can be done to improve the financial viability of the Ann Arbor and Michigan Northern through line segmentation and re-configuration (Chapter Five), consideration will be given to rail user interview results not yet discussed.

¹²⁸The reader is reminded that discussion of Ann Arbor rail operations in this Chapter and Chapter Five pertain to originating and terminating freight traffic only. The overall financial status of the railroad must include an analysis of the cross-lake ferry operation and on-line bridge traffic.

Routing and Pooling of Rail Shipments. Many firms in the U.S. employ traffic managers (i.e., Georgia Pacific, Chapter Two) that have knowledge of rates and service characteristics of all major modes of transportation. The traffic manager's job is to utilize available transportation services in a manner that will contribute to lower firm costs and improved customer service. In the area of consistent rail transit time, many traffic managers have found that routing is a key to reducing variance in transit time. Frequently, the traffic manager can route his cars around major bottlenecks (like the Chicago gateway).

Another technique often used by firms to improve rail service is to pool their shipments. Frequently, a number of firms on a rail line will want to move a commodity but will not have, individually, enough volume to make-up a carload. Rather than ship their commodity at expensive less-than-carload rail rates, the firms will come together and pool their shipments to make a carload. Less-than-carload shipments tend to encounter more delays at classification yards than full cars; in addition to paying a higher rate rail users tend to experience less reliable rail service on the shipment.

As part of the interview, rail users on the Ann Arbor and Michigan Northern were asked if they specified routing of their shipments and if they engaged in pooling their shipments with other firms. In addition, the rail users were asked if they would be interested in pooling their shipments or engaging in other cooperative efforts with other rail users in the future. Tables 4-19, 4-20, and 4-21, on the next few pages, present their responses.

Twenty-seven (36 percent) of the rail users on the Ann Arbor indicated that they do specify the routing of their shipments. In contrast, none of the Michigan Northern rail users said they specified routing of their shipments (see Table 4-19).

TABLE 4-19
ANN ARBOR AND MICHIGAN NORTHERN
RAIL LINES

Railroad	Do Shippers Specify the Routing of Their Shipments?					
	Yes		No		Total	
	Number	Percent	Number	Percent	Number	Percent
Ann Arbor (ConRail)	27	36	49	64	76	100
Michigan Northern	0	0	68	100	68	100

Routing requires knowledge of the possible routes and rate alternatives. Most rail users on branch lines are small, however, and cannot afford a traffic manager to acquire this knowledge; nor do they have the time to invest in acquiring the information themselves. Consequently, branch line rail users must rely on the local train agent for this information. The responsiveness of the train agent to their requests, therefore, has a bearing on whether the rail user routes his shipments or not. Approximately 60 percent of the Ann Arbor rail users that routed their shipment relied on their local train agent. The remaining 40 percent.

employed traffic managers. Although a number of rail users on the Michigan Northern indicated they had considered routing, the Penn Central agent was very non-cooperative; so, they did not follow through.

In contrast to routing, a number of Michigan Northern rail users had pooled shipments. Twenty of the 22 lumber firms on the line indicated they had split carloads of lumber in the past; more than one-half (12) indicated that the pooled shipments were arranged by their broker and in some cases they did not even know which dealers they were splitting a carload with. The remaining eight lumber dealers indicated they had actually promoted split carloads with other dealers on the line. Two elevators indicated they had split bagged fertilizer shipments. Six other firms on the Michigan Northern line indicated they had split carloads of food products, paper products, and coal (see Table 4-20).

TABLE 4-20
ANN ARBOR AND
MICHIGAN NORTHERN RAIL LINES

Railroad	Have Have Rail Users Engaged in Pooling of Shipments?					
	Yes		No		Total	
	Number	Percent	Number	Percent	Number	Percent
Ann Arbor (ConRail)	21	28	55	72	76	100
Michigan Northern	28	37	40	63	68	100

Fewer shippers on the Ann Arbor (21) than on the Michigan Northern indicated they had pooled shipments with other rail users. Again, lumber dealers (15) utilized pooling arrangements the most. Two furniture stores indicated they had once made arrangements to split a carload of furniture originating at the same plant in the south. A number of grain elevators indicated they had split carloads of fertilizer and bagged dog food in the past. Lower rates was the reason given by grain elevators for seeking to pool shipments. One elevator manager, however, indicated his experience with pooled shipments of fertilizer was not good. On one occasion he split a carload of fertilizer with two other elevators. He was the last stop on the line and by the time the rail car reached him, half of his fertilizer bags were broken and a few were missing. According to the railroad, the car had not been properly sealed after the first elevator removed its part of the shipment and the shipment was vandalized during the night. The elevator filed a damage claim with the railroad but no action has been taken for over a year. The elevator now receives its fertilizer shipments by truck.

Problems arise also for lumber dealers that split carloads. According to a few of Michigan Northern lumber dealers, shipments often become damaged due to the large amount of handling involved in the separation and unloading. In addition, some dealers hold a car two or three days while waiting for a convenient time to unload their portion of the shipment. This tends to add to the erratic nature of rail transit time experienced by many rail users.

Thirty-three and 45 percent of the rail users on the Ann Arbor and Michigan Northern, respectively, said they would pool their shipments or engage in other cooperative efforts if it would result in lower rates and/or better service. An additional 25 and 20 percent of the Ann Arbor and Michigan Northern rail users, respectively, indicated they might pool shipments or engage in other types of cooperative efforts (see Table 4-21).

TABLE 4-21

ANN ARBOR AND
MICHIGAN NORTHERN RAIL USERS

Would You Pool Shipments or Engage in Other Cooperative Efforts in the Future?

Railroads	Yes		No		Maybe		Total	
	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent
Ann Arbor (Conrail)	25	33	32	44	19	25	76	100
Michigan Northern	31	45	24	35	13	20	68	100

Rehabilitation of the Ann Arbor and Michigan Northern Lines. In Chapter Two the argument was made that poor and deteriorating track and roadbed conditions lead to poor rail service and subsequently to a decline in the demand for rail service. It was also noted that frequently railroads and rail users get caught-up in a sequence of behavior and counter-behavior; this leads to the deterioration of track and structures and the eventual abandonment of rail service on many lines. As part of this research project, an effort was

made to determine the physical condition of the Ann Arbor and Michigan Northern lines. Efforts were also made to determine the importance rail users on the two lines place on the condition of their lines.

A number of estimates have been made of the cost to rehabilitate the Ann Arbor and Michigan Northern lines to different operating standards. Two recent estimates, for example, have been made of costs necessary to upgrade the Michigan Northern line from its present substandard condition to Federal Railroad Administration (FRA) Class 2 standards (25 mph). One of the studies was conducted in 1975 by the Railroad Section of the Michigan Public Service Commission. They estimated it would cost \$3.5 million to rehabilitate the line to FRA Class 2 standards. ¹²⁹

The study, however, underestimated the full cost of rehabilitation because it did not include auxiliary track areas (yards, local spurs, and branches), signals or communications aspects, bridges, buildings and other fixed facilities. In a second report submitted (September 1976) to the Rail Freight and Ports Authority Section, Michigan Department of State Highways and Transportation, Michigan Northern officials estimated rehabilitation costs close to 5 million dollars to upgrade the line to FRA Class 2 standards. ¹³⁰

¹²⁹ Information was provided in a letter from C.E. Magoon, Supervisor, Railroad Section, Michigan Public Service Commission to James Schuman, Chairman, Rail Advisory Committee, November 17, 1975.

¹³⁰ Michigan Northern Railway, Special Rehabilitation Projects, A Report Submitted to Rail Freight and Ports Authority Section, Michigan Department of State Highways and Transportation, September 29, 1976.

The Michigan Northern Report estimated rehabilitation costs for bridges, buildings and other fixed facilities as well as yards and spurs. Using Michigan Northern figures and a ten-year amortization period, the average (annual) cost to rehabilitate a mile of track would be approximately \$2,230.

In comparison to the Michigan Northern line, the Ann Arbor is in good condition. The Michigan Public Service Commission Report (cited before) estimated that it would cost about \$1.7 million to rehabilitate the Ann Arbor line up to FRA Class 2 standards (25 mph). This figure also includes estimated costs for auxiliary trackage areas (yards, local spurs and branches), signals and communication equipment, bridges, buildings and other fixed facilities. The Report also estimated it would cost between \$6 and \$6.5 million to rehabilitate the Ann Arbor to FRA Class 3 standards (40 mph). Many people familiar with the Ann Arbor situation believe that the track and roadbed should be upgraded to Class 3 standards if a service-oriented freight operation is to be sustained.¹³¹ With a ten-year amortization period, the (annual) cost to rehabilitate a mile of Ann Arbor track to Class 3 standards would be between \$2,020 to \$2,188.

Rail user attitude towards the rehabilitation of their rail line varied. Rail users on the Ann Arbor and Michigan Northern were asked if rehabilitation of lines was necessary to improve rail service. Twenty and 38 percent of the Ann Arbor and Michigan

¹³¹Ann Arbor Railroad Properties: Operating Proposal to Michigan Department of State Highways and Transportation, Harlan, Bethe & Meyers, Inc., Hardy & Chapman, and V.M. MaTanaphy & Associates, Inc., September, 1976.

Northern rail users, respectively, said yes; an additional 47 and 28 percent, respectively, indicated "maybe" (see Table 4-22).

TABLE 4-22
ANN ARBOR AND
MICHIGAN NORTHERN RAIL LINES

Rail Users	Yes		No		Maybe		Total	
	No.	Per-cent	No.	Per-cent	No.	Per-cent	No.	Per-cent
Ann Arbor (Conrail)	15	20	25	33	36	47	72	100
Michigan Northern	26	38	23	34	19	28	68	100

Rail users on both lines were also asked about their willingness to help finance rehabilitation projects on their lines. Their responses, for the most part, were very noncommittal. In general, those rail users who indicated they might contribute expressed concern about protecting their investments in the event the line was abandoned. In addition, many rail users questioned whether rail service would be improved much by rehabilitation of track; they felt that the primary cause of poor rail service was the unreliable service provided by the interline carriers.

A number of rail users on both lines indicated they would consider contributing to a rehabilitation project only if all users

on the line paid their share. Finally, 32 rail users on the Ann Arbor and 21 rail users on the Michigan Northern indicated that under no circumstances would they pay for rehabilitation; they felt the responsibility for maintenance and upkeep of line was the rail-road's.

Summary. The purpose of the section has been to consider opportunities for increasing the present level of rail use on the Ann Arbor and Michigan Northern lines. The results of interviews with 76 and 68 rail users on the Ann Arbor and Michigan Northern, respectively, were presented and discussed.

Estimates of the demand for rail service on the two lines were made. The importance of various dimensions of rail service quality on the demand for rail service were examined; available rail cars and consistent transit time were found to be the dimensions of rail service quality of greatest concern to rail users. Based on rail user responses, it was estimated that improving rail service on the two lines would result in sizeable increases in rail use over their present levels. On the Ann Arbor, it was estimated that improved rail service would lead to 16, 24, and 23 percent increases in carloads, tons, and carrier gross revenues, respectively. Increases on the Michigan Northern were estimated to be slightly higher with 27, 22, and 38 percent increases in carloads, tons, and carrier gross revenues, respectively.

Even with these increases, it was found that the Ann Arbor and Michigan Northern would still sustain large operating losses.

Table 4-23 summarizes the financial status of the two railroads under conditions of improved rail service.

Table 4-23

FINANCIAL STATUS OF ANN ARBOR AND
MICHIGAN NORTHERN UNDER CONDITIONS OF
IMPROVED RAIL SERVICE

Railroad Financial and Other Characteristics	Ann Arbor	Michigan Northern
MILES	333	247
CARLOADS (1976, Improved Serv.)	22,878	2,566
OP. REV. (1976, Improved Serv.)	\$4,116,703	\$ 333,927
OP. EXPENSES	\$7,004,082	\$1,064,414
NET OP. REVENUES	(\$2,887,379)	(\$ 730,487)
REHAB. COSTS (Class 2)*	\$1,700,000	\$5,000.00
REHAB. COSTS (Class 3)*	\$6,000.00 - \$6,500.00	not calculated

*Annual cost based on a 10 year amortization period.

Time did not permit interviews with C.O.-Northwest rail users. Consequently, estimates of potential increases in rail use in response to improved rail service could not be made. For the purposes of this research effort, the operating revenue and cost figures estimated in Chapter Three for the C.O.-Northwest will be used in later analysis.

Future Opportunities for Increasing Rail Use Levels on the Ann Arbor,
Michigan Northern, and C.O.-Northwest

The demand for rail service in a given region will vary with changes in economic activity and the demand for alternative modes of transportation. The purpose of this section is to consider changes

that are taking place in the economic base and business activities of the 21 counties served by the Ann Arbor, Michigan Northern, and C.O.-Northwest rail lines (see Figure 4-1). A detailed study of the economic characteristics of the 21 counties is beyond the scope of this research effort. For the purposes of this study, consideration will be given to population and employment changes at the county level over a 12-year period (1959 to 1972). This information will be suggestive of changes in the aggregate demand for freight transportation services.

Available data does not permit modal split analysis at the county level. Some information on modal splits, however, is available at the state level. This information, plus state and county data on the distribution of trucks by major use, will be used to measure the relative change in demand for rail and truck service in the 21-county area.

Population and Employment Changes at the County Level. For the purposes of discussion, the 21 counties have been placed into three groups--Region 1, Region 2, and Region 3. Counties in Region 1 include: Emmet, Charlevoix, Antrim, Kalkaska, Grand Traverse, Leelanau, Benzie, Manistee, Wexford, and Missaukee. Rail service to these counties is provided primarily by the Michigan Northern and C.O.-Northwest. A portion of the Ann Arbor line cuts across the bottom tier of counties. Region 2 contains the counties of Osceola, Mecosta, Montcalm, and Kent. These counties receive rail service from the Michigan Northern. Counties making up Region 3

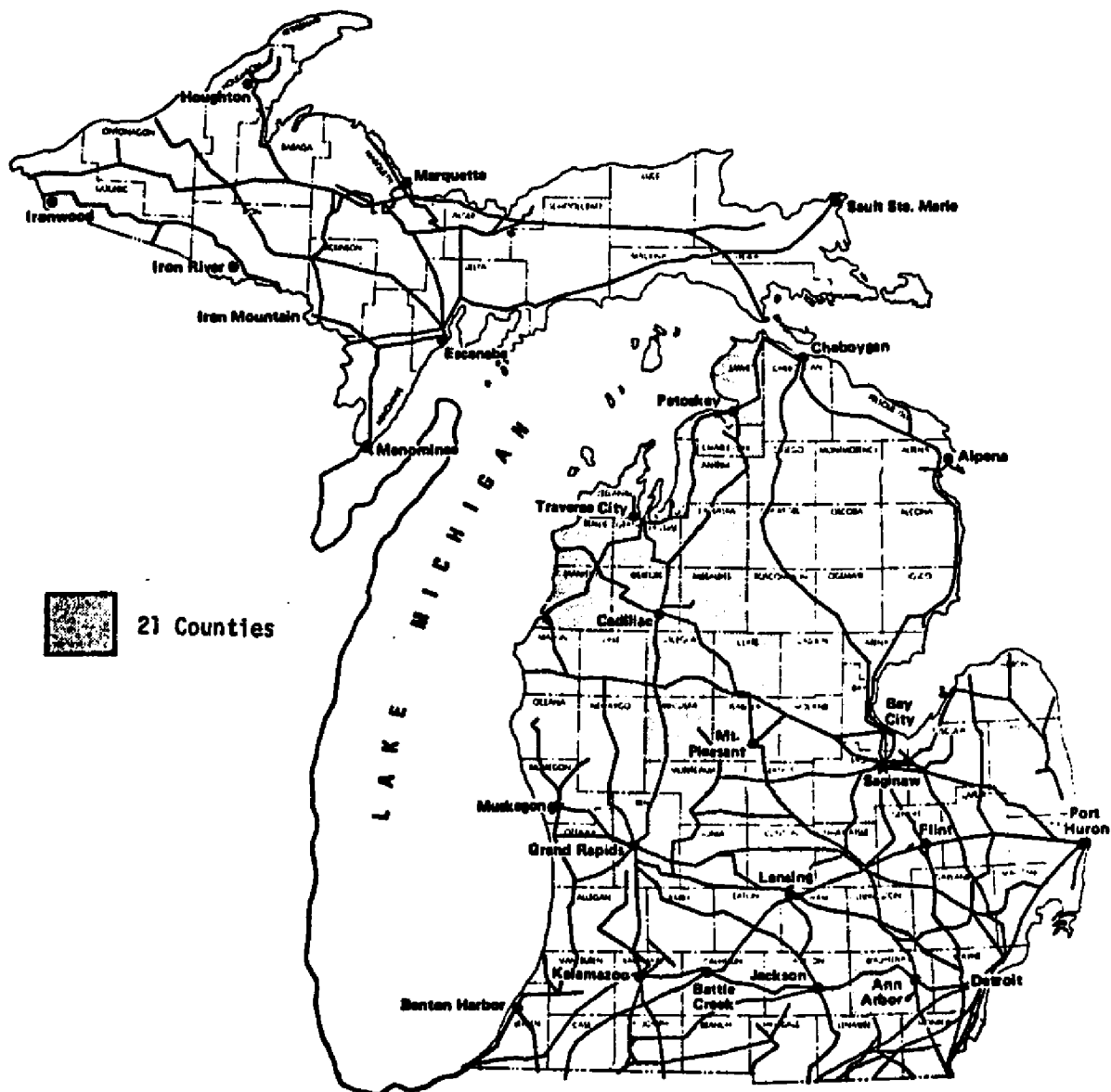


FIGURE 4-1

21-COUNTY AREA SERVED BY ANN ARBOR
MICHIGAN NORTHERN, C.O.-NORTHWEST RAIL LINES

include: Clare, Isabella, Gratiot, Shiawassee, Livingston, Washtenaw, and Monroe. Rail service to these counties is provided by the Ann Arbor.

Between 1959 and 1972, Region 1 experienced a 22.4 percent increase in population. Of the counties in this region, Kalkaska had the largest gain (39.2 percent) while Manistee had the lowest increase (11.8 percent). Table 4-24 displays this information. Region 2 experienced a 16.3 percent increase in population while Region 3 had a 21 percent increase for the 1959-1972 period. Population increases in Region 2 ranged from a high of 45.8 percent (Mecosta) to a low of 14.4 percent (Kent). In Region 3, Livingston County had the highest increase (70 percent) while Gratiot experienced the lowest population increase (9.4 percent). The overall increase in population for the 21-county area from 1959 to 1972 was 19.2 percent.

While population growth has been taking place in the 21-county area, growth in manufacturing and wholesaling activities has not. The percent of the labor force employed in the manufacturing and wholesaling sectors has declined slightly (on the average) over the 1959-1972 period (see Tables 4-25, 4-26, and 4-27). The percent employed in transportation and public utilities has remained constant or increased slightly; contract construction has increased slightly (on the average) in all three regions. The percent employed in retailing, on the other hand, has increased in the three regions. The growth in retailing, relative to the other

TABLE 4-24
POPULATION CHANGE
IN SELECTED MICHIGAN COUNTIES
1960 and 1972

County	1960 (000)	1972 (000)	Percent Change 1960-1972
Emmet	15,904	19,700	23.8
Charlevoix	13,421	17,600	31.1
Antrim	10,373	14,200	36.8
Kalkaska	4,832	6,100	39.2
Grand Traverse	33,490	42,700	27.5
Leelanau	9,321	11,300	21.2
Benzie	7,834	9,100	16.2
Manistee	19,042	21,300	11.8
Wexford	18,466	20,900	13.1
Missaukee	6,784	7,800	14.9
TOTAL - REGION 1	139,467	170,700	22.4
Osceola	13,595	16,400	20.6
Mecosta	21,051	30,700	45.8
Montcalm	35,795	41,500	15.9
Kent	363,187	415,600	14.4
TOTAL - REGION 2	433,628	504,200	16.3
Clare	11,647	18,400	57.9
Isabella	35,348	47,600	34.6
Gratiot	37,012	40,500	9.4
Shiawassee	53,446	66,800	24.9
Livingston	38,233	65,000	70.0
Washtenaw	172,440	240,600	39.5
Monroe	101,120	123,700	22.3
TOTAL - REGION 3	449,246	544,100	21.0
TOTAL (3 REGIONS)	1,022,341	1,219,000	19.2

Source: Michigan Statistical Abstract, 1960, 1972.

TABLE 4-25

NON-AGRICULTURAL EMPLOYMENT DISTRIBUTION IN EMMET, CHARLEVOIX, ANTRIM, KALKASKA,
GRAND TRAVERSE, WEXFORD, MANISTEE, MISSAUKEE, LEELANAU, AND BENZIE COUNTIES,
MICHIGAN, 1959 - 1972

Year	Total County Employment	Contract Construction		Manufacturing		Transportation and Public Utilities		Wholesaling		Retailing	
		No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
					EMMET COUNTY						
1959	2,762	153	5.5	613	22.2	184	6.7	187	8.0	804	29.1
1965	4,338	452	10.4	1,292	29.8	195	4.5	243	5.6	979	22.6
1972	5,819	545	9.4	938	16.1	328	5.6	277	4.7	1,320	22.7
					CHARLEVOIX COUNTY						
1959	2,628	38	1.4	1,754	66.7	95	3.6	46	1.7	352	13.4
1965	3,185	79	2.5	1,570	42.3	189	5.9	95	3.0	390	12.2
1972	3,750	134	3.6	1,780	47.5	251	6.7	168	4.5	670	17.8
					ANTRIM COUNTY						
1959	998	62	6.2	569	57.0	-	-	27	2.7	210	21.0
1965	1,368	71	5.2	791	57.8	-	-	19	1.4	248	18.1
1972	2,199	112	5.1	1,076	50.0	-	-	47	2.1	391	17.9
					KALKASKA COUNTY						
1959	416	-	-	134	32.2	-	-	7	1.7	83	2.0
1965	295	3	1.0	107	36.3	-	-	35	11.8	99	33.5
1972	560	29	5.2	118	21.1	8	1.4	-	-	226	40.3
					GRAND TRAVERSE COUNTY						
1959	6,012	375	6.2	1,791	29.8	455	7.6	475	7.9	1,382	23.0
1965	8,487	480	5.6	2,282	26.8	643	7.6	651	7.7	1,997	23.5
1972	11,432	737	6.4	2,341	20.5	816	7.1	804	7.0	3,151	27.6

(continued)

TABLE 4-25 (continued)

Year	Total County Employment	Contract Construction		Manufacturing		Transportation and Public Utilities		Wholesaling		Retailing	
		No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
WEXFORD COUNTY											
1959	3,443	109	3.2	1,527	44.3	184	5.3	220	6.4	818	23.7
1965	4,296	131	3.0	1,837	42.7	264	6.1	225	5.2	968	22.5
1972	5,066	85	1.7	1,929	38.0	257	5.0	311	6.1	1,175	23.2
MANISTEE COUNTY											
1959	3,500	134	3.8	2,016	57.6	97	2.8	133	3.8	564	16.1
1965	4,512	159	3.5	2,656	58.8	173	3.8	143	3.2	727	16.1
1972	4,614	213	4.6	2,370	51.3	159	3.4	424	9.2	555	18.5
MISSAUKEE COUNTY											
1959	334	22	6.6	9	2.3	11	3.3	36	10.7	199	59.5
1965	324	26	8.0	34	10.5	15	4.6	7	2.2	141	43.5
1972	503	60	12.0	47	9.3	23	4.6	-	-	230	45.7
LEELANAU COUNTY											
1959	514	52	10.1	157	30.5	16	3.1	58	11.3	108	21.0
1965	707	68	9.6	195	27.6	28	4.0	9	1.3	202	28.5
1972	1,206	161	13.3	159	13.2	32	2.6	5	.4	306	25.3
BENZIE COUNTY											
1959	818	51	6.2	394	48.2	6	.7	26	3.2	183	22.4
1965	1,065	77	7.2	539	50.6	-	-	17	1.2	211	19.8
1972	1,539	119	7.7	680	44.2	44	2.8	-	-	331	21.5

TABLE 4-26

NON-AGRICULTURAL EMPLOYMENT DISTRIBUTION IN OSCEOLA,
MECOSTA, MONTCALM, AND KENT COUNTIES, MICHIGAN, 1959-1972

Year	Total County Employment	Contract Construction		Manufacturing		Transportation and Public Utilities		Wholesaling		Retailing	
		No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
				OSCEOLA COUNTY							
1959	2,092	34	1.6	1,310	62.6	23	1.1	111	5.3	387	18.5
1965	2,474	48	1.9	1,607	64.9	50	2.0	97	3.9	396	16.0
1972	3,167	166	5.2	1,891	59.7	169	5.3	104	3.3	509	16.1
				MECOSTA COUNTY							
1959	2,360	112	4.7	984	41.7	171	7.2	95	4.0	620	26.3
1965	3,406	139	4.1	1,535	45.1	260	7.6	60	1.7	895	26.3
1972	3,788	162	4.3	1,463	38.6	289	7.6	89	2.3	1,144	30.2
				MONTCALM COUNTY							
1959	6,357	135	2.1	3,869	60.8	169	2.6	280	4.4	1,120	17.6
1965	8,269	159	1.9	5,101	61.7	165	2.0	278	3.4	1,455	17.6
1972	8,672	163	1.9	4,375	50.4	192	2.2	261	3.0	1,846	21.3
				KENT COUNTY							
1959	99,687	4,379	4.4	46,965	47.1	5,611	5.6	7,023	7.0	15,689	15.7
1965	121,750	4,842	3.9	55,021	45.2	6,524	5.4	9,532	7.8	20,298	16.7
1972	143,163	6,106	4.3	55,704	39.0	6,854	4.8	11,971	8.4	26,696	18.6

TABLE 4-27

**NON-AGRICULTURAL EMPLOYMENT DISTRIBUTION IN CLARE, ISABELLA, GRATIOT, SHIAWASSEE,
LIVINGSTON, WASHTENAW, AND MONROE COUNTIES, MICHIGAN, 1959-1972**

Year	Total County Employment	Contract Construction		Manufacturing		Transportation and Public Utilities		Wholesaling		Retailing	
		No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
					<u>CLARE COUNTY</u>						
1959	1,055	32	3.0	102	9.7	-	-	44	4.2	431	40.8
1965	1,870	34	1.8	659	35.2	106	5.6	57	3.0	525	28.1
1972	2,532	40	1.6	545	21.5	135	5.3	77	3.0	957	37.8
					<u>ISABELLA COUNTY</u>						
1959	3,294	147	4.5	805	24.4	217	6.6	282	8.6	993	30.1
1965	3,630	157	4.3	497	13.7	191	5.3	300	8.3	1,365	37.6
1972	5,575	191	3.4	776	13.9	370	6.6	307	5.5	2,118	38.0
					<u>GRATIOT COUNTY</u>						
1959	6,630	135	2.0	3,536	53.3	340	5.1	495	7.5	1,213	18.3
1965	7,958	309	3.9	3,778	47.4	560	7.0	368	4.6	1,369	17.2
1972	8,625	204	2.4	3,414	39.6	689	7.9	418	4.8	1,858	21.5
					<u>SHIAWASSEE COUNTY</u>						
1959	9,690	156	1.6	5,365	55.4	468	4.8	340	3.5	2,083	21.5
1965	11,551	234	2.0	6,493	56.2	613	5.3	479	4.1	2,067	17.8
1972	10,547	224	2.1	4,563	43.3	765	7.3	391	3.7	2,525	23.9
					<u>LIVINGSTON COUNTY</u>						
1959	4,308	193	4.5	1,847	42.8	111	2.6	115	2.6	1,036	24.0
1965	5,162	214	4.1	2,254	43.7	239	4.6	135	2.6	1,139	22.1
1972	7,712	439	5.6	2,840	36.8	198	2.6	206	2.7	1,983	25.7

(continued)

TABLE 4-27 (continued)

Year	Total County Employment	Contract Construction		Manufacturing		Transportation and Public Utilities		Wholesaling		Retailing	
		No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.	No.	Pct.
WASHTENAW COUNTY											
1959	37,006	1,424	3.8	20,928	56.5	1,447	3.9	925	2.5	6,567	17.7
1965	53,876	2,192	4.1	30,612	56.8	1,833	3.4	1,216	2.3	8,796	16.3
1972	70,549	2,671	3.8	35,386	50.2	2,306	3.3	1,274	1.8	13,553	19.2
MONROE COUNTY											
1959	13,123	566	4.3	7,207	54.9	330	2.5	467	3.5	2,698	20.5
1965	14,444	602	4.2	7,300	50.5	774	5.4	448	3.1	2,931	20.3
1972	20,193	2,692	13.3	8,375	41.5	1,151	6.0	472	2.3	3,985	19.7

economic activities, may not favor the railroads. Trucks have a comparative advantage for moving small, high-value commodities up to about 300 miles.¹³²

Percent employed in different business sectors is only one measure of economic activity and perhaps not a very good one. For example, a manufacturer may increase output (and demand for rail service and other transport modes) while at the same time reducing its labor force by substituting capital for labor. This seems unlikely in Region 1 and Region 2 which contain primarily rural counties where labor is relatively abundant and cheap.

The general increases in population and relative growth in the retail sectors suggest a steady, perhaps increasing, demand for freight transportation service. Recent interviews with rail using firms (described in the previous section) in the 21-county area, however, indicate a switch away from rail to truck on many retail products because of unreliable rail service. Lumber dealers, food distributors, feed and fertilizer dealers, and even farm implement dealers have gone to trucks to reduce high inventory costs caused by inconsistent rail deliveries.

¹³²Trucks tend to have a comparative cost advantage on short distance movements for a number of reasons. First, railroad costs are relatively high for short-distance moves because of their high fixed costs. Also, the effective cost of rail service (to the firm) may be higher than the published rate when service factors are accounted for. Everything else considered, however, rising fuel costs will effect the costs of truck service more than rail service. Consequently, the distance over which trucks have a comparative advantage may decline with higher fuel costs.

Michigan Railroads Losing Freight to Trucks. There is some evidence to suggest Michigan railroads are losing freight traffic to trucks (and other modes) in all major commodity categories. For example, in 1967 Michigan railroads accounted for 75.5 percent of outbound ton-miles for Food and Kindred Products; trucks accounted for 24.4 percent. In 1972, rail's share fell to 52.5 percent and the share moving by truck increased to 47.4 percent. Rail's share of outbound Lumber and Wood Products ton-miles declined from 47.6 percent in 1967 to 22.6 percent in 1972. During the same period, trucks' share rose from 51.4 percent to 78.1 percent. The only commodity category in which Michigan railroads increased their share of outbound ton-miles was "Primary Metal Products." Rail's share increased from 28.4 percent in 1967 to 72.7 percent in 1972; while trucks' share declined from 69.2 percent to 26.4 percent (see Table 4-28).

TABLE 4-28

MICHIGAN, PERCENT DISTRIBUTION OF OUTBOUND COMMODITIES
BY MEANS OF TRANSPORTATION

1967 and 1972

COMMODITY	NUMBER MILLION OF TON-MILES		ALL MEANS OF TRANSPORT		RAIL		MOTOR CARRIER (PERCENT)		PRIVATE TRUCK		AIR		WATER		OTHER	
	1967	1972	1967	1972	1967	1972	1967	1972	1967	1972	1967	1972	1967	1972	1967	1972
MICHIGAN TOTAL	18,209	17,467	100	100	67.7	66.5	25.4	21.8	4.8	5.1	.3	.2	1.5	6.2	.3	.6
FOOD/KINDRED PRODUCTS	1,611	1,543	100	100	75.5	52.5	13.6	26.9	10.8	20.7	--	--	.1	--	--	.5
APPAREL	77	112	100	100	84.1	77.9	6.5	19.3	4.4	.3	2.7	2.4	--	--	--	.4
LUMBER/WOOD PRODUCTS	241	180	100	100	47.6	22.6	10.0	8.5	42.4	68.7	--	--	--	--	--	.3
FURNITURE & FIXTURES	334	226	100	100	64.5	41.5	29.4	43.2	5.6	14.4	.2	.3	.3	--	--	.8
PULP, PAPER/ALLIED PRODUCTS	812	1,140	100	100	64.9	53.6	24.2	35.8	10.7	9.8	--	.1	--	--	.2	.9
CHEMICALS/ALLIED PRODUCTS	2,755	2,361	100	100	78.0	64.8	17.5	29.0	4.2	6.2	.1	.1	--	--	.2	.1
PETROLEUM/COAL PRODUCTS	184	195	100	100	46.2	1.4	30.1	95.6	23.1	3.2	--	.1	--	--	.6	--
RUBBER/MISC. PLASTIC PRODUCTS	126	280	100	100	47.3	34.9	52.1	53.2	.2	9.4	.3	.8	--	--	.1	.5
STONE, CLAY, GLASS- PRODUCTS	1,184	--	100	100	58.8	--	17.8	--	1.9	--	--	--	21.3	--	.3	--
PRIMARY METAL PRODUCTS	2,148	1,448	100	100	44.5	44.6	52.0	45.5	3.3	9.8	.1	.1	--	.1	--	.1
FABRICATED METAL PRODUCTS	1,100	1,580	100	100	28.4	72.7	62.7	17.4	6.5	9.0	.9	.8	--	--	1.5	.2
MACHINERY	1,044	980	100	100	63.2	23.3	30.9	68.0	4.6	6.2	.6	.7	.1	--	.6	.2
ELECTRICAL MACHINERY	260	238	100	100	33.4	51.7	61.1	34.8	2.9	11.8	1.2	.7	.9	--	.5	1.3
TRANSPORTATION EQUIPMENT	6,200	7,072	100	100	83.2	79.2	14.3	14.3	1.6	4.4	.4	.3	.4	--	.1	1.8
INSTRUMENTS/PHOTO- GRAPHIC GOODS	26	--	100	100	.6	--	86.7	--	.2	--	2.6	--	.3	--	9.6	--
MISC. PRODUCTS	137	112	100	100	23.6	23.9	70.7	68.5	1.2	5.4	.1	.2	1.4	--	3.0	2.4

SOURCE: COMMODITY TRANSPORTATION SURVEY, AREA SERIES, AREA REPORT 3, 1972 CENSUS OF TRANSPORTATION, BUREAU OF CENSUS, U.S. DEPARTMENT OF COMMERCE

Although data are not available on the modal split of freight movements in the 21-county area served by the Ann Arbor, Michigan Northern, and C.O.-Northwest, the increase in commercial truck traffic on roads paralleling the rail lines suggests a growing demand for truck service. Traffic counts taken by the Michigan Department of State Highways and Transportation indicate that commercial truck traffic has increased 46.9 percent between 1970 and 1975 on roads paralleling the Michigan Northern, the C.O.-Northwest, and the northern half of the Ann Arbor lines (see Table 4-20). The traffic counts are based on an average 24-hour day. By itself, this information does not prove the railroads are losing traffic to trucks. It is consistent, however, with earlier information (i.e., shipper surveys and data presented in Table 4-28) that does indicate Michigan railroads are losing freight traffic to trucks.

So far our discussion on the potential demand for rail service in the areas served by the Ann Arbor, Michigan Northern and C.O.-Northwest has been very indirect at best. The data and information we have considered indicate that there is a demand for transportation services. The relative increase in retail activity in the 21-county area would suggest that growth in commercial traffic is in manufactures, commodities for which trucks tend to have the advantage in terms of speed and handling costs.

Industrial Development Potential. Few studies on the potential for industrial development and related demand for rail service in the 21-county area served by the Ann Arbor, Michigan Northern and

TABLE 4-29

**COMMERCIAL TRUCK TRAFFIC ON ALL WEATHER MICHIGAN ROADS
THAT PARALLEL PORTIONS OF THE ANN ARBOR, MICHIGAN NORTHERN,
AND C.O.-NORTHWEST RAIL LINES, 1970 and 1975**

Rail Line and Parallel Road	Number of Commercial Trucks		Percent Change 1970-1975
	1970	1975	
<u>Ann Arbor</u>			
Rail Line: Ashley to Clare Road: Michigan 27	5,810	9,540	64.2
Rail Line: Clare to Frankfort Road: Michigan 115	3,060	4,070	33.0
<u>Michigan Northern</u>			
Rail Line: Grand Rapids to Cadillac Road: Michigan 131	7,980	10,370	29.9
Rail Line: Cadillac to Petoskey Road: Michigan 131	3,280	5,700	73.8
Rail Line: Petoskey to Mackinaw City Road: Michigan 68 and 31	1,910	2,880	50.8
<u>C. & O. - Northwest</u>			
Rail Line: Manistee to Traverse City Road: Michigan 31	1,920	3,120	62.5
Rail Line: Traverse City to Petoskey Road: Michigan 31	1,050	2,230	20.5
TOTAL	25,810	37,910	46.9

Source: Trunkline Commercial Traffic (average 24-hour count), Michigan
Department of State Highways and Transportation, 1970 and 1975.

C.O.-Northwest have been published. One study,¹³³ however, attempts to determine the industrial development potential of the northwestern section of the lower peninsula. This is the same area that was labeled "Region 1". The study was particularly concerned with relating industrial development to the future demand for rail service.

As part of the 1975 study, a geologic survey was made of the area. The results of the survey indicate that natural resources exist to support the development of chemical, petro-chemical, and oil refining industries. In addition, substantial deposits of sand and limestone offer potential for developing refractory and extractive industry. In general, industrial activity of this type has a fairly high demand for rail service.

The study also found communities and firms along the Michigan Northern Line between Cadillac and Petoskey to be promoting industrial development. It is interesting to note that the highway (Michigan 131) paralleling the Michigan Northern between Cadillac and Petoskey experienced a 73.8 percent increase in commercial truck traffic between 1970 and 1975 (see Table 4-29). The major population center in the Region--Traverse City, Charlevoix, Petoskey, Cadillac, and Manistee--were also cited by the report as having potential for industrial expansion. The report concludes by stating:

¹³³V.M. Malanaphy and Associates, Inc., An Evaluation of Region 10: Northern Michigan Railroad Needs, November, 1975.

...The Region has an excellent potential for economic expansion...The industries best suited for the area are, by and large, rail oriented and cessation of rail service in the area would do irreparable harm to the future growth and development of the Region.

...It can therefore be concluded that there is a need for continuation of rail service in the Region. Development of the Region through the retention of a rail system tailored to the Region's present and potential industrial centers should in turn result in a self-sustaining system. 134

Summary. In this section we have attempted to address the question of potential demand for rail service in the areas served by the Ann Arbor, the Michigan Northern, and the C.O.-Northwest. Available data and information have not allowed us to answer the question satisfactorily. There is some evidence to suggest, however, that traffic in manufactures on the Michigan lines is increasing; and that unless the railroads improve the reliability of service they provide, they will not share in the movement of this traffic.

Information on the future demand for rail service in the 21-county area is limited and by its nature only suggestive of what might be. One study, however, indicates excellent potential for the development of economic activity that requires rail service in the northwestern part of the state (Lower Peninsula).

Two general conclusions can be drawn from this Chapter:

(1) Present demand for rail service on the Ann Arbor, Michigan Northern (assuming improved service), and the C.O.-Northwest does not produce revenues adequate to cover the railroads' cost of providing service.

¹³⁴Ibid., 125-126.

(2) Although sources of potential demand for rail service on the Ann Arbor, Michigan Northern, and C.O.-Northwest may develop in the future, there is no guarantee that they will.

The viability of a rail line can be increased by reducing the railroad's operating costs as well as increasing its revenues. In the next chapter, consideration will be given to the effect that adjustments in line length can have on the railroad's net operating income.

CHAPTER FIVE

THE FINANCIAL CONSEQUENCES OF ORGANIZING THE ANN ARBOR, MICHIGAN NORTHERN, AND C.O.-NORTHWEST RAIL LINES INTO A REGIONAL RAIL SUBSYSTEM

In Chapter Three, using 1973 figures, we determined that the Ann Arbor, Michigan Northern, and C.O.-Northwest were sustaining operating deficits. The losses for the Ann Arbor and the Michigan Northern were quite large--\$3,358,087 and \$666,535, respectively; losses on the C.O.-Northwest were considerably less--\$55,470 (see Table 3-22).

In Chapter Four, we examined the opportunities for improving the viability of the Ann Arbor and the Michigan Northern. Interviews with Ann Arbor and Michigan Northern rail users revealed that improvements in rail service would lead to estimated increases in 1976 operating revenues of \$764,075 and \$92,306 for the Ann Arbor and the Michigan Northern, respectively.

In this Chapter we will examine the affects that line segmentation and reconfiguration might have on the operating revenues and costs of the three railroads.

Sequential Rail Link Analysis

Light Density Lines and Unused Railroad Capacity. In many rural areas it is common to find two or three branch lines operating where freight traffic is capable of supporting only one line. The low volume of shipments on these lines often lead to unused train-unit capacity and high per unit operating costs. In such situations, the branch line railroads often seek to reduce their costs either by (1) reducing the frequency of service on their lines, and/or (2) postponing maintenance and rehabilitation of track and other structures.

The general outcome of such railroad behavior is deterioration in the quality of rail service available to users on the line. As unreliable rail service raises the effective price of the service, many users shift to less expensive modes (usually truck). The loss of users on the line causes the railroad's financial position to deteriorate even more. Eventually it becomes economical for the railroad to abandon service on the line entirely even though the demand for (improved) rail service may be enough to sustain rail operations.

In situations, such as the one just described, it may be possible to improve the financial viability of rail operations in the area by organizing the independent lines into a subsystem. For example, take a region that is served by three rail lines, all of which are losing money and are about to be abandoned. Suppose that the three lines intersect at a number of stations. It may be possible to abandon service on the light density portions of the lines and link

the remaining portions via their intersection points (stations) into a viable or potentially viable rail subsystem.

As was noted earlier, we can think of a rail line as a series of links (or segments) between freight traffic generating points (stations). Each segment represents a set of incremental revenues and costs to the railroad. If the railroad provides service over more than one segment, the sum of the incremental revenues and costs constitute the railroad's total operating revenues and costs for providing service on the line. A railroad may find that it can improve its net operating income position by modifying its operations through segment adjustments.

Sequential Rail Link Analysis: An Example. The following examples will illustrate the sequential link approach to evaluate rail lines.¹³⁵ Suppose railroad "I" is operating a line, AD, comprised of three segments--AB, BC, and CD (see Figure 5-1). In Panel (a), monthly operating revenues (O.R.) equivalent to \$30,000, \$22,000, and \$10,000 are generated on segments AB, BC, and CD, respectively. Total operating revenues for the line AD are \$62,000 (sum of AB, BC, and CD). Monthly operating costs (O.C.) for the line segments are \$25,000 (AB), \$20,000 (BC), and \$25,000 (CD). Total operating costs for the line AD are \$70,000 (sum of AB, BC, and CD). Now operating income for the line is a negative \$18,000 per month. The railroad is considering abandonment of the line. Abandoning the

¹³⁵For a discussion of this approach, see Marc A. Johnson, "A Sequential Link Approach to Evaluating Transportation Facility Adjustments," Southern Journal of Agricultural Economics, Vol. 8, No. 1, July 1976, 27-34.

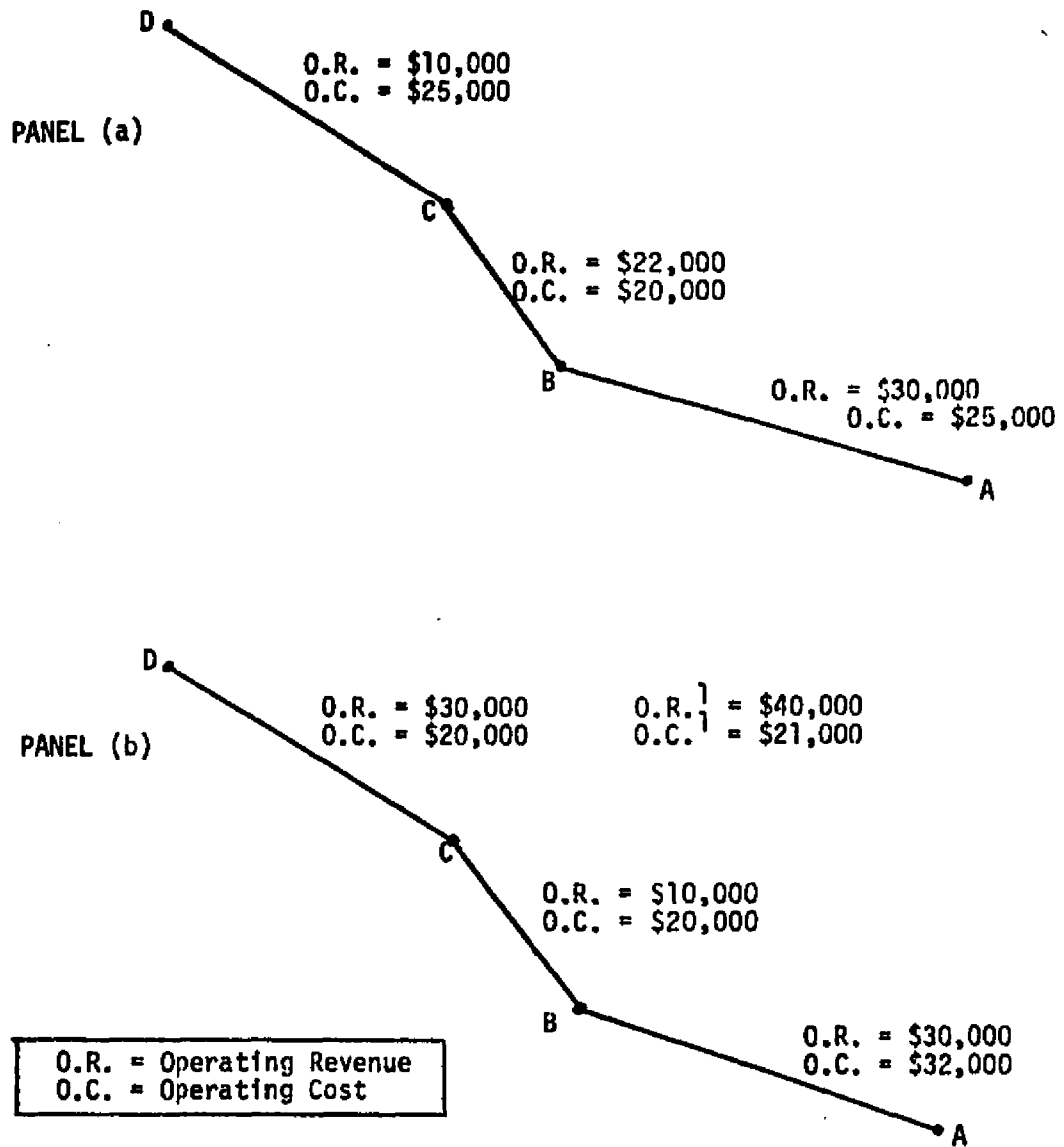


FIGURE 5-1

LINE SEGMENT ANALYSIS
HYPOTHETICAL SITUATIONS
RAILROAD I

entire line is not necessary, however. If the railroad abandons service on segment CD, it can operate the shorter line (AC) with a positive net income of \$7,000 per month.

In another situation, Panel (b), railroad "I" may be sustaining operating losses of \$2,000 per month on its line, AD. Even though segment CD generates a positive net operating income, it is not enough to offset the losses on segments AB and BC. Again, the railroad is considering abandonment of the line. Suppose, however, that a new shipper locates on segment DC. Suppose also that the railroad is operating train-units with unused capacity. The railroad could handle the additional traffic generated by the new shipper at a relatively small incremental cost. With the new shipper, operating revenues (O.R.¹) for segment DC become \$40,000 and operating costs (O.C.¹) become \$21,000. Line segment DC now generates net operating revenues of \$19,000, more than enough to cover the operating deficits of line segment BC (\$10,000) and line segment AB (\$2,000). In such a situation, the railroad would be justified in retaining service on the entire line.

NOW consider Figure 5-2 illustrating the operations of two railroads "I" and "II", that intersect at one point (D). Railroad I operates line AD and Railroad II operates the line XZ. Railroad I has decided to abandon service on its line because it is incurring operating deficits of \$5,000 per month even though segment DC generates a positive operating income of \$20,000 per month. Railroad II is also considering abandonment of its line XZ. Operating deficits on segment XY (\$10,000 per month) are not offset by the

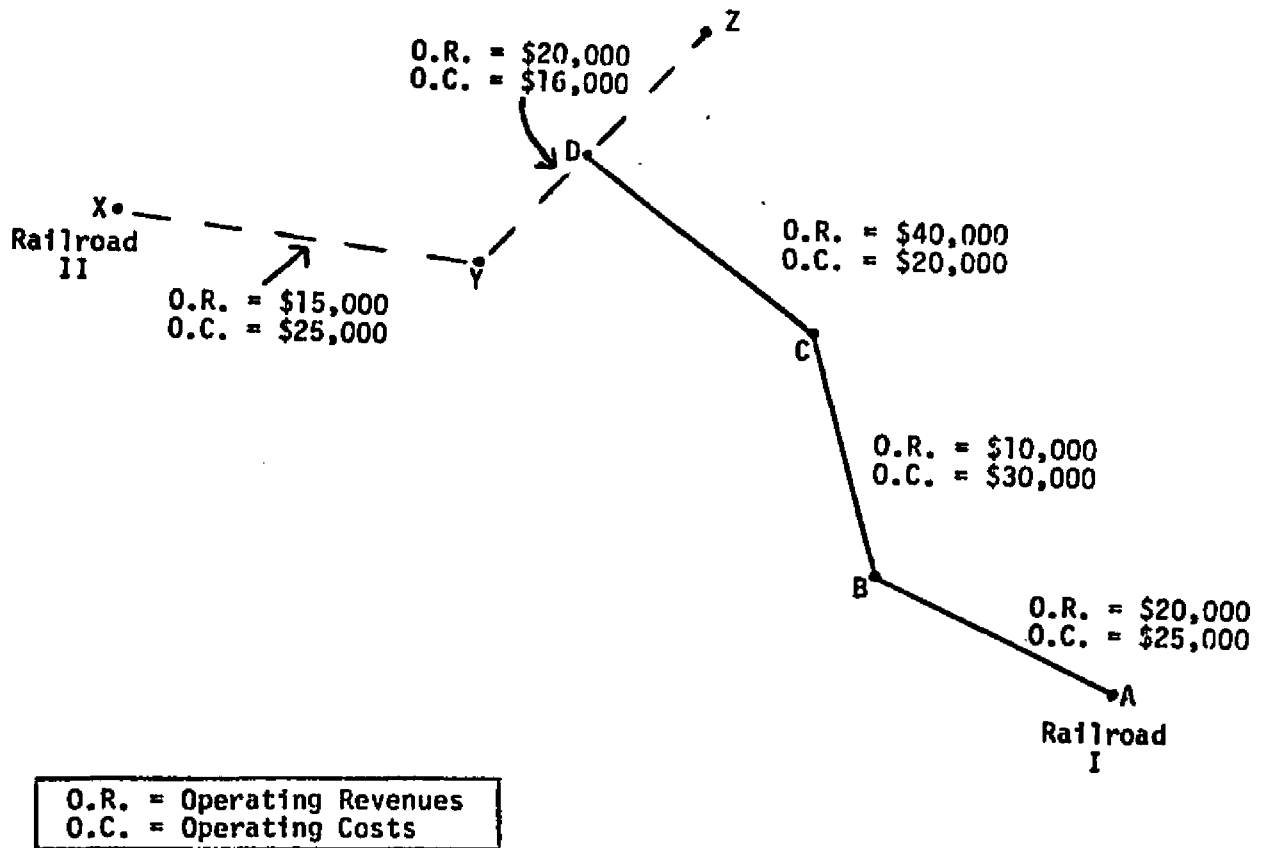


FIGURE 5-2
 LINE SEGMENT ANALYSIS
 HYPOTHETICAL SITUATIONS
 RAILROADS I & II

\$4,000 per month operating surplus on segment YZ. If Railroad II were to purchase segment CD from Railroad I, the line XYDCZ would generate a positive operating income of \$14,000 per month. On the other hand, it would not help Railroad I to purchase segment YZ. from Railroad II. The \$4,000 in positive net operating income would not offset the net operating deficits of \$5,000 per month on line AD.

Although these examples have been highly simplified, they illustrate a procedure that can be used for analyzing the financial impact of line segment adjustments--deletions and additions. This procedure will be used to evaluate alternative combinations of the Ann Arbor, Michigan Northern, and C.O.-Northwest lines.

Evaluation of Line Segmentation and Alternative Regional Rail Subsystems

Data Used. For purposes of evaluating individual line segmentation and alternative line combinations, data presented in Table 5-1 will serve as our starting point. The operating figures for the Ann Arbor and Michigan Northern are based on the railroads' 1976 operations. For the C.O.-Northwest, operating figures for 1973 will be used.

Unused Train-Unit Capacity. Both the Ann Arbor and the Michigan Northern operated with unused train-unit capacity in 1976; ¹³⁶ they continue to do so in 1977.

¹³⁶Information on Ann Arbor's operating capacity was provided by Mr. Dennis Cullen, a ConRail official in Owosso, during an interview on April 18, 1977. Information on Michigan Northern operating capacity was provided by Ms. Beth Andrus, President of Michigan Northern Railway, during an interview on April 12, 1977.

The Ann Arbor is presently operating at about 80 percent train-unit capacity between Toledo and Cadillac. According to the ConRail official in charge of Ann Arbor operations, approximately 5,000 more cars a year could be handled with an increase in operating costs of only 5 to 8 percent. Unused train-unit capacity between Toledo and Cadillac is about 15 cars per day and between Cadillac and Frankfort 10 cars per day.

Unused train-unit capacity for Michigan Northern's operations is close to 60 percent. Michigan Northern officials estimate with their current operating schedule, they could handle 15 additional cars a day with only a slight increase in costs (3 to 5 percent). At 15 cars a day, the Michigan Northern could move 5,500 additional cars a year, retaining as profit nearly 100 percent of the gross revenues generated by this traffic.

Information was not obtained on unused train-unit capacity with current C.O.-Northwest operations. Time did not permit a detailed analysis of the C.O.-Northwest operations.

A word of strong caution is advised in interpreting the results of analysis in this Chapter. The operating data present in Table 5-1 (and subsequently, Tables 5-2 through 5-9) is based largely on estimates. Although the estimates have been made by people familiar with the operations of the three railroads, they may not be completely accurate. To the extent that the estimates

are accurate, the results of line segmentation on the Michigan Northern and C.O.-Northwest should be fairly accurate also.

The analysis becomes difficult, however, when the three rail lines are linked together to form different rail subsystems. Operating the lines as a subsystem may result in an entirely different set of revenue and cost figures than are shown for lines as independent operations. For example, train schedules and train-units (locomotive horsepower and crew size) may be changed to reflect different operating conditions. Such changes will affect operating costs. Operating revenues may change also as traffic is routed over the subsystem rather than over formerly independent lines to different connecting carriers. The division of revenues per car may change.

With these words of caution, we will turn to line segment analysis of the Michigan Northern and C.O.-Northwest. This will be followed by analyses of five alternative regional rail subsystems made up of various segments of the Michigan Northern and C.O.-Northwest linked to the Ann Arbor rail line. For the purposes of analysis in this Chapter, the Ann Arbor will remain intact. The Ann Arbor will serve as the backbone to the regional system.

Michigan Northern Line Segment Analysis. In Table 5-2, the Michigan Northern is segmented into five links. Based upon this segmentation, we find that the Cedar Springs to Cadillac link generates over 40 percent of the total deficit on the line. While being responsible for 32 percent of the Michigan Northern's operating costs, this segment contributes only 12 percent of the railroad's

TABLE 5-1

**BREAK EVEN POINTS FOR ANN ARBOR, MICHIGAN NORTHERN
AND C.O.-NORTHWEST RAIL OPERATIONS IN 1976
WITH IMPROVED RAIL SERVICE**

RAIL OPERATION CHARACTERISTICS	ANN ARBOR	MICHIGAN NORTHERN ^{b/}	C.O.- NORTHWEST ^{c/}
MILES	333	247	133
CARLOADS	22,878	2,566	4,253
TONS	1,394,202	146,897	209,875
OPERATING REVENUES	\$4,116,703	\$333,927	\$747,869
OPERATING COSTS	\$7,004,082	\$1,064,414	\$803,339
NET OPERATING INCOME	(\$2,887,379)	(\$ 730,487)	(\$55,470)
DOLLAR INCREASE IN OP. REVENUES TO BREAK EVEN	\$2,887,379	\$730,487	\$55,470
PERCENT INCREASE IN OP. REVENUES TO BREAK EVEN	70%	219%	7%
DOLLAR DECREASE IN OP. COSTS TO BREAK EVEN	\$2,887,379	\$730,487	\$55,470
PERCENT DECREASE IN OP. COSTS TO BREAK EVEN	41%	69%	7%
NET OP. REVENUE PER ADDITIONAL CARLOAD	\$150 ^{d/}	\$118 ^{f/}	n.a. ^{h/}
INCREASE IN CARLOADS (NUMBER) TO BREAK EVEN	19,249 ^{e/}	6,190 ^{g/}	n.a.
PERCENT INCREASE IN CARLOADS TO BREAK EVEN	84%	241%	n.a.

^{a/}The Ann Arbor rail line is defined to include stations between Frankfort and Toledo, and Owosso and Saginaw. Stations between Ashley and Durand are excluded.

^{b/}The Michigan Northern rail line includes stations between Grand Rapids and Mackinaw City, and Walton Jct. and Traverse City.

^{c/}The C.O.-Northwest rail line includes stations between Manistee and Petoskey.

TABLE 5-1 (continued)

d/ The Ann Arbor is operating at about 80 percent train-unit capacity between Toledo and Frankfort. Ann Arbor officials estimate that an additional 15 cars a day (5,475 cars a year) can be handled with only a slight increase in operating costs (\$4 per additional car). If we assume service is improved and rail users increase their carloads by 3,200, 2,275 additional carloads can be originated or terminated at a net revenue of \$150 per car, to the Ann Arbor.

e/ At a net revenue of \$150 per car, it would require 22,387 additional originating or terminating carloads to break even. The Ann Arbor will have to add more train-units to handle total carload increases of more than 2,275. This will alter train-unit capacity and net revenue per car. Consequently, it may require more than 22,387 carloads to break even.

f/ The Michigan Northern is operating at about 40 percent train-unit capacity between Grand Rapids and Mackinaw City. Michigan Northern officials estimate an additional 16 cars a day (5,840 cars a year) can be handled with only a slight increase in operating costs (\$5 per additional car). If we assume service is improved and rail users increased their carloads by 550, 5,340 additional carloads can be originated or terminated at a net revenue of \$118 per car to the Michigan Northern.

g/ In contrast to the Ann Arbor, the Michigan Northern could (almost) break even by increasing the number of cars it moved up to present train-unit capacity.

h/ The degree of unused train-unit capacity in present C.O.-Northwest operations was not determined. Time did not permit an analysis of the C.O.-Northwest operations.

TABLE 5-2

MICHIGAN NORTHERN RAIL LINE SEGMENT ANALYSIS: 1976 CARLOADS
 OPERATING REVENUES AND COSTS, NET OPERATING COSTS
 (WITH IMPROVED RAIL SERVICE)

STATIONS	CARLOADS		OPERATING REVENUES		OPERATING COSTS		NET OPERATING REVENUES
		%		%		%	
GRAND RAPIDS- MACKINAW CITY	2,566	100	\$333,927	100	\$1,064,414	100	(\$730,487)
GRAND RAPIDS- CEDAR SPRINGS	1,064	41	96,313	29	106,441	10	(10,128)
CEDAR SPRINGS- CADILLAC	306	12	40,604	12	340,612	32	(300,008)
CADILLAC- PETOSKEY	1,052	41	182,225	55	404,477	38	(222,252)
PETOSKEY- MACKINAW CITY	22	1	2,744	4	117,087	11	(114,343)
WALTON JCT.- TRAVERSE CITY	122	5	12,041	4	95,797	9	(83,756)
CADILLAC- TRAVERSE CITY- PETOSKEY	1,174	46	194,266	59	500,274	47	(306,008)

operating revenues. In contrast, the Grand Rapids to Cedar Springs segment generates 29 percent of the Michigan Northern's operating revenues and only 10 percent of the operating costs. This segment of the line also generated 41 percent of the total carloads for 1976.

The Cadillac to Petoskey segment is by far the largest generator of operating revenue with 55 percent of the total. It also accounted for 38 percent of the railroad's operating cost. The Petoskey to Mackinaw City segment is the weakest segment of the line; and, the Walton Jct. to Traverse City segment is not much stronger. In fact, interviews with rail users on the segment indicate that 95 percent of the traffic either originates or terminates at Traverse City.

Segment analysis of the Michigan Northern suggests that the long-term viability of the railroad might be improved by abandoning service between Grand Rapids and Cadillac as well as between Petoskey and Mackinaw City. Serious consideration, however, should be given to operating the Grand Rapids to Cedar Springs segment as an independent short line with connections with other carriers at Grand Rapids. Or, the segment could be served by ConRail. This segment is nearly breaking even now and if operated independent from the remaining portions of the Michigan Northern, it may become profitable.

The remaining segments--Cadillac to Traverse to Petoskey--would constitute the Michigan Northern line. This version retains 46 percent, 59 percent, and 47 percent of the carloads, operating revenues, and operating costs, respectively, of the original line.

Reconfiguring the Michigan Northern line in this manner reduces its operating deficit by 42 percent, from \$730,487 to \$306,008. (see Table 5-2) The viability of the Michigan Northern might be improved even more if service was discontinued over the Walton Jct. to Traverse City segment. This alternative will be considered momentarily when the C.O.-Northwest and Michigan Northern are considered together. Figure 5-3 illustrates the Michigan Northern Cadillac-Traverse City-Petoskey line and the different stations comprising it.

C.O.-Northwest Line Segment Analysis. In contrast to the Michigan Northern, the C.O.-Northwest appears to possess profitable segments (Table 5-3). The Grawn to Petoskey segment is responsible for over 80 percent of the carloads and 85 percent of the operating revenues for the entire line. The traffic on the line is fairly concentrated around the Traverse City and the Charlevoix-Petoskey areas. These two segments constitute 77 percent of the carloads in 1973 and 74 percent of the operating revenues.

Clearly one measure for improving the viability of the C.O.-Northwest line would be to discontinue service on the Manistee to Grawn segment. In doing this, however, the C.O.-Northwest would lose its connections with its parent company at Manistee and the Ann Arbor carriers at Thompsonville. The C.O.-Northwest would have to rely on its connections with the Michigan Northern at Traverse City. Figure 5-4 illustrates the C.O.-Northwest Grawn to Petoskey line and the various stations comprising it.

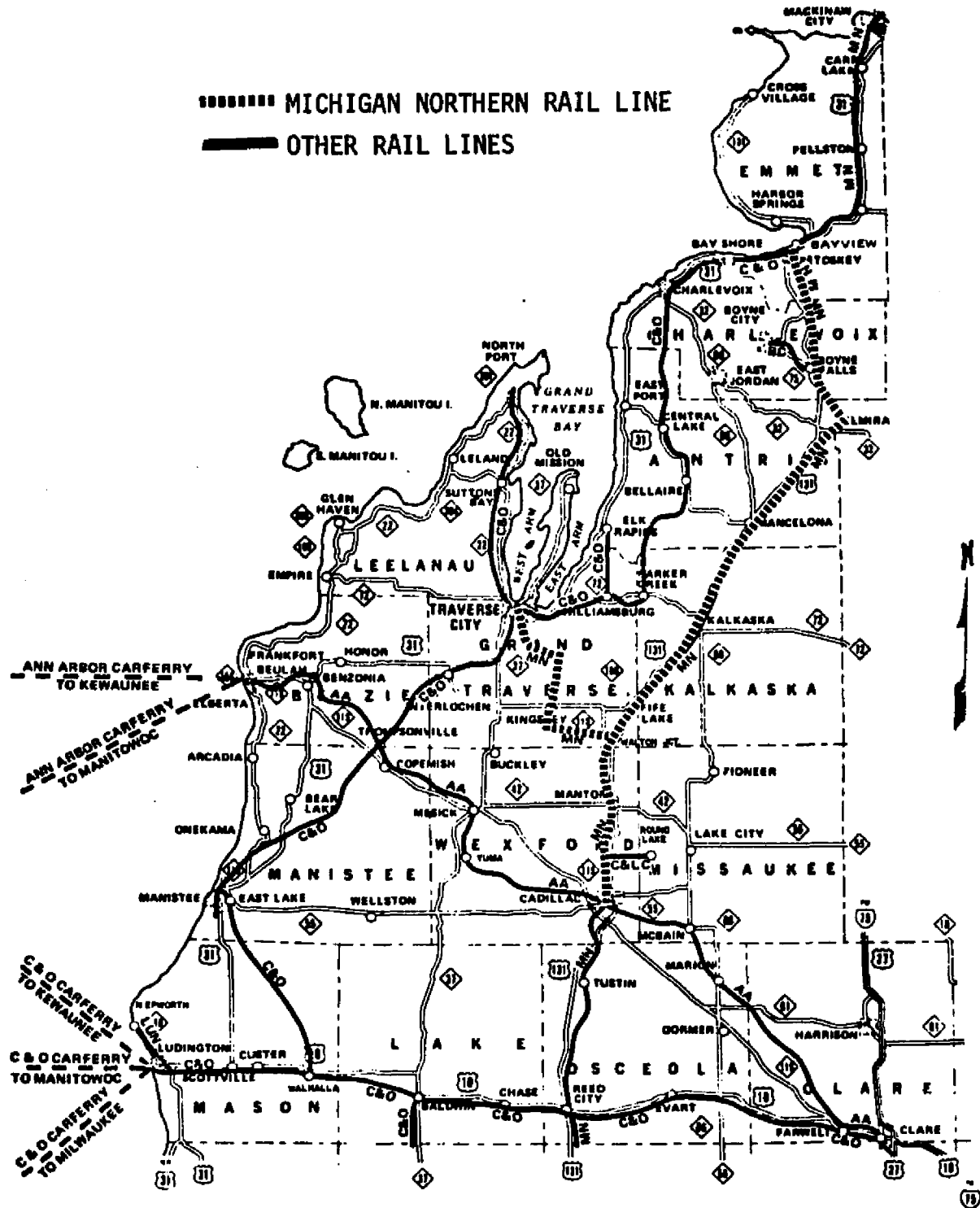


FIGURE 5-3

MICHIGAN NORTHERN RAIL LINE
 Cadillac-Traverse City-Petoskey

TABLE 5-3

**C.O.-NORTHWEST RAIL LINE SEGMENT ANALYSIS: 1973 CARLOADS
OPERATING REVENUES AND COSTS, NET OPERATING INCOME**

LINE SEGMENTS- STATIONS	CARLOADS	%	OPERATING REVENUES	%	OPERATING COSTS	%	NET OPERATING REVENUES
MANISTEE-PETOSKEY	4,253	100	\$747,869	100	\$803,339	100	(\$55,470)
MANISTEE-THOMPSONVILLE	662	13	97,223	13	160,668	20	(63,445)
THOMPSONVILLE-GRAWN	148	3	14,957	2	80,334	10	(65,377)
GRAWN-PETOSKEY	3,590	82	635,689	85	562,337	70	73,352
THOMPSONVILLE-BATES	1,744	41	284,190	38	241,002	30	43,188
GRAWN-BATES	1,744	41	284,190	38	170,688	21	113,522
PETOSKEY-CHARLEVOIX	1,531	36	269,233	36	120,501	15	148,732

(negative)

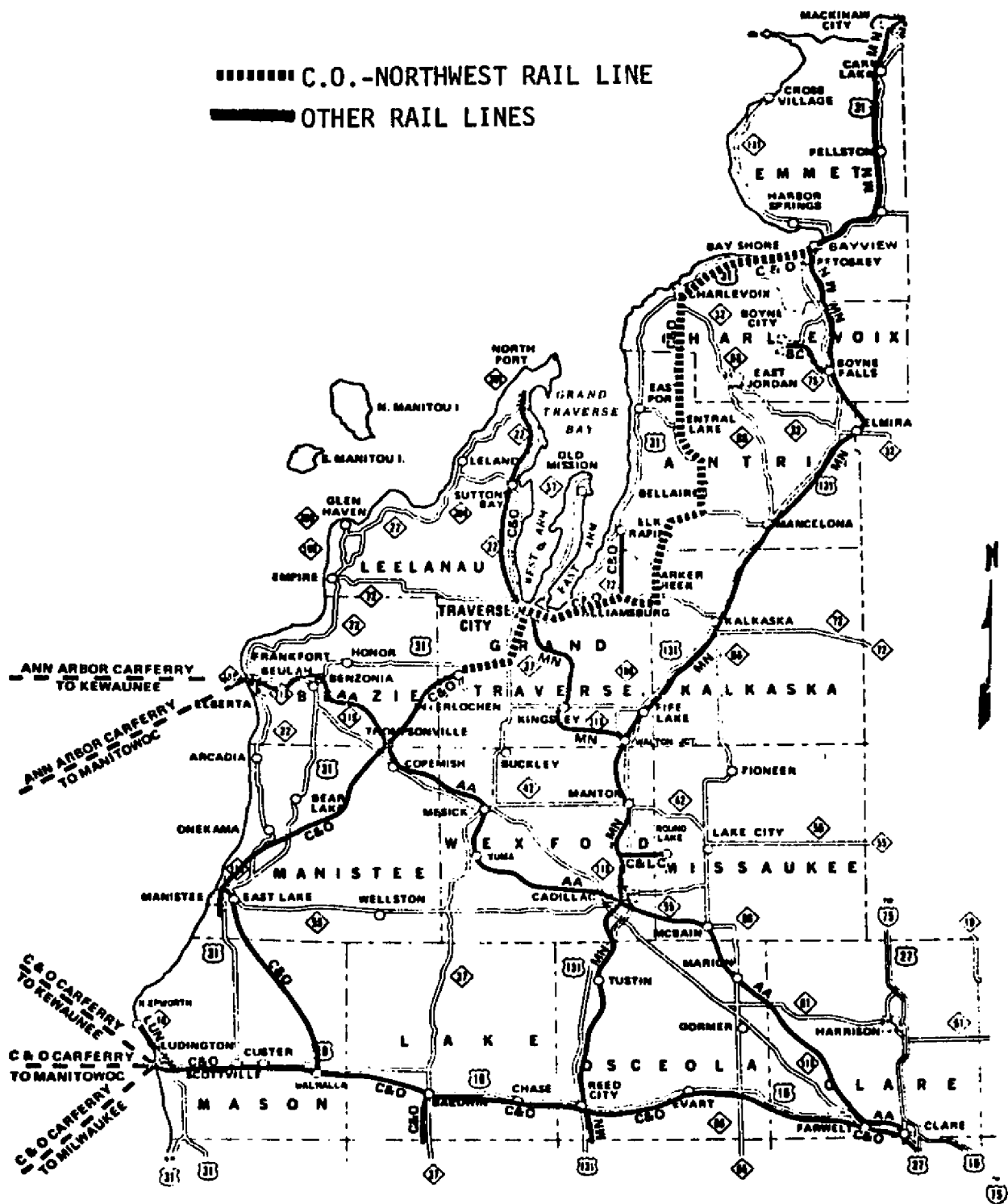


FIGURE 5-4

C.O.-NORTHWEST RAIL LINE
 Grawn-Petoskey

Analysis of Alternative Line Combinations. The purpose of this section is to consider alternative combinations of the Ann Arbor, Michigan Northern, and C.O.-Northwest lines in a regional system context. Basically, the procedure is to link the three lines together into a system. Then by deleting various segments of the Michigan Northern and/ or the C.O.-Northwest, a number of regional rail systems can be considered. The purpose for doing this is to see if one system (combination of line segments) looks more promising than another.

Five alternative systems will be examined. For each system, a map is provided plus a table with the following selected operating and financial characteristics: miles, carloads, and tons; operating revenues, operating costs, and net operating income; dollar and percent increase in operating revenues to break even; and, dollar and percent decreases in operating costs to break even.

For the purposes of this analysis it is assumed that two railroads will be in operation: One railroad operating the Ann Arbor line and the second railroad operating the Michigan Northern/ C.O.-Northwest segments. The two railroads will have interchange points at Cadillac and/or Thompsonville.

It is also assumed that present levels of unused train-unit capacity in Ann Arbor and Michigan Northern operations will permit the addition of C.O.-Northwest traffic without the need to run additional train-units. The operation of additional train-units

would alter the present operating costs for the three railroads. To determine what the new operating costs might be is beyond the scope of this research effort.

Alternative Regional Rail Subsystems. The following pages present the five alternative rail systems.

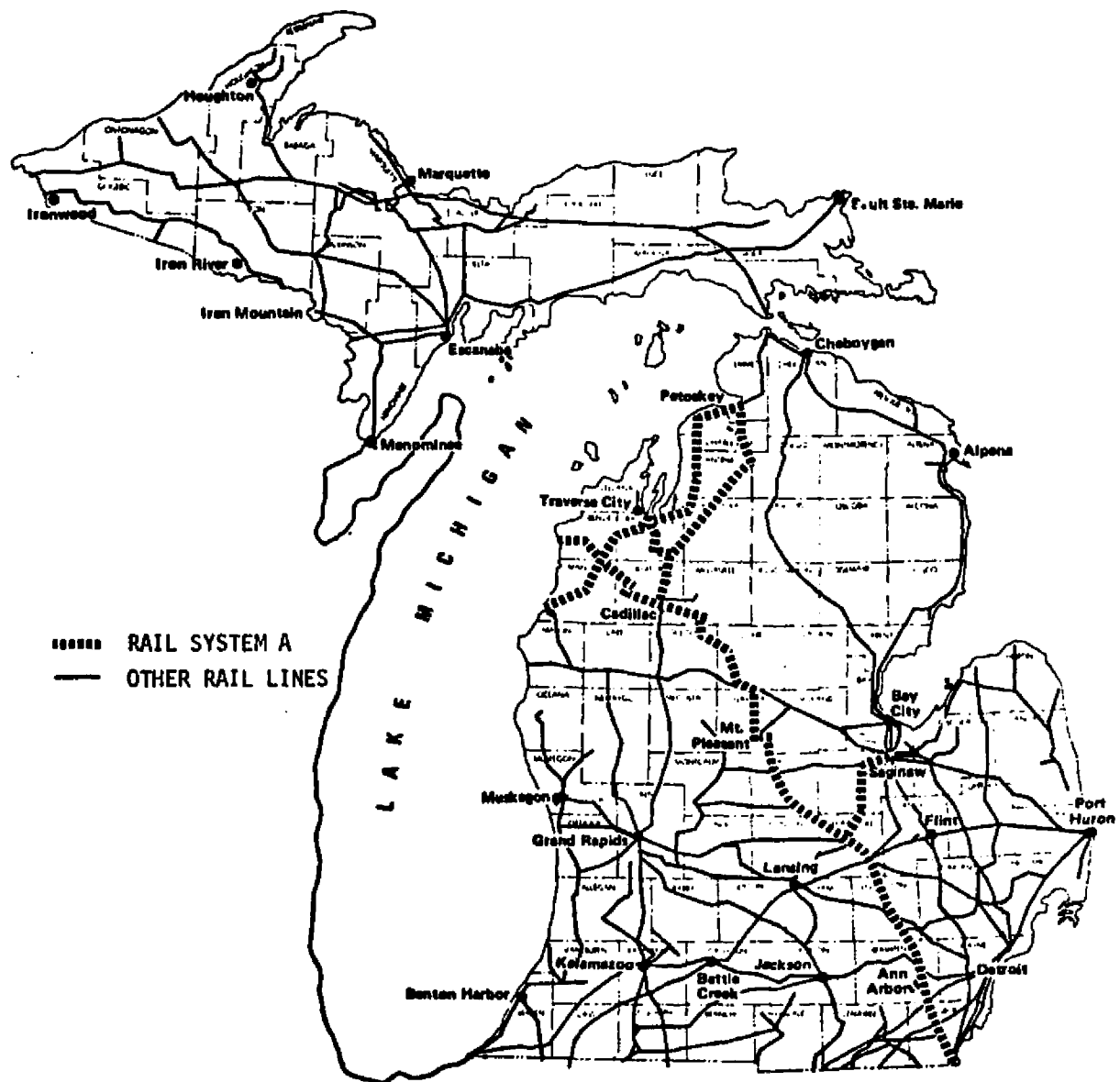


FIGURE 5-5

SYSTEM A

Toledo-Frankfort, Owosso-Saginaw;
Cadillac-Traverse City-Petoskey
Manistee-Petoskey

TABLE 5-4

SYSTEM A

Toledo-Frankfort, Owosso-Saginaw;
 Cadillac-Traverse City-Petoskey;
 Manistee-Petoskey

Miles	583
Carloads	28,305
Tons	1,668,515
Operating Revenues	\$5,058,838
Operating Costs	\$8,307,695
Net Operating Income	(\$3,248,857)
Dollar Increase in Operating Revenues to Break Even	\$3,248,857
Percent Increase in Operating Revenues to Break Even	64%
Dollar Decrease in Operating Costs to Break Even	\$3,248,857
Percent Decrease in Operating Costs to Break Even	38%

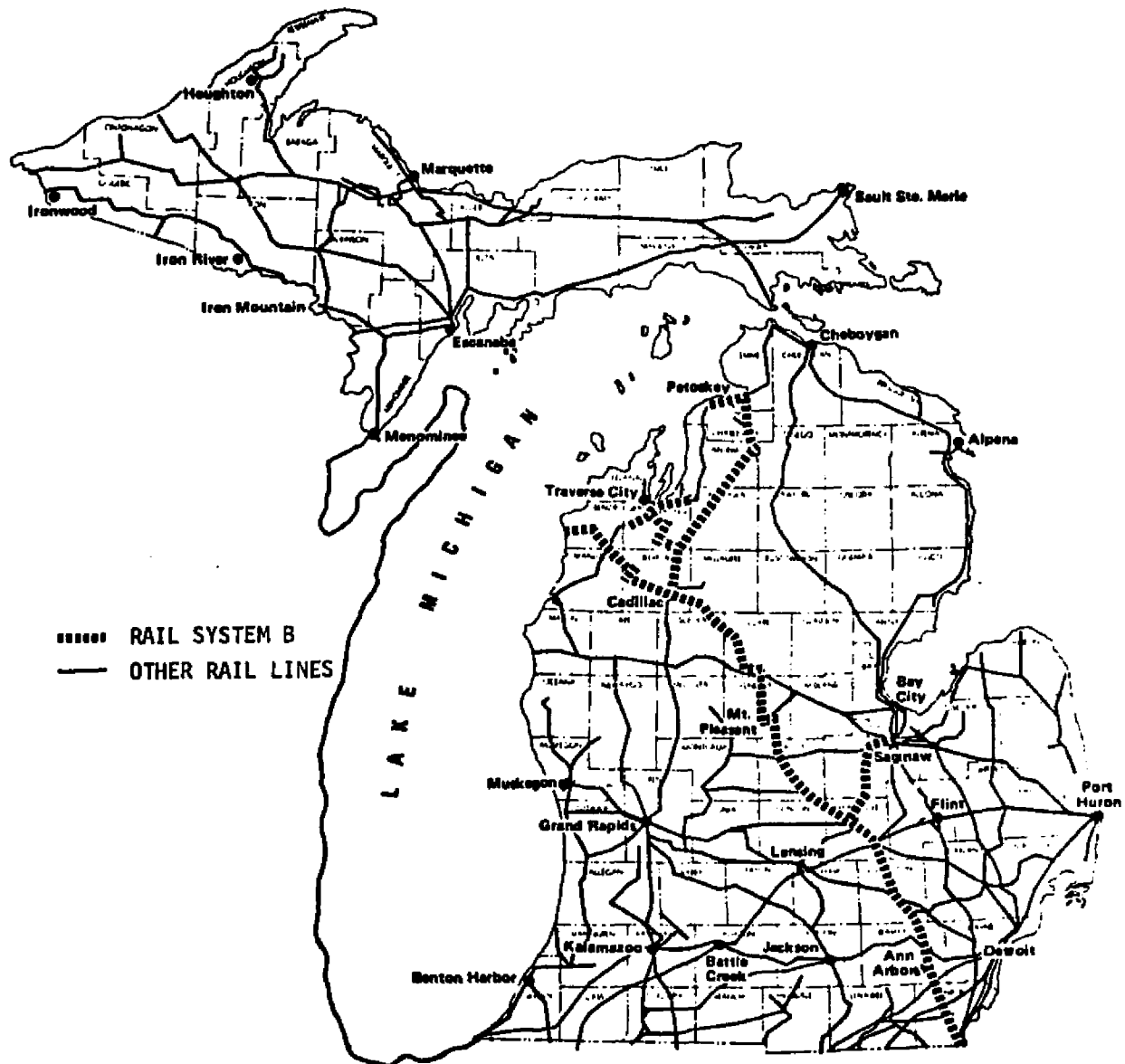


FIGURE 5-6

SYSTEM B

Toledo-Frankfort, Owosso-Saginaw;
 Cadillac-Traverse City-Petoskey
 Grawn-Bates, Charlevoix-Petoskey

TABLE 5-5

SYSTEM B

Toledo-Frankfort, Owosso-Saginaw;
 Cadillac-Traverse City;
 Grawn-Bates, Charlevoix-Petoskey

Miles	462
Carloads	27,327
Tons	1,603,395
Operating Revenues	\$4,864,392
Operating Costs	\$7,775,525
Net Operating Income	(\$2,931,133)
Dollar Increase in Operating Revenues to Break Even	\$2,931,133
Percent Increase in Operating Revenues to Break Even	60%
Dollar Decrease in Operating Costs to Break Even	\$2,931,133
Percent Decrease in Operating Costs to Break Even	38%

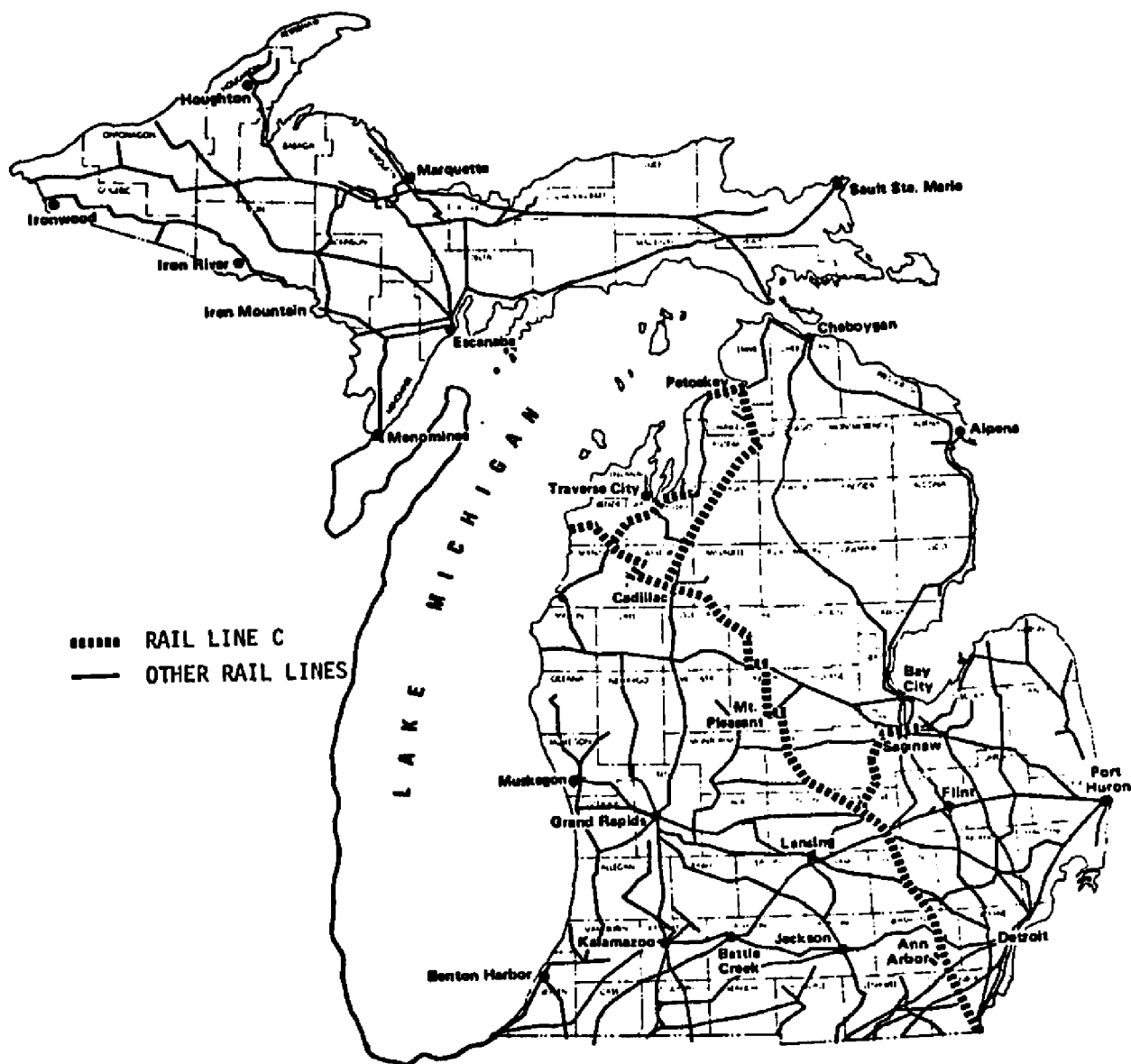


FIGURE 5-7

SYSTEM C

Toledo-Frankfort, Owosso-Saginaw
 Cadillac-Petoskey-Charlevoix;
 Thompsonville-Bates

TABLE 5-6
SYSTEM C
Toledo-Frankfort, Owosso-Saginaw;
Cadillac-Petoskey-Charlevoix;
Thompsonville-Bates

Miles	488
Carloads	27,312
Tons	1,602,720
Operating Revenues	\$4,918,467
Operating Costs	\$7,909,934
Net Operating Income	(\$2,991,467)
Dollar Increase in Operating Revenues to Break Even	\$2,991,467
Percent Increase in Operating Revenues to Break Even	60%
Dollar Decrease in Operating Costs to Break Even	\$2,991,467
Percent Decrease in Operating Costs to Break Even	38%

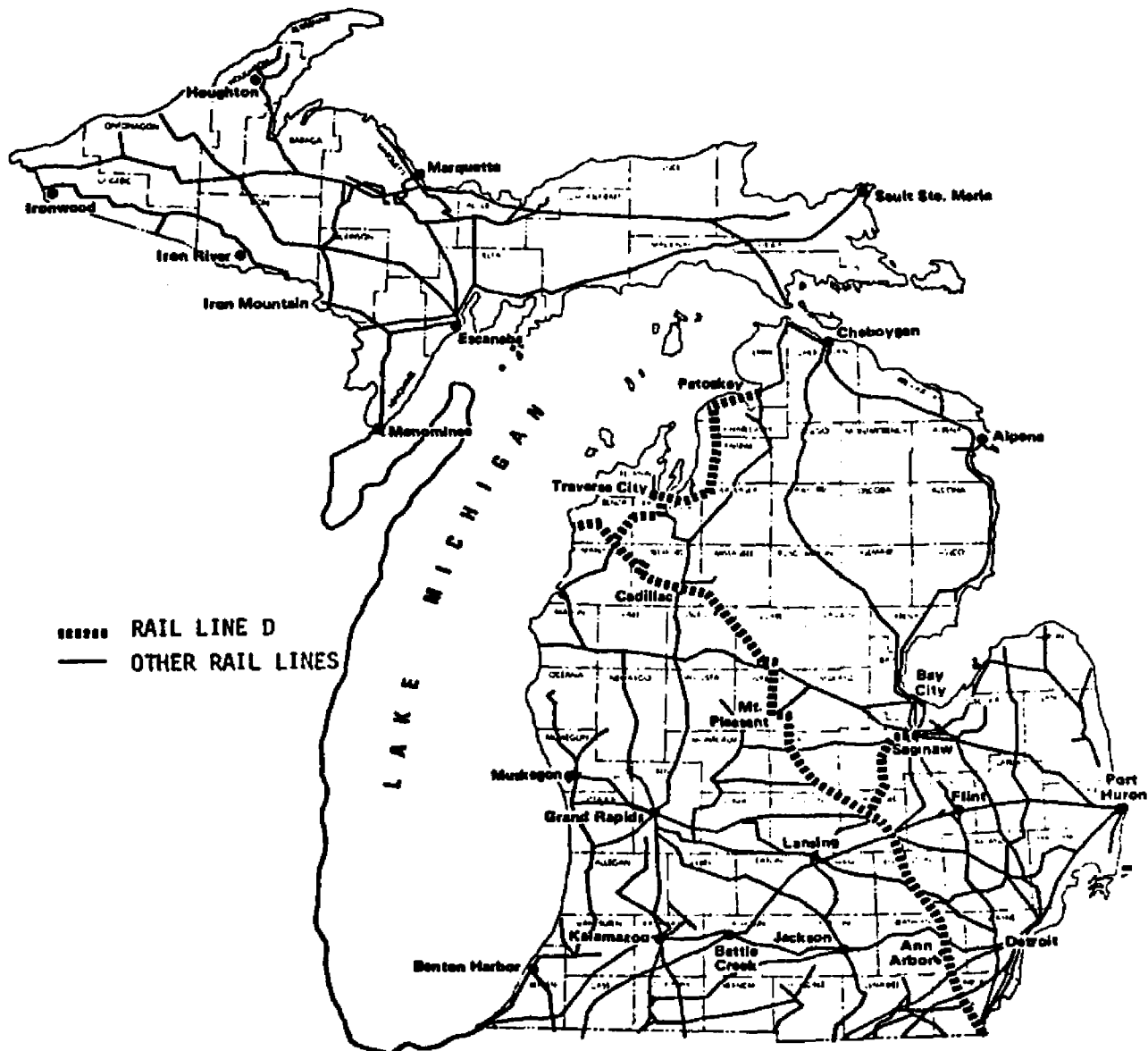


FIGURE 5-8

SYSTEM D
Toledo-Frankfort, Owosso-Saginaw;
Thompsonville-Petoskey

TABLE 5-7
SYSTEM D
Toledo-Frankfort, Owosso-Saginaw;
Thompsonville-Petoskey

Miles	439
Carloads	26,616
Tons	1,554,374
Operating Revenues	\$4,961,615
Operating Costs	\$8,147,027
Net Operating Income	(\$3,185,412)
Dollar Increase in Operating Revenues to Break Even	\$3,185,412
Percent Increase in Operating Revenues to Break Even	64%
Dollar Decrease in Operating Costs to Break Even	\$3,185,412
Percent Decrease in Operating Costs to Break Even	39%

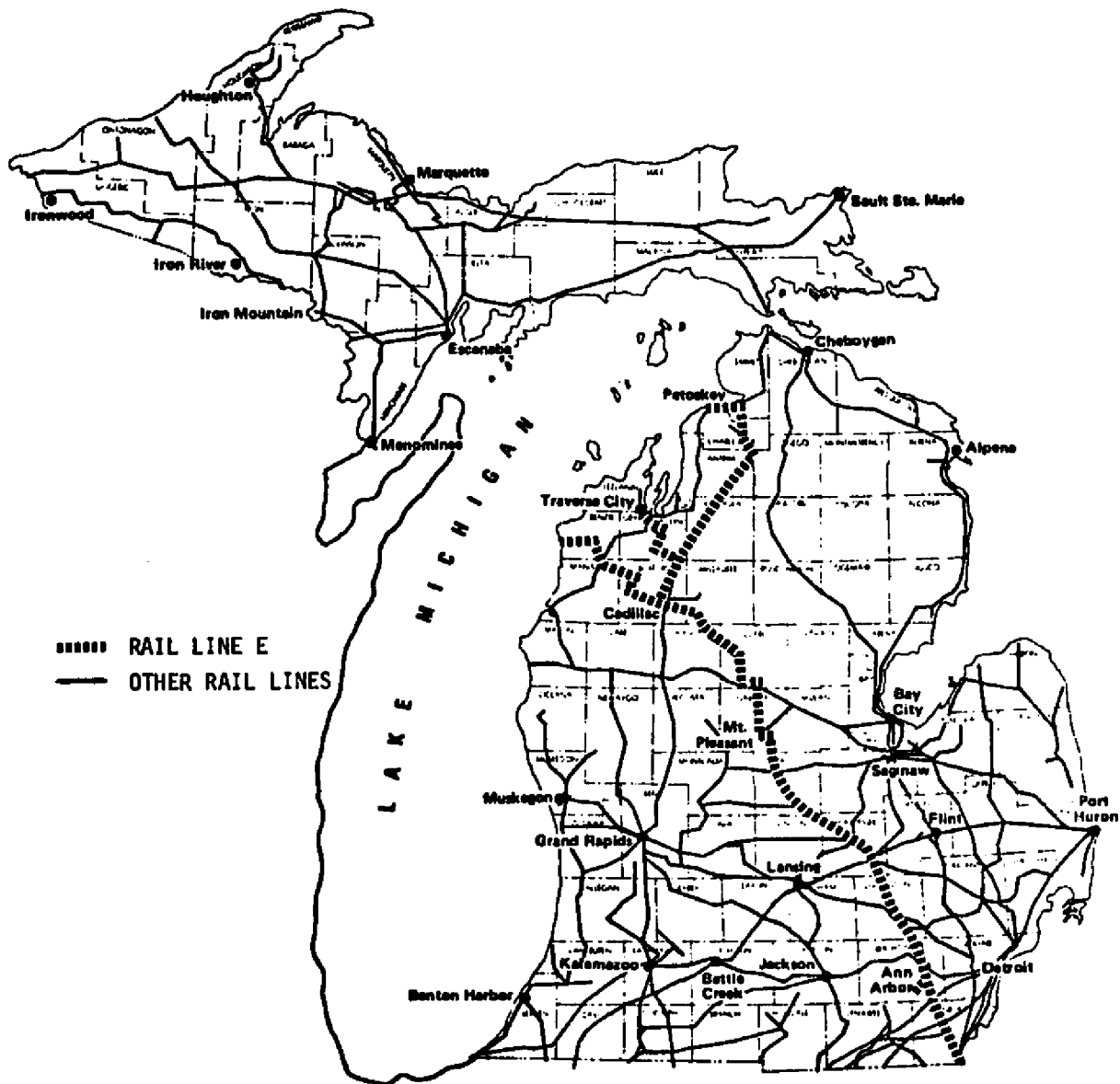


FIGURE 5-9

SYSTEM E

Toledo-Frankfort, Owosso-Saginaw;
Cadillac-Traverse City-Petoskey-Charlevoix

TABLE 5-8

SYSTEM E

Toledo-Frankfort, Owosso-Saginaw;
 Cadillac-Traverse City-Petoskey-Charlevoix

Miles	443
Carloads	25,583
Tons	1,481,000
Operating Revenues	\$4,580,202
Operating Costs	\$7,624,857
Net Operating Income	(\$3,044,655)
Dollar Increase in Operating Revenues to Break Even	\$3,044,655
Percent Increase in Operating Revenues to Break Even	66%
Dollar Decrease in Operating Costs to Break Even	\$3,044,655
Percent Decrease in Operating Costs to Break Even	40%

Because the Ann Arbor operating revenue and cost figures overwhelm the Michigan Northern and C.O.-Northwest figures (see Table 5-1), analysis of alternative regional rail subsystems involving the three lines will be done in two steps. First, Table 5-9 provides a financial comparison of five Michigan Northern-C.O.-Northwest combinations. Next, in Table 5-10, the Ann Arbor is linked to the five Michigan Northern--C.O.-Northwest subsystems and evaluated again in terms of net operating revenues.

Data presented in Table 5-9 indicates that linking the Grawn to Bates and Charlevoix to Petoskey segments of the C.O.-Northwest to the Michigan Northern improves the financial viability of the Michigan Northern substantially. Without the added traffic from the C.O.-Northwest segments the Michigan Northern would sustain a net operating loss of \$306,008, or \$240 per carload (see Table 5-2). By linking the C.O.-Northwest segments with the Michigan Northern, however, a regional rail subsystem is formed that nearly breaks even--losing only \$43,754, or about \$10 per carload (see System B, Table 5-9).

The figures presented in Table 5-10 indicate that the five regional rail subsystems, involving the Ann Arbor, Michigan Northern and C.O.-Northwest, are nearly equal in terms of their net operating income; all five subsystems lost about \$3,000,000. Relative to the four other subsystems, System B shows the greatest promise (see Table 5-10).

TABLE 5-9

COMPARISON OF THE FINANCIAL STATUS OF ALTERNATIVE REGIONAL RAIL SYSTEMS
MICHIGAN NORTHERN AND C.O.-NORTHWEST

REGIONAL RAIL SUBSYSTEM CHARACTERISTICS	SYSTEM A	SYSTEM B	SYSTEM C	SYSTEM D	SYSTEM E
MILES	250	129	155	106	110
CARLOADS	5,527	4,549	4,434	4,865	2,705
NET OPERATING INCOME	(\$361,478)	(\$ 43,754)	(\$104,088)	(\$298,033)	(\$157,276)
PERCENT INCREASE IN OPERATING REVENUES TO BREAK EVEN	38%	6%	19%	35%	33%
PERCENT DECREASE IN OPERATING COSTS TO BREAK EVEN	28%	6%	29%	26%	25%

(NEGATIVE)

SYSTEM A - CADILLAC-TRAVERSE CITY-PETOSKEY; MANISTEE-PETOSKEY

SYSTEM B - CADILLAC-TRAVERSE CITY-PETOSKEY; GRAWN-BATES, PETOSKEY-CHARLEVOIX

SYSTEM C - CADILLAC-PETOSKEY-CHARLEVOIX; THOMPSONVILLE-BATES

SYSTEM D - THOMPSONVILLE-PETOSKEY

SYSTEM E - CADILLAC-TRAVERSE CITY-PETOSKEY-CHARLEVOIX

TABLE 5-10

COMPARISON OF THE FINANCIAL STATUS OF ALTERNATIVE REGIONAL RAIL SYSTEMS
ANN ARBOR, MICHIGAN NORTHERN, AND C.O.-NORTHWEST COMBINED

REGIONAL RAIL SUBSYSTEM CHARACTERISTICS	SYSTEM A	SYSTEM B	SYSTEM C	SYSTEM D	SYSTEM E
MILES	583	462	488	439	443
CARLOADS	28,305	27,327	27,317	26,616	25,583
NET OPERATING INCOME	(\$3,248,857)	(\$2,931,133)	(\$2,991,467)	(\$3,185,412)	(\$3,044,655)
PERCENT INCREASE IN OPERATING REVENUES TO BREAK EVEN	64%	60%	62%	64%	66%
PERCENT DECREASE IN OPERATING COSTS TO BREAK EVEN	39%	38%	38%	39%	40%

(NEGATIVE)

SYSTEM A - TOLEDO-FRANKFORT, OWOSSO-SAGINAW; CADILLAC-TRAVERSE CITY-PETOSKEY; MANISTEE-PETOSKEY

SYSTEM B - TOLEDO-FRANKFORT, OWOSSO-SAGINAW; CADILLAC-TRAVERSE CITY-PETOSKEY; GRAWN-BATES, PETOSKEY-CHARLEVOIX

SYSTEM C - TOLEDO-FRANKFORT, OWOSSO-SAGINAW; CADILLAC-PETOSKEY-CHARLEVOIX; THOMPSONVILLE-BATES

SYSTEM D - TOLEDO-FRANKFORT, OWOSSO-SAGINAW; THOMPSONVILLE-BATES

SYSTEM E - TOLEDO-FRANKFORT, OWOSSO-SAGINAW; CADILLAC-TRAVERSE CITY-PETOSKEY-CHARLEVOIX

Summary

Sequential link analysis of the Michigan Northern and C.O.-Northwest lines suggest a number of tentative conclusions:

1. The viability of the Michigan Northern would be improved by discontinuing service on the Grand Rapids to Cadillac and Petoskey to Mackinaw City segments (see Table 5-2).
2. The Grand Rapids to Cedar Springs segment of the Michigan Northern would probably be viable if operated as a short line railroad (see Table 5-2).
3. The C.O.-Northwest could be operated profitably if service were discontinued on the Manistee to Grawn segment (see Table 5-3).
4. The viability of the Michigan Northern would be improved substantially if traffic from the C.O.-Northwest segments (Grawn to Bates and Charlevoix to Petoskey) was routed over the Michigan Northern (see Table 5-9).
5. Alternative rail subsystems linking segments of the Michigan Northern and C.O.-Northwest to the Ann Arbor might improve the long-term chances for viable rail service to the areas of the state served by the three railroads (see Tables 5-1 and 5-10).

CHAPTER SIX

IMPROVING THE VIABILITY OF SELECTED MICHIGAN RAIL LINES: SUMMARY, RECOMMENDATIONS, AND FURTHER RESEARCH

The general goal of this research effort has been to identify initiatives that Michigan transportation officials and planners can consider for improving the long-term viability of three Michigan rail lines: the Ann Arbor, the Michigan Northern, and the C.O.-Northwest. To achieve this goal, three specific research tasks were undertaken.

1. Identification of factors that affect the financial viability of rail lines in general.
2. Determination of the financial and operating status of the Ann Arbor, the Michigan Northern, and the C.O.-Northwest rail lines. This determination is followed by an analysis of the opportunities for improving the financial viability of the three Michigan rail lines.
3. Specification of programs and policies that Michigan transportation officials and planners can consider for improving the long-term viability of the Ann Arbor, Michigan Northern, and C.O.-Northwest rail lines.

An institutions, behavior, and performance analytical framework is employed in this research effort. The analytical framework can be briefly described as follows. Institutions are the rules and regulations, which along with physical constraints, define the range of choices (actions) open to individuals and groups. The procedures individuals and groups employ for selecting among the choices open to them, and their choices, is called "behavior".

The flow of consequences following from individual and group choice-making is defined as "performance".

It was noted that improving performance, in many situations, requires modifications of existing institutions to encourage and reward alternative behavior by individuals and groups. In this regard, special attention was given to the recent work of Hirschman and Olson on the relationship between improved firm and organization performance and alternative modes of individual and group behavior.

The research effort was placed in the context of the institutions, behavior, and performance framework in the following way. The viability of railroad operations in general, and a certain rail line in particular, was hypothesized as determined by the outcome of railroads and rail users acting individually and jointly in both production and consumption of rail service. Further, the range of choices available to railroads and rail users for the production and consumption of service was hypothesized as determined by federal and state legislation, statutes and regulations, and market conditions. Finally, it was hypothesized that improving the viability of a rail line may be achieved by encouraging railroads and rail users to alter their individual and joint behavior. The change in behavior may be accomplished within the framework of existing institutions or it may require their modification. Analyses of railroad operations in the U.S. and Michigan, discussed in Chapters Two, Three, and Four, tend to support these hypotheses.

With the above discussion as background, the remainder of this Chapter is divided into three sections: summary, recommendations, and further research needed. The summary is divided into two parts. The first part summarizes the major factors and key relationships that influence the viability of railroad operations in general. This is followed by a review of the financial and operating status of the Ann Arbor, the Michigan Northern, and the C.O.-Northwest rail line operations. Opportunities for improvement in the financial viability of the three rail lines is also noted.

Specific recommendations for improving the financial viability of the three Michigan lines are presented in section two. Finally, areas of further research are discussed in section three.

SUMMARY

Major Factors and Key Relationships Affecting Railroad Operations

In Chapter Two a number of factors that have contributed to the financial problems of many railroads were discussed. Attention was also given to railroad-rail user dynamics and their impact on branch line viability. These factors and relationships are summarized below.

Changing Demand for Transportation Services. Freight transportation is a factor of production to the firm. It is not wanted in its own right, but only for the service it provides in the

production process. Thus, the demand for transportation service is a derived demand.

Although the overall elasticity of demand for transportation is probably low, cross elasticities between modes are probably high. The demand for a given transport mode will depend on the rate and service characteristics (speed, reliability, shipment size, etc.) offered by that mode and all competing modes. The nature of demand will also be influenced by the type of commodity being shipped. Since commodities possess different characteristics, they are often sensitive to different aspects of transport costs. For example, a particular commodity's elasticity of demand with respect to price and service characteristics will vary according to the value, density, volume, fragility, or perishability of the commodity.

As the U.S. economy has matured, changes in the location of population, economic activity, technology, and consumption patterns have altered the intercity freight market. Traffic in manufactures is growing relative to bulk commodities. The value of manufactures per unit of freight is, in general, greater than that for non-manufactured goods because of greater amounts of labor and capital inputs used in their production. And, as the amount of working capital tied-up in manufactured goods rise, there is a strong tendency for firms to opt for speedier, more reliable delivery as a way to control inventory costs, stock-outs, and loss of customer sales. Increasingly, products are competing in the market place on the basis of quality or service. Consequently, the demand for freight transportation has become more service-elastic and less price-elastic.

Intermodal Competition for Manufactures. Motor carriers are the railroads' principal competitor for traffic in manufactures. Difference in modal technologies and regulation tend to give trucks the competitive advantage in the movement of manufactures.

The difference in rail and truck technologies affects their comparative costs in transporting commodities. This point can be better understood by separating rail and truck costs on the basis of terminal operations and line-haul operations. Because railroad terminal operations are considerably more complex than those of trucking, they tend to be more expensive for all but the largest shipments. Although trucks perform the same basic terminal operations as rail (pick-up and delivery, handling and billing) they have the advantage of being able to go directly to their points of destination. In contrast, a loaded rail car must be switched onto the proper train at its origin, perhaps be switched a number of times at intermediate yards, and finally switched at its destination. In addition, railroads must maintain spur lines to shipper sidings.

While terminal costs are expensive relative to those experienced by trucks, rail line-haul costs are relatively cheap. The capacity of an average boxcar for moving manufactures is 50 tons; trains consisting of 50 to 150 boxcars are common. In contrast, most trucks have a maximum capacity of 20 or 30 tons and do not have the basic economies associated with large and long hauls that railroads do.

Trucks, however, have a decided inventory advantage over railroads. Since the minimum shipment size with the railroads is larger than with trucks, railroads force the firm to hold larger inventories. And since inventories tie-up working capital, railroads increase inventory costs. In addition, to the extent rail transit time is slower and less reliable than truck service, railroads increase the firm's inventory costs.

Although railroads can move many manufactured goods at lower cost over long distances than trucks, the rate structure does not reflect this. The Interstate Commerce Commission's desire to maintain the traditional rate structure established at the turn of the century has kept rail and truck rates on comparable levels. And, for most manufactures, if truck and rail rates are kept at comparable levels, the traffic will usually go by the trucks which offer better service at the same cost.

Railroad Cooperation and Competition. The quality of rail service that firms receive depends upon how well railroads cooperate with each other in the movement of freight shipments. It has been estimated that one-half of all rail shipments, accounting for 70 percent of revenue ton-miles (1973), travel over two or more railroads to reach their destination. This (interline) traffic is important to the welfare of virtually every railroad; it creates a high level of interdependence in the railroad industry and demands a high degree of cooperation and coordination among rail carriers.

The situation is complicated by the fact that railroads also compete with one another. They compete both to originate traffic and to share in interline traffic. This competition undermines the

cooperation and coordination their interdependence requires. On interline movements, many railroads promote their welfare at the expense of other railroads and the system as a whole. The profit motive impels individual railroads to perform their part of the interline movement in whatever way minimizes the costs to themselves, with only slight regard for the effect on the quality of service to the rail user, or long-run costs.

Railroad Costs, Revenues, and Cash-Flow Problems. Due to their large fixed cost component, railroad costs do not vary much over the broad range of change in traffic levels; railroad revenues, in contrast, do vary with changes in traffic levels. One consequence of this is that fluctuations in the economy often create cash-flow problems for railroads.

It is common practice in the industry for railroads to postpone costs in the short run to stabilize their cash flow when revenues fluctuate widely. Deferring maintenance and rehabilitation of track, roadbeds, and other structures, and equipment in lean years and playing "catch-up" in good years is a procedure used by many railroads to stabilize their financial position.

Postponing rehabilitation and maintenance of rail line facilities often results in substandard track and equipment conditions. This results in slower transit time, derailments, shipment damages, and generally unreliable rail service. Reducing train speed due to poor track conditions also means higher labor and fuel costs. Faced with higher operating costs, the next step for many railroads is to reduce the frequency of service offered, thereby reducing operating costs.

Railroad and Rail User Behavior and Counter-Behavior. Faced with unreliable rail service, many users abandon rail for another mode, usually truck. Although the published freight rates may be higher for the trucks, their effective price compared to railroads is less when the costs of unreliable service are considered. Other users protest declines in rail service quality by threatening to abandon their use of the service if service does not improve. When service fails to improve, they shift to other modes.

Once a firm makes the decision to shift from rail service to truck service, it may be difficult for the railroad to recapture the business. The shift to trucks may require the firm to invest in new facilities, alter production practices, and even to possibly change markets. Such investments represent fixed inputs (assets) and the firm can only justify, economically, reverting to rail service if the expected benefits (lower transportation costs, access to new markets, etc.) outweigh the costs.

For the railroad, the loss of rail users results in a reduction in revenues with almost no reduction in costs due to its cost structure (of high fixed-costs and relatively small variable costs). The decrease in revenues may encourage the railroad to pursue additional cost-saving behavior (e.g., reducing the frequency of service even more or cutting overhead costs by reducing the number of freight agents on the line, or eliminating the sales representative position).

The rail line becomes enmeshed in a vicious circle of poor service, declining traffic, rising unit costs, cost-saving practices, poor service, etc. that spirals relentlessly toward the point

that the remaining traffic cannot cover the railroad's cost of operation and complete abandonment of service takes place.

Strategies for Retaining and Improving Branch Line Service. Over the past two or three decades, a combination of factors has rendered thousands of branch line miles uneconomical to operate; and the viability of many more branch lines is in doubt. Many branch lines were originally constructed to tap areas rich in natural resources (e.g., minerals, timber, and agricultural products); as the resources of these areas have been depleted, many railroads have found the lines uneconomical to operate. In addition, population shifts from rural to urban areas, changing consumption patterns and the rise of intermodal competition, particularly truck, have combined to reduce the demand for rail freight service by 60 to 70 percent in many rural areas.

Rail service on many branch lines about to be abandoned has been retained and in some cases improved, through various private and public-private efforts. For example, rail users have provided railroads with operating subsidies to retain service and have, on occasion, also helped to finance branch line rehabilitation and modernization projects. In other situations, government acting alone or in cooperation with rail users and the railroad has financed operating subsidies and rehabilitation projects.

Since rail service possesses characteristics of a collective-consumption service, volunteer rail user efforts to retain and improve service on a line may fail. Failure may be the result of "free rider" behavior or high organizational costs that frustrate

individual efforts to get organized. In such situations, rail users may turn to government for help. Some states and municipalities, for example, have purchased branch line properties about to be abandoned to preserve the right-of-way and to retain the option for rail service in the future. After the purchase has been made, the governmental unit either becomes the operator or leases the railroad properties to an independent short line railroad.

Many rural areas are served by two or more branch lines. Low volume on the lines has led the railroads to reduce their costs by deferring maintenance on track and other structures. As a result, the productive base of many rural rail systems--the physical plant--has gradually deteriorated to the point where major rehabilitation and modernization is needed.

Where investment in rehabilitation and modernization of two or three branch lines in a given area cannot be justified, it may be justified for one. Consolidation of freight traffic from two or three lines onto one line may allow the branch line railroad to realize the scale economies inherent in its operation. The consolidation of traffic lowers the railroad's operating costs, improves its financial position, and makes it unnecessary to adopt cost-saving procedures that led to poor rail service.

Rail User Size and Rail Service Quality. Large volume rail users tend to have fewer problems in obtaining rail cars or with slow and unreliable rail service than do the smaller rail users. There are two reasons for this: (1) large volume rail users tend to use service on a fairly constant and predictable basis, and

(2) large volume rail users often represent a substantial portion of the railroads' operating revenue.

Railroads follow operating procedures (car classification, blocking, scheduling, routing, switching, interchanging and so on) designed to reduce their per-unit (ton-mile) costs for handling freight shipments--interline and local. The fairly constant and predictable demand of large volume rail users allows the railroads to plan their service activities so as to achieve economies of scale in handling and equipment use. In contrast, small volume rail users with infrequent demand for rail service can be a source of expense to the railroads. To accommodate the service desires of small, infrequent rail users (e.g., faster transit time, increased frequency of service) oftentimes requires that railroads operate train-units substantially below their capacity; this results in high per-unit operating costs.

Rail Users' Association, Quality of Rail Service and Branch Line Viability. A rail users' association, providing a framework for group action, can often achieve for its members what is impossible on an individual basis. The association, for example, can hire a traffic manager to provide members with information on alternative rates, routes, and interline railroads. The association, through its traffic manager, may also be able to bargain effectively with interline railroads for improved service by offering to route its members' shipments over their line.

The rail users' association may be able to contribute to the increased viability of their branch line by working closely with the branch line railroad on problems of mutual concern--frequency

of service, provision of freight cars, and maintenance and rehabilitation of the line and structures.

Some Concluding Points. Over the years, regulation has restricted the railroads' ability to adjust their rates to reflect changing market conditions and demand for rail service. As a consequence, railroads have adopted various operating procedures (for interline and local movements) designed to minimize their individual costs. The operating procedures have sought to take advantage of scale economies inherent in railroad technology. From the rail users' viewpoint, the operating procedures developed by the railroads favor the large volume rail users. And, as a result, large volume rail users consistently receive better rail service than users with smaller volume and infrequent use.

Smallness does not necessarily preclude a rail user from receiving improved rail service, however. A group of small volume rail users, for example, coordinating their rail shipments through a rail users' association may achieve the status of a large volume rail user; the association may be able to bargain effectively for improved rail service for its members, on both their interline and local shipments. In addition, the viability of a rail line operation may be improved through the coordinated efforts of the rail users through their association and the railroad.

Even though rail user group efforts may lead to improved rail service, etc., there is no guarantee that such group action will

occur voluntarily. If the nature of the group effort involves subsidizing the continued operation or rail service and/or rehabilitating track and equipment, the incentive to be a "free rider" may discourage many rail users from participating. On the other hand, many rail users may be willing to participate in an already established and proven organization. Many may not be willing, however, to bear the risk and the initial organizational costs of starting the users' association. In such cases, where the ability of those rail users willing to bear the initial organizational costs fall short, government may be turned to for help.

Ann Arbor, Michigan Northern, and C.O.-Northwest Rail Operations

In Chapters Three, Four and Five, consideration was given to the financial status of the Ann Arbor, Michigan Northern, and C.O.-Northwest lines. Opportunities for improving the viability of the three lines were also examined. The results of these efforts are summarized below.

Financial Operation Status of the Ann Arbor, Michigan Northern, and C.O.-Northwest Rail Lines. Using the most recent set of operating revenue and cost data available (1973), all three of the Michigan railroads were found to be sustaining operating deficits. The losses for the Ann Arbor and Michigan Northern were quite large--\$3,358,087 and \$666,535, respectively; losses on the C.O.-Northwest were considerably less--\$55,470.

The Ann Arbor was found to be primarily an originator of freight traffic (based on total number of carloads). Although the Ann Arbor line operated at a deficit in 1973, the southern third of the line was profitable; the Owosso to Toledo segment generated over 70 percent of the carloads and 60 percent of the gross revenues for the entire line. The Michigan Northern was found to be primarily a terminator of freight with traffic clustered around commercial centers on the line--Grand Rapids, Cadillac, Traverse City, and Petoskey. The C.O.-Northwest traffic split fairly evenly between originating and terminating shipments. The C.O.-Northwest traffic clustered around Traverse City and the Charlevoix-Petoskey area.

Freight shipments on the three lines were found to be fairly concentrated in a few commodity groups; less than 25 percent of the commodity groups on each line accounted for over 80 percent of total carloads, tons, and gross carrier revenues. In addition, for the rail users on the three lines, the midwest constituted the primary market for their shipments--inbound and outbound.

Opportunities for Increasing Rail Use Levels on the Ann Arbor and Michigan Northern Rail Lines. Interviews with 76 Ann Arbor and 68 Michigan Northern rail users revealed that improvements in rail service would have caused many of them to increase their use of rail service in 1976. For the Ann Arbor, it was estimated that improved rail service would have led to increases of 16, 24, and 23 percent in carloads, tons, and gross carrier revenues, respectively, in 1976. Increases on the Michigan Northern were estimated to be slightly higher with increases of 27, 22 and 38 percent in carloads, tons, and carrier gross revenues, respectively.

Nevertheless, even if rail service was improved and rail users on the two lines increased their use of rail service as indicated, it was found that the Ann Arbor and Michigan Northern would still sustain large operating losses. Improved service would reduce the Ann Arbor's operating deficit by 14 percent--from \$3,358,087 in 1973 to \$2,887,379 in 1976. In contrast, even with improved service, Michigan Northern's operating deficit increased by 9 percent--from \$666,535 in 1973 to \$730,487 in 1976.

Improved rail service on the Michigan Northern would lead to a 5 percent increase in rail use measured in carloads between 1973 and 1976; however, the railroad's operating deficits on the line would remain 9 percent below their 1973 level. The 1976 operating deficit for the Michigan Northern was estimated to be \$730,487 as compared to \$665,535 in 1973. This result does not imply that improved rail service on the Michigan Northern leads to lower rail revenues. Indeed, without improved rail service, the Michigan Northern's operating deficits in 1976 are estimated to be even greater (see Table 4-18).

The revenue an additional carload will generate for the railroad will vary according to the value of the commodity being transported. Therefore, the composition of carloads moved on a line is just as important in determining the railroad's revenue as is the number of carloads moved. In the case of the Michigan Northern, the decline in rail service quality between 1973 and 1975 caused many firms moving high-value commodities to switch from rail to

truck. Consequently, the composition of rail freight moving on the Michigan Northern line in 1976 is different from that of 1973; furthermore, the increase in rail revenues in response to improved service is not as great as might be anticipated.

A number of dimensions of rail service quality were identified as important by Ann Arbor and Michigan Northern rail users. Of particular concern to rail users on both lines, however, was the consistency of transit time and available rail cars. Inconsistent transit time, according to the rail users interviewed, results in higher inventory costs as it becomes necessary to carry larger inventories to prevent stock-outs and loss of sales. In addition, the interviewees indicated that late (or early) deliveries of rail shipments frequently result in additional handling costs as extra help has to be hired to unload and store the shipments.

Late delivery of rail cars was a particular problem for those shipping grain. Late cars caused delays in outbound shipments, thus resulting in increased inventory costs, storage bottlenecks, and loss of business as farmers would take their grain to another elevator.

Other aspects or dimensions of rail service quality mentioned by Ann Arbor and Michigan Northern rail users as being important included--faster transit time, improved spotting, reduction of damage in transit, provision of loading and unloading facilities, and available storage facilities.

Discussions with Ann Arbor and Michigan Northern officials revealed their awareness of rail user concern for reliable service.

Their response was to point out the limited control they had over the quality of service their shipments receive once they leave the Ann Arbor and Michigan Northern lines. Both railroads indicated that they were trying to provide service to their users on a frequent basis; but they were also concerned about minimizing unused train-unit capacity and operating costs.

On the question of routing shipments, 35 percent of the Ann Arbor rail users said they did route while none of the Michigan Northern users indicated they specified the routing of their shipments. A common reason given by Michigan Northern users for not routing their shipments was that they did not know what options were available. In addition, Michigan Northern users indicated that the railroad (Penn Central) was uncooperative in providing alternative routing information.

Nearly 40 percent of the Michigan Northern rail users indicated that they had pooled their shipments (split a carload) with other users; in contrast, only 30 percent of the Ann Arbor users indicated that they had pooled their shipments with others.

Close to half of the rail users on the Ann Arbor (45 percent) and Michigan Northern (50 percent) indicated they would be interested in pooling arrangements or other cooperative efforts that would lower their rates and/or improve their service. Many rail users on both lines, however, said they needed more information on how such agreements would work prior to making any final judgments.

Although many rail users on both lines felt that rehabilitation of track and structures was needed to improve rail service (i.e., reduce transit delays, derailments, and shipment damages), they were very noncommittal regarding their willingness to contribute to any rehabilitation projects. The users expressed concern in two areas: (1) The security of their investment--what would happen if rail service was terminated after they had invested in the rehabilitation of the line? and (2) The sharing of rehabilitation costs--would rail users be allowed to benefit from improved service without bearing any of the cost?

Many community officials have argued that the potential demand for future rail service in the 21-county area served by the three Michigan lines is good; available data and information did not permit empirical investigation of this claim, however. In addition, mechanisms do not presently exist to translate this concern for the future availability of rail service (option demand) into the financial help the three railroads need to justify continued operations.

With respect to the demand for future transportation service, there is some evidence to suggest that traffic in manufactures in the 21-county area is increasing. Unless the three Michigan railroads improve the reliability of their service, however, they probably will not share in the movement of this traffic. One factor, however, rising fuel prices, may improve the positions of the three Michigan railroads vis-a-vis trucks even if the quality of rail service is not improved.

Finally, sequential line segment analyses of the Michigan Northern and C.O.-Northwest indicated that opportunities exist for improving the viability of the two lines by discontinuing service on portions of the lines. Consideration of alternative combinations of the three Michigan lines in a regional subsystem context also illustrated the potential for improving the viability of rail service to the 21-county area.

Some Concluding Points. In the past, railroads have generally been unresponsive to Michigan rail user complaints of poor service. This has led many Michigan rail users to reduce their use of rail service or abandon it altogether. This, in turn, has added to the financial problems of the three Michigan rail operations.

Under present circumstances, group action by Michigan rail users, through a rail users' association or similar organization, may prove to be an effective means for improving rail service and enhancing the long-term viability of the three Michigan lines. Since rail user group action has not occurred on the three Michigan lines to date, its chances of success cannot be known with certainty beforehand. What does seem fairly certain, however, is the continued deterioration and eventual abandonment of rail service on the three Michigan lines if present railroad-rail user relationships continue in their present form.

RECOMMENDATIONS

Research results indicate that improving the viability of the Ann Arbor, Michigan Northern, and C.O.-Northwest rail lines will require either increasing operating revenues or decreasing operating costs, or both, on the three lines. Whether the necessary changes in operating revenues and costs occur, however, will depend upon the behavior of the rail users on the three Michigan lines as well as the actions of the three Michigan railroads.

Under existing federal and state rail reorganization legislation, Michigan transportation officials have the authority and resources to (1) encourage rail user and railroad behavior and (2) make changes in the configuration of Michigan's rail system that are likely to lead to improvements in the financial position of the three Michigan rail lines.

Keeping these two points in mind, and drawing upon the analyses presented in earlier chapters, the following recommendations for improving the viability of the Ann Arbor, Michigan Northern, and C.O.-Northwest are offered to Michigan transportation officials for their consideration.

Recommendation One: Consider the requirement that rail users' associations be established on the northern two-thirds of the Ann Arbor (Byron-Frankfort) and the Michigan Northern (Cadillac-Traverse City-Petoskey) as a condition of State subsidies to continue rail service on these lines. (The southern third of the Ann Arbor, from Byron to Toledo, is profitable and does not require State support.)

Rail users' associations have the potential for improving the viability of the Ann Arbor and Michigan Northern in two ways: (1) The users' associations may be able to bargain for improved rail service with inter-line carriers. Improved rail service, in turn, should lead not only to an increase in the level of rail use by present users, but also it should attract new users. The increase in demand for rail service will improve the viability of the two rail lines; (2) The users' association may be able to coordinate its members' demand for rail service so as to minimize the railroads' operating costs which, in turn, improves the viability of the lines. The rail users' associations may also enter into joint investment agreements with the railroads and/or state or local transportation authorities to rehabilitate track, construct unloading/loading and storage facilities, etc. Such investments are likely to improve the quality of rail service available, thereby increasing the demand for rail service and the viability of the lines. The importance of a rail users' association is the leverage it gives rail users in their efforts to improve the quality of service they receive.

Even though a rail users' association offers promise of mutual gain, the willingness of rail users to participate will be based, largely, on their expected individual gains. Consequently, organizational factors that determine individual rail user benefits, such as rules and procedures for sharing costs and making group decisions that are binding on individual members, will affect the willingness of individual rail users to participate in the association.

In addition, since many of the benefits a rail users' association can provide its members can also be enjoyed by non-members, participation in a rail users association

may not occur on a voluntary basis. For example, if a rail users' association pays a subsidy to the railroad to continue rail service and/or share in the rehabilitation of track, etc., non-association rail users will benefit from the continued rail service and improved rail service, even though they have not shared in the costs. If enough rail users decide to be non-members hoping to benefit from the efforts of others who become members, the rail users' association may never be established.

Establishing a rail users' association involves the bearing of initial organizational costs and risk. Many rail users, however, may decide to maximize their own position by not joining the association until after it is established. In this way they can avoid bearing any of the organizational costs and risk. Again, if enough rail users follow this course of action, the association may never get started.

The ability of a rail users' association to bargain and work effectively with railroads to improve rail service and to enhance the viability of rail operations is also tied to the level of rail user participation. The larger the number of rail users participating, the more effective the association is likely to be.

The Ann Arbor (northern two-thirds) and the Michigan Northern are comprised of a large number of small rail users. Consequently, the likelihood that rail users' associations will be formed voluntarily on these lines is doubtful for the reasons discussed above. In addition, interview results with rail users on the two lines indicate an interest in various cooperative efforts, but also an unwillingness of rail users to commit themselves

to participation in a rail users' association or other cooperative efforts until they can evaluate the obligations of membership.

Michigan transportation officials can take a number of steps to encourage and facilitate the formation of rail users' associations on the Ann Arbor and Michigan Northern. To begin with, Michigan transportation officials can strongly encourage the formation of rail users' associations on the two lines by making the availability of operating subsidies contingent on their formation. Transportation officials will have to give careful consideration to questions of what level of rail user participation constitutes the formation of a rail users' association. To operate successfully the associations need to control a substantial portion of the volume of freight originating or terminating on the two lines. Whether this means 100 percent or 75 percent rail user participation will have to be decided.

In addition, attention must be given to the fact that non-association rail users may benefit from the efforts of association members without bearing any of the costs. Should the non-association rail users be charged something for these benefits? If so, in what form and how much? If this problem is not handled successfully, the incentive to be a member and participate in association activities will be substantially less.

Michigan transportation officials can facilitate the formation of rail users' associations on the Ann Arbor and Michigan Northern by designating a state agency to organize and finance an extensive information campaign. Part of the information campaign should include the sponsorship of meetings with rail users, community representatives, and railroad officials.

The purpose of the meetings should be to discuss the benefits and problems the users' associations are likely to encounter in their efforts to improve rail service. The designated state agency should also work with rail users' associations by hiring a traffic manager and a small staff.

Paying the overhead costs of the traffic manager and his small staff can be handled in a number of ways. Either the State of Michigan could pay the overhead costs with subsidy money or the members of the association could pay through some type of surcharge on their shipments. The possibility also exists for the State and the users to share the cost. Communities' contributions represent a third method for financing the traffic manager and his staff. Since, in general, communities receiving rail service benefit from its presence, they may be willing to pay something to retain it. Paying a portion of the overhead for the rail users' association is one way communities can contribute. The designated State agency should contact communities on the Ann Arbor and Michigan Northern about the possibilities of their financial contributions.

Recommendation Two: Michigan transportation officials should establish rail service contract and evaluation committees on the Ann Arbor and the Michigan Northern. The committees should be composed of representatives from the contract carriers, the rail users' associations, and State transportation representatives. The committees should be charged with the responsibility of negotiating and adjusting operating subsidy contracts. The committees should also review, periodically, the financial status of the lines and determine what actions would be appropriate for achieving improvements.

Subsidy contracts should specify clearly the type and frequency of service to be provided, the obligations of the State as well as the railroads and rail users in such matters as the maintenance and rehabilitation of track, grade crossings, etc. Contract terms should be specified so as to encourage railroads and rail users to improve the viability of the rail lines. The railroads should be encouraged to reduce their operating costs and increase the volume of business on the lines. This might be accomplished in the following manner:

- a. Establish fixed subsidy amounts to be paid to the two railroads for the contract period; the payments would be adjusted to reflect inflation and changing business environment. Given the fixed subsidy payments, the railroads would be encouraged to reduce their operating costs by being allowed to keep a certain percentage of any savings in operating costs they might realize during the contract period. To prevent the railroads from cutting back on the quality of service just to reduce their operating costs, the rail users' associations would monitor and report the railroads' performance over the contract period. If it can be shown that the railroads' cost-saving efforts resulted in poor service, the railroads would not be allowed to retain the savings.
- b. In a similar fashion, the railroads would be allowed to retain a certain percentage of the gross revenues earned above the estimated gross revenue figure used to calculate the operating subsidy. In this way, the railroads are given an incentive to solicit new business.

Whether these incentives lead to improvements in the viability of the Ann Arbor and Michigan Northern depends, in large part, on the initial specification of subsidies to be received on the two lines. A railroad wanting to maximize its position would likely try to overestimate the operating costs and underestimate the operating revenues for the provision of service on the line during contract negotiations. To the extent this occurs, the contract railroad may subsequently do well financially, while the financial position and long-term viability of the rail line does not improve at all or by only a small amount. The likelihood of such contract occurrences should be reduced, however, through the use of contract-evaluation committees that can collect and analyze operating information on the lines prior to contract negotiations.

Recommendation Three: Michigan transportation officials should consider allowing rail service to be discontinued on the Michigan Northern line between Cedar Springs and Cadillac and between Petoskey and Mackinaw City. In 1976, net operating revenues for the Michigan Northern (Grand Rapids-Mackinaw City) was a negative \$730,487 (see Table 5-2). Two segments of the line, Cedar Springs to Cadillac and Petoskey to Mackinaw City, generated over 50 percent (\$4,4,531) of the net loss.

Freight shipments on the Cedar Springs to Cadillac segment in 1976 accounted for 12 percent of the carloads (306), 12 percent of the gross operating revenues (\$40,604), and 32 percent of the operating costs (\$340,612) for the line as a whole. Average subsidy payment per carload was approximately \$1,000.

The Petoskey to Mackinaw City segment represented an even greater financial burden. Freight shipments on this segment in 1976 accounted for only one percent of the total number of cars (22) moved on the entire line. In addition, the 22 carloads accounted for 4 percent (\$2,744) of the gross revenues and 11 percent (\$117,087) of the operating costs for the line as a whole. Average subsidy payment per carload was approximately \$5,200.

By discontinuing service on these two segments of the Michigan Northern, the State of Michigan would save close to \$500,000 in subsidy money, money that could be used to support service on other lines.

Interviews with rail users on these two segments of the Michigan Northern revealed that loss of rail service would have no effect on their business activities. They would shift to truck with few problems; there would be no plant closing or job losses. In fact, the rail users interviewed indicated that they were already relying on trucks to provide the bulk of their transportation needs and that they used rail service only occasionally. In addition, the rail users indicated that improved rail service would lead them to increase their use of rail service only marginally (10 to 15 percent).

Dimension lumber, drilling mud, and a few shipments of fertilizer and feed constituted the majority of shipments on the two segments. Truck service was economical for moving these commodities according to the firms interviewed. Finally, discontinuing rail service on the Cedar Springs to Cadillac and Petoskey to Mackinaw City

segments does not mean the firms on these segments will be without rail service entirely. Sixty percent of the firms will remain within 20 miles of rail line and all firms will be within 30 miles of a rail line. These are short distances to truck; truck-train transshipments can be established with little difficulty.

Recommendation Four: Michigan transportation officials should evaluate alternative ways for continuing rail service on the Grand Rapids to Cedar Springs segment of the Michigan Northern. The segment nearly broke even in 1976, losing \$10,128 or only \$10 per carload (see Table 5-2). Two alternatives to consider for retaining rail service would be (1) a short line railroad operation or (2) contracting with ConRail to provide service.

Recommendation Five: If the C.O. railroad should abandon its C.O.-Northwest branch line, Michigan transportation officials should strongly consider the Michigan Northern acquiring operations of the Grawn to Petoskey segment. In 1976, the Grawn to Petoskey segment showed positive earnings of over \$70,000. Linking this C.O.-Northwest segment to the Michigan Northern would improve the viability of rail service to the northwestern part of Michigan's Lower Peninsula (see Table 5-10).

Recommendation Six: Federal funds (provided by the RRR and RRRR Acts) to assist state and local authorities in retaining rail service on profitable lines will be ending shortly. Operating subsidies needed to continue service on the Ann Arbor and Michigan Northern and other Michigan lines in the future will become the

responsibility of the state and local interests-- public and private. Many communities and potential users have expressed the desire to retain service, even if it means continuing presently unprofitable service. The communities and potential users have indicated they value the option for future use of rail service.

Presently, however, a mechanism, such as a regional transportation authority with taxing and debt-financing power, does not exist to articulate the option demand for rail service held by individuals and communities located on the Ann Arbor and Michigan Northern. Consequently, it is recommended that Michigan transportation officials begin working with communities and regional groups in the evaluation of alternative methods for articulating the option demand held by many for rail service. Failure to articulate this option demand may mean the loss of rail service in the future.

Recommendation Seven: Michigan transportation officials should employ the sequential rail link analysis (demonstrated in Chapter Five) to evaluate other unprofitable rail lines in Michigan. Traffic on rail lines is often distributed unevenly with clustering occurring at a few stations. In such cases, opportunities may exist for the railroad to operate the line profitably if it can relieve itself of the light density segments. Rail users located on the segments where service is discontinued need not lose access to rail service. Public and private interests can cooperate in the development of truck service between the firms, places of business and the nearest rail station. Michigan transportation officials may find that selective rail service abandonment and promotion of truck-train transshipments may

not only improve the viability of a particular line, but also will lead to an increase in the overall quality of transportation services to an area. The State may find it more economical to help firms adjust to truck and truck-train alternatives than to pay the subsidy and rehabilitation costs on a line (or line segment) necessary to retain and to improve rail service.

It is further recommended that Michigan transportation officials explore the possibilities of establishing rail users' associations on other lines in the State. Many lines ¹³⁷ are close to breaking even; concerted efforts by rail users and railroads, in the ways described in earlier chapters, may turn them into profitable operations.

FURTHER RESEARCH

Additional research in a number of areas is suggested by the results of this research effort; a few of these areas are briefly discussed below.

1. Evaluation of Alternative Institutions. This research effort has focused primarily on rail users' associations as a means for improving the viability of the Michigan rail lines studied. There is good reason for this. Analysis of the problems of unprofitable Michigan rail lines indicated that improving the quality of rail service is a key to increasing the demand for rail service. However, since the quality of rail service

¹³⁷For analysis of the financial status of Michigan's unprofitable rail lines see: Michigan Railroad Plan, Phase II, Michigan Department of State Highways and Transportation, 1976.

Michigan rail users received is determined by the railroad's performance outside of Michigan as well as by the Michigan railroads, it was necessary to find a way to influence the performance of both sets of railroads. The rail users' association proved to be a logical way for doing this given the reasons explored in earlier chapters.

No doubt the rail users' association is not the only way, and perhaps not even the best way, for improving the viability of Michigan's unprofitable rail lines. Consequently, research is needed to identify, contrast, and compare the value of alternative institutional arrangements. In Chapter Four, a number of alternatives based on public and private ownership and operation of rail lines were considered. Vermont provided an example of public ownership and private operation of a rail line while a small railroad in Oregon illustrated the public ownership and operation alternative. Presently in Michigan, a form of the public ownership and private operations alternative is in use. The State of Michigan either owns or leases portions of the bankrupted Ann Arbor and Penn Central and is using federal-state subsidy funds to contract for rail service.

The question still remains, however, as to what long-term arrangements would be best for insuring a viable rail system in Michigan? Should the State and/or local government become the owner and operator of railroads in Michigan? State ownership and operation is considered by some Michigan transportation officials as a viable alternative. Should the State of Michigan push the development of short-line railroads, rail users' associations, and the like? Are these alternatives better suited for some rail lines than for others?

Is a short-line/rail users' association combination a feasible option? How do alternative strategies affect the willingness of rail users and railroads to work together towards improving rail service in Michigan? Do the alternative strategies improve the quality of service Michigan rail users receive from interline carriers? These are a few important questions that must be answered regarding alternative institutional arrangements offered for improving the viability of rail operations in Michigan.

2. Investigate Opportunities for Developing Off-Line Traffic. Michigan transportation officials should investigate opportunities for developing sources of off-line traffic adjacent to the Ann Arbor, the Michigan Northern, and the C.O.-Northwest rail lines. Many industries are located a short distance from these lines and they may be interested in rail service, particularly if fuel prices continue to rise in the future. Many off-line firms may support the development of intermodal operations such as "piggyback" services. Piggyback rates are usually less than truck rates on comparable shipments. Developing the intermodal market would definitely improve the financial positions of the Ann Arbor, Michigan Northern, and C.O.-Northwest rail lines. Discussions with Michigan Northern officials indicate that many firms in the northwest section of the Lower Peninsula are interested in piggyback services.
3. Demand Analysis. One of the basic arguments underlying this research effort has been that there is a relationship between the demand for rail service and the quality of rail service. For the most part, this argument was supported by the results of interviews with 114 rail users on the Ann Arbor and Michigan Northern lines.

In general, the rail users interviewed exhibited economic threshold behavior towards changes in rail service quality. That is, users would tolerate declines in rail service quality until the effective price of consuming rail service equaled the effective price of the next least-cost mode; at this point, they would reach their economic threshold point and decide to abandon rail service for another mode.

The interview results also revealed that rail users have different economic threshold points depending on the commodity involved and the relevant dimension of rail service quality. For example, firms shipping manufactured goods appeared to be more sensitive to variance in transit time than firms shipping semi-processed material. The interview results, however, did not permit precise measurement of these relationships.

Transportation officials concerned with rail line viability might benefit from knowledge of the economic threshold points for various rail using firms. Such knowledge may be useful in specifying the service requirements of contracts with subsidized carriers or estimating the demand for rail service when various dimensions of rail service quality change. Therefore, it is recommended that Michigan transportation officials consider research to determine the economic threshold points of various rail users by commodity and dimensions of rail service quality (e.g., time in transit, variance in transit time, damages in transit, available rail cars, frequency of service, and so on).

Efforts might also be made to determine the economic threshold points for potential rail users. That is, if transit time for a particular commodity was reduced by

25 percent, how many firms presently using truck service would shift to rail service? Or, if the variance in transit time on a particular commodity, say lumber, was reduced from seven to three days, what effect would this have on lumber dealers currently receiving shipments by truck?

To answer these and similar questions will require the development of a firm's economic threshold model. Development of such a model will permit the derivation of a firm's demand curve for rail service. It will also facilitate the estimation of the firm's future demand for rail service with different service quality. With this information available, Michigan transportation officials can "target" their efforts in those areas that promise the greatest return.

APPENDIX A

APPENDIX A

ANN ARBOR AND MICHIGAN NORTHERN
RAIL USER SURVEYANN ARBOR AND MICHIGAN NORTHERN
RAIL USER SURVEY

Firm _____

Address _____

Railroad _____

I. Freight Movements

A. Inbound

1975

<u>Commodity</u>	<u>Tons</u>	<u>Carloads</u>	<u>Origin</u>
1. _____	/	/	/
2. _____	/	/	/
3. _____	/	/	/
4. _____	/	/	/
5. _____	/	/	/

1976

<u>Commodity</u>	<u>Tons</u>	<u>Carloads</u>	<u>Origin</u>
1. _____	/	/	/
2. _____	/	/	/
3. _____	/	/	/
4. _____	/	/	/
5. _____	/	/	/

Comments:

RAIL USERS SURVEY, CONTD.

2

B. Outbound

1975

<u>Commodity</u>	<u>Tons</u>	<u>Carloads</u>	<u>Destination</u>
1. _____	/	/	/
2. _____	/	/	/
3. _____	/	/	/
4. _____	/	/	/
5. _____	/	/	/

1976

<u>Commodity</u>	<u>Tons</u>	<u>Carloads</u>	<u>Destination</u>
1. _____	/	/	/
2. _____	/	/	/
3. _____	/	/	/
4. _____	/	/	/
5. _____	/	/	/

Comments:

II. Elements of Rail Service Quality

A. Inbound

1975		Time-in-Transit (Days)		Damages-in-Transit (\$/\$1000)		Inventory Time (Days)
Commodity	Origin	/Rail	/Truck/	/Rail	/Truck/	
1.	/	/	/	/	/	/
2.	/	/	/	/	/	/
3.	/	/	/	/	/	/
4.	/	/	/	/	/	/
5.	/	/	/	/	/	/
1976		Time-in-Transit (Days)		Damages-in-Transit (\$/\$1000)		Inventory Time (Days)
Commodity	Origin	/Rail	/Truck/	/Rail	/Truck/	
1.	/	/	/	/	/	/
2.	/	/	/	/	/	/
3.	/	/	/	/	/	/
4.	/	/	/	/	/	/
5.	/	/	/	/	/	/

Comment:

4

B. Outbound

1975

<u>Commodity</u>	<u>Destination</u>	<u>Equipment</u> <u>Delay(Days)</u>		<u>Promotional</u> <u>Visits</u>		<u>Time-in-</u> <u>Transit(Days)</u>		<u>Damages-in-</u> <u>Transit</u>		<u>2Rail Shipments</u> <u>to Truck</u>
		<u>/Rail/Truck/</u>		<u>/Rail /Truck/</u>		<u>/Rail / Truck/</u>		<u>/Rail / Truck/</u>		
1.	/	/	/	/	/	/	/	/	/	/
2.	/	/	/	/	/	/	/	/	/	/
3.	/	/	/	/	/	/	/	/	/	/
4.	/	/	/	/	/	/	/	/	/	/
5.	/	/	/	/	/	/	/	/	/	/

1976

<u>Commodity</u>	<u>Destination</u>	<u>Equipment</u> <u>Delay(Days)</u>		<u>Promotional</u> <u>Visits</u>		<u>Time-in-</u> <u>Transit(Days)</u>		<u>Damages-in-</u> <u>Transit</u>		<u>2Rail Shipments</u> <u>to Truck</u>
		<u>/Rail/Truck/</u>		<u>/Rail /Truck/</u>		<u>/Rail / Truck/</u>		<u>/Rail / Truck/</u>		
1.	/	/	/	/	/	/	/	/	/	/
2.	/	/	/	/	/	/	/	/	/	/
3.	/	/	/	/	/	/	/	/	/	/
4.	/	/	/	/	/	/	/	/	/	/
5.	/	/	/	/	/	/	/	/	/	/

Comments:

RAIL USERS' SURVEY, CONTD.

5

III. Firm Characteristics

1. Number of Employees

2. Truck Ownership

Number

3. Modal Split

% Rail

% Truck

4. Markets

Rail Service:

Truck Service:

IV. Firm's Operating Procedures

1. What aspects (elements) of transportation service do you consider to be most important to your business operations; and which, ultimately play a decisive role in your choice of transportation modes?

a. rates

b. transit time

c. variance in transit time

d. frequency of service

e. car and equipment availability

f. damages

g. other (specify)

RAIL USERS' SURVEY, CONTD.

6

2. How did rail service provided by Ann Arbor (Penn Central) fair with respect to these aspects of rail service?

3. Has rail service improved with ConRail (Michigan Northern)? How?

4. From your point of view, how can rail service be improved?

RAIL USERS' SURVEY, CONTD.

7

5. If rail service were improved (in which way?), how would it affect your use of rail service?

<u>Commodity</u>	<u>Tons</u>	<u>Carloads</u>	<u>Markets</u>
1. _____	/	/	/
2. _____	/	/	/
3. _____	/	/	/
4. _____	/	/	/
5. _____	/	/	/

Comment:

6. Did you specify routings with Ann Arbor (Penn Central)?
7. Do you specify routings with ConRail (Michigan Northern)?
8. Have you ever engaged in pooling of shipments (l.c.l. or otherwise) with other firms? Yes _____ No _____ Which firms? When? How did it workout?
9. Would you consider pooling in the future if it meant a chance for reduced rates and/or improved service?

RAIL USERS' SURVEY, CONTD.

8

10. Do you see opportunities for improving rail service through cooperative efforts with other shippers? Explain?
11. Would you be interested in a joint investment with ConRail (Michigan Northern) and/or other shippers to construct loading and unloading facilities, sidings, TOFC-COFC ramps, etc.?
12. Do you feel that rehabilitation of your line is necessary for improving rail service? Under what conditions would you be willing to contribute financially to the rehabilitation of your rail line?

RAIL USERS' SURVEY, CONTD.

9

13. Under what conditions would you be willing to contribute financially to a operating subsidy to maintain rail service on your rail line?

14. Do you have any additional comments or observations to make with respect to rail service on your line, in Michigan, in the US?

APPENDIX B

TABLE B-1
ANN ARBOR RAIL USERS SURVEY

Station	Commodity ¹	Inbound (IB) Origin Outbound (OB) Destination	Car- loads	Traffic Data								Key Rail Service Elements ⁵	
				1975 ²		1976-Estimate 1 ³		1976-Estimate 2 ⁴		Gross ⁶			
				Tons	Gross Revenue	Car- loads	Tons	Gross Revenue	Car- loads		Tons		Revenue
Frankfort	Fruit	(IB) CA	25	670	4,250	25	670	4,250					
	Waffles	(IB) PA	10	250	3,000	10	250	3,000					
	Frozen Food	(OB) E. Coast	11	222	3,575	11	222	3,575					
	Frozen Food	(OB) CA	10	205	4,500	10	205	4,500					
	Frozen Food	(OB) MI	2	40	290	2	40	290					
	Frozen Food	(OB) Canada	2	80	780	2	80	780					
	Dimension Lumber	(IB) W. Coast	3	120	750	3	120	750					
	Steel	(IB) IL	3	180	450	3	180	450					
	Frozen Food	(OB) South	3	240	1,125	3	240	1,125					
	Christmas Trees	(OB) W. Coast	3	45	750	5	75	1,250	2	30	500 Avail. Rail Cars, Fast. Trans. Time		
	Filter Powder	(IB) NV	2	100	440	2	100	440					
	Frozen Fruit	(OB) TN	6	300	2,310	6	300	2,310	5	250	1,925 Avail. Rail Cars		
	Cans	(IB) PA	10	30	1,500	6	18	900					
	Fresh Fruit	(IB) W. Coast	5	300	900								
	Frozen Fruit	(OB) E. Coast	9	540	3,465	6	360	2,310					
	Frozen Fruit	(OB) W. Coast	1	60	350	1	60	350					
Honor	Dimension Lumber	(IB) W. Coast	9	270	1,800	10	300	2,000					
	Roofing Shingles	(IB) IL	1	40	190	4	160	760					
Beulah	Dimension Lumber	(IB) W. Coast	3	120	720	3	120	720					
	Roofing Shingles	(IB) South	2	80	200	2	80	200					
	Brick	(IB) Ohio	2	100	400	2	100	400					
Thompson- ville	Christmas Trees	(OB) W. Coast	6	90	1,500	6	90	1,500					

TABLE B-1, Continued

Ann Arbor Rail Users Survey continued..
Page 2

Station	Commodity ¹	Inbound (IB) Origin Outbound (OB) Destination	Car- loads	1975 ²		Traffic Data		1976-Estimate 1 ³		1976-Estimate 2 ⁴		Gross ⁶		Key Rail Service Elements ⁵
				Tons	Gross Revenue	Car- loads	Tons	Gross Revenue	Car- loads	Tons	Gross Revenue	Tons	Gross Revenue	
Yuma	Sand	(OB) OH	3,000	300,000	798,000	4,000	400,000	1,064,000	2,000	200,000	532,000	Avail. Rail Cars		
Copemish	Shrubs	(IB) W. Coast	3	36	300	2	24	200						
Cadillac	Can Goods	(IB) U.S.	60	900	6,000	60	900	6,000						
	Telephone Poles	(IB) South	12	680	1,620	15	840	2,025						
	Dimension Lumber	(IB) W. Coast	15	600	3,600	20	800	4,800	10	400	2,400	Cons. Trans. Time		
	Roofing Shingles	(IB) South	4	150	450	6	225	675	10	370	1,110	Cons. Trans. Time		
	Dimension Lumber	(IB) NC	2	80	400	3	120	600	12	480	2,400	Cons. Trans. Time		
	Roofing Shingles	(IB) OH	4	160	640	4	160	640	3	120	480	Unloading Facilities		
	Furniture	(IB) MA	10	250	1,600	9	225	1,440						
	Grain	(IB) OH	2	160	960	3	240	1,440	5	400	2,400	Cons. Trans. Time		
	Fertilizer	(IB) OH							8	640	2,400	Fast. Trans. Time		
	Christmas Trees	(OB) South	20	240	2,800	15	180	2,100	20	240	2,800	Avail. Rail Cars, Fast. Trans. Time		
	Beer & Wine	(IB) CA	12	600	2,100	15	750	2,625	12	600	2,100	Increased Service Frequency		
	Plywood	(IB) W. Coast	72	2,000	12,000									
	Balsa Wood	(IB) FL	30	1,800	4,350									
	Resin	(IB) TX	15	500	2,000									
	Aluminum	(IB) LA							10	500	1,200	Unloading Facilities		
	Beer	(IB) GA	22	1,100	4,774	30	1,500	6,510						
	Urethane Pads	(IB) PA	296	2,960	44,400	296	2,960	44,400						
	Containers	(IB) IL	400	4,000	50,000	400	4,000	50,000						
	Bucket Seats	(OB) OH	220	4,500	180,400	220	4,500	180,400						
	Int. Auto Trim	(OB) MI	96	672	18,720	96	672	18,720						
	Bucket Seats	(OB) Canada	143	2,703	11,726	143	2,703	11,720						

TABLE B-1, Continued

Ann Arbor Rail Users Survey continued..
Page 3

Station	Commodity ¹	Inbound (IB) Origin Outbound (OB) Destination	Car- loads	1975 ²		Traffic Data 1976-Estimate 1 ³		1976-Estimate 2 ⁴		1976-Estimate 2 ⁴		Key Rail Service Elements ⁵
				Tons	Gross Revenue	Car- loads	Tons	Gross Revenue	Car- loads	Tons	Gross Revenue	
Cadillac	Furniture	(OB) E. Coast	20	120	2,600	12	72	1,560				
	Crude Rubber	(IB) LA	9	610	1,800	12	813	2,400				
	Zinc Oxide	(IB) MT	2	60	250	3	90	375				
	Carbon Black	(IB) LA							72	4,880	8,928	Unloading Facilities
	Crude Rubber	(IB) KY							14	950	2,590	Lower Rail Rates
	Oil	(IB) OH							10	300	1,650	Storage Facilities
	Brick	(IB) OH	20	1,000	3,500	25	1,250	4,375	10	500	1,750	Lower Rail Rates
	Brick	(IB) TN	10	500	1,200	10	500	1,200	10	500	1,200	Fast. Trans. Time
	Christmas Trees	(OB) South	18	216	2,700	5	60	750	25	300	3,750	Fast. Trans. Time, Red. Dam. in Trans.
	Dimension Lumber	(IB) W. Coast	13	550	2,925	8	320	1,800	10	400	2,250	Cons. Trans. Time, Red. Rail Rates
	Coke	(IB) Midwest	60	3,000	9,300	60	3,000	9,300				
	Clay	(IB) AL	24	1,200	3,600	24	1,200	3,600				
	Coke	(IB) IN	40	1,600	6,400	25	1,000	4,000	20	800	3,200	Unloading Facilities
	Refractory Mat.	(IB) AL	5	300	610	4	240	488				
	Metal	(IB) IL	15	600	1,875	12	480	1,500				
Lucas	Paper Products	(IB) WI	8	120	384	11	165	528				
	Frozen Food	(IB) W. Coast							30	600	7,500	Increased Service Frequency
Lucas	Coal	(IB) KY	4	200	800	2	100	400				
McBain	Fertilizer	(IB) MI	17	850	1,700	17	850	1,700	2	100	200	Cons. Trans. Time
	Feed	(IB) IL	16	1,150	3,200	16	1,150	3,200	4	285	800	Increased Service Frequency
	Dimension Lumber	(IB) W. Coast	21	1,050	5,250	21	1,050	5,250	3	150	750	Red. Rail Rates
	Feed	(IB) IL	10	400	1,600	12	440	1,920				
	Fertilizer	(IB) MO							12	600	2,100	Unloading Facilities
	Fertilizer	(IB) MI							4	200	400	Unloading Facilities

TABLE B-1, Continued

Ann Arbor Rail Survey continued..
Page 4

Inbound (IB)				Traffic Data								1976-Estimate 2 ⁴		Key Rail Service Elements ⁵
Station	Commodity ¹	Origin Outbound (OB) Destination	Car- loads	1975 ²		1976-Estimate 1 ³		1976-Estimate 2 ⁴		Gross ⁶				
				Tons	Gross Revenue	Car- loads	Tons	Gross Revenue	Car- loads	Tons	Gross ⁶			
Marion	Dimension Lumber	(IB) W. Coast	3	150	810	4	200	1,080	2	100	540	Cons. Trans. Time		
	Roofing Shingles	(IB) IL	2	100	400	2	100	400	3	150	600	Red. Rail Rates		
	Anhydrous Ammonia	(IB) OH	5	125	1,530	6	150	1,836	2	50	612	Cons. Trans. Time		
	Fertilizer	(IB) MI	4	200	800	4	200	800						
	Potash	(IB) Canada	1	75	175	2	150	350						
Farwell	Plastic Resin	(IB) GA	3	120	450									
Clare	Dimension Lumber	(IB) W. Coast	21	1,400	5,250	21	1,400	5,250						
	Brick	(IB) OH	9	360	1,665	9	360	1,665	3	120	555	Red. Dem. in Trans.		
	Insulation	(IB) IN	1	22	80	1	22	80						
	Farm Equipment	(IB) MO	2	24	180	2	24	180	2	24	180	Unloading Facilities		
	Wheat	(OB) OH	12	900	9,600	12	900	9,600	18	1,350	14,400	Avail. Rail Cars		
	Potash	(IB) Canada	1	50	175	2	100	350	2	100	350	Cons. Trans. Time		
	Liq. Nitrogen	(IB) AL	1	50	140	2	100	280	8	400	1,120	Cons. Trans. Time		
Neesbush	Potash	(IB) Canada	15	1,500	3,000	17	1,700	3,400	3	300	600	Cons. Trans. Time		
	Phosphate	(IB) FL	32	2,360	5,760	32	2,360	5,760	3	220	540	Fast. Trans. Time		
	Urea	(IB) Ohio	8	640	2,400	9	720	2,700	5	400	1,500	Fast. Trans. Time		
	Dimension Lumber	(IB) Canada	5	150	1,200	5	150	1,200						
Mt. Pleasant	Soybean Meal	(IB) Illinois	15	1,200	3,600	17	1,360	4,080	3	240	720	Cons. Transit & Fast. Transit Time		
	Potash	(IB) Canada	15	1,200	3,000	16	1,280	3,200	4	320	800	Cons. Transit & Fast. Transit Time		
	Fertilizer	(IB) Alabama	30	1,500	3,810	33	1,650	4,191	2	100	254	Cons. Transit & Fast. Transit Time		
	Fertilizer	(IB) Illinois	40	2,100	6,825	42	2,250	7,312	3	107	348	Cons. Transit & Fast. Transit Time		
	Soybean Meal	(IB) Illinois	150	10,000	36,000	160	10,667	38,400	40	2,667	9,600	Cons. Transit & Fast. Transit Time		
	Calcium Carbonate	(IB) Illinois	30	1,200	5,250	32	1,280	5,600	8	320	1,400	Cons. Transit & Fast. Transit Time		
	Dog Food	(IB) Illinois	20	800	4,000	22	880	4,400	3	120	600	Cons. Transit & Fast. Transit Time		
	Urea	(IB) Canada	8	640	1,600	9	720	1,800	1	80	200	Cons. Transit & Fast. Transit Time		

TABLE B-1, Continued

Ann Arbor Rail Survey continued..
Page 5

		Inbound (IB) Origin	1975 ²		Traffic Data 1976-Estimate 1 ³			1976-Estimate 2 ⁴			Key Rail Service Elements ⁵	
Station	Commodity ¹	Outbound (OB) Destination	Car- loads	Tons	Gross Revenue	Car- loads	Tons	Gross Revenue	Car- loads	Tons		Gross Revenue ⁶
Shepherd	Paper	(IB) Ohio	10	600	920	52	3,120	4,784				
	Scrap Paper	(OB) Ohio	12	240	1,080	52	2,040	4,683				
	Fertilizer	(IB) Iowa	1	60	139	1	60	139	15	900	2,085	Consistent Transit Time
	Fertilizer	(IB) Canada	11	740	4,070	11	740	4,070	5	336	1,850	Consistent Transit Time
	Corn	(OB) East Coast	16	1,440	4,560	18	1,620	5,130	6	540	1,710	Available Rail Cars
	Oats	(OB) South	4	320	740	4	320	740	1	80	185	Available Rail Cars
	Wheat	(OB) Michigan							20	2,000	10,000	Available Rail Cars
	Dimension Lumber	(IB) West Coast	2	60	420	2	60	420				
Alma	Dimension Lumber	(IB) Canada	7	280	2,100	8	320	2,400	7	280	2,100	Reduced Rail Rates
	Plywood	(IB) Mississippi	6	240	696	7	280	812	3	120	348	Consistent Transit Time
	Roofing Shingles	(IB) Ohio	4	160	640	5	200	800	1	40	160	Faster Transit Time
	Roofing Shingles	(IB) Illinois	3	120	480	3	120	480	1	40	160	Consistent Transit Time
	Roofing Shingles	(IB) Illinois							25	1,000	4,000	Faster Transit Time
	Plastic Pison	(IB) Ohio	25	1,250	8,750	60	3,000	21,000				Reduced Damages in Transit
Ithaca	Fertilizer	(IB) Illinois	5	200	600	5		600	5	200	600	Consistent Transit Time
	Grain	(OB) East Coast	40	4,000	8,000	40	4,000	8,000	40	4,000	8,000	Available Rail Cars
	Beans	(OB) Texas	35	3,100	12,250	35	3,100	12,250	35	3,100	12,250	Available Rail Cars
	Feed Concentrate	(IB) Indiana	75	5,625	12,750	75	5,225	12,750	25	1,875	4,250	Consistent Transit Time
	Oyster Shells	(IB) Alabama	12	480	1,200	12	480	1,200	6	240	600	Consistent Transit Time
	Fiber Glass	(IB) Ohio	15	375	1,200	30	750	2,400				
	Steel Beams	(IB) Pa.	10	500	1,850	10	500	1,850	5	250	925	Faster Transit Time
	Sheet Metal	(IB) Pa.	10	500	2,000	10	500	2,000	5	250	1,000	Consistent Transit Time
	Scrap Metal	(OB) Pa.	30	1,500	5,400	30	1,500	5,400	10	500	1,800	Faster Transit Time
	Non-Ferrous Metal	(OB) Texas	10	500	1,500	10	500	1,500	8	400	1,200	Faster Transit Time
	Farm Equipment	(IB) Missouri	8	160	720	5	100	450	5	100	450	Faster Transit Time

TABLE B-1, Continued

Ann Arbor Rail Survey continued...
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Station	Commodity ¹	Inbound (IB) Origin Outbound (OB) Car- Destination loads	1975 ²		Traffic Data 1976-Estimate 1 ³			1976-Estimate 2 ⁴			Key Rail Service Elements ⁵	
			Tons	Gross Revenue	Car-loads	Tons	Gross Revenue	Car-loads	Tons	Gross Revenue ⁶		
Ithaca cont.	Dimension Lumber	(IB) Georgia						3	120	540	Consistent Transit Time, Faster Transit Time	
	Roofing Shingles	(IB) Ohio						16	560	2,880	Consistent Transit Time, Faster Transit Time	
	Telephone Poles	(IB) Georgia						5	150	310	Consistent Transit Time, Faster Transit Time	
North Star	Fertilizer	(IB) Canada	2	160	400	2	160	400	4	320	800	Consistent Transit Time
	Fertilizer	(IB) Florida	2	160	250	2	160	250	3	240	375	Consistent Transit Time
	Grain	(OB) East Coast	20	2,000	6,500	20	2,000	6,500	25	2,500	8,125	Available Rail Cars
	Beans	(OB) Southwest	20	2,000	4,000	20	2,000	4,000	25	2,500	5,000	Available Rail Cars
	Beans	(OB) Tennessee	10	1,000	3,000	10	1,000	3,000	15	1,500	4,500	Available Rail Cars
Byron	Dimension Lumber	(IB) West Coast	4	1,600	1,000	5	2,000	1,000				
Cohoctah	Fertilizer	(IB) Illinois	5	250	600	5	250	600				
	Fertilizer	(IB) Ohio	5	250	750	5	250	750				
	Potash	(IB) Canada	1	100	400	1	100	400				
	Grain	(OB) East Coast	30	3,000	5,700	25	2,500	4,750	40	4,000	7,600	Available Rail Cars, Faster Transit Time
Howell	Dimension Lumber	(IB) West Coast	30	1,200	7,200	30	1,200	7,200	10	400	2,400	Consistent Transit Time, Reduced Rail Rates
	Plywood	(IB) West Coast	15	600	2,850	15	600	2,850	5	200	950	Consistent Transit Time, Reduced Rail Rates
	Dimension Lumber	(IB) Louis.	17	680	1,700	25	1,000	2,500	20	800	2,000	Consistent Transit Time
	Asphalt	(IB) Ohio	90	7,473	18,683	90	7,473	18,683				
	Oil	(IB) New York	36	1,260	5,760	36	1,260	5,760				
Whitemore Lake	Plastic Resin	(IB) Texas	15	700	2,505	15	700	2,505				
	Auto Parts	(OB) U.S.	1,100	27,500	99,000	1,100	27,500	99,000	50	1,500	4,500	Available Rail Cars
Ann Arbor	Wine	(IB) California	40	1,200	3,000	45	1,350	3,375				
	Dimension Lumber	(IB) West Coast	200	8,000	44,000	200	8,000	44,000				

TABLE B-1, Continued

Ann Arbor Rail Survey continued..
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Station	Commodity ¹	Inbound Origin Outbound (OB) Destination	(IB) Car- loads	1975 ²		Traffic Data 1976-Estimate 1 ³		1976-Estimate 2 ⁴			Key Rail Service Elements ⁵	
				Tons	Gross Revenue	Car- loads	Tons	Gross Revenue	Car- loads	Tons		Gross Revenue ⁶
Ann Arbor continued	Dimension Lumber	(IB) South	300	12,000	36,000	300	12,000	36,000				
	Dimension Lumber	(IB) Canada							5	200	1,400	Faster Transit Time
	Brick	(IB) South	25	1,250	2,500	30	1,500	3,000	10	500	1,000	Consistent Transit Time, Reduced Damages in Transit
Salina	Plastic	(IB) Ohio	150	11,250	26,250	200	15,000	35,000				
	Auto Parts	(OB) U.S.	3,450	51,750	345,000	3,600	54,000	360,000				
Milan	Dimension Lumber	(IB) W. Coast	60	3,000	14,100	32	1,280	7,520	50	2,000	11,750	Consistent Transit Time, Reduced Rail Rates
Dundee	Plastic Resin	(IB) Texas	1	60	200	1	60	200				
	Plastic Resin	(IB) Louisiana	2	120	600	2	120	600				
	Grain	(OB) E. Coast	400	40,000	72,000	400	40,000	72,000	100	10,000	18,000	Available Rail Cars
	Coal	(IB) Kentucky	800	56,000	112,000	800	56,000	112,000				
	Coal	(IB) Ohio	200	14,000	28,000	200	14,000	28,000				
	Coal	(IB) Pa.	273	19,100	40,950	273	19,100	40,950				
	Coke	(IB) Virginia							62	4,960	7,440	Reduced Rail Rates
	Gypsum	(OB) Michigan	385	25,550	40,425	385	25,550	40,425				
	Cement	(OB) Midwest	3,445	275,700	482,300	3,445	275,700	482,300				
Toledo, Ohio	Food Products	(IB) Calif.	108	3,240	19,440	108	3,240	19,440				
	Paper Material	(IB) Wisconsin	416	6,240	83,200	416	6,240	83,200				
	Feed Pellets	(OB) Midwest	480	4,800	48,000	450	4,500	45,000	50	500	5,000	Available Rail Cars
	Paper Material	(IB) Wisconsin	197	11,820	39,400	200	12,000	40,000				
	Paper Material	(IB) Canada	200	12,000	36,000	200	12,000	36,000	25	1,500	4,500	Consistent Transit Time
	Coal	(IB) W. Va.	312	15,600	31,200	312	15,600	31,200				
TOTAL			18508	1,113,628	3,066,912	19,689	1,122,620	3,352,628	3,189	272,464	764,075	

% CHANGE
1975-1976

% INCREASE 1976-1 to 1976-2
VIA IMPROVED RAIL SERVICE

+6.4 +10.7 9.3%

+16.2% +24.2% =22.7%

TABLE B-1, Continued

Ann Arbor Rail Users Survey continued..
Page 6

FOOTNOTES

- ¹Commodities are grouped by shipper on a per station basis. The number of shippers at any station (and for all stations) can be determined by adding the number of commodity groupings under each station heading.
- ²1975 traffic data (cars, tons) was collected by field and telephone surveys by Bob Bryant, Michigan Department of Commerce, and John Koehler Jim Satchel UPTRAH, Michigan Department of State Highways and Transportation. The present survey verified their figures and made changes and additions, as necessary.
- ³1976 - Estimate 1 traffic figures (cars, tons) are estimates made by the shippers at the time of this survey. The estimates are based on present rail service quality characteristics, i.e., transit time, variance in transit time, frequency of service, car supply, damages, and rates.
- ⁴1976 - Estimate 2 traffic figures (cars, tons) are shipper estimates based on improved rail service. Specific changes in rail service quality important to shippers are listed in the column Key Rail Service Elements.
- ⁵It should be noted that many of the rail service variables listed involve the performance of railroads beyond the Michigan carrier. For example, increasing transit time and reducing the variance of transit time associated with a given shipment (inbound or outbound) may involve three or four railroads.
- ⁶1975, 1976 - Estimate 1, 1976 - Estimate 2 revenue figures are estimates. For the most part, shippers are not sure of the freight charges they paid on their rail shipments. And, even if they do know the total freight charge paid, they do not know what percent went to the Michigan carrier. Therefore the following procedure was used to estimate revenues earned by Michigan carriers. The freight charges for comparable shipments (commodity, tons, origin, destination) were determined from the 100% 1973 Ann Arbor and Penn Central (Michigan Northern portion) waybill tapes. These figures were then used to estimate the 1975 and 1976 revenue figures presented here.

TABLE B-2
MICHIGAN NORTHERN RAIL USERS SURVEY

Station	Commodity ¹	Inbound (IB) Origin Outbound (OB) Destination	Car- loads	1975 ²		Traffic Data 1976-Estimate 1 ³			1976-estimate 2 ⁴			Key Rail Service Element
				Tons	Gross Revenue	Car- loads	Tons	Gross Revenue	Car- loads	Tons	Gross Revenue ⁶	
Pellston	Dimension Lumber	(IB) West Coast	2	50	384	4	150	768	3	90	576	Increased Service Frequency
	Christmas Trees	(OB) ALA	10	140	700	15	200	1,050	5	70	350	Avail. Rail Cars
Petoskey	Brick	(IB) Ohio	12	720	2,268	17	1,020	3,213	8	480	1,512	Cons. Trans. Time, Reduce Damage
	Dimension Lumber	(IB) West Coast	3	120	526							
	Asphalt Roofing Products	(IB) IL	2	100	340	5	250	850	3	150	510	Unloading Facilities
	Feed Fertilizer	(IB) Ohio (IB) Ohio							12 6	862 420	1,680 1,371	Fast. Trans. Time Cons. Trans. Time, Car spot
	Charcoal	(IB) TN	4	200	640	4	200	640				
	Wine	(IB) CA	10	500	1,750	10	500	1,750	6	300	1,050	Cons. & Fast. Trans. Time
	Asbestos	(IB) IN							3	60	300	Unloading Facilities
	Dimension Lumber	(IB) West Coast	40	1,200	7,680	45	1,350	8,640	7	210	1,344	Cons. Trans. Time, Incr. Freq.
	Dimension Lumber	(IB) West Coast	3	150	555	5	250	925	6	300	1,110	Cons. Trans. Time, Incr. Freq.
	Dimension Lumber	(IB) South	15	750	3,675	20	1,000	4,900	3	150	735	Cons. Trans. Time, Incr. Freq.
	L.P. Gas	(IB) MI	18	1,296	2,790	20	1,440	3,100	1	72	155	Increased Service Frequency
	L.P. Gas	(IB) MISS	12	864	1,260	14	1,008	1,470	2	144	210	
	Flour	(IB) IA	6	240	1,344							
	Can Goods	(IB) IA	6	240	960							
	Timber	(OB) KY	3	135	370	6	270	742	4	180	494	Fast. Trans. Time, Incr. Freq.
	Paper Products	(IB) WI	40	840	2,880	45	900	3,240	10	200	720	Unloading Facilities

TABLE B-2, Continued

Station	Commodity ¹	Inbound (IB) Origin Outbound (OB) Destination	Car- loads	1975 ²		Traffic Data 1976-Estimate 1 ³			1976-Estimate 2 ⁴			Key Rail Service Element ⁵
				Tons	Gross Revenue	Car- loads	Tons	Gross Revenue	Car- loads	Tons	Gross Revenue ⁶	
	Scrap Iron	(OB) PA	24	1,440	9,100	24	1,440	9,100				
	Dimension Lumber	(IB) West Coast	2	80	260	2	80	260	2	80	260	Cons. Trans. Time, Incr. Freq.
	Poles Scrap Cable	(IB) South (OB) MI							5 20	300 1,000	500 3,640	Cons. Trans. Time Incr. Freq., Avail. Cars
Boyne City	Dimension Lumber	(IB) West Coast	3	85	357	3	85	357	5	150	595	Incr. Freq., Unloading Facility
	Cross Arms	(IB) South	2	80	240	2	80	240				
	Insulators	(IB) East	2	80	280	2	80	280				
	Food (USDA)	(IB) U.S.	28	560	3,500	28	560	3,500				
Boyne Falls	Timber	(OB) South	19	950	2,470	22	1,110	2,860	5	250	650	Available Rail Cars
	Cedar Paneling	(IB) West Coast	12	446	1,606	20	743	2,678				
Elmira	Farm Equipment	(IB) IL	1	16	95	1	16	95				
Mancelona	Pipe	(IB) Ohio	27	1,080	8,100				100	3,800	30,000	Unloading Facilities
	Feed	(IB) Ohio	2	160	252	2	160	252	12	960	1,512	Fast. Trans. Time
	Oyster Shells	(IB) MD							6	240	1,656	Const. Trans. Time
	Timber	(OB) TX	2	130	400	4	160	800	5	200	1,000	Avail. Cars, Fast. Trans. Time
Kalkaska	Christmas Trees	(OB) TX	16	400	2,160	8	200	1,080	15	375	2,025	Avail Rail Cars, Fast. Trans.
	Gel Additive	(IB) SD	12	480	3,600	26	1,040	7,800				
	Pipe Pipe	(IB) PA (OB) TX	253	15,000	121,400	3	180	1,050	7	420	2,450	Fast. Trans. Time, Reduce Rates

TABLE B-2, Continued

Station	Commodity ¹	Inbound (IB) Origin Outbound (OB) Destination	Car- loads	1975 ²		Traffic Data 1976-Estimate 1 ³			1976-Estimate 2 ⁴			Key Rail Service Element ⁵
				Tons	Gross Revenue	Car- loads	Tons	Gross Revenue	Car- loads	Tons	Gross Revenue ⁶	
	Gel Additive	(IB) GA	13	650	3,120	13	650	3,120				
	Bentonite	(IB) WY	13	650	2,340	13	650	2,340				
	Bautes	(IB) TX	14	700	2,520	14	700	2,520				
	Gel Additive	(IB) WY	10	500	1,800	10	500	1,800				
	Ground Ore	(IB) MO	30	1,500	9,000	30	1,500	9,000				
	Gel Additive	(IB) WY	19	970	3,301	19	917	3,301				
	Gel Additive	(IB) FLA	18	917	4,402	18	917	4,402				
	Bentonite	(IB) WY	18	917	3,121	18	917	3,121				
	Coal	(IB) KY	3	180	297	2	100	197				
	Soybean Meal	(IB) IL	2	150	200							
	Fertilizer	(IB) Ohio	1	50	135							
Traverse City	Furniture	(IB) South	6	180	732	6	180	732				
	Dimension Lumber	(IB) South	15	1,200	2,100	18	1,440	2,520	8	640	1,120	Const. Trans. Time
	Dimension Lumber	(IB) West Coast	10	400	1,200	12	480	1,440	10	400	1,200	Const. Trans. Time, Reduced Rate
	Soybean Meal	(IB) IL	16	1,200	1,600	31	2,325	3,100				
	Oyster Shell	(IB) MO	8	450	2,208	19	1,068					
	Poles	(IB) South	12	480	1,200	10	400	1,000				
	Furniture	(IB) GA	4	20	488	6	30	732				
Manton	Dimension Lumber	(IB) West Coast	13	585	1,625	5	200	625	25	1,000	3,125	Storage Facilities
	Dimension Lumber	(IB) West Coast	35	1,400	4,375	50	2,000	6,250				
	Dimension Lumber	(IB) West Coast	20	800	2,400	15	600	1,800	30	1,200	3,600	Const. Trans. Time, Incr. Freq.

TABLE B-2, Continued

Station	Commodity ¹	Inbound (IB) Origin Outbound (OB) Destination	Traffic Data			1976-Estimate ²			1976-Estimate ³			Key Rail Service Element ⁵
			Car-loads	Tons	Gross Revenue	Car-loads	Tons	Gross Revenue	Car-loads	Tons	Gross Revenue ⁶	
Cádlillac	Coke	(IB) KAN	12	600	3,240	12	600	3,240				
	Dimension Lumber	(IB) West Coast	2	90	270	3	405		8	360	1,080	Reduced Rail Rates
	Dimension Lumber	(IB) West Coast	12	575	1,725	15	720	2,160	10	480	1,140	Const. Rail Time
	Roofing Shingles	(IB) IL	12	575	1,500	13	624	1,625	5	240	625	Inc. Serv. Freq, Reduced Rates
	L.P. Gas	(IB) IL	100	7,300	10,000	110	8,030	11,000	10	730	1,000	Fast. Trans. Time, Incr. Freq.
Tustin	Dimension Lumber	(IB) West Coast	1	70	115	1	70	115	4	280	460	Reduced Rail Rates
Leroy	Dimension Lumber	(IB) West Coast	8	320	920	8	320	920	4	160	460	Incr. Freq.
Reed City	Motor Oil	(IB) TX	12	360	1,518	12	360	1,518				
	Barites	(IB) ARK	20	1,000	3,000	20	1,000	3,000				
	Bentonite	(IB) WYO	10	500	1,000	10	500	1,000				
	Asbestos	(IB) Canada	3	150	330	3	150	330				
	Clay	(IB) FLA	5	250	567	5	250	567				
	Paper	(IB) KAN	2	100	234	2	100	234				
	Dimension Lumber	(IB) West Coast	4	160	500	4	160	500				
Big Rapids	Pipe	(IB) PA	21	1,445	4,200	28	2,221	4,200	15	975	3,000	Incr. Freq.
	Dimension Lumber	(IB) West Coast	1	40	125				10	400	1,250	Const. Trans. Time, Incr. Freq.
	Paper Products	(IB) WISC	12	264	500	12	264	500				
	Dimension Lumber	(IB) South	25	1,875	3,575	30	2,250	4,290	10	650	1,430	Const. Trans. Time, Incr. Freq.
	Dimension Lumber	(IB) ORE	6	300	750	10	500	1,250				
	Coal	(IB) W. VA	4	300	400	6	400	600				
	Roofing Shingles	(IB) IL							5	200	625	Const. Trans. Time, Reduced Freq

TABLE B-2, Continued

Station	Commodity ¹	Inbound (IB) Origin Outbound (OB) Destination	Car- loads	1975 ²		Traffic Data 1976-Estimate 1 ³			1976-Estimate 2 ⁴			Key Rail Service Element ⁵
				Tons	Gross Revenue	Car- loads	Tons	Gross Revenue	Car- loads	Tons	Gross Revenue ⁶	
	Brick	(IB) South	20	1,000	3,160	20	1,000	3,160	10	500	1,580	Reduced Damage
Starwood	Soybean Meal	(IB) IL	2	450	182	2	450	182	4	320	720	Const. Trans. Time, Incr. Freq.
	Potash	(IB) Canada	6	600	1,200	6	600	1,200				
	Liquid Nitrogen	(IB) KY	3	150	450	3	150	450				Avail. Rail Cars
	Grain	(IB) East Coast							15	1,200	2,250	
Howard City	Dimension Lumber	(IB) West Coast	12	384	1,200	12	384	1,200	12	384	1,200	Incr. Freq.
	Fertilizer	(IB) Canada	6	600	600	6	600	600	4	400	400	Const. Trans. Time
	Feed	(IB) IL	3	150	267	3	150	267	5	250	446	Fst. Trans. Time
	Seed Beans	(IB) IDO	1	50	100	1	50	100				Avail Rail Cars
	Beans	(OB) ME	1	50	150	1	50	150	3	300	450	
Cedar Springs	Dimension Lumber	(IB) West Coast	4	240	400	4	240	400				
	Coal	(IB) KY	14	900	1,540	6	390	1,660	10	500	1,100	Reduced Damage
	Fertilizer	(IB) MI	6	300	675							
	Farm Equipment	(IB) PA	2	150	520	2	150	520	4	200	1,040	Const. Trans. Time, Incr. Freq.
	Tires	(IB) IO	10	120	1,024							
	Dolomitic Lime	(IB) Ohio	610	42,700	48,800	725	57,475	58,000				

TABLE B-2, Continued

Station	Commodity ¹	Inbound (IB) Origin Outbound (OB) Destination	1975 ²			Traffic Data 1976-Estimate 1 ³			1976-Estimate 2 ⁴			Key Rail Service Element ⁵
			Car- loads	Tons	Gross Revenue	Car- loads	Tons	Gross Revenue	Car- loads	Tons	Gross Revenue ⁶	
Rockford	Rock Salt	(IB) Detroit	1	60	86	1	60	86				
	Sodium Carbonate	(IB) WYO	4	202	200	4	202	200				
	Ferrous Sulphate	(IB) GA	7	343	588	7	343	588				
	Ferrous Sulphate	(IB) MD	6	303	720	6	303	720				
	Tannin Oil	(IB) MASS	4	126	600	4	126	600	2	60	300	Const. Trans. Time
	Sea Animal Oil	(IB) MASS	11	285	1,650	11	285	1,650	3	90	600	Fast. Trans. Time
	Pig Skins	(IB) MINN	24	1,003	2,520	24	1,003	2,520	10	400	1,050	Incr. Freq.
	Pig Skins	(IB) NEBR	37	1,063	2,220	37	1,063	2,220	10	400	600	Incr. Freq.
	Pig Skins	(IB) WISC	2	64	204	2	64	204				
	Scrap Leather	(OB) WISC	57	3,277	4,560	57	3,277	4,560	15	900	1,200	Avail. Rail Cars
	Clay	(IB) GA	20	800	2,142	20	800	2,142				
	Waste Paper	(IB) U.S.	80	2,400	5,904	80	2,400	5,904				
	Coals	(IB) IL							30	1,500	3,000	Const. Trans. Time, Incr. Freq.
TOTAL			2,096	116,739	353,647	2,014	120,315	241,621	552	26,582	92,306	
PERCENT CHANGE 1975 - 1976						-3.9%	+3.0%	-31.7%				
PERCENT INCREASE 1976-1 to 1976-2 VIA IMPROVED RAIL SERVICE									+27.4%	+22.1%	+38.2%	

FOOTNOTES

¹ Commodities are grouped by shipper on a per station basis. The number of shippers at any station (and for all stations) can be determined by adding the number of commodity groupings under each station heading.

² 1975 traffic data (cars, tons) was collected by field and telephone surveys conducted by Bob Bryant, Michigan Department of Commerce, and John Koehler and Jim Satchel, UPTAN, Michigan Department of State Highways and Transportation. The present survey verified their figures and made changes and additions as necessary.

³ 1976 - Estimate 1 traffic figures (cars, tons) are estimates made by the shippers at the time of this survey. The estimates are based on present rail service quality characteristics, i.e., transit time, variance in transit time, frequency of service, car supply, damages, and rates.

TABLE B-2, Continued

- ⁴ 1976 - Estimate 2 traffic figures (cars, tons) are shipper estimates based on improved rail service. Specific changes in rail service quality important to shippers are listed in the column "Key Rail Service Elements".
- ⁵ It should be noted that many of the rail service variables listed involve the performance of railroads beyond the Michigan carrier. For example, increasing transit time and reducing the variance of transit time associated with a given shipment (inbound or outbound) may involve three or four railroads.
- ⁶ 1975, 1976 - Estimate 1, 1976 - Estimate 2 revenue figures are estimates. For the most part, shippers are not sure of the freight charges they paid on their rail shipments. And, even if they do know the total freight charge paid, they do not know what percent went to the Michigan carrier. Therefore the following procedure was used to estimate revenues earned by Michigan carriers. The freight charges for comparable shipments (commodity, tons, origin, destination) were determined from the 100% 1973 Ann Arbor and Penn Central (Michigan Northern portion) waybill tapes. These figures were then used to estimate the 1975 and 1976 revenue figures presented here.

APPENDIX C

APPENDIX C

REGIONSRegion 1 (States)

Maine
New Hampshire
Vermont
Massachusetts
Rhode Island
Connecticut
New York
New Jersey

Region 2 (States)

Pennsylvania
Delaware
Maryland
District of Columbia
Virginia
West Virginia
Kentucky

Region 3 (States)

Michigan
Wisconsin
Ohio
Indiana
Illinois

Region 4 (States)

North Carolina
Tennessee
South Carolina
Georgia
Mississippi
Florida

Region 5 (States)

Minnesota
North Dakota
South Dakota
Iowa
Nebraska
Missouri
Kansas

Region 6 (States)

Arkansas
Oklahoma
Louisiana
Texas

Region 7 (States)

Montana
Wyoming
Colorado
Utah
New Mexico
Arizona

Region 8 (States)

Idaho
Washington
Oregon
Nevada
California

Region 9

Canada

TABLE C-1

ANN ARBOR RAILWAY
1973 INBOUND AND OUTBOUND CARLOADS, BY COMMODITY BY REGION

Commodity	Region									Total	Percent
	1	2	3	4	5	6	7	8	9		
Farm Products	811	145	122	11	2	4	-	29	1	1125	5
Forest Products	-	-	-	50	-	111	16	15	10	202	1
Fresh Fish or Other Marine Products	-	4	-	2	-	-	-	-	-	6	0
Metallic Ores	-	-	-	-	6	2	-	-	-	8	0
Coal	204	2334	146	233	-	-	-	-	-	2917	12
Crude Petroleum, Natural Gas, or Gasoline	-	-	-	-	-	-	-	-	-	-	0
Nonmetallic Minerals	16	5	1720	38	5	4	4	5	16	1813	8
Ordinance or Accessories	-	-	-	-	-	-	-	-	-	-	0
Food or Kindred Products	29	30	103	21	25	39	1	116	7	369	2
Tobacco Products	-	-	-	-	-	-	-	-	-	-	0
Basic Textiles	-	1	103	1	1	1	-	-	-	107	1
Apparel	1	-	-	-	-	-	-	-	-	1	0
Lumber or Wood Products	4	37	82	63	21	111	74	504	372	1263	5
Furniture or Fixtures	68	193	438	49	329	45	6	23	7	1158	5
Pulp, Paper, or Allied Products	52	22	84	16	22	16	3	4	77	296	1
Printed Matter	-	-	-	-	-	-	-	-	-	-	0
Chemicals or Allied Products	71	106	153	37	19	151	6	5	53	901	4
Petroleum or Coal Products	25	50	418	106	15	6	-	-	10	630	3
Rubber or Misc. Plastic Products	2	18	70	2	-	4	-	-	-	104	0
Leather or Leather Products	-	-	-	-	-	-	-	-	-	-	0
Stone, Clay, or Glass Products	3	259	3807	3359	21	86	3	21	5	7564	32
Primary Metal Products	-	6	20	11	24	3	1	16	-	81	0
Fabricated Metal Products	6	11	26	5	4	-	-	1	1	54	0
Machinery	2	11	21	-	11	-	-	2	-	47	0
Electrical Machinery	2	1	1	-	-	-	-	-	4	8	0
Transportation Equipment	555	386	1925	306	612	1	-	354	393	4632	20
Misc. Products of Manufacturing	-	-	-	-	-	-	-	-	-	-	0
Waste or Scrap Materials	-	-	72	107	-	1	-	-	11	191	1
Misc. Freight Shipments	-	22	29	1	15	-	-	-	-	67	0
Containers, Shipping	7	-	28	2	2	-	-	-	17	56	0
Shipper Association or Similar Traffic	-	-	-	-	-	-	-	-	-	-	0
Misc. Mixed Shipments	-	-	1	-	-	-	-	-	-	1	0
Small Packaged Freight Shipments	-	-	-	-	2	-	-	-	-	2	0
TOTAL	1858	3641	9775	4420	1136	585	114	1095	984	23608	100
PERCENT	8	15	41	19	5	2	1	5	4		100

Source: Ann Arbor 100% Waybill Tape.

TABLE C-2

ANN ARBOR RAILWAY
1973 INBOUND CARLOADS, BY COMMODITY BY REGION

Commodity	Region									Total	Percent
	1	2	3	4	5	6	7	8	9		
Farm Products	9	-	-	-	-	-	-	1	1	11	0
Forest Products	-	-	-	-	-	-	-	-	-	-	0
Fresh Fish or Other Marine Products	-	4	-	2	-	-	-	-	-	6	0
Metallic Ores	-	-	-	-	6	2	-	-	-	8	0
Coal	204	2334	146	233	-	-	-	-	-	2917	36
Crude Petroleum, Natural Gas, or Gasoline	-	-	-	-	-	-	-	-	-	-	0
Nonmetallic Minerals	16	5	451	38	5	4	4	5	16	544	7
Grain or Accessories	-	-	-	-	-	-	-	-	-	-	0
Food or Kindred Products	9	21	94	21	18	39	1	97	-	300	4
Tobacco Products	-	-	-	-	-	-	-	-	-	-	0
Basic Textiles	-	1	100	1	1	1	-	-	-	104	1
Apparel	-	-	-	-	-	-	-	-	-	-	0
Lumber or Wood Products	4	37	49	61	21	111	74	504	369	1230	15
Furniture or Fixtures	11	-	7	4	-	-	-	-	1	23	0
Pulp, Paper, or Allied Products	52	22	63	16	22	16	3	4	77	275	3
Printed Matter	-	-	-	-	-	-	-	-	-	-	0
Chemicals or Allied Products	71	106	442	35	19	150	4	3	53	883	11
Petroleum or Coal Products	25	50	412	106	15	6	-	-	10	624	8
Rubber or Misc. Plastic Products	-	18	5	2	-	4	-	-	-	29	0
Leather or Leather Products	-	-	-	-	-	-	-	-	-	-	0
Stone, Clay, or Glass Products	3	48	360	53	21	16	3	21	5	530	7
Primary Metal Products	-	6	18	11	24	3	1	16	-	79	1
Fabricated Metal Products	6	11	16	1	3	-	-	1	1	39	1
Machinery	-	8	21	-	11	-	-	2	-	42	1
Electrical Machinery	-	-	1	-	-	-	-	-	-	1	0
Transportation Equipment	33	81	153	-	3	1	-	6	1	278	3
Misc. Products of Manufacturing	-	-	-	-	-	-	-	-	-	-	0
Waste or Scrap Materials	-	-	5	-	-	1	-	-	-	6	0
Misc. Freight Shipments	-	22	26	1	15	-	-	-	-	64	1
Containers, Shipping	7	-	28	2	2	-	-	-	17	56	1
Shipper Association or Similar Traffic	-	-	-	-	-	-	-	-	-	-	0
Misc. Mixed Shipments	-	-	1	-	-	-	-	-	-	1	0
Small Packaged Freight Shipments	-	-	-	-	2	-	-	-	-	2	0
TOTAL	450	2774	2398	587	188	354	90	660	551	8052	100
PERCENT	6	35	30	7	2	4	1	8	7		100

Source: Ann Arbor 100% Waybill Tape.

TABLE C-3

ANN ARBOR RAILWAY
1973 OUTBOUND CARLOADS, BY COMMODITY BY REGION

Commodity	Region									Total	Percent
	1	2	3	4	5	6	7	8	9		
Farm Products	802	145	122	11	2	4	-	28	-	1114	7
Forest Products	-	-	-	50	-	111	16	15	10	202	2
Fresh Fish or Other Marine Products	-	-	-	-	-	-	-	-	-	-	0
Metallic Ores	-	-	-	-	-	-	-	-	-	-	0
Coal	-	-	-	-	-	-	-	-	-	-	0
Crude Petroleum, Natural Gas, or Gasoline	-	-	-	-	-	-	-	-	-	-	0
Nonmetallic Minerals	-	-	1269	-	-	-	-	-	-	1269	8
Ordnance or Accessories	-	-	-	-	-	-	-	-	-	-	0
Food or Kindred Products	20	9	7	-	7	-	-	19	7	69	1
Tobacco Products	-	-	-	-	-	-	-	-	-	-	0
Basic Textiles	-	-	3	-	-	-	-	-	-	3	0
Apparel	1	-	-	-	-	-	-	-	-	1	0
Lumber or Wood Products	-	-	33	2	-	-	-	-	3	38	0
Furniture or Fixtures	57	193	431	45	329	45	6	23	6	1135	7
Pulp, Paper, or Allied Products	-	-	21	-	-	-	-	-	-	21	0
Printed Matter	-	-	-	-	-	-	-	-	-	-	0
Chemicals or Allied Products	-	-	11	2	-	1	2	2	-	18	0
Petroleum or Coal Products	-	-	6	-	-	-	-	-	-	6	0
Rubber or Misc. Plastic Products	2	-	73	-	-	-	-	-	-	75	1
Leather or Leather Products	-	-	-	-	-	-	-	-	-	-	0
Stone, Clay, or Glass Products	-	211	3447	3306	-	70	-	-	-	7034	45
Primary Metal Products	-	-	2	-	-	-	-	-	-	2	0
Fabricated Metal Products	-	-	10	4	1	-	-	-	-	15	0
Machinery	2	3	-	-	-	-	-	-	-	5	0
Electrical Machinery	2	1	-	-	-	-	-	-	4	7	0
Transportation Equipment	522	305	1872	306	609	-	-	348	392	4354	28
Misc. Products of Manufacturing	-	-	-	-	-	-	-	-	-	-	0
Waste or Scrap Materials	-	-	67	107	-	-	-	-	11	185	1
Misc. Freight Shipments	-	-	3	-	-	-	-	-	-	3	0
Containers, Shipping	-	-	-	-	-	-	-	-	-	-	0
Shipper Association or Similar Traffic	-	-	-	-	-	-	-	-	-	-	0
Misc. Mixed Shipments	-	-	-	-	-	-	-	-	-	-	0
Small Packaged Freight Shipments	-	-	-	-	-	-	-	-	-	-	0
TOTAL	1408	867	7377	3033	948	231	24	435	433	15556	100
PERCENT	9	6	47	25	6	1	0	3	3		100

Source: Ann Arbor 100% Maybill Tape.

TABLE C-4

MICHIGAN NORTHERN RAIL LINE
1973 INBOUND-OUTBOUND COMBINED CARLOADS, BY COMMODITY BY REGION

Commodity	Region									Total	Percent
	1	2	3	4	5	6	7	8	9		
Farm Products	3	-	3	2	2	-	2	-	-	12	0
Forest Products	1	2	2	25	23	112	45	25	-	235	10
Food or Kindred Products	9	4	61	5	44	4	1	6	-	134	6
Lumber or Wood Products	7	20	42	59	13	20	9	162	119	451	18
Pulp, Paper, or Allied Products	2	-	62	10	21	2	-	-	-	97	4
Clay, Concrete, and Glass	2	13	53	57	16	7	66	2	8	224	9
Transportation Equipment	3	10	25	1	-	-	-	-	-	39	2
Containers, Shipping	-	-	1	-	-	-	-	-	-	1	0
Fresh Fish and Other	-	4	-	-	-	-	-	-	-	4	0
Coal	-	93	-	-	-	-	-	-	-	93	4
Chemicals or Allied Products	-	3	14	6	19	8	-	1	12	63	3
Petroleum or Coal Products	-	30	80	5	17	14	-	-	22	168	7
Fabricated Metal Products	-	6	38	-	1	36	-	-	-	81	3
Machinery	-	6	5	2	7	12	-	5	-	37	2
Electrical Machinery	-	6	6	1	1	-	-	3	-	17	1
Waste or Scrap Materials	-	28	164	4	-	-	-	3	3	202	8
Nonmetallic Minerals	-	-	283	33	38	5	1	-	-	360	15
Misc. Mixed Shipments	-	-	1	-	-	1	-	-	-	2	0
Furniture or Fixtures	3	8	13	2	6	-	-	1	-	33	1
Metallic Ores	-	-	-	-	1	-	-	-	-	1	0
Misc. Products of Manufacturing	-	-	-	-	-	1	-	-	1	2	0
Rubber or Misc. Plastics	1	3	-	-	5	-	-	-	-	9	0
Textile Mill Products	-	-	2	3	-	1	-	-	-	6	0
Shipper Association	-	-	1	-	-	-	-	-	-	1	0
Primary Metal Products	-	54	78	-	6	4	-	3	4	149	6
Misc. Freight Shipments	-	-	10	3	-	7	-	-	-	20	1
TOTAL	31	290	944	218	220	234	124	211	169	2441	100
PERCENT	1	12	39	9	9	9	5	9	7		100

Source: Penn Central 100% Waybill Tape.

TABLE C-5

MICHIGAN NORTHERN RAIL LINE
1973 INBOUND CARLOADS, BY COMMODITY BY REGION

Commodity	Region									Total	Percent
	1	2	3	4	5	6	7	8	9		
Farm Products	1	-	1	-	2	-	2	-	-	6	0
Food or Kindred Products	4	-	57	4	44	4	1	6	-	120	6
Lumber or Wood Products	1	19	19	51	12	19	9	162	119	411	21
Pulp, Paper, or Allied Products	2	-	62	10	21	2	-	-	-	97	5
Clay, Concrete, and Glass	2	13	52	57	16	7	66	2	8	223	12
Transportation Equipment	2	7	2	-	-	-	-	-	-	11	1
Containers, Shipping	-	-	-	-	-	-	-	-	-	0	0
Fresh Fish and Other	-	4	-	-	-	-	-	-	-	4	0
Coal	-	93	-	-	-	-	-	-	-	93	5
Chemicals or Allied Products	-	3	14	6	19	8	-	1	12	63	3
Petroleum or Coal Products	-	29	73	5	16	14	-	-	22	159	8
Primary Metal Products	-	54	78	-	6	4	-	3	4	149	8
Fabricated Metal Products	-	6	37	-	1	36	-	-	-	80	4
Machinery	-	6	5	2	7	12	-	5	-	37	2
Electrical Machinery	-	6	6	1	1	-	-	3	-	17	1
Waste or Scrap Materials	-	1	63	4	-	-	-	3	3	79	4
Nonmetallic Minerals	-	-	283	33	38	5	1	-	-	360	19
Misc. Mixed Shipments	-	-	1	-	-	1	-	-	-	2	0
Furniture or Fixtures	-	-	10	1	1	-	-	-	-	12	1
Metallic Ores	-	-	-	-	1	-	-	-	-	1	0
Misc. Products of Manufacturing	-	-	-	-	-	-	-	-	1	1	0
Rubber or Misc. Plastics	-	3	-	-	5	-	-	-	-	8	0
Textile Mill Products	-	-	1	3	-	1	-	-	-	5	0
TOTAL	12	244	769	177	190	113	79	185	169	1938	100
PERCENT	1	13	39	9	10	6	4	9	9		100

Source: Penn Central 100% Waybill Tape.

TABLE C-6

MICHIGAN NORTHERN RAIL LINE
1973 OUTBOUND CARLOADS, BY COMMODITY BY REGION

Commodity	Region									Total	Percent
	1	2	3	4	5	6	7	8	9		
Farm Products	2	-	2	2	-	-	-	-	-	6	1
Forest Products	1	2	2	25	23	112	45	25	-	235	47
Food or Kindred Products	5	4	4	1	-	-	-	-	-	14	3
Lumber or Wood Products	6	1	23	8	1	1	-	-	-	40	8
Furniture or Fixtures	3	8	3	1	5	-	-	1	-	21	4
Rubber or Misc. Plastics	1	-	-	-	-	-	-	-	-	1	0
Transportation Equipment	1	3	23	1	-	-	-	-	-	28	6
Petroleum or Coal Products	-	1	7	-	1	-	-	-	-	9	2
Waste or Scrap Materials	-	27	96	-	-	-	-	-	-	123	25
Nonmetallic Minerals	-	-	-	-	-	-	-	-	-	0	0
Textile Mill Products	-	-	1	-	-	-	-	-	-	1	0
Clay, Concrete, and Glass	-	-	1	-	-	-	-	-	-	1	0
Fabricated Metal Products	-	-	1	-	-	-	-	-	-	1	0
Misc. Freight Shipments	-	-	10	3	-	7	-	-	-	20	4
Containers, Shipping	-	-	1	-	-	-	-	-	-	1	0
Shipper Association	-	-	1	-	-	-	-	-	-	1	0
Electrical Machinery	-	-	-	-	-	-	-	-	-	0	0
Misc. Products of Manufacturing	-	-	-	-	-	1	-	-	-	1	0
TOTAL	19	46	175	41	30	121	45	26	0	503	100
PERCENT	4	9	35	8	6	24	9	5	0		100

Source: Penn Central 100% Waybill Tape.

TABLE C-7

C.O.-NORTHWEST RAIL LINE
1973 INBOUND-OUTBOUND COMBINED CARLOADS, BY COMMODITY BY REGION

Commodity	Region									Total	Percent
	1	2	3	4	5	6	7	8	9		
Food or Kindred Products	87	30	127	60	100	34	13	102	2	555	13
Containers, Shipping	4	-	-	-	-	-	-	-	-	4	0
Coal	-	15	-	-	-	-	-	-	-	15	1
Clay, Concrete, or Glass	1	14	925	37	24	-	70	-	7	1078	25
Machinery	-	4	1	-	-	-	-	5	-	10	0
Nonmetallic Minerals	-	2	47	2	-	-	-	1	3	55	1
Lumber or Wood Products	9	5	134	23	35	53	46	375	258	938	22
Petroleum or Coal Products	-	1	431	69	4	11	-	-	1	517	12
Rubber or Misc. Plastics	19	2	12	6	3	32	1	4	1	80	2
Transportation Equipment	-	-	9	1	1	-	1	-	-	12	0
Pulp, Paper, or Allied Products	3	5	20	36	-	10	-	-	2	76	2
Textile Mill Products	1	-	3	-	10	-	-	-	-	14	0
Waste or Scrap Materials	-	-	63	1	6	-	-	-	-	70	2
Chemicals or Allied Products	2	2	55	1	10	2	1	-	11	84	2
Fabricated Metal Products	75	21	143	1	25	2	-	-	-	267	6
Electrical Machinery	-	1	3	-	-	-	-	-	-	4	0
Primary Metal Products	4	4	13	3	-	-	2	-	-	26	1
Furniture or Fixtures	14	38	268	7	29	8	7	1	-	372	9
Farm Products	1	-	2	-	2	-	-	3	6	14	1
Fresh Fish and Other	-	-	-	4	-	-	-	-	-	4	0
Misc. Mixed Products	-	-	-	-	-	-	-	6	-	6	0
Forest Products	-	-	2	10	-	35	-	5	-	52	1
TOTAL	220	144	2258	261	249	187	141	503	290	4253	100
PERCENT	5	3	53	6	6	5	3	12	7		100

Source: C. & O. 100% Waybill Tape.

TABLE C-8

C.O.-NORTHWEST RAIL LINE
1973 INBOUND CARLOADS, BY COMMODITY BY REGION

Commodity	Region									Total	Percent
	1	2	3	4	5	6	7	8	9		
Food or Kindred Products	6	-	35	8	49	4	4	56	2	164	7
Containers, Shipping	4	-	-	-	-	-	-	-	-	4	0
Coal	-	15	-	-	-	-	-	-	-	15	1
Clay, Concrete, or Glass	1	14	55	37	23	-	70	-	7	207	9
Machinery	-	1	1	-	-	-	-	5	-	7	0
Nonmetallic Minerals	-	2	27	2	-	-	-	1	3	35	2
Lumber or Wood Products	2	2	32	13	35	51	46	373	258	812	35
Petroleum or Coal Products	-	1	431	69	4	11	-	-	1	517	22
Rubber or Misc. Plastics	-	2	11	2	3	-	-	-	-	18	1
Transportation Equipment	-	-	7	-	-	-	-	-	-	7	0
Pulp, Paper, or Allied Products	3	5	19	36	-	10	-	-	2	75	3
Textile Mill Products	1	-	3	-	10	-	-	-	-	14	1
Waste or Scrap Materials	-	-	51	1	6	-	-	-	-	58	3
Chemicals or Allied Products	1	2	44	1	10	2	1	-	11	72	3
Fabricated Metal Products	69	19	140	1	25	-	-	-	-	254	11
Electrical Machinery	-	1	1	-	-	-	-	-	-	2	0
Primary Metal Products	4	4	13	1	-	-	2	-	-	24	1
Furniture or Fixtures	1	-	7	2	2	-	1	-	-	13	1
Farm Products	-	-	-	-	1	-	-	3	6	10	0
Fresh Fish and Other	-	-	-	4	-	-	-	-	-	4	0
TOTAL	92	68	877	177	168	78	124	438	290	2312	100
PERCENT	4	3	38	8	7	3	5	19	13		100

Source: C. & O. 100% Waybill Tape.

TABLE C-9

C.O.-NORTHWEST RAIL LINE
1973 OUTBOUND CARLOADS, BY COMMODITY BY REGION

Commodity	Region								Total	Percent
	1	2	3	4	5	6	7	8		
Food or Kindred Products	81	30	92	52	51	30	9	46	391	20
Furniture or Fixtures	13	38	261	5	27	8	6	1	359	19
Fabricated Metal Products	6	2	3	-	-	2	-	-	13	1
Lumber or Wood Products	7	3	102	10	-	2	-	2	126	6
Farm Products	1	-	2	-	1	-	-	-	4	0
Rubber or Misc. Plastics	19	-	1	4	-	32	1	4	61	3
Chemicals or Allied Products	1	-	11	-	-	-	-	-	12	1
Machinery	-	3	-	-	-	-	-	-	3	0
Transportation Equipment	-	-	2	1	1	-	1	-	5	0
Clay, Concrete, or Glass	-	-	870	-	1	-	-	-	871	45
Electrical Machinery	-	-	2	-	-	-	-	-	2	0
Waste or Scrap Materials	-	-	12	-	-	-	-	-	12	1
Forest Products	-	-	2	10	-	35	-	5	52	3
Nonmetallic Minerals	-	-	20	-	-	-	-	-	20	1
Pulp, Paper, or Allied Products	-	-	1	-	-	-	-	-	1	0
Primary Metal Products	-	-	-	2	-	-	-	1	3	0
Misc. Mixed Products	-	-	-	-	-	-	-	6	6	0
TOTAL	128	76	1381	84	81	109	17	65	1941	100
PERCENT	7	4	71	4	4	6	1	3		100

Source: C. & O. 100% Waybill Tape.

BIBLIOGRAPHY

BIBLIOGRAPHY

- Ainsworth, Don P. "Implications of Inconsistent Railroad Service." Canadian Transportation Research Forum, (May 1972).
- Ballou, Ronald H. Business Logistics Management. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1973.
- Bayliss, B.T. Demand for Freight Transport--Practical Results of Studies on Market Operations. Paris: European Conference of Ministers of Transport, 1973.
- Belovarc, K., and J.T. Kneafsey, Determinants of Line Haul Reliability. Studies in Railroad Operations and Economics, Vol. 3. M.I.T. Report R72-40, 1972.
- Barts, George H. "Increasing Returns in the Railway Industry." Journal of Political Economy, LXII (1974).
- Buck, Solum Justus. The Granger Movement: 1870-1880. Cambridge, Mass.: Harvard University Press, 1913.
- Coneybeer, Thomas. "Rail Car Routing Policies and Practices." Transportation Journal, (Summer 1976).
- Cotter, Cornelius. Government and Private Enterprise. New York: Holt, Rinehart, and Winston, 1960.
- Council of State Governments. Railroad Rehabilitation: A Program to Upgrade Selected Branch Lines in Iowa. Lexington, Ky.: 1976.
- Council of State Governments. The States and Rural Rail Preservation: Alternative Strategies. Lexington, Ky.: Iron Works Pike, 1974.
- DeJarnett, Kenneth R. "Regulatory Policy and Decisions Relating to Rail Contract Rates." Transportation Journal, (Winter 1973).
- Due, John F. "The City of Prineville Railway and Economic Development of Crook County." Economic Geography, (April 1967).
- Due, John F. "The City of Prineville Railway--A Case Study in Government Enterprise." Quarterly Review of Economics and Business, V (Winter 1965).

- Folk, J.F. Models Investigating Rail Trip Reliability. Studies in Railroad Operations and Economics, Vol. 6. M.I.T. Report R72-40, 1972.
- Friedlander, Ann F. The Dilemma of Freight Transportation Regulation. Washington, D.C.: The Brookings Institution, 1969.
- Harlan, Betke & Meyers, Inc., et al. Ann Arbor Railroad Properties: Operating Proposal to Michigan Department of Highways and Transportation. (September 1976).
- Hirschman, Albert O. Exit, Voice and Loyalty: Response to Decline in Firms, Organizations, and States. Cambridge, Mass.: Harvard University Press, 1970.
- Hirschman, Albert O. Development Projects Observed. Washington, D.C.: The Brookings Institution, 1967.
- Hitton, George W. "Great Lakes Car Ferries: An Endangered Species." Trains, (January 1975).
- Interstate Commerce Commission Docket No. AB-18 (Sub-No. 19).
- Interstate Commerce Commission. Uniform System of Accounts--Railroad Companies. Washington, D.C.: U.S. Government Printing Office, 1975.
- Johnson, Marc A. Community Evaluation of Railroad Branch Lines: Principles and Procedures. Report No. 38. Center for Rural Manpower and Public Affairs. Department of Agricultural Economics, Michigan State University, (April 1975).
- Johnson, Marc A. "Market and Social Investment and Disinvestment in Railroad Branch Lines: Evaluation Procedures and Decision Criteria." Unpublished Ph.D. dissertation, Michigan State University, 1975.
- Johnson, Marc A. "A Sequential Link Approach to Evaluating Transportation Facility Adjustments." Southern Journal of Agricultural Economics, VIIla, (July 1976).
- Johnson, Marc A. The Michigan Freight Transportation Survey: An Empirical Investigation of Modal Choice. A Report to the Michigan Department of Highways and Transportation, 1975.
- Johnson, Marc A. "Service Quality and Transportation Demand." American Journal of Agricultural Economics, LIII (August 1976).

- Kalko, Gabriel. Railroads and Regulation. Princeton, N.J.: Princeton University Press, 1965.
- Kearney, A.T., Inc. Analysis of Railroad Operating Ferry and Lighterage Operations. Report for United States Railway Association, 1975.
- Keefe, Kevin P. "How Michigan Got into the Railroad Business." Trains, (October 1976).
- Kolsen, H.M. The Economics of Control of Road-Rail Competition: A Critical Study of Theory and Practices in the United States of America, Great Britain, and Australia. Sydney, Australia: Sydney University Press, 1968.
- Lang, A. Scheffer and Carl D. Martland. Reliability in Railroad Operations. Studies in Railroad Operations and Economics, Vol. 8. M.I.T. Report R72-74, 1972.
- Locklin, Phelp D. Economics of Transportation. Homewood, Ill.: Richard D. Irvin, Inc., 1972.
- Malanaphy, Vincent E. An Evaluation of the United States Railway Association Preliminary System Plan as It Pertains to The Ann Arbor Railroad. (April 10, 1975).
- Malanaphy, Vincent M. and Associates, Inc., An Evaluation of Region 10: Northern Michigan Railroads' Needs. (November 1975).
- Martland, C.D. and J.M. Sussman. "Rail Service Reliability--An Analysis of Operating Data." Canadian Transportation Research Forum, (May 1972).
- Martland, Carl D. Rail Trip Time Reliability: Evaluation of Performance Measures and Analysis of Trip Time Data. Studies in Railroad Operations and Economics, Vol. 2. M.I.T. Report R72-74, 1972.
- Martland, Carl D. Procedures for Improving Railroad Reliability. Studies in Railroad Operations and Economics, Vol 12. M.I.T. Report R74-30, 1973.
- Meyer, John R, et. al. The Economics of Competition in the Transportation Industries. Cambridge, Mass.: Harvard University Press, 1959.
- Michigan Department of Highways and Transportation. Michigan Railroad Plan: Annual Update. Lansing, Michigan, (August 1976).

- Michigan Department of Highways and Transportation. Truckline Commercial Traffic: 1970 and 1975. Lansing, Michigan, (1976).
- Michigan Northern Railway. Special Rehaulitation Projects. A Report Submitted to the Rail Freight and Ports Authority Section. Michigan Department of Highways and Transportation, (September 1976).
- Michigan Statistical Abstract: 1960, 1972.
- Moody's Transportation Manual: 1975.
- Morton, Alexander L. "Intermodal Competition for Intercity Transport of Manufacturers." Land Economics, XLVIII, (November 1972).
- Morton, Alexander L. "Balkanization in the Railroad Industry." Canadian Transportation Research Forum, (October 1974).
- National Transportation Research Project. Summary of Shipper's Questionnaire Survey. Washington, D.C., 1966.
- Nelson, Robert A. and William R. Greiner. "The Relevance of the Common Carrier under Modern Economic Conditions." Transportation Economics. New York: Columbia University Press, 1965.
- Norris, Frank. The Octopus. New York: Doubleday and Company, Inc., 1958.
- Norton, Hugh S. Modern Transportation Economics. 2nd ed. Columbus, Ohio: E. Merrill Publishing Company, 1971.
- Office of Transportation Planning, U.S. Department of Transportation. Industrial Shipper Survey--Plan Level. Washington D.C.: U.S. Government Printing Office, 1975.
- Olson, Mancur. The Logic of Collective Action: Public Goods and the Theory of Groups. Cambridge, Mass.: Harvard University Press, 1965.
- Patton, Edwin P. and C. John Langely Jr. Handbook for Preservation of Local Railroad Service. Washington, D.C.: Government Printing Office, 1976.
- Peat, Marwick, Mitchell and Co. Reorganization Study of the Ann Arbor Railroad. A Report to Mr. John N. Chase, Jr., Trustee, Ann Arbor Railroad Company. Washington, D.C., 1974.

Proceedings--American Association of Railroad Superintendents.
(1961).

"Railroading's Rising Star." Forbes Magazine, (April 1, 1976).

Rail Service Planning Office, Interstate Commerce Commission.
The Public Response to the Secretary of Transportation's Rail Service Report. Washington, D.C.: U.S. Government Printing Office, February 1975.

Reebie Associates. Toward an Effective Demurrage System. Final Report to the Federal Railroad Administration, July 1972.

Reid, Robert M., John D. O'Doherty, Joseph M. Sussman, and A. Scheffer Lan. The Impact of Classification Yard Performance on Rail Trip Time Reliability. Studies in Railroad Operations and Economics, Vol. 4. M.I.T. Report R72-40, 1972.

Report of the Presidential Railroad Commission. Rifkind Report. Washington, D.C.: U.S. Government Printing Office, February 1962.

R.L. Banks and Associates, Inc. Michigan Segmented Line Analyses: Traffic, Revenue, Cost and Community Impact. Agreement No. 75-1603. Washington, D.C., October 1975.

R.L. Banks and Associates, Inc. Short Line Techniques to Improve Financial Viability of Light Density Lines--Major Railroads. Washington, D.C., May 1974.

Roberts, Robert. "Ex-Rutland Line is Successful as Employee-Owned Green Mountain." Modern Railroads, (June 1971).

Roberts, Robert. "Small Railroad Thinks Big." Modern Railroads, (June 1969).

Roberts, Robert. "Short Line is Key Link in Food Distribution Chain." Modern Railroads, (April 1972).

Sampson, Roy J. and Martin T. Farris. Domestic Transportation: Practice, Theory, and Policy. New York: Houghton Mifflin Co., 1966.

Schmid, A. Allan. The Economics of Property, Power and Public Choice: Consequences of Institutional Alternatives. Unpublished Manuscript. Department of Agricultural Economics, Michigan State University, 1974.

Shaffer, Frank and Nancy Ford. "As the Shippers See It." Modern Railroads, (February 1973).

Smith, Bill C. "What Constitutes a Bona Fide Shippers' Cooperative?" Transportation Journal, (Winter 1969).

"Speaking of Service." Transportation and Distribution Management, (October 1973).

Statistical Abstracts of the U.S., 1967.

Sussman, Joseph M., Carl D. Martland, and A. Scheffer Lang. Reliability in Railroad Operations: Executive Summary. Studies in Railroad Operations and Economics, Vol. 9. M.I.T. Report R73-4, 1972.

Sussman, Joseph M. "Research Needs and Priorities in Rail Service Reliability." Railroad Research Study Background Papers. Transportation Research Board, July 1975.

Sussman, Joseph M. and Carl D. Martland. Improving Railroad Reliability: A Case Study of Southern Railway. Studies in Railroad Operations and Economics, Vol. 5. M.I.T. Report R74-29, 1974.

Task Force on Railroad Productivity. Improving Railroad Productivity. A Report to the National Commission on Productivity and the Council of Economic Advisors. Washington, D.C.: U.S. Government Printing Office, 1973.

United Research, Inc. The Freight Potential of the New York, New Haven and Hartford Railroad: 1965-1970. Cambridge, Mass., 1962.

U.S. Department of Commerce. Bureau of Census. Commodity Transportation Survey. Area Series Area Report 3. Washington, D.C.: U.S. Government Printing Office, 1972.

U.S. Department of Transportation. National Transportation Trends and Choices (to The Year 2,000). Washington, D.C.: U.S. Government Printing Office, January 1977.

U.S. Department of Transportation. Secretary of Transportation. Rail Service in the Midwest and Northeast Region, Vol. 2. Washington, D.C.: U.S. Government Printing Office, February 1, 1974.

U.S. Department of Transportation. 1974 National Transportation Report: Current Performance and Future Prospects. Washington, D.C.: U.S. Government Printing Office, July 1975.

- United States Railway Association. Preliminary System Plan: Volume I. Washington, D.C.: U.S. Government Printing Office, February 26, 1975.
- United States Railway Association. Preliminary System Plan: Volume II. Washington, D.C.: U.S. Government Printing Office, February 26, 1975.
- U.S. Senate Committee on Commerce. The Penn Central and Other Railroads. Washington, D.C.: U.S. Government Printing Office, 1972.
- Watson, Peter L., et. al. "Factors Influencing Shipping Modal Choice for Intercity Freight: A Disaggregate Approach." Canadian Transportation Research Forum. (April 1971).
- Weisbrod, Burton A. "Collective-Consumption Services of Individual-Consumption Goods." Quarterly Journal of Economics, LXXVIII (August 1964).
- Williams, Ernest W., Jr. The Regulation of Rail-Motor Competition. New York: Harper and Bros., 1958.
- Williams, Ernest W., Jr. Ed. The Future of American Transportation. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1971.