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ECONOMIC BENEFITS OF

LAKE MICHIGAN CAR FERRY SERVICE

VOLUME I

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Prepared for
Michigan Department of State Highways and Transportation
(Contract No. 76-1579)

December 1976

TERA, Inc.
Suite 888, 1901 No. Fort Myer Drive
Arlington, Virginia 22209
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The opinions, findings, and conclusions expressed in this Report are those of the contractor and not necessarily those of the Michigan State Highway Commission or the Wisconsin Department of Transportation.

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1.	P. 25, Last line	Peninusla	Peninsula
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4.	P. 67, Line 6	Wisconsin and Michigan	Michigan and Wisconsin
5.	P. 72, Line 24 (in footnote 1)	Mackinak	Mackinac
6.	P. A-4, Line 19	Grant	Grand
7.	P. A-5, Line 14	differend	differs
8.	P. A-7, Line 18	Sheyboygan	Sheboygan
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FOREWORD

Rail car and auto/passenger ferry service in Lake Michigan are presently in a state of disrepair. The railroad companies which operate the service have applied to the Interstate Commerce Commission for service abandonment. Local and State officials in Michigan and Wisconsin view the service as an important transport connection to the regional economies, particularly in northern Wisconsin and western Michigan. In addition, the car ferry service is seen as an integral part of a total transportation system in the Western Great Lakes region by reducing time and cost as well as relieving congestion in the Chicago gateway.

The Governors of Michigan and Wisconsin recently commissioned a Bi-State Task Force to evaluate the Lake Michigan Car Ferry Service and recommend actions to maintain its viability and improve its usefulness. This report on the *Economic Benefits of Lake Michigan Car Ferry Service* is prepared by TERA to assist the Bi-State Task Force in their deliberations and evaluation of institutional alternatives to continue operations. The Report is prepared under contract to the Michigan Department of State Highways and Transportation (MDSHT) with funding from both MDSHT and the Wisconsin Department of Transportation (WisDOT).

The successful completion of the study within a very short time period was only possible through the invaluable assistance of many State and local officials, industry representatives and Federal agencies. Individual contributors are too numerous to mention. However, special appreciation is due to the following: Mr. James C. Kellogg, Deputy Director of the MDSHT for his interest and perception of the need to study the economic benefits associated with the car ferry service; Mr. Edgerton W. Bailey, Acting Assistant

Administrator, Rail Freight and Port Facility Division, Bureau of Urban and Public Transportation, MDSHT, for his expert guidance and leadership as Study Manager; Mr. Douglas F. Haist, Director, Bureau of Transport Service, Division of Planning, WisDOT, for his advice and critical review throughout the project; Messrs. Nguyen T. Quan and Frederick Stancel, Jr. of MDSHT for assistance in data gathering and analysis; and other officials at MDSHT, WisDOT, Michigan Department of Commerce, Bi-State Task Force, Interstate Commerce Commission and Federal Railroad Administration for critique, assistance and advice.

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EXECUTIVE SUMMARY

Background

The Lake Michigan car ferries provide a vital transportation link across Lake Michigan, a significant geographic barrier to the east and west movement of goods by rail. The ferries grew up in an environment of vigorous competition among railroads to serve western markets, by providing an alternative to an all-rail route around the Lake. Smaller railroads combined to provide "bridge" service through Ontario and into Wisconsin and western markets, crossing the intervening water barriers on ferries, thus competing with the New York Central's hold on rail movements to the Chicago interchange with western railroads. This function of the ferry-rail network, especially in Michigan, is exemplified by the Ann Arbor Railroad on which little traffic originates, but over which interlined traffic avoids the congested Chicago interchange.

As the Ann Arbor and other local roads providing connecting service through the ferry crossings were integrated into larger rail systems, conflicting incentives were created for rail management. Still, the economic and service advantages of the ferry system were pursued as a means of avoiding the congestion and delays encountered in a through-Chicago routing. Consequently, the ferry service continued to grow in absolute volume into the 1950's, though its market share peaked in the 1920's. But the conflict of interest within the owning railroad - the avoidance

by a railroad of "short hauling" itself, thus, sharing in a smaller proportion of the through rate on interlined traffic - became more severe as railroad technology improved conditions in the Chicago gateway and brought on the use of longer trains and larger cars which reduced the number of car per trip by the ferry boats. The structure of railroad rate sharing and the lack of intermodal thinking in railroad management has stalled the development of technological improvements in ferry operations and equipment which could keep it apace with the rest of transportation technology. Solutions involving independent ownership of the boats and increased pursuit of truck traffic have their own institutional problems both with the nature of competition and the regulatory framework.

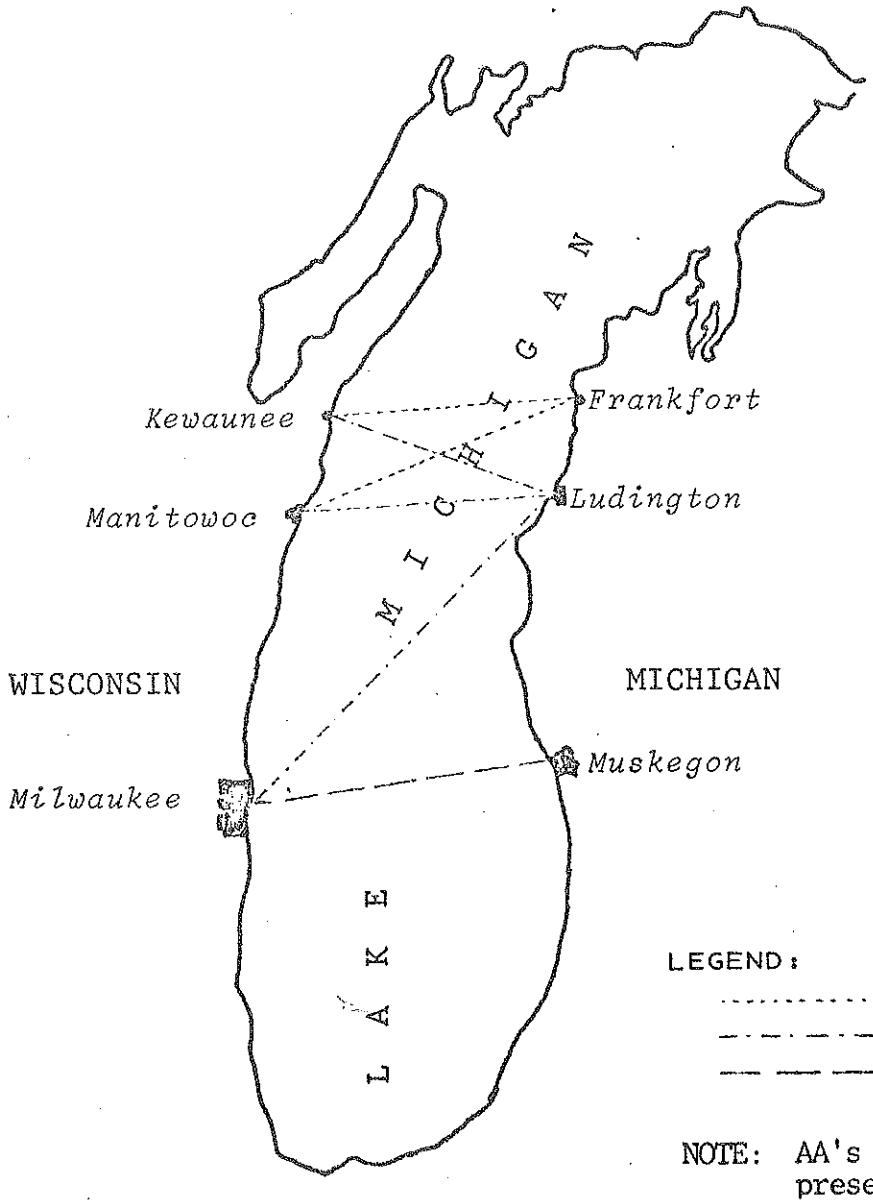
The ferry service has been in a state of decline, accelerating in recent years to unanimous petitions in 1975 to the ICC by the owning railroads to abandon all service. Presently existing service may be seen in Figure 1, which charts the Lake ferry routes now authorized. One of these routes, the Ann Arbor ferry connecting Frankfort, Michigan to Manitowoc, Wisconsin, was embargoed in August, 1975, when one of AA boats, the *Arthur K. Atkinson,* broke a crankshaft. The level of repair on all of the vessels has been low in anticipation of abandonment and AA's bankruptcy.

Objective

This study was done at the initiative of the Michigan Department of State Highways and Transportation with support from the Wisconsin Department of

FIGURE 1

CAR FERRY ROUTES



NOTE: AA's Frankfort-Manitowoc route is presently embargoed.

Transportation. Its findings are intended to assist the Bi-State Ferry Task Force, appointed by the Governors of Michigan and Wisconsin, to evaluate alternative options and recommend actions on the future disposition of and the nature and extent of state involvement in the Lake Michigan car ferry service.

Although a number of studies of the Lake Michigan car ferry service have been undertaken recently, there is no comprehensive study of the economic benefits derived from the service. This is a serious shortcoming in any attempt to evaluate public policy concerning the Lake ferries. It is the objective of this study to compute and detail the economic and employment benefits of the car ferry service to the States of Michigan and Wisconsin, the affected port communities on both shores of Lake Michigan, and the shippers of goods across or around the Lake who benefit from the ferry.

Analysis of Benefits

A benefit analysis seeks to determine the contribution a particular activity makes to the level of economic welfare in a given region during a specific time period. The temporal and spatial bases for the study were established as the year of 1973 and the States of Michigan and Wisconsin. The benefits may be narrowly or broadly conceived. First, a narrow conception of benefits was used in estimating the transportation cost savings to shippers caused by the existence of the ferry service. This is the kind of benefit analysis used by the U.S. Army, Corps of Engineers to evaluate waterway improvements. However, in a broader sense, the

effects of transportation cost and time savings on the market structure of industries in the affected regions and the further induced economic activity generated by the employment in these affected industries should also be recognized. This analysis was also done.

The results of estimated benefits are shown in Table 1. Since they represent different perceptions of benefits, the values shown in the table are not additive across. These are discussed below:

Transportation cost savings represents the tariff differential times the volume of traffic affected by the differential. The car ferry service establishes a short-line distance between many possible origin-destination pairs, east and west of the Lake. By virtue of the ICC Docket 28300, through rail tariffs in many instances are based on the short-line distance and are in effect for traffic flowing between the relevant points irrespective of the routing. This study estimates the total savings to shippers for whom the ferry represents the short-line route. The estimates were divided into benefits to users of the ferry and to non-users who share the same rate advantage in routing their shipments through the Chicago gateway.

Employment benefits are calculated at three levels of economic proximity to the ferry: Direct, indirect, and induced. Direct employment benefits are the employees maintained for the ferry service itself and the railroad employees whose jobs directly depend on the service. Indirect employment benefits are those which accrue to industries whose current level of production depends upon the markets made accessible by the current freight rate structure and transit times.

TABLE 1

SUMMARY OF CAR FERRY BENEFITS
BY REGION

Region	Transportation Cost Savings ($000)	Employment (number)	Earnings ($000)	Taxes ($000)
Michigan	4,653	3,238	55,370	4,562
Muskegon	-	118	2,102	196
Ludington	-	828	11,670	1,148
Frankfort	-	347	3,777	469
Rest of State	-	1,945	37,821	2,749
Wisconsin	4,413	11,284	172,030	17,641
Milwaukee	-	3,390	51,931	4,466
Manitowoc	-	402	4,816	465
Kewaunee	-	77	1,511	126
Rest of State	-	7,415	113,772	12,584
Subtotal	9,066	14,522	227,400	22,203
Other States in Immediate Hinterland	3,406	N/E	N/E	N/E
Other States in Extended Hinterland	4,279	N/E	N/E	N/E
TOTAL	16,752	14,522	227,400	22,203

N/E - Not Estimated.

Source: Tables III-11, IV-5, V-3, and Chapter II.

This was estimated by surveying a sample of shippers in Michigan and Wisconsin to determine the employment effects of a cancellation of ferry service. Finally, the induced benefits are the employment effects of the demand for local services by the railroad employees and the employees in industries who would be affected by a transportation cost increase. The induced benefits were estimated by applying an "employment multiplier" to the sum of direct and indirect employment.

Earnings benefits are the income to the factors of production which support and are supported by the ferry service. They, too, are divided into direct, indirect, and induced. The direct earnings benefits were estimated from the costs of operating the ferries and the ferry-tied railroads. These benefits are the direct payments made into the income stream by the operation itself. The indirect and induced benefits are estimated based on the average contribution of each employee in the relevant industries to the gross product of the region.

Tax benefits are the state tax revenues which are derived directly from the income stream. This figure is important as the states contemplate funding for the maintenance of the service.

An important distinction must be made between the benefits, primarily earnings and employment benefits, and the potential losses upon abandonment. Many adjustments exist within the law and the economy to soften the impact on the personal income of the affected workers. For this reason, the induced employment and earnings benefits which arise from the expenditure of workers may not be

entirely lost because transfer payments to laid off workers make up for some lost earnings. Still, the concept of the employment and earnings benefit remains a valid measure of the value of the service to the area as any income transfers must come out of economic activity generated in some other area. There are other reasons why benefits may exceed the costs of abandonment. These lie in the possible labor market effects of workers released from one job, providing the manpower to do some other economically rewarding job. However, while this sounds good in theory, labor market friction, regional growth patterns and personal inabilities to move or retrain,mitigate its validity in practice.

Conclusions

Accounting for full market effects, the car ferries contributed to the economies of Wisconsin and Michigan in the employment of 14.5 thousand people and the generation of $227 million in earnings and $22 million in taxes. This is done partly out of the direct employment and expenditures made by the car ferry operation and the $9 million savings in transportation costs to Michigan and Wisconsin shippers. That $9 million means larger markets for goods produced in the two states; hence, larger employment and earnings well above the initial savings.

Although the transportation cost savings are nearly evenly split between shippers in the two states, the benefits arising from these savings are not. The benefits from the service are three times as large in Wisconsin as in Michigan. This is due to the greater dependency of the Wisconsin economy on eastern markets

than of the Michigan economy on western markets. Not only is the Wisconsin figure larger, but as Wisconsin's gross product is smaller than Michigan, it represents an even greater proportion of the State's economic activity. This amounts to approximately 1.5 percent of Wisconsin's non-agricultural production compared to Michigan's 0.2 percent. The relative importance of ferry dependent income to the local economies of the port counties is much greater. In this case, the two most significantly affected counties are Mason and Benzie in Michigan in which are located the ports of Ludington and Frankfort. The C&O ferry operations are based in Ludington and are the largest in terms of employment and expenditures of the other ferry operations. However, Ludington is also a larger community than Frankfort out of which the Ann Arbor ferries are based. The benefits flowing to each of these two cities comprises a significant proportion of the county economic welfare - nearly 39 percent in Frankfort and 22 percent in Ludington. In Muskegon, a much larger city, the importance of the GTW ferry is estimated at approximately one half of one percent of the area's gross product. In Wisconsin, the three port counties of Milwaukee, Manitowoc, and Kewaunee benefit at a rate of 1.4, 2,2, and 5.1 percent of their respective economies from the continued operation of the ferry service.[1]

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[1]The percentages are computed based on the U.S. Bureau of the Census, *Census of Business Area Series.*

In evaluating the estimate of benefits, two key figures must be kept in mind. They are:

- The estimate of employment elasticity to ferry abandonment as derived from the survey of shippers. The sample revealed a -0.12 percent job dependence on the ferry service. The figure for Wisconsin was -1.1 percent. These were applied to all manufacturing production workers in the State of Michigan. Due to time and budgetary constraints in the study, the sample size in both states were limited.

- The estimate of the multiplier as derived from the study made by Eric Schenker, et al.[2] The multipliers were 1.9962 in Michigan and 2.5738 in Wisconsin. The total job effect is found by multiplying the sum of ferry and ferry dependent rail employees and ferry dependent manufacturing employees (computed by the elasticity estimates) times the multiplier. The theoretical base for this approach is strong and it is common in economic benefit studies. The empirical basis for the values chosen is somewhat weaker as time and resources limit the depth of analysis and the statistical refinements which may be employed.

Largely due to the above two shortcomings, the benefit estimates must be viewed as preliminary and subject to refinement when more comprehensive studies are undertaken.

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[2] Schenker, Tee Koh, Kochan and Bunamo, *An Estimate of the Quantitative Impact of the St. Lawrence Seaway on the Hinterland's Economy*, Proceedings of the 13th Conference on Great Lakes Research, Buffalo, New York, April, 1970.

CHAPTER I: HISTORICAL PERSPECTIVE OF THE CAR FERRY SERVICE

Introduction

The objective of this Report is to determine the value of the Lake Michigan car ferry service to the Michigan and Wisconsin economies. Measuring the benefits derived from the service is a complex task to be performed in a short time. Doing so has required selecting a single period of time (the year of 1973) and examining the service in depth. The results of the analysis will form an important element in the States' decisions about continuing the service. But a broader perspective is needed. The year of 1973 is but one year in the life cycle of a car ferry service that has been on the Great Lakes for over 120 years. At times in that cycle, the car ferries have been both relatively and absolutely more important to the Michigan and Wisconsin economies than they were in 1973. Furthermore, by 1973 all three carriers had cut back service across Lake Michigan, setting in motion the expectation among users that the life cycle of ferry service was short lived.[1]

Several basic questions are examined in this Chapter as background to the more precise findings which follow:

- What basic conditions and requirements gave rise to the car ferry service on the Great Lakes - St. Lawrence System?
- How well have the car ferries adapted to technological challenges, changing markets, and competitive conditions?

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[1] Since 1973, two carriers filed to abandon service and one (the Ann Arbor) filed for bankruptcy.

- What were the basic causes of the decline of car ferry service that have culminated in the Lake Michigan abandonment syndrome?
- What are the contemporary implications of the historical findings?

The chronological history of the car ferry service on the Great Lakes - St. Lawrence System is included in Appendix A. It summarizes the origins of the major car ferry operations, their major accomplishments, and the specific causes of each carrier's decline. This Chapter provides an overview of the historical conditions giving rise to the car ferry operations, the causes for their decline, and the contemporary implications of the decline. The reader is referred to Appendix A for specific case detail and historical trend data. Chapters 2-5, in turn, provide the specific analysis of the benefits of the car ferry service during the year of 1973 to the Michigan and Wisconsin economies.

Originating Conditions

Car ferry operators brought wide gauge Canadian rail cars across the St. Lawrence River to United States ports over 120 years ago. But it was not until after the Civil War that car ferries initiated the concept of a rail-water bridge to the West. A unique confluence of technological, economic, and strategic factors brought the car ferry service into existence. Strategically, this was a period in which the railroads were coming of age and were able to compete on a direct basis with water transportation. Cornelius Vanderbilt had given up shipping and had been able to knit together a single, standard gauge line reaching from New York to Chicago in 1869 - the New York Central.[2] Other railroads serving

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[2] *Casebook of Business History*, N.S.B. Gras and Henrietta Larson, Harper Brothers, Crofts and Company, New York, 1938.

the East Coast from Buffalo, the major trans-shipment port on the Lakes had three alternative means of access to burgeoning commerce of the West. They could go South of the Lakes by all rail route in head-to-head competition with the efficient and ruthless New York Central System. They could go over the Lakes by break bulk all water service as many did. Or they could go North of the Lakes by the straight line, airhead Ontario route by some combination of rail-water service. The latter railroads pursued what was called the bridge concept which really meant penetrating the Chicago and Western markets that were monopolized by the New York Central by means of using the car ferry as a bridge across the waterways. Utilizing rail car ferries, they had bridged the Detroit River in the 1860's, the St. Clair River in the 1870's, the Mackinac Straits in the 1880's, and finally, Lake Michigan in the 1890's.

The basic technological concept behind the initiation of car ferry service is simple discovery: It was more economic to transport the whole car with cargo intact than to transport the individual units piecemeal or break bulk in maritime terminals. The car ferries are, thus, the original container ship; only, the container box consisted of a rail car on wheels. The original roll-on-roll-off ship may be more appropriate. It is interesting to note that in the United States the term "car ferry" means a conveyor of railroad cars. In European useage, "car" ferries carry automobiles and "train" ferries carry rail cars. Ferries of every conceivable type (auto, truck and rail) successfully operate in Japan, carrying a high proportion of inter-city freight traffic and inter-island passengers.[3] But in the United States, car ferries started and have remained primarily as waterborne

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[3]Minister of Transportation, *Annual Report for the Year of 1972*, Tokyo, Japan, March, 1973.

extensions of railroads. As the car ferries evolved, they became the largest and most sophisticated ship on the Lakes by the turn of the Century. Their contribution to world shipping was in terms of ice breaking technology - the forward propellors, curved bow and trimming tanks that later enabled Finland to become the world's leader in ice breaking technology.

Several spacial-economic considerations gave rise to the car ferry business. The first is that because of the unique geographic configuration of the Lakes, the short line distance between much of the Northeastern and Northwestern regions of North America is across Lake Michigan and accessible through Michigan and Wisconsin. This spacial fact has been institutionalized in railroad rates based on short line mileages whether shipments are moved across or around the Lakes. This widespread equalization of distances and rates was a powerful influence in facilitating industrial development in Michigan and Wisconsin - considerably North of the trunk line railroads and the East-West axis of industrial development in the United States.

Finally, the economic incentive for initiating car ferry service was that it cost less to cross the water by ferry than it did to bridge over, tunnel, under, or go around the water. The major saving was in capital rather than operating costs. The car ferry and accommodating slips required but a small fraction (a couple of hundred thousand in 1870-1900) of the capital costs to bridge, tunnel, or build tracks across or around the waterway. In this respect, the waterway

provided free rights-of-way for railroads. But the operating costs of the car ferry were probably higher than railroad costs on a straight ton-mile basis. As a consequence, as traffic grew, it tended to spread the capital costs over a greater volume and reduced the average unit costs of bridges and tunnels beneath those of car ferries. This occurred at the short haul river crossings. On the longer haul lake crossing, the car ferries persisted because of the savings in distance as well as capital costs. Though the operating costs per ton/mile by car ferry would be higher than by rail, the circuitous mileage by rail to many points around the Lakes more than offset its unit operating cost advantages. As a consequence, the growth of volume of traffic around and across the Lakes did not necessarily spread the overhead and result in lower average unit costs by rail than by car ferry. It is important to note that railroads have low marginal costs and can use destructive pricing techniques more effectively than the car ferries. Destructive pricing practice was not in most cases a major cause for the decline of the car ferries, most of whom were railroad owned. Instead the decline of the car ferry service was the result of more subtle influences.

Causes of Decline

The causes of the decline of the car ferry services on the Great Lakes are almost as numerous as the circumstances of the individual lines (see Appendix A). In order to come to grips with the basic causes and avoid a laundry list of symptomatic effects, it is necessary to classify the causes. Several functional categories might be suggested under which the causes of failure might be grouped and examined.

The functional categories include:

(1) Technological obsolescence or displacement.

(2) Relative declines in productivity or performance.

(3) Escalating costs and losses.

(4) Supply failure and over-expansion.

(5) Market failures and competition.

(6) Institutional and legislative impediments.

The categories are, of course, interrelated, i.e., technological obsolescence will cut production and performance, will increase costs and produce market failures. Some of the causes are irremedial while others are susceptible to change.

A review of the car ferry experience on the Lakes will assist in clarifying and classifying the causes of decline on the total Great Lakes System. Following is a brief description of the causes listed above.

(1) Technological obsolescence. The river ferries were subject to technological displacement by bridges and tunnels. Bridges and tunnels are a capital intensive substitute for car ferries. They are an economically efficient substitute only when distances are short and volume of traffic is high. Once they are put in place, they tend to displace car ferry service as at Buffalo, the St. Lawrence, and the Mackinac Straits (where the service is currently operating under state subsidy). But it is interesting to note that at the Detroit-St. Clair River crossing, car ferries are making a come back, in part, by shifting their mode of operation to low cost and labor saving barge and tow systems.

(2) Decline in productivity. Hilton lays claim to the fact that it is the relative loss in car ferry productivity that has resulted in the decline in service. The railroads have, as he asserts, successfully "attempted to increase productivity by running longer trains with longer or higher cars." And it is also true that the car ferries have stood still and thus retrogressed in relative productivity. But the losses in productivity were not inevitable nor irremedial as he suggests, stating "there is no way to accomplish this (gain in productivity) with a car ferry: it has finite dimensions and finite capacity."[4] Yet, most naval architects agree that there is nothing inherent in the car ferry to limit its dimension or capacity. And many barges can be added to a tow where waterway dimensions are adequate. In fact, water carriers on the Lakes have more flexibility on dimensions and capacity than do the railroads operating on tracks and through constricted tunnels. The real impediment to increasing car ferry productivity is economic, not technological: The lack of capital investment in new ferries and not the inherent limitations of ship design.[5] Railroad net earnings over the past 20 years (2.6 percent on equity) have been lower than for any other major industry and they had little incentive to invest in car ferries.

(3) Escalating car-ferry costs have been documented in recent reports as one of the major causes of the decline of the car ferries. Most of the reports point to the increases in crew, fuel, and other operating costs but few document the much greater increases in capital costs. Yet, capital investments in car ferries have increased from around $250,000 in the 1890's to around $1 million in

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[4] G. W. Hilton, "Great Lakes Car Ferries: An Endangered Species," *Trains*, January, 1975, Volume 35, No. 3, p.44.

[5] Relative increases in speed and reductions in terminal time should also be considered in measuring relative gains in carrier productivity.

1920, to $5 million in the 1950's, to over $17 million today. Neither gains in ferry performance nor the inflationary devaluation of the construction dollar fully account for these increases in ship investments.[6] Instead, there appears to have been an erosion of lake ship yard productivity and economies of scale as production of car ferries was discontinued over 20 years ago. A movement in the reverse direction may lower capital costs. Crew expenses and fuel costs have also increased disproportionately over the years, but the increases are also not irreversible. The shift to tug-barge operations could reverse both capital and crew costs. Also, shifting the C&O ferries from coal to diesel would substantially reduce fuel costs. It is interesting to note that the maritime unions recommended diesel engines for the *Badger* and the *Spartan* although it meant fewer jobs on each ship.

Growing financial losses were a bottom line signal of the failure of most of the car ferries that have passed into history. But a number of ferries preservered long after book losses set in because of the contribution that they made to the owning railroads. Furthermore, some railroads recognized that the book losses were not real but rather derived from arbitrary accounting practices. Revenues of the ferries, for instance, are usually computed on an arbitrary basis or divisions based upon the ton-mileage actually hauled rather than the value of service or cost considerations. Common costs are shared between the rail and ferry side of the operation in accord with an arbitrary 50 percent cost formula of the ICC. Under such circumstances, it is impossible to determine even to this day

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[6] For example, price inflation, which has been at about 2.1 percent a year compounded since 1890, would account for a $250,000 ship in 1890. $1.46 million today. An increase of approximately 50 percent in productivity might bring the price up to $2.2 - $2.5 million, but not to $17 million.

whether losses in Lake Michigan car ferry service are real economic losses. It is true, however, that utilizing the same formula, losses have increased or profits have declined. An announcement of selective abandonment and erosion of services will, in any event, lead to growing losses as a self-fulfilling prophecy.

(4) Supply failures and over expansion has had a role in the decline of the Great Lakes car ferries. The decline of coal shipments is the most obvious case and it was the primary Westbound traffic over Lake Michigan and more than half of the Northbound traffic over the six cross lake services which spanned Lakes Erie and Ontario. The demise of lumber trades in the Lower Peninsula, Michigan, on the other hand, is credited by Hilton as having given momentum to the cross Lake Michigan leap of the badly overexpended Ann Arbor and the predecessors to the Pere Marquette. For that matter, many regard the Lake car ferries as the waterborne part of the railroad overexplosion which occurred after 1890. The Ann Arbor, for instance, is regarded by Hilton as an "unnecessary" railroad. Investigations by the USRA confirm that the railroads are substantially overexpanded and subsequent authorizations to abandon have triggered cross Lake Michigan abandonments. While it may be true that there are an excess number of services on land and some redundancies on routes across Lake Michigan, there is no evidence that some level of service is not required and both privately profitable and publicly beneficial. It is, moreover, a highly questionable practice

to use the same formula for car ferry abandonment which is used for sections of track because the cost levels and structures are entirely different.

Returning to the supply based failures, it is useful to inquire whether the decline of coal, forestry products, grain, or any other single product really resulted in the failure of car ferry services. Coal was probably the only item moving Northbound across Lake Ontario and probably accounts for the disappearance of the three mid-lake operators. But in other cross-lake services, coal was rapidly replaced by petroleum products and petrochemicals, grain with grain products, minerals with manufactures, and rail passengers with automobile passengers. In fact, the interstate and provincial ton mileage has approximately kept pace with the growth of the gross national product and growth in interstate passenger mileage has exceeded it.[7] Both freight and passenger markets were growing, including those moving between the effected regions.[8] But, they were changing in product composition and forms of modal reliance. However, the railroads, partly by their own choice, were being left out of many markets, i.e., petroleum products, dairy products, new automobiles (until 1958). In fact, most high value manufactured items were being taken over by trucks, and passengers were turning to automobiles and air. This suggests that the failure was not simply a production based, supply failure, but a market failure on part of the railroads which owned and controlled the car ferry service.

(5) Market failures and competition have not been properly evaluated as a factor in the decline of car ferry service. As waterborne extensions of railroads,

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[7] *1972 Census of Transportation*, commodity series, U.S. Department of Commerce and the *1972 National Transportation Report*, U.S. Department of Transportation, 1975.

[8] For the specific lakes' region, see *The Multiregional Input-Output Studies*, K. Polenska, DOT, 1973, *Michigan Commerce and Commercial Policy Study*, J. L. Hazard, MSU, Bureau of Business and Economic Analysis, East Lansing, 1966.

the car ferries suffered even more seriously than their parent railroads from the "monopolistic hangover." In the beginning, that mattered little because the railroads controlled more than 90 percent of the inter-city passenger and freight market. But with the rise of competitive alternatives which have progressively reduced the rail share to less than one percent of passengers and 40 percent of the inter-city freight ton-mileage, the problem has become more serious. As milk, dairy products, petroleum products, and high value freight shipments of several times the value of interstate rail freight traffic shifted to trucks, the rail car ferries were virtually locked out of the market. Some ferries carried trucks as residual cargoes but no one was able to launch regular roll-on-roll-off trailer service. As railroads backed out of passenger service, the Lake Ontario Car Ferry Company and the Mackinac Transportation Company lost their passenger connections. Aside from the C&O car ferries and the Wisconsin-Michigan Steamship Company, no one made an attempt to cultivate that 90 percent of the inter-city passengers that move by automobiles. Despite the lack of advertising and promotion and irregular schedules, tourist growth persisted until the late 1960's. Market potentials were there, but the ferries were unable to tap it, in part, because of their inflexible commitment to rail freight cars. If the ferries ramain as tightly wedded to the railroads, their success will depend upon the successful revitalization of the national railroad system. The prospects of rail revitalization have improved with restructuring, massive public assistance, and regulatory reform.

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Competition has also had a role in the decline of the car ferry service. Trucks and pipeline services have improved substantially since car ferries hit the relative peak in the 1920's and the technological peak in the 1950's. Moreover, car ferries are particularly vulnerable to intensified competition from the railroads. Railroads control the flow of traffic to and from the car ferries and compete for parallel movements. As the small railroads that increased the ferry services have been absorbed into larger railroads with parallel track, the conflict of interest has grown. No railroad is apt to short-haul itself even if the ferry is economic.

(6) Institutional and legal impediments have also had a role in the decline of the car ferries. The major institutional problems arise from the peculiar "love-hate" relationship between the railroads and the car ferries as they have evolved over time. Most of the car ferries have germinated from short haul railroads seeking short line access to new markets. That was what inspired the Ann Arbor, four of the five American car ferry services across Lake Erie, and the Canadian car ferry service across Lake Ontario. Some were designed to afford short line railroads with access to new markets. Others were designed to break a railroad movement on existing markets. Examples of the latter include the attempts of the Pere Marquette, Grand Trunk, and Wabash to afford short line Eastern railroads with bridge access to Chicago and Western markets under the dominant control of Vanderbilt's New York Central. Similarly, the independent Michigan-Ohio Ferry Company sought to break the New York Central monopoly in

Detroit. But as railroads grew and merged, many had direct overland services or interline connections to the same markets. That puts the ferry service in the anamolous position of competing with other divisions of the same railroad which is referred to as short hauling the railroad. That has happened to the Grand Haven-Milwaukee service after acquisition by the Grand Trunk and movement to Ludington, the Pere Marquette after being acquired by the C&O, and even the Ann Arbor while it was owned by the Wabash and conceivably could be the case today as it is operated by Con Rail. All of the larger systems have longer haul rail access directly to Chicago and through the Chicago interline connections to other markets. Since no railroad is likely to short haul itself, nor a favored interline partner, the ferry service receives, at best, questionable routing priority. Since the rates by all rail and rail-ferry service are ultimately the same, the routing discretion is sometimes left by shippers to carrier personnel who will accord performance to the long haul all-rail route. The pattern of long haul discrimination experienced by the car ferries is similar to that experienced by the Lake ports in the battle for Seaway shipment over many years.

Some have suggested that a more favorable institutional arrangement might involve independent competitive ownership of the car ferry. But when that has been tried in three cases (the Lake Michigan Car Ferry Company, the Michigan-Ohio Car Ferry Company, and the early Grand Haven-Milwaukee service), the railroads have been able to cut off the independent in a matter of a few years.[9] The railroads are in a strategic position to either cut off access by removing interchange, through

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[9]The three past experiences discussed here should not be interpreted as a likely or unlikely consequence in the future, if and when similar independent operations are established.

tariffs, or equitable divisions of through rates, or imposing discriminatory switching charges or offering cut rate competition on parallel routes. The result of this two-sided pincer attack has been to put the independent competitor out of business before it can get a charge of destructive competition before the Interstate Commerce Commission. The basic problem, then, is the inability of the ICC to reach a timely decision and reinforce its power over equitable terms on intermodal interchange at reasonable through rates.

A similar problem exists to the entry of independent, intermodal carriers. When the KK Truck Trailer Service Company bought the state ferries with a view to initiating roll-on-roll-off service between Milwaukee and Muskegon, it encountered enormous opposition from the Wisconsin and Michigan line and the three car ferries which only incidentally haul trucks. As a result, the ICC rejected the KK application for a Certificate of Public Convenience and Necessity. Clearly, some regulatory reforms and a good deal of litigation are to be required to launch a new intermodal service.

The other legal impediment to continuation of car ferry service has been the legislative setting of increasing stringent environmental, safety, and service standards or what might be termed increasingly detailed non-economic regulation. The burden of Federal and State mandated standards were particularly constraining to water carriers for several reasons. This was because the clean water standards were more rigorous than other standards and occurred earlier. Water standards required sewage holding tanks, bilge water oil filtering devices,

and even exhaust water temperature controls, all of which were extremely costly to the aged ships. The impact of non-economic regulations on the car ferries were mitigated over time by their application to land based modes and somewhat more careful considerations of trade offs in their applications.

Altogether, the influences of technological lag, relative decline in productivity, cost escalation, and railroad oversight created conflicts of interest with owning railroads and institutional and legal impediments were a powerful set of influences precipitating the decline of car ferry service. It appears that many of the causes are remedial, but, as always, at a cost in resources, time, and effort. The first question, then, is what is the value of holding the service in place. Measuring the value of the car ferry service to the Michigan and Wisconsin economies is the primary objective of this Report. The Report is a result of a contract between the Michigan Department of State Highways and Transportation (MDSH&T) and TERA, Inc. Funding of the study was provided jointly by the MDSH&T and the Wisconsin Department of Transportation. The findings reported in this

study are intended to assist the Bi-State Ferry Task Force, appointed by the Governors of Michigan and Wisconsin to evaluate alternative options and recommend actions as to the nature and extent of future Lake Michigan car ferry service.

Report Overview

How can the contemporary value of the Lake Michigan car ferry service to the Michigan and Wisconsin economies be estimated? Most accurately by choosing the most recent year for which data is available and measuring the specific types of economic benefits that the two-state economies derived from the car ferry service. There are four distinct types of economic benefits and each is examined in the succeeding chapters in the following areas:

Chapter II: Transportation Cost Savings derived by shippers in Michigan and Wisconsin that reach Western and Eastern markets respectively - both those using the car ferry service directly and those indirectly benefiting from the lower rates (applying to shipments which move around the Lakes) by rail as a consequence of application of the short-line distance principle.

Chapter III: Employment examines the number of jobs that (1) derive directly from the conduct of car ferry operations and related rail service ashore; (2) derive indirectly from manufacturing and tourist services that depend upon car ferry services for access to markets; and (3) jobs deriving from secondary and induced employment supporting the basic industries in (1) and (2).

Chapter IV: Earnings and Income examines the earnings and incomes that derive to persons, business firms, and establishments in Michigan and Wisconsin as a consequence of the car ferry services, including wages, values added to manufacture and services.

Chapter V: Taxes measures the taxes (business, personal and sales) that derive to state and local governments in Michigan and Wisconsin as a consequence of the business activity generated by the car ferry service.

Chapter VI: Summary recaps and summarizes the total measurable employment and income of benefits of the car ferry services as received by individuals, business establishments, and governments in Michigan and Wisconsin economies.

CHAPTER II: TRANSPORTATION COST SAVINGS

Introduction

The existence of the Lake Michigan car ferry service provides a significant saving to the manufacturing establishments in Michigan and Wisconsin. This saving is a consequence of the shorter distance through the car ferry in reaching markets across the lake compared to the more circuitous Chicago gateway routing. Railroad rate making in class rates is based upon the shortest railroad distance between two points regardless of the actual route a shipment follows. Rates are determined on the basis of what is generally known as ICC Docket 28300. Since commodity rate making is generally related to the class rates, it therefore follows that both class and commodity rates usually make use of the shortest distance principle.

The circuity around the lake has a significant impact depending upon the relative position of the origin and destination points in relation to the north-south axis which passes through the middle of the lake, and their horizontal proximity. As will be further explored in the following discussion, the more circuitous the Chicago gateway route, the greater the anticipated rate increase if the Lake Michigan car ferry service is abandoned.

It should be recognized that manufacturers in Michigan and Wisconsin enjoy the lower rail rates established because of the existence of the car ferry service, not because they actually use the service. In other words, transportation

cost savings accrue to all shippers regardless of whether the service is actually used or not. Therefore, two groups of shippers which benefit from the ferry can be distinguished:

- Those shippers which presently use the car ferry service and, therefore, directly benefit from the lower rail rates (users).
- Those shippers which presently use the Chicago gateway routing but pay a lower rail rate due to distance equalization (non-users).

The transportation cost savings estimated in this Chapter relate to both groups of shippers. A number of studies have been made in the past which allude to these benefits. Some studies report specific corporate experience in testimony before the Interstate Commerce Commission in hearings related to the car ferry service abandonment.[1] One study done by Kearney Management Consultants presented a comparison of the "average cost per car" of rail transportation with and without the ferries, using several alternative routings.[2] However, the comparisons were made for a few geographic points only and no attempt was made to measure the cost impact on shippers. No comprehensive analysis of transportation cost savings to the manufacturers in Michigan and Wisconsin had been undertaken in the past. This study is the first known attempt at documenting origin-destination (O-D) movements by shippers which use the car ferry service as well as those which make use of the more circuitous routing around the Lake, and estimating the transportation cost savings as a consequence of the service. This attempt is constrained by the availability of data. However, the concept

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[1] For a discussion of specific hearings, see Exhibit 1 of V.M. Malanaphy & Associates, Inc., *Analysis of the U.S. Railway System Preliminary System Plan*, Washington, D.C., submitted to the Michigan Department of State Highways and Transportation, April 10, 1975.

[2] A.T. Kearney, Inc., *Analysis of Railroad Operated Ferry and Lighterage Operations*, U.S.R.A. Planning Project No. 6, specially Appendix D.

and methodology are equally applicable to a broader data base when and if such data are available.

This Chapter is divided into three parts. First, the relevant geographic area is described and two distinct sub-areas are identified (the immediate and extended hinterlands). Secondly, the methodology and available data are described. Third, the results of analysis are presented.

The Hinterland

A breakdown of rail revenues from traffic which goes on the Lake Michigan ferries is presented in Appendix E, listed by places of origin and by places of termination. The Appendix shows that the ferries provide a transportation link on East and Westbound movements for a wide area which includes Alaska, British Columbia, Maine, Florida, and Texas.

Existing studies indicate the composition of these movements. Out of 27,000 cars which were loaded on the Ann Arbor ferry in 1973, 55 percent terminated in just three states: Michigan, Wisconsin, and Ohio. Including three more states (Pennsylvania, New York, and Minnesota) brings the total to 78 percent. Out of the same 27,000 cars, 56 percent originate in three areas: Michigan, Wisconsin, and Minnesota. Adding Ohio, Saskatchewan, and British Columbia, brings the total to 72 percent.[3]

The degree of impact of the ferry on each state in the hinterland is determined by two considerations:

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[3]Source: A.T. Kearney, Inc., *op. cit.*, Chapter II.

(1) The position of the state on the global north-south axis relative to the lake.

(2) Proximity to the Lake.

The effect of the first determinant is obvious. The more directly the Lake lies in the path of an east-west shipment, the more likely that the shortest railroad route for that movement is determined by the existence of the car ferry. Conversely, when both origin and destination are north or south of the lake, the freight rate between them will not be directly affected by the existence of the car ferry. The effect of the second determinant is less obvious, but just as important. The farther the origin point and destination point are from the Lake, the greater the railroad distance is between the two points. The distance traveled from origin to destination via the car ferry route could be sufficiently great so that a detour around the lake would result in a negligible percentage increase in total miles.

The impact of total ferry service abandonment in the hinterland in terms of additional shipping expenses is estimated in this Chapter. However, some states are analyzed in greater detail than others because of their proximity to and relative geographic position with respect to the Lake. It is thought that because of such factors, these states would be evaluated by a more detailed analysis of benefits derived from the ferry service. The other states are also considered in the analysis, but in less detail. The sub-divisions of the hinterland may be respectively called:

(1) Immediate hinterland (IH)

(2) Extended hinterland (EH)

The immediate hinterland consists of the following areas: Michigan, Wisconsin, Minnesota, North Dakota, Ohio, Pennsylvania, and New York. The origin-destination (O-D) network in the immediate hinterland is mapped out in Figure II-1. To facilitate the computation of savings to shippers, these states have been sub-divided into regions. The regional sub-divisions are specified in Table II-1 and illustrated in Figure II-2. The Upper Peninsula of Michigan is noted among these regions as part of the immediate hinterland West of the Lake. As shown in Appendix B, movements to/from the Upper Peninsula having potential routing via the car ferry are Eastbound. The southern portions of Ohio are not listed in Table II-1 because they are too far South to be directly affected by the shortest mileage routing via the ferry.

Appendix B provides a detailed listing of all commodities that moved from one side of the Lake to the other side of the Lake between points in the immediate hinterland for the year 1973. The list includes Eastward as well as Westward movements. Of all commodities that moved between points in the immediate hinterland, 17 major commodity groups comprised 64 percent of total tonnage and 70 percent of total tariffs paid by shippers to the railroads.

In terms of tonnage, the six biggest STCC groups were: food and kindred products; transportation equipment; paper, pulp, and allied products; chemicals and allied products; lumber and wood products (excluding furniture); and fabricated metal products (except ordinance, machinery, and transportation equipment). In terms of tariffs paid by shippers to the railroads, the ordering was the same except that machinery (excluding electrical) displaced lumber and wood products

FIGURE II-1

IMMEDIATE HINTERLAND OF THE LAKE MICHIGAN FERRY SYSTEM

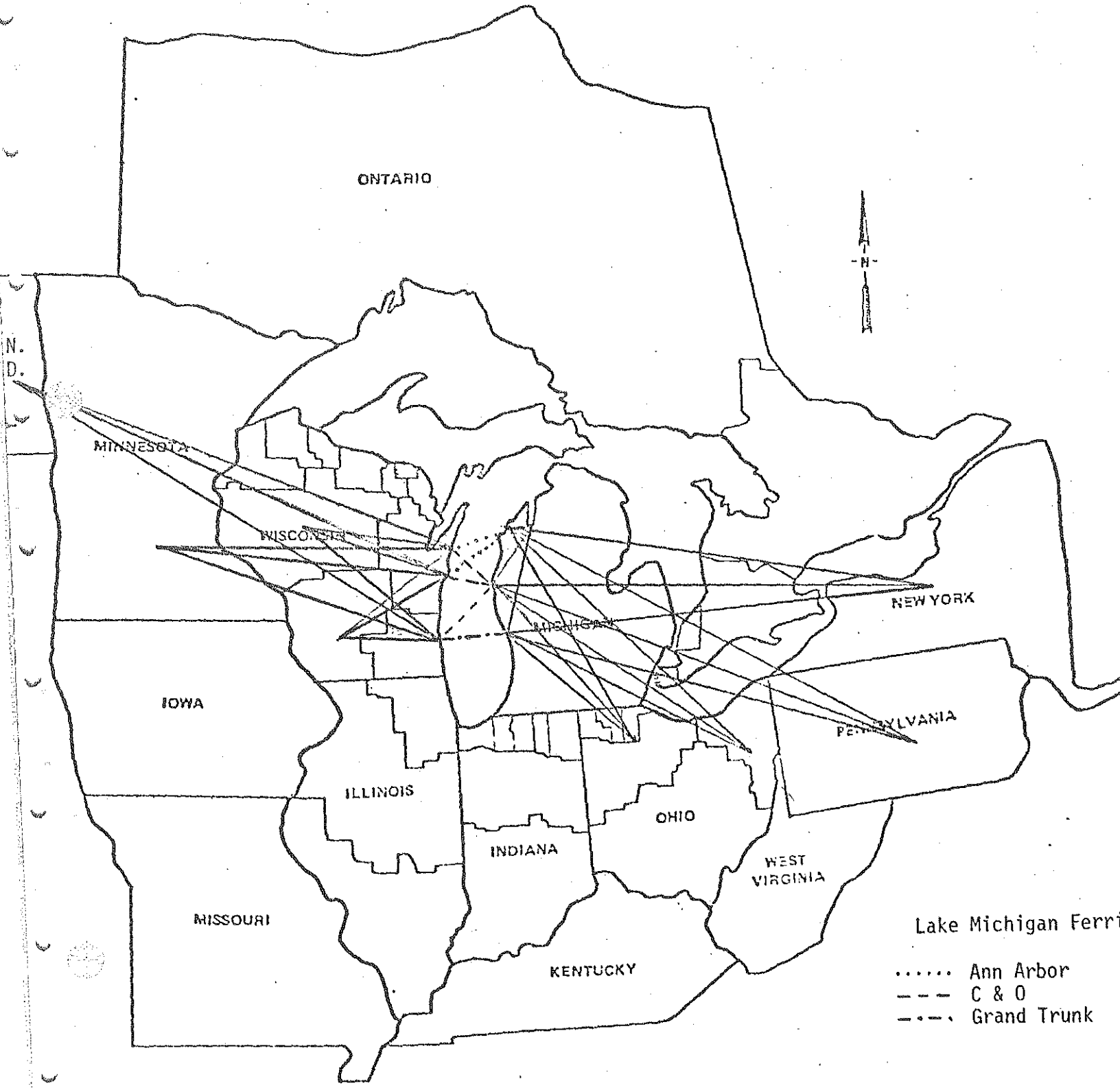

TABLE II-1

DEFINITION OF REGIONS IN THE IMMEDIATE HINTERLAND FOR ORIGIN-DESTINATION ANALYSIS

Region/States		REGIONS EAST OF LAKE MICHIGAN: Counties in Region:		
1	Michigan 1	Berrien	Monroe	Wayne
		Cass	Van Buren	Livingston
		St. Joseph	Kalamazoo	Oakland
		Branch	Calhoun	Macomb
		Hillsdale	Jackson	Lapeer
		Lenawee	Washtenaw	St. Clair
2	Michigan 2	Cheboygan	Bay	Sanilac
		Presque Isle	Huron	Clinton
		Alpena	Midland	Shiawassee
		Alcona	Gratiot	Genessee
		Iosco	Saginaw	Eaton
		Arenac	Tuscola	Ingham
3	Michigan 3	Crawford	Gladwin	Kent
		Oscoda	Newaygo	Ionia
		Roxcommon	Mecosta	Allegan
		Ogemaw	Isabella	Barry
		Osceola	Montcalm	
		Clare	Ottawa	
4	Michigan 4	Oceana, Muskegon		
5	Michigan 5	Emmet	Montmorecy	Wexford
		Charlevoix	Benzie	Missaukee
		Leelanau	Grand Traverse	Mason
		Antrim	Kalkaska	Lake
		Ostego	Manistee	
6	Ohio	Lucas, Ottawa, Wood		
7	Ohio	Lorain	Summit	Columbiana
		Cuyahoga	Portage	Carroll
		Lake	Trumbull	Harrison
		Geauga	Mahoning	Jefferson
		Ashtabula	Stark	Belmont
		Medina		
8	Pennsylvania	All		
9	New York	All		

TABLE II-1 (Continued)

REGIONS WEST OF LAKE MICHIGAN:

Region/State	Counties in Region:			
10 Wisconsin 1	Polk	Eau Claire	Waushara	Douglas
	Barron	Clark	Marquette	Bayfield
	Rusk	Marathon	Green Lake	Ashland
	Price	Buffalo	Vernon	Iron
	St. Croix	Trempealeau	Crawford	Burnett
	Dunn	Jackson	Richland	Washburn
	Chippewa	Wood	Sauk	Sawyer
	Taylor	Portage	Columbia	
	Lincoln	La Crosse	Grant	
	Langlade	Monroe	Iowa	
	Pierce	Juneau	La Fayette	
	Pepin	Adams	Green	
11 Wisconsin 2	Oconto	Brown	Sheboygan	
	Menominee	Keweunee	Marinette	
	Shawano	Winnebago	Forest	
	Door	Calumet	Florence	
	Waupaca	Manitowoc	Vilas	
	Outagamie	Fond Du Lac	Oneida	
12 Wisconsin 3	Ozaukee	Waukesha	Kendsha	
	Washington	Jefferson	Walworth	
	Dodge	Dane	Rock	
	Milwaukee	Racine		
13 North Dakota	All			
13 Minnesota	All			
14 Michigan 6	All of Upper Peninusla			

FIGURE II-2

REGIONS IN THE IMMEDIATE HINTERLAND (NUMBERED)

(except furniture) in the top six. The commodity breakdown on tonnage and tariffs paid is listed on Table II-2.

Appendix E shows a detailed breakdown of originating and terminating traffic by states and Canadian provinces in the extended hinterland. The Lake Michigan car ferry service provides a transportation link on East and Westbound movements for a large area outside the seven states in the immediate hinterland for which a detailed analysis of transportation cost savings is done. The Tables in the Appendix show a wide area including Alaska, British Columbia, Florida, Maine, and Texas, which make use of the car ferry service. 55.7 percent of rail revenues from Eastbound movements in the ferry hinterland originate from states and provinces in the extended hinterland; as for Westbound movements, the corresponding figure is 39.3 percent. Traffic terminating in states in the extended hinterland accounts for 31.1 percent of total rail revenues from Eastbound traffic and 22.1 percent of total rail revenues from Westbound traffic.

Methodology and Available Data

The basic approach used to estimate the cost savings to shippers is made up of the following seven steps:

Step 1: Determine the average freight rate on each commodity group for each origin-destination pair in the hinterland which prevails because of the existence of the ferry.

Step 2: Re-compute each freight rate cited in Step 1 to reflect any increase which would result from abandonment of the ferry. The increased rates are a result of mileage increases, without the ferry line, constructed under Docket 28300 Mileage Tariff. This procedure for computing rates is indicated by the history of railroad rate making.

TABLE II-2

VOLUME OF COMMODITIES SHIPPED AND RAIL SHIPPING COSTS BETWEEN POINTS IN THE IMMEDIATE HINTERLAND
(Ferry Users and non-Ferry Users)

Commodities STCC No.	Description	Tons (thousands)	Rail Costs (million $)
20	Food & kindred products	1,589.9	26.58
22	Textile mill products	20.0	1.41
24	Lumber & wood products, except furniture	230.6	2.40
26	Pulp, paper & allied products	1,040.6	17.72
27	Printed matter	9.4	.21
28	Chemicals & allied products	676.2	7.15
29	Petroleum & coal products	73.3	1.10
30	Rubber & misc. plastics products	33.8	1.10
32	Stone, clay, glass & concrete products	119.8	1.82
34	Fabricated metal products, except ordinance machinery & transportation	143.4	3.60
35	Machinery, except electrical	76.1	2.49
36	Electrical machinery, equipment & supplies	31.2	1.77
37	Transportation Equipment	1,122.4	27.87
39	Misc. products of manufacturing	12.9	0.44
40	Waste & scrap materials	86.7	1.20
41	Misc. freight shipments	9.0	0.27
42	Containers, shipping, returned empty	14.5	0.27
XX	All other commodities	2,976.5	41.51
	TOTAL	8,266.3	138.91

Source: Appendix B

Step 3: Compute the difference in freight rates with and without the ferries for each O-D pair on each commodity group.

Step 4: Determine the volume (in units consistent with freight rate quotations) of commodities shipped in the hinterland and list by O-D pairs.

Step 5: Multiply the volume of each commodity for each O-D pair by the relevant freight rate differential as determined in Step 3.

Step 6: Sum up the results of Step 5 according to the states concerned in order to determine the state-by-state impact of ferry abandonment on shipping expenses.

Step 7: Identify benefits according to whether they accrue to ferry users (direct beneficiaries) or to non-ferry users (indirect beneficiaries).

Steps 1 through 5 yield the same results as the following procedure:

(a) Determine the expense of shipping each commodity group by rail as determined by the existence of the ferries and identify the region of origin and destination of each shipment.

(b) Determine the anticipated percentage change in the freight rate for each commodity group between each pair of regions if the ferries were all abandoned.

(c) Multiply each item from (a) by the corresponding percentage change determined in (b).

For computational speed and simplicity, this procedure was used whenever possible to estimate cost savings, instead of going through each of the first five steps.

Except for freight rate changes, all variables in the analysis are assumed to be constant. However, it should be pointed out that truck rates tend to follow changes in rail rates and involve about twice the inter-city rail revenue.

The analysis ignores the increase in trucking rates that could result from elimination of competition posed by the ferry service. This omission may have caused the cost savings estimates to be understated.

Another variable ignored in the analysis is the possible decrease in the volume of shipments because of increases in transportation costs. This omission tends to overstate the estimates of transportation cost savings. However, the loss of sales indicated by any decrease in the volume of shipments would be a greater loss to states' income than if the states were to absorb the increases in freight rates.

Finally, it should also be pointed out that other ferry service benefits (such as savings in shipping time by the avoidance of "switch through the Chicago terminal district with the consequent risk of damage..."[4]) exist, but were not calculated.

Four categories of cost savings to shippers are identified in the analysis:

(1) Cost saving to direct beneficiaries in the immediate hinterland (to actual ferry users - $USERS_{IH}$).

(2) Cost saving to indirect beneficiaries in the immediate hinterland (to non-ferry users - Non-$USERS_{IH}$)

(3) Cost saving to direct beneficiaries in the extended hinterland ($USERS_{EH}$)

(4) Cost saving to indirect beneficiaries in the extended hinterland (Non-$USERS_{EH}$)

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[4]Erik Schenker, *The Port of Milwaukee, An Economic Review*, University of Wisconsin Press, Madison, 1967, p. 28.

Estimates of percentage changes in rail rates in the immediate hinterland as a consequence of ferry abandonment were obtained from a report by the Freight Traffic Service Company (FTSC).[5] FTSC provided percentage change estimates for twenty commodity groups on 50 O-D pairs. This data is presented in Appendix C. The origins and destinations examined by FTSC were specific cities. In order to make use of the FTSC estimates, the immediate hinterland was divided up into regions such that the cities considered by FTSC are as close as possible to the population centers of gravity of each regional sub-division. A comparison of population centers of gravity and cities on which FTSC based its estimates is shown in Figure II-3.

The FTSC report provides percentage change data on the freight rates of the 17 commodities listed on Table II-2. A weighted average of the given 17 percentage changes was computed for each O-D pair in order to generate a comparable estimate for other STCC groups. Total revenues collected by the railroads from each of the 17 commodity groups were used as weights in this computation.

Freight rate changes in the extended hinterland were estimated on the basis of FTSC estimates for the immediate hinterland. It can be observed that the anticipated freight rate changes at the fringes of the immediate hinterland range from 0 to 10 percent depending on the commodity and the O-D pair. As shipping points recede away from the lake past these fringes, the percentage rate changes which would result from ferry abandonment would diminish. By using this concept,

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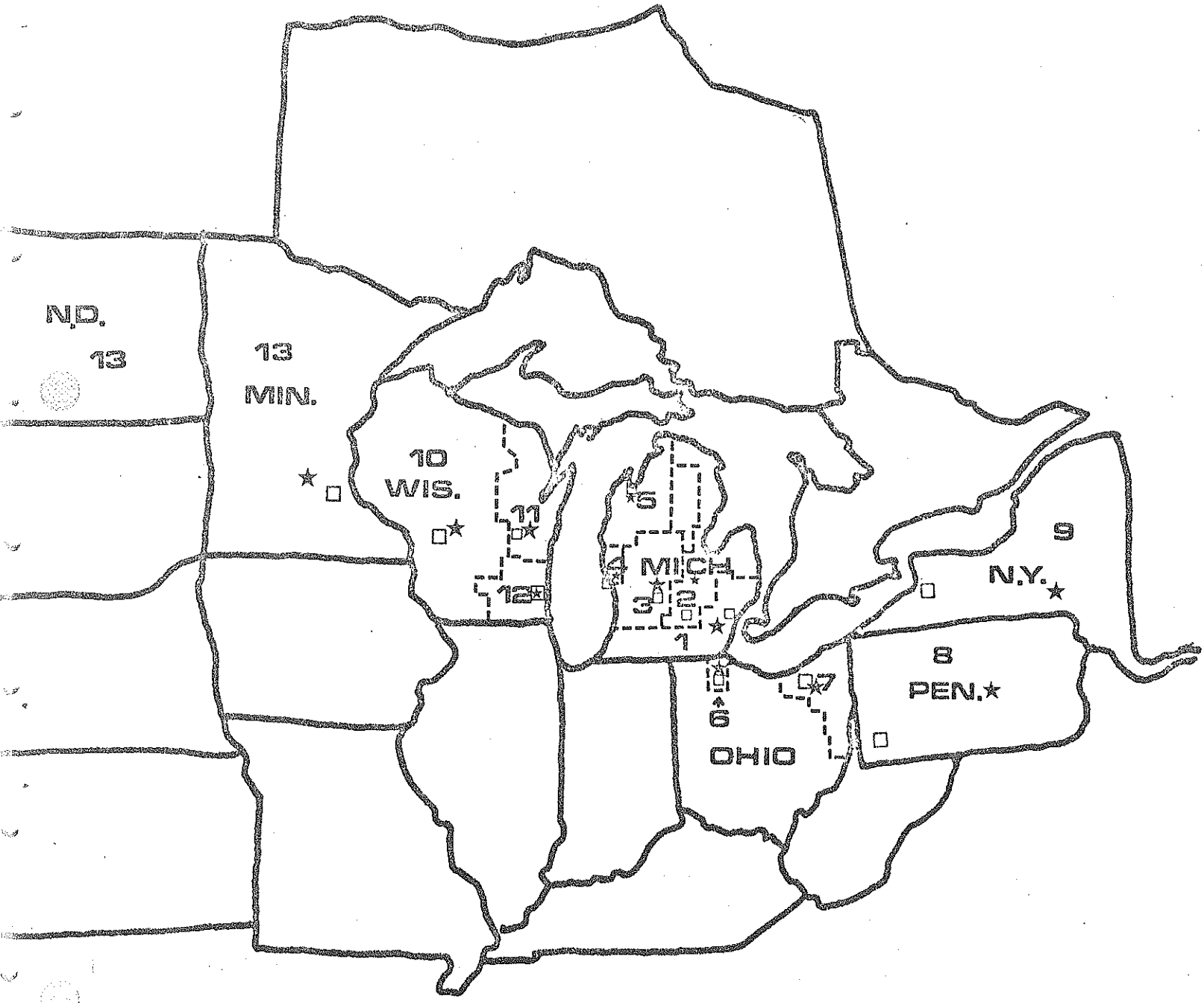
[5] Freight Traffic Service Company, *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975. Due to budgetary and time constraints in the study, an independent investigation of expected increase in rail freight tariffs as a result of service abandonment was not conducted by TERA.

FIGURE II-3

LOCATION OF POPULATION CENTERS OF GRAVITY OF REGIONS IN THE IMMEDIATE HINTERLAND VERSUS CITIES ON WHICH FTSC PERCENTAGE CHANGE ESTIMATES WERE BASED



□ Cities on which estimates of rate changes were based.

★ Population centers of gravity computed from U.S. Department of Commerce, Bureau of the Census estimates.

the percentage increases in freight rates in the extended hinterland were assumed to be those shown in Appendix E.

The percentage chosen for the extended hinterland were based on a single leg of the total movement to and from the Lake ferries so that the transportation cost savings computed by originating state are additive to the savings computed by destination state. Thus, a movement originating in British Columbia is assumed to enjoy a one percent benefit on the first leg of the trip. If this movement terminates in New Hampshire, it is assumed to gain an additional one percent benefit on the second leg. While if it terminates in Mississippi, no additional benefit is assumed. This is because New Hampshire is just East of the hinterland while Mississippi is too far South relative to the north-south axis of the Lake. By computing benefits in this manner, it was possible to obtain transportation cost savings in the extended hinterland without knowing specific O-D pairs or commodity groups.

The analysis uses 1973 railroad traffic data which is readily available from public records and from computer tapes of various government agencies.[6] Although the analysis yields 1973 results, the estimates are indicative of the general magnitude of the sum of cost savings to non-ferry users and ferry users. Although the actual ferry traffic has been on the decline in recent years, this adds to the ranks of shippers who do not ship on the ferry but benefit from it anyway because of lower freight rates.

Data on traffic flow in 1973 between regions in the immediate hinterland were obtained from a special run of a one percent waybill sample tape at the Federal

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[6]Assistance received from the Interstate Commerce Commission, Bureau of Economics, Federal Railroad Administration, and Michigan Department of State Highways and Transportation is greatly appreciated.

Railroad Administration (FRA). This data is presented in Appendix B. Multiplying this data by 100 yields an estimate of total traffic flow of each commodity group between points in the immediate hinterland. The shipping expenses incurred on these flows were then multiplied by the anticipated percentage increases in the freight rates to yield estimates of transportation expenses which all shippers (ferry users and non-ferry users) in the immediate hinterland would have paid in the absence of the ferries. Using previously established labels, this benefit is equal to $USERS_{IH}$ + $Non\text{-}USERS_{IH}$. A summary table of these benefits is presented in Table II-3.

Since traffic flow data on actual ferry users in the immediate hinterland is not simultaneously available by commodity groupings and by O-D pairs for all railroads, an estimating procedure had to be used to approximate this flow. Complete data on Ann Arbor traffic was available with all the required details from a 100 percent waybill tape at the Michigan Department of State Highways and Transportation. This data was used to compute cost savings on twenty major commodities shipped on the Ann Arbor between points in the hinterland. The tables of benefits to Ann Arbor shippers of twenty commodities are presented in Appendix D. The sum of benefits on these twenty was found to be $459,117. Since these twenty commodities contributed only 88.8 percent of total rail revenues generated by shipments that used the Ann Arbor, the cost saving was adjusted accordingly to 100 percent.

TABLE II-3

COST SAVINGS TO SHIPPERS IN THE IMMEDIATE HINTERLAND
Ferry Users and Non-Ferry Users, 1973

Origin	Destination	Cost Savings	
Area 1	Area 10	$ 46,655	
1	11	180,455	
1	12	393,837	
1	13	639,998	
			1,260,945
Area 2	Area 10	21,707	
2	11	119,924	
2	12	793,554	
2	13	878,373	
			1,813,558
Area 3	Area 10	14,958	
3	11	25,384	
3	12	260,312	
3	13	43,170	
			343,824
Area 4	Area 10	86,534	
4	12	99,459	
4	13	16,082	
			202,075
Area 5	Area 10	287,956	
5	11	281,222	
5	12	94,161	
5	13	369,161	
			1,032,500
Area 6	Area 12	24,990	
6	13	3,033	
			28,023
Area 7	Area 10	8,472	
7	11	52,935	
7	12	133,991	
7	13	95,488	
			290,886
Area 8	Area 10	10,303	
8	11	103,318	
8	12	54,451	
8	13	000	
			168,072
Area 9	Area 10	62,694	
9	11	211,109	
9	12	336,794	
9	13	202,021	
			812,618

COST SAVINGS TO SHIPPERS IN THE IMMEDIATE HINTERLAND
Ferry Users and Non-Ferry Users, 1973

Origin	Destination	Cost Savings	
Area 10	Area 1	$ 95,197	
10	2	36,820	
10	3	12,358	
10	4	43,501	
10	5	18,734	
10	6	1,203	
10	7	9,503	
10	8	31,519	
10	9	148,630	
	Total		397,465
Area 11	Area 1	442,228	
11	2	81,369	
11	3	13,120	
11	4	9,614	
11	5	323,798	
11	6	10,640	
11	7	62,902	
11	8	293,743	
11	9	603,493	
	Total		1,840,907
Area 12	Area 1	308,262	
12	2	773,702	
12	3	31,057	
12	4	19,239	
12	5	15,084	
12	6	5,182	
12	7	21,181	
12	8	38,540	
12	9	922,885	
	Total		2,135,132
Area 13	Area 1	431,215	
13	2	338,902	
13	3	125,757	
13	4	10,887	
13	5	21,918	
13	6	22,082	
13	7	103,262	
13	8	000	
13	9	1,092,415	
	Total		2,146,438
	Total Cost Savings		$ 12,472,443

Source: Computed from traffic data provided by FRA and rate change data from FESC.

The formula for adjusting it is as follows:

$$\text{Percentage benefit omitted} = \frac{\text{benefit to all commodities} - \text{benefit to 20 commodities}}{\text{benefit to all commodities}}$$

hence,

$$\text{Benefit to all commodities} = \frac{\text{benefit to 20 commodities}}{\text{1-percentage benefit omitted}}$$

where percentage benefit omitted is assumed to be equal to the percentage of rail revenues omitted in the computation which is 11.2 percent.

The rest of the estimation of benefit to users in the immediate hinterland is based on two assumptions:

(1) All Ann Arbor traffic between points in the immediate hinterland is assumed to be shipped via the ferry on the basis of the recognized policy of Ann Arbor management to route all traffic to the West Coast and Western trunk line territory via the Kewaunee gateway. This assumption implies that the benefits to shippers on the Ann Arbor is identical to benefits to ferry users on the Ann Arbor.

(2) The savings to shippers on the Ann Arbor is an analog to savings to shippers on the C&O ferries and the GTW ferry.

The second assumption enables the upgrading of the Ann Arbor cost savings to reflect total cost savings to all ferry users in the immediate hinterland by applying the following equation:[7]

$$\text{USERS}_{IH} = \text{USERS}_{IH,\ AA\ FERRY} \times \frac{\text{total rail revenues from all ferry traffic between points in the immediate hinterland}}{\text{total rail revenues from AA ferry traffic between points in the immediate hinterland}}$$

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[7]Based on data in Appendix E, the fraction in this equation was found to be $\frac{100}{37}$

The cost saving benefits to non-ferry users in the immediate hinterland can then be computed by solving:

$$\text{Non-USERS}_{IH} = (\text{USERS}_{IH} + \text{Non-USERS}_{IH}) - \text{USERS}_{IH}$$

Traffic data on ferry shipments originating or terminating in the extended hinterland were generated from computer runs and publications available at the Interstate Commerce Commission. This data is presented in Appendix E. By multiplying each traffic flow by the corresponding anticipated percentage change in the freight rate, the benefits to ferry users in the extended hinterland (USERS_{EH}) was estimated.

Finally, the total benefit to non-ferry users in the extended hinterland (Non-USERS_{EH}) can be estimated by assuming that the immediate hinterland is an analog of the extended hinterland such that:

$$\frac{\text{USERS}_{EH}}{\text{Non-USERS}_{EH}} = \frac{\text{USERS}_{IH}}{\text{Non-USERS}_{IH}}$$

hence,

$$\text{Non-USERS}_{EH} = \frac{\text{USERS}_{EH} \times \text{Non-USERS}_{IH}}{\text{USERS}_{IH}}$$

Summary of Estimated Benefits (Cost Savings)

By performing the computations detailed in the preceding section and by using the data described in the same section, the following shipping cost savings in the

year 1973 were estimated:

In the immediate hinterland:

direct benefits to ferry users, $USERS_{IH}$	$1,396,889
indirect benefits to non-ferry users, $Non\text{-}USERS_{IH}$	11,075,554

In the extended hinterland:

direct benefits to ferry users, $USERS_{EH}$	479,300
indirect benefits to non-ferry users, $Non\text{-}USERS_{EH}$	3,800,000
Total	$16,751,743

Based on Table II-3, the benefits from the ferries that accrue to Michigan and Wisconsin in the year 1973 in terms of shipping cost savings were:

Michigan	$4,652,902
Wisconsin	4,413,249
Total	$9,066,151

The above tabulations were done on the assumption that shipping costs are absorbed by shippers. To the extent that they are able to pass on cost savings to their customers, the consumers in the receiving states were benefited by the existence of the ferry system.

The total savings of $12.5 million to the users and non-users in the immediate hinterland correspond to nine percent of the total railroad revenue of $138.9 million reported in Table II-2. As shown in Table B-3 of Appendix B, the total revenue of all Eastbound movements by rail from Wisconsin to the regions within the immediate hinterland is $36.44 million (see page B-38). Compared to the $4.4 million cost savings estimate for the shippers in Wisconsin, this corresponds to a 12.1 percent savings in transportation costs. On the Michigan side, the $4.65 million

transportation cost savings to the shippers represent 13.2 percent of the total rail revenue originating in Michigan and terminating in the six regions west of the lake included in the immediate hinterland. (See Table B-4, page B-57 of Appendix B).

The "Summary of Estimated Benefits" has been conservatively estimated, and may appear to be at variance with the estimates by industrial shippers, particularly in Wisconsin, where a single enterprise has stated that if rate equalization with Chicago is lost, and the rates now under the leverage of short-line car ferry rates were to go to regular class and mileage scales, that single company would be prejudiced to the extent of $1 million per year, and would be forced to terminate its Wisconsin operations. Similar estimates have come from a number of large shippers.

There have been extensive discussions among shippers and with car ferry line officials as to possible future alteration of the rate structures involved. There is general agreement that if and when car ferry service is terminated, the western railroads will presumably seek re-opening of rate division agreements to improve their earnings, now somewhat reduced by virtue of the short-line mileages reflected in the eastern territory rate structure. While a broad re-adjustment of the present tariffs might be spread over years, it is considered inevitable. What level of rates might emerge is surely speculation, but there have been forecasts by knowledgeable traffic officials that the net effect would probably be in the range of 25 percent over the present favorable system of rates.

In addition to possible or probable upward revision of rail tariffs (and of parellel competitive trucking rates) there are other elements of uncertainty,

such as probable loss of valuable transit privileges on grain and grain products, and the anticipation that if all of the traffic concerned moves through the Chicago gateway, the historic factors of congestion and lost time will again be factors of worry for shippers to and from the affected astern territory.

Since transportation is a major factor of cost in the modern economy, there is also speculation and concern as to the competitive posture of hundreds of firms, North of the east-west Chicago axis, who may have in future to reprice products to reflect higher freight rates and thus, may lose sales or in marginal situations, might abandon their business.

CHAPTER III: EMPLOYMENT

Introduction

The car ferry service across Lake Michigan contributes to the creation of employment benefits. Some of these benefits are derived directly from jobs necessary for ferry operations. Officers, seamen, engineers, oilers, and other workers supporting the ferry operations aboard the ferry boats constitute direct employment for offshore operations. Onshore, ticket sellers, dock hands, traffic control, and maintenance crews also constitute direct employment for the operations of the ferry service.

In addition, a large portion of the rail operations of the Ann Arbor and the Green Bay and Western Railroads directly depends on traffic interlined through the ferry service. Therefore, on these two roads, the proportions of their total traffic interchanged on the ferries results in direct employment benefits for line haul operations. These benefits are also considered as direct employment.

As opposed to direct employment benefits, ferry operations also contribute to the creation of indirect and induced employment. Indirect employment benefits are created because manufacturing and service industry operations partially depend upon the ferry service. To illustrate, a manufacturing establishment in Wisconsin shipping a portion of its output to Eastern markets by rail takes

advantage of a low rail rate via the car ferry regardless of the actual routing (across or around Lake Michigan). As described in the preceding Chapter, abandonment of ferry operations is expected to eliminate this rail advantage, which will adversely affect the shipper's competitive advantage. The eventual effect of rail rate increase on company operations depends on the extent of competition, the magnitude of any increase in rail rates, and the importance of transportation costs to total cost. In a price competitive industry where transportation costs constitute a significant portion of delivered price, such as chemicals, pulp, paper, etc., the effect of increasing rail costs will be more significant than industries where non-price competition is predominant or where transportation costs are a small part of total cost, such as electronic equipment. However, the basic principle of an adverse effect due to an increase in transportation costs is valid regardless of the industry; only the magnitude of the effect will depend upon the industry. The indirect employment benefits are, therefore, defined as that portion of a manufacturer's workforce which is expected to be adversely affected by an increase in railroad rates as a consequence of car ferry service abandonment.

The total of direct and indirect employment benefits described above constitute primary employment benefits. In addition, secondary, tertiary, and other employment benefits are also created through the multiplier effects. These are defined as induced employment.

In this chapter, the primary and induced employment due to car ferry operations are estimated.

Primary Employment

Direct Primary Employment

Direct primary employment related to the marine operations of the Ann Arbor Railroad, the Chesapeake and Ohio Railway, and the Grand Trunk Western Railroad are estimated for each railroad operation as follows:

Ann Arbor Railroad. In 1973, Ann Arbor Railroad operated two vessels on Lake Michigan between Frankfort, Michigan, and Kewaunee and Manitowoc in Wisconsin. Since then, the Ann Arbor has operated only one vessel, the *Viking*, which was originally built in 1925 and rebuilt in 1965.[1] In addition to the *Viking*, Ann Arbor Railroad infrequently charters Grand Trunk Western car ferries when a need arises. The general maintenance, manning, and provisioning of the Ann Arbor vessels are supervised from facilities in Frankfort, Michigan.

As detailed in Table III-1, the *Viking* and the *Atkinson* have a total crew of 35 and 41 men, respectively, with 12 relief workers each. In addition, the railroad employs one agent at Kewaunee and a total of 49 ferry related workers in Frankfort.[2]

The car ferry operations of the Ann Arbor Railroad provide a vital portion of the overall company operations. It has been said that, "It is highly unlikely that continued operation of rail services could be justified in any context other than in conjunction with ferry service."[3] However, as officially recognized by

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[1] *Arthur K. Atkinson*, originally built in 1917 and subsequently repowered, suffered a broken crankshaft in one of the two diesel engines and was taken out of service in August, 1973. The vessel has been in layup condition since this casualty.

[2] Harbridge House, Inc., *Analysis of Lake Michigan Car Ferry Service*, a report prepared for the Wisconsin Department of Transportation, November, 1975, p. IV-19.

[3] R. L. Banks and Associates, *Lake Michigan and Mackinac Straits Car Ferry Service*, a report prepared for the Michigan Department of State Highways and Transportation, September, 1975, p. 39.

TABLE III-1

CREW OF ANN ARBOR FERRIES, 1973

Job Title	*Viking*	*Atkinson*
Master	1	1
Mates	3	3
Wheelsmen	3	3
Lookouts	3	3
Watchmen	3	3
Deckhands	3	3
Car Handlers	3	3
Chief Engineer	1	1
Assistant Engineers	3	3
Electricians	2	2
Oilers	3	3
Firemen	-	3
Wipers	-	3
Cooks	2	2
Porters	2	2
Cabin Watch	1	1
Cabin Maid	1	1
Purser	1	1
TOTAL CREW	35	41
RELIEF WORKERS	12	12

Source: Michigan Traffic Company, *Survey of Vessels and Docks of Ann Arbor Railroad, Chesapeake and Ohio Railroad and Grand Trunk Railroad*, a report prepared for the Michigan Department of State Highways and Transportation, December 1975, pp. AA-28, AV-15.

the Michigan Department of State Highways and Transportation,[4] Ann Arbor provides a potential as a branch line for local service, as a feeder route into the northwest portion of the Lower Peninsula, and as a trunk route connecting Toledo, Ohio with Kewaunee, Wisconsin, bypassing the Chicago gateway. Whether the Ann Arbor will continue to function as a trunk route over the long term is presently unknown. The present subsidy gives the States of Michigan and Wisconsin the time needed to develop and weigh different options for trunk route service. Integral to the trunk route function is the car ferry service which will be affected by the ultimate disposition of the Green Bay and Western Railroad (GB&W) which connects with the Ann Arbor at Kewaunee.[5] GB&W is heavily dependent on interchange traffic at Kewaunee. In 1973, 28 percent of the GB&W system carloads were interchanged with the Ann Arbor system at Kewaunee. Assuming a proportional relationship between traffic and employment, this corresponds to 140 GB&W jobs.[6] On the Michigan side, 28 percent of total Ann Arbor traffic in 1973 was ferry related.[7] Of the total of 401 Ann Arbor employees in 1973, 252 were employed in land-based operations. Therefore, 71 land-based jobs (252 X .28) in the Ann Arbor Railroad are supported by ferry operations. Therefore, including the 100 marine jobs shown in Table III-1 and the 49 port-based jobs, a total of 220 Ann Arbor jobs are sustained by the ferry service at Frankfort.

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[4] *Michigan Railroad Plan*, Phase II, December, 1975, Chapters 4 and 5.

[5] There is a current petition before the ICC by the Burlington Northern to gain control of the GB&W. Also a similar request by a consortium of Wisconsin railroads has been filed before the ICC.

[6] Approximately 500 total employment estimates taken from R.L. Banks, *op. cit.*, p. 47.

[7] A.T. Kearney, *Analysis of Railroad Operated Ferry and Lighterage Operations*, a report prepared for the U.S. Railroad Association, January, 1975, p. II-15.

Chesapeake and Ohio (C&O) Railroad. The C&O operates three vessels on Lake Michigan between the ports of Ludington, Michigan, and Milwaukee, Manitowoc and Kewaunee, Wisconsin. These vessels are the *City of Midland*, the *Spartan* and the *Badger* with crews as shown in Table III-2. Shore-based facilities located in Ludington include all machinery, warehouse and shops to support repair and maintenance work. Ferry-related port jobs of the C&O are shown in Table III-3. In 1973, 20 percent of GB&W traffic was interchanged with the C&O at Kewaunee. This contributes to approximately 100 GB&W jobs in Wisconsin as a result of the C&O ferry service between Ludington and Kewaunee. At the port of Manitowoc, the C&O interchange with Chicago and Northwestern (CNW) requires 10 CNW jobs (1 engineer, 3 clerks, 5 switchmen, 1 roadmaster).[8] Interchange functions at Milwaukee are undertaken by C&O.

The C&O car ferry traffic in relation to the total volume handled by the C&O system constitutes an insignificant portion of overall operations. As opposed to the impacts on the Ann Arbor and the GB&W, the existence of the car ferry service cannot be used as a factor contributing to overall line employment for C&O. It could also be argued that the elimination of car ferry service would contribute to an increase in employment due to longer length of haul via the Chicago gateway connecting C&O with the Soo line, and CNW systems for northbound movements in Wisconsin. Therefore, the net employment impact of the C&O car ferry service on the C&O and CNW is assumed to cover only marine and port functions and exclude other employment along the rail network.

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[8] Harbridge House, Inc., *op. cit.*

TABLE III-2

CREW OF C&O FERRIES

Job Title	*Badger*	*City of Midland*	*Spartan*
Master	1	1	1
Mates	3	3	3
Wheelsmen	3	3	3
Lookouts	3	3	3
Watchmen	3	3	3
Deckhands	3	3	3
Car Handlers	4	4	4
Patrolmen	1	1	1
Engineers	7	7	7
Oilers	3	3	3
Water Tenders	3	3	3
Firemen	3	3	3
Coal Passers	3	3	3
Eng. Util. and Wipers	2	2	2
Stewards, Cooks and Waiters	8	8	8
Porters and Maid	3	3	3
Pantry Man	1	1	1
Purser	1	1	1
Clerk	1	1	1
TOTAL	56	56	56
RELIEF WORKERS	6	6	6

Source: Michigan Traffic Company, *op. cit.*, pp. CB-20, CM-16, CS-21

TABLE III-3

FERRY RELATED PORT JOBS OF C&O

Job Title	Location				Total
	Milwaukee	Manitowoc	Kewaunee	Ludington	
Agent or General Manager	3	1	1	1	6
Engineer	1	-	-	-	1
Clerical	6	5	-	35	46
Switchmen	4	-	-	20	24
Maintenance & Repair	-	-	-	66	66
Miscellaneous	2	-	-	8	10
TOTAL	16	6	1	130	153

Source: Harbridge House, Inc., *An Analysis of Lake Michigan Car Ferry Service*, a report prepared for the Michigan Department of State Highways and Transportation, November, 1975, Exhibit IV-5.
Milwaukee data obtained from a survey made by a member of TERA's study team.

Grand Trunk Western (GTW) Railroad. GTW operates two car ferries between the port of Muskegon, Michigan and Milwaukee, Wisconsin. The vessels are the *City of Milwaukee* and the *Madison*. At present, only the *Madison* is required to maintain service with the *City of Milwaukee* made available for bare-bottom chartering. Table III-4 shows crew data for the *Madison*. No crew is maintained for the *City of Milwaukee*. Port-based employment of GTW to support ferry operations amount to two jobs in Milwaukee and five jobs in Muskegon.[9] Due to the reasons given above in the discussion for C&O, the impact of GTW car ferry operations on other employment is negligible.

City Government of Milwaukee. The city of Milwaukee employs eleven laborers to maintain track in the dock area, one custodian and five persons on 1/10 time (supervisor, traffic clerk and electrician) which are directly related to the operation of the ferry system in that city.

Summary of Direct Employment. Based on the estimates discussed above, Table III-5 presents, in a summary format, the direct employment associated with the car ferry service broken down by geographic area and railroad company. The Lake Michigan car ferry service directly contributes to the creation of 893 jobs in the three railroads which perform the service and the two which interchange traffic in Wisconsin. Since the car ferry operations are based in Michigan, 70 percent of the direct job benefit is located in Michigan (619). On the Wisconsin side, the real significance of the service is the 240 line employment of GB&W. This is considered a conservative estimate based on the proportion of GB&W interchange traffic at Kewaunee with Ann Arbor and C&O. In numerous instances, it has been stated that if the ferry services to Kewaunee are abandoned, GB&W will cease operations, thus causing a loss to Wisconsin of approximately 500 jobs, GB&W's entire work force.

582 jobs which correspond to 65 percent of the total direct employment are marine and port-based. The remaining 35 percent (311 jobs) are related to the line traffic of the railroads.

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[9] Survey of Milwaukee port employment by a member of the study team. (GTW switching in Milwaukee is done by C&O personnel.)

TABLE III-4

CREW OF GTW FERRIES

Job Title	*Madison*
Master	1
Mates	3
Wheelsmen	3
Watchmen	3
Lookouts	3
Car Handlers	3
Engineers	4
Oilers	3
Firemen	3
Wiper	1
Cooks	2
Porters	3
Waiter	1
Cabin Watch	1
TOTAL	34
RELIEF WORKERS	5

Source: Michigan Traffic Company, *op. cit.*, pp. GN-11, GCN-11.

TABLE III-5

SUMMARY DIRECT EMPLOYMENT OF LAKE MICHIGAN
CAR FERRY SERVICE, 1973

Railroad	MICHIGAN				WISCONSIN				
	Frankfort	Ludington	Muskegon	Total	Kewaunee	Manitowoc	Milwaukee	Total	Total
Ann Arbor:	149	-	-	220	1	-	-	1	221
Marine	100	-	-	100	-	-	-	-	100
Port	49	-	-	49	1	-	-	1	50
Other	-	-	-	71	-	-	-	-	71
Grand Trunk Western:	-	-	44	44	-	-	2	2	46
Marine	-	-	39	39	-	-	-	-	39
Port	-	-	5	5	-	-	2	2	7
Chesapeake and Ohio:	-	316	-	316	1	6	16	23	339
Marine	-	186	-	186	-	-	-	-	186
Port	-	130	-	130	1	6	16	23	153
Green Bay and Western:	-	-	-	-	1	-	-	241	241
Port	-	-	-	-	1	-	-	1 (1)	1
Other	-	-	-	-	-	-	-	240	240
Chicago and Northwestern:	-	-	-	-	-	10	6 (2)	16	16
Port	-	-	-	-	-	10	6	16	16
TOTAL	149	316	44	580	3	16	36 (3)	295	875
Marine	100	186	39	325	-	-	-	-	325
Port	49	130	5	184	3	16	36	55	239
Other	-	-	-	71	-	-	-	240	311

[1] 100 jobs due to C&O service between Ludington and Kewaunee plus 140 jobs due to AA Frankfort-Kewaunee service.

[2] Includes 3 switchmen from the Milwaukee Rd.

[3] Includes 12 city employees: 11 laborers and 1 custodian.

Source: See text

Indirect Primary Employment

Some manufacturing and service establishments, due to peculiarities in their activities or location, depend on the Lake Michigan car ferry service. This dependence can be viewed in two parts. The first is the dependence of manufacturing establishments to the car ferry based rail rates. The second part is those tourist-oriented service establishments (hotels, motels, and restaurants) located in the six port cities which serve passenger traffic employment attracted by the ferry service. In the following discussion, indirect employment benefits for both manufacturing and service establishments are estimated for Michigan and Wisconsin separately.

Michigan. As part of this study, the dependence of manufacturing establishments' sales to transportation costs was determined by surveying a sample of 74 manufacturers in Michigan. The respondents were queried as to the anticipated percentage decreases in sales due to a ten percent increase in transportation costs. Table III-6 presents the results obtained. The question was formulated for a ten percent increase in transportation costs because the results of analyses related to transportation cost savings[10] indicate an increase of approximately ten percent.

The data in Table III-6 indicate a transportation cost elasticity of sales in the neighborhood of -.56. The average transportation cost as a percentage of sales price is approximately 18 percent for the sample of manufacturers. Therefore, the total cost elasticity of sales corresponds to - 3.11, i.e., a one percent increase in total costs results in a 3.11 percent decrease in sales.[11] Cost

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[10] See Chapter II.

[11] (-.56/.18) $\varepsilon p = \varepsilon t/(t/p)$ where εp = price elasticity; εt = transportation cost elasticity; t = transportation cost, and p = price.

TABLE III-6

RELATION OF SALES TO CHANGES IN TRANSPORTATION COSTS
FOR MICHIGAN MANUFACTURERS

Percent Reduction in Sales Due to 10% Increase in Transportation Cost	Number of Firms
0	29
1	1
5	2
7	1
10	5
12.5	2
15	2
20	1
22.5	1
25	1
30	3
Unknown	26
Total Respondents	74

Source: Michigan Department of State Highways and Transportation and TERA, Inc., 1976 survey of Michigan manufacturers.

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elasticity of demand in the domestic markets has not been studied extensively to develop empirical estimates. However, in the area of international trade price competitiveness and import demand functions for U.S. trade have been studied on numerous occasions. A study made by M. E. Kreinin developed an unlagged price elasticity ranging from -.5 to -1.5 depending on the commodity.[12] These values were found for quarterly data from 1964 to the first quarter of 1970. H. B. Junz and R. R. Rhomberg conducted a study to estimate average price elasticities of market shares of manufactured exports in 13 industrial countries. In this study, annual lags of market shares behind the price variable ranging from zero to five years were analyzed and the total elasticity was estimated at around -2.88.[13] Another study conducted by J. E. Price and J. B. Thornblade estimated the price elasticity of substitution between competing foreign suppliers to U.S. markets ranging from -.164 (telecommunications equipment from Japan) to -6.414 (new automobiles and trucks from Italy).[14] The elasticity coefficient of -3.11 estimated as a result of the survey of Michigan manufacturers appear reasonable in that it reflects a higher sensitivity of demand in the domestic markets compared to most estimates for international trade. To amplify, a ten percent increase in freight rates would result in a 1.8 percent increase in the prices of goods made in Michigan and sold in Western markets. This would result in a reduction of sales of 3.1 X 1.8 or 5.6 percent. Thus, out of an estimated $200 million in westbound

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[12] Mordechai E. Kreinin, "Disaggregated Import Demand Functions," *Southern Economic Journal*, July, 1973, p. 19 ff.

[13] Helen B. Junz and Rudolf R. Rhomberg, "Price Competitiveness in Export Trade Among Industrial Countries," *American Economic Review*, May, 1973, p. 412 ff.

[14] James E. Price and James B. Thornblade, "U.S. Import Demand Functions Disaggregated by County and Commodity," *Southern Economic Journal*, July, 1972, p. 46 ff.

traffic, the loss in sales due to freight rate increase would be $11.2 million assuming that the transportation cost increases are fully passed through.

Another area of inquiry in the Michigan manufacturers survey was the anticipated level of change in employment if the Lake Michigan car ferry service is entirely discontinued. As shown in Table III-7, approximately 27 jobs out of a total employment in the sample group of 22,676 are expected to be lost if the car ferry service is abandoned. This translates to a job loss of 0.12 percent in Michigan's manufacturing employment. Based on the 1972 Bureau of the Census estimate of total production workers employed in manufacturing in Michigan (767,900)[15] this further translates to 922 manufacturing jobs dependent on the car ferry service.

In addition to manufacturing jobs, the car ferry service contributes to port city based employment in service establishments such as hotels, motels, and restaurants. To estimate jobs for the three port cities in Michigan, a telephone interview was conducted with local businesses in Frankfort and Ludington. The GTW service between Muskegon and Milwaukee does not carry passengers. Therefore, no job benefits due to passenger traffic accrue to Muskegon.

The hotel-motel establishments in Ludington[16] maintain a capacity of 478 rooms with 167 employees. The car ferry related occupancy is estimated at approximately 30 percent which corresponds to a hotel-motel indirect employment benefit of 50 jobs. Sixteen restaurants operating in Ludington employ a total of 225 workers and estimate 20 percent of their business as car ferry related. This corresponds to 45 restaurant employees.

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[15] U.S. Bureau of the Census, *Census of Manufacturers, 1972: Area Series, Michigan*, U.S. Government Printing Office, Washington, D.C., 1975, p. 23-4.

[16] Statistics for Ludington are adapted from: City of Ludington, Office of the Mayor, letter to Interstate Commerce Commission dated March 30, 1976 and verified by the Michigan Department of State Highways and Transportation.

TABLE III-7

MANUFACTURING JOBS DEPENDENT UPON CONTINUANCE OF CAR FERRY SERVICE

Percent Employment Dependent on Car Ferry	Number of Firms	Total Employees	Jobs Dependent on Car Ferry [a]
0	56	22,522	0
10	2	42	4.2
15	1	28	4.2
20	1	65[b]	13.0
27.5	1	8	2.2
30	2	11	3.3
0	4	Unknown	-
Unknown	7	1,859	-
TOTAL		22,676[c]	27

(a) Percent employment dependent on car ferry X total employees.

(b) Actual response shows five full-time and 175 part-time employees.

(c) Excludes the 1,859 employees in seven firms where percent dependency to car ferry is unknown.

Source: Michigan Department of State Highways and Transportation and TERA, Inc. 1976 survey of Michigan manufacturers.

The survey of hotel-motel establishments in Frankfort indicated a 20 percent car ferry related occupancy in a total capacity of 61 rooms. These establishments employ 17 workers. Therefore, car ferry related hotel-motel employment in Frankfort is four workers. The six restaurants employ 51 workers and estimate car ferry related business at approximately 40 percent which translates to an indirect employment benefit of 21 workers at restaurants in Frankfort.

Wisconsin. A survey similar to the Michigan manufacturers survey was conducted in Wisconsin to establish the sensitivity of sales to changes in transportation cost and the degree of dependence of manufacturing jobs to the Lake Michigan car ferry service. The transportation cost elasticity of sales in manufacturing was found to be approximately -.64. The Wisconsin manufacturers surveyed reported an average of 11.5 percent of total cost for transportation. Therefore, the total cost elasticity of sales of goods manufactured in Wisconsin is -5.53, an estimate significantly greater than Michigan's -3.11. Greater elasticity in Wisconsin is in the expected direction signifying a greater dependency on the part of Wisconsin shippers on the car ferry service since markets are concentrated East of Lake Michigan (as also reflected by the imbalance in the East vs. Westbound movements across the Lake). However, the results of the survey should be viewed with caution because of the limited scope of the samples. A more exhaustive survey is expected to provide answers with greater significance; however, it is not expected to change the relationship between Michigan and Wisconsin results.

The Wisconsin survey resulted in a total employment dependency of 523 jobs in 50 companies which have a total work force of 47,412 production employees. This translates to 1.1 percent of Wisconsin's total manufacturing employment. Given 1972 production worker data for Wisconsin (360,800),[17] the total indirect employment benefit of the Lake Michigan car ferry service to manufacturers in Wisconsin is 3,969 jobs.

Hotel-motel establishments in the three port cities of Wisconsin maintain a total capacity of 9,039 rooms.[18] Specific information on the degree of car ferry related business has not been gathered for Wisconsin. Consequently, a method was chosen which relates the employment dependency per 10,000 ferry passengers in Michigan to the cities of Wisconsin. Based on the Michigan survey, ferry dependent hotel and motel employees per 10,000 ferry passengers at Ludington and Frankfort is 5.55. Similarly, ferry dependent restaurant employees is 6.78 per 10,000 passengers. In 1973, 37,015, 46,672, and 13,818 ferry passengers disembarked in Milwaukee, Manitowoc, and Kewaunee, respectively.[19] Applying the values of 5.55 and 6.78 to the above numbers, an estimate of total service establishments employment impact is found to be 120.

Indirect employment benefits of the car ferry service in Michigan and Wisconsin are given by industry and region in Table III-8. 5,131 jobs are found to be indirectly dependent upon the ferry service by virtue of the transportation cost advantage it gives to the regional industry and the local jobs in service establishments to support the passenger traffic.

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[17]U.S. Bureau of the Census, *Census of Manufacturing, 1972: Area Series, Wisconsin*, U.S. Government Printing Office, Washington, D.C., 1975, p. 50-4.

[18]Data provided by Wisconsin Department of Transportation.

[19]Harbridge House, Inc., *op. cit.*, p. IV-38 (two-way traffic data divided by 2).

TABLE III-8

INDIRECT PRIMARY EMPLOYMENT BENEFITS
OF CAR FERRY SERVICE

Area	Manufacturing[1]	Service		Total
		Hotel-Motel	Restaurant	
Michigan	922	54	66	1,042
Muskegon	15	-	-	15
Ludington	2	50	45	97
Frankfort	-	4	21	25
Rest of State	905	-	-	905
Wisconsin	3,969	54	66	4,089
Milwaukee	1,235	21	25	1,281
Manitowoc	82	26	32	140
Kewaunee	11	7	9	27
Rest of State	2,641	-	-	2,641
TOTAL	4,891	108	132	5,131

[1] Local job benefits calculated on the basis of the proportion of county to state value added estimates in manufacturing for 1972.

Source: See text.

Summary of Primary Employment

Total primary employment consists of both direct and indirect employment. Table III-9 summarizes the primary employment benefits of the car ferry service by region. The total of 6,006 primary employees dependent upon the ferry service create induced employment benefits in the region. Induced benefits are estimated in the next section.

Induced Employment

The Multiplier Concept

The direct and indirect employment benefits created by the Lake Michigan car ferry service contributes to the creation of induced employment benefits through the multiplier effects, a term used by economists to describe the economic interdependence among producing units in a region. To describe the concept of the multiplier effects and demonstrate the induced employment benefits, it is best to use an illustration. Consider a member of the crew employed by the Ann Arbor Railroad in operating the *Viking* between Frankfort and Kewaunee. The earnings of this crew member are not entirely saved; some part of it is used to buy food, another part is used to buy shelter, yet another part is for personal goods and services, etc. The portion this crew member spends on, for example, food, constitutes a part of the revenues to the retail store. The retail store in turn uses its revenues to purchase materials, supplies, and services, and pays for wages, utilities, and other necessities for operating a store. Therefore, a portion of a retail store's earnings and employment is supported by the crew member. However, the support does not end with the retail store. The purchases made by the retail store

TABLE III-9

TOTAL PRIMARY EMPLOYMENT BENEFITS
OF THE CAR FERRY SERVICE

Area	Direct	Indirect	Total
Michigan	580	1,042	1,622
Muskegon	44	15	59
Ludington	318	97	415
Frankfort	149	25	174
Rest of State	69	905	974
Wisconsin	295	4,089	4,384
Milwaukee	36	1,281	1,317
Manitowoc	16	140	156
Kewaunee	3	27	30
Rest of State	240	2,641	2,881
TOTAL	875	5,131	6,006

Source: Tables III-5 and III-8.

contributes to the employment in wholesale establishments, which in turn creates employment in manufacturing of consumer goods. Manufacturers of consumer goods purchase raw materials and semi-finished goods and invest in capital goods. Therefore, further jobs are created throughout the manufacturing and trade cycle. The further away in the cycle from the crew member, the less the magnitude of the effect of his employment. Eventually the effects become too small to measure. The sum total of the measurable employment effects is termed the multiplier. In other words, a given primary employment (direct plus indirect), in this case, employment as a result of Lake Michigan car ferry service, creates additional jobs in the regional economy throughout the manufacturing and trade cycle.

A number of alternative methodologies have been developed in the past to estimate the value of the multiplier to be used in computing induced benefits. The input-output model provides a straight forward estimation of this value. Unfortunately, input-output models to characterize the economic structure of the States of Michigan and Wisconsin, as well as the six port counties do not exist from which the direct observation of the value of the multiplier can be made.[20] An alternative methodology is to use an econometric formulation to estimate local and non-local employment for an industry and converting these estimates to monetary values by use of region specific value added figures per worker.

The multiplier values used to estimate induced benefits in this study are taken from a study conducted by Eric Schenker, et al.[21] The concepts, methodology

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[20] One I/O Table at the state level was developed as part of an interregional I/O model (U.S. Department of Commerce, *A Multiregional Input/Output Model for the U.S.*, EDA Report No. 21, National Technical Information Service, Washington, D.C., 1970) at the 83 sector detail based on interindustry transaction data for 1963. The detail in this table is not compatible with most industry sectors used in this study.

[21] Schenker, Tee Koh, Kochan and Bunamo, *An Estimate of the Quantitative Impact of the St. Lawrence Seaway on the Hinterland's Economy*, Proceedings of the 13th Conference on Great Lakes Research, Buffalo, New York, April, 1970.

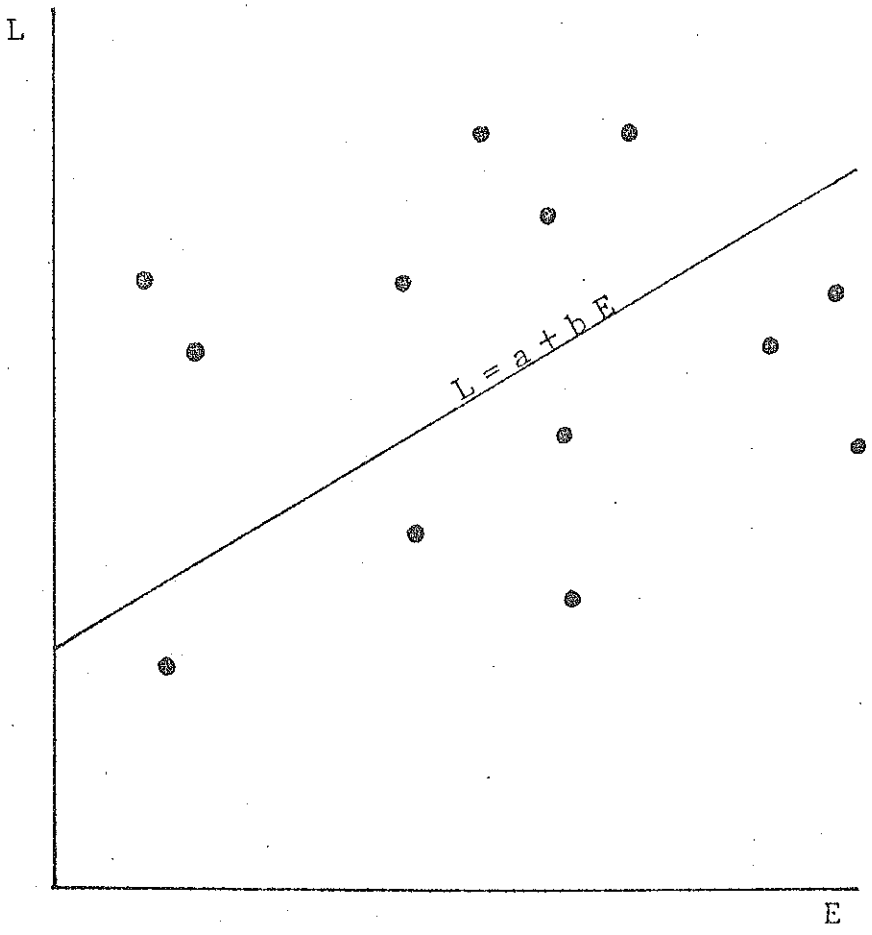
and conclusions of the Schenker study is documented in Appendix F. Basically, the methodology involves first a determination of the amount of export oriented employment to total employment in the state. Export oriented employment is defined as that portion of a region's total employment which produces goods or services for consumption outside the region. Export oriented employment is the base for estimating multiplier effects in the region. In the following discussion, a brief description of the method used by Eric Schenker in estimating the multipliers for Michigan and Wisconsin is presented.

Schenker Study

The method chosen by Eric Schenker to compute multipliers for the Great Lakes states is a three-stage computation. The first stage is to compute a "location quotient." Then, based on the location quotient, a "specialization ratio " is found. This ratio determines the proportion of workers in the applicable industries who are export oriented. The third step uses simple (bivariate) linear regression to compute the value of the multiplier. This may be illustrated in the graph given in Figure III-1. The dots in the graph are the observations of export oriented employment and local employment (defined as total minus export oriented employment) for different years (Schenker used 1958 through 1966). The line with the equation "L = a + b E" is the regression line computed by the "ordinary least squares" method. "b" is the regression coefficient and is understood as the amount of change in L for a unit change in E. If "b" were 1.5, then the equation would say that 1.5 local workers would be added (subtracted) for each export oriented worked added (subtracted). The

FIGURE III-1

ESTIMATION OF THE MULTIPLIER VALUE



E = export oriented employment in the region

L = local employment in the region (total - E)

multiplier relates total employment changes to changes in E. Total employment is the sum of E and L, hence the multiplier is 2.5 (one export oriented worker plus 1.5 local workers).

The first two steps are necessary to determine the amount of export oriented employment in a region. This is done on an industry-by-industry basis for 22 general classifications of manufacturing industries. For each industry, the proportion of industry's employment to the state's total employment is compared to a like proportion for all of the United States. If the state proportion is greater than the proportion nationwide, then some portion of that industry's employment is considered export oriented. To compute the portion of a given industry's employment which is export oriented, Schenker computed a "specialization ratio." This ratio is zero for all industries with a location quotient less than or equal to one, that is, with a lower or identical proportion of workers in the industry as for the nation as a whole. For industries having export oriented employment (location quotient greater than 1), employment in excess of the national norm is considered export oriented. The proportion of workers in the industry said to be export oriented is computed by multiplying the specialization ratio by the total workers in the industry. The specialization ratio is computed by the following formula:

$$(q - 1)/q \quad \text{for } (q > 1)$$

where q is the location quotient for export oriented industries. For example, if in the State of Wisconsin six percent of total employees worked in industry A in a given year, while nationally only four percent worked in that industry, then the location quotient would be 1.5 (6/4) and the specialization ratio would be

.333 ((1.5-1)/1.5). This means that 33.3 percent of the employees in industry A in Wisconsin are export oriented. When all of the export oriented workers are summed over all the industries for a given year, one dot on Figure III-1 is obtained. By using the same approach, other observations are plotted for different years and estimates for the parameters (a and b) are computed.

The value of b found for Wisconsin and Michigan are .9962 and 1.5738, respectively. In other words, each primary job created in Michigan contributes to the creation of .9962 induced jobs. The corresponding induced job value for Wisconsin is 1.5738.

Regional Induced Employment

Based on the results obtained from the Schenker study, Table III-10 shows the induced employment benefits of the car ferry service. The estimates shown in the Table include a small amount of double counting, because a small portion of indirect primary jobs are associated with those establishments which are directly suppliers of the three railroads providing the car ferry service. Since induced job benefits are calculated by taking into account total primary jobs (direct plus indirect), indirect jobs created because of direct employment are counted twice. However, such double counting is believed to be a very insignificant portion of the total induced jobs because the basis for estimating indirect jobs was users or beneficiaries of the service in terms of rail rates, rather than suppliers to the three railroads. Therefore, if the indirect job benefit accidentally includes the viewpoint of a supplier, it would be insignificant.

TABLE III-10

INDUCED EMPLOYMENT BENEFITS

REGION	NUMBER OF JOBS
Michigan(1)	1,616
Muskegon	59
Ludington	413
Frankfort	173
Rest of State	971
Wisconsin(2)	6,900
Milwaukee	2,073
Manitowoc	246
Kewaunee	47
Rest of State	4,534
TOTAL	8,516

(1) Table III-9 totals multiplied by .9962

(2) Table III-9 totals multiplied by 1.5738

Source: See Text.

Summary of Employment Benefits

As shown in Table III-11, the Lake Michigan car ferry service contributes (directly, indirectly, and through the multiplier effects) to 3238 Michigan and 11,284 Wisconsin jobs. Forty-one percent of the total employment benefit is a consequence of primary effects (6,006 jobs). The remaining 59 percent (8,516 jobs) are a consequence of the induced effects through the multiplier. The total employment benefits in Michigan correspond to 0.5, 21.8, and 29.8 percent of employment in Muskegon, Ludington, and Frankfort, respectively. The local economies in Frankfort and Ludington depend to a very large extent of the car ferry service. On the Wisconsin side, the corresponding figures are 1.2, 2.1 and 2.6 percent for Milwaukee, Manitowoc, and Kewaunee, respectively.[22] Although the total employment benefit in Wisconsin is more than three times compared to Michigan (11,284 versus 3,238), the employment proportion at the port-based counties are smaller in Wisconsin because of considerably lower direct employment and higher total employment base.

[22]Total employment base includes employment in Manufacturing, Wholesale and Retail Trade, and Selective Services as reported by the U.S. Bureau of the Census. (See Tables G-7 and G-15 in Appendix G for Totals.)

TABLE III-11

SUMMARY EMPLOYMENT BENEFITS

REGION	PRIMARY	INDUCED	TOTAL
Michigan	1,622	1,616	3,238
Muskegon	59	59	118
Ludington	415	413	828
Frankfort	174	173	347
Rest of State	974	971	1,945
Wisconsin	4,384	6,900	11,284
Milwaukee	1,317	2,073	3,390
Manitowoc		246	402
Kewaunee	30	47	77
Rest of State	2,881	4,534	7,415
TOTAL	6,006	8,516	14,522

Source: Tables III-9 and III-10.

CHAPTER IV: EARNINGS AND INCOME

Introduction

The existence of the car ferry service benefits the economies of Michigan and Wisconsin and the region as a result of dollar expenditures to support ferry operations directly and the level of economic activity dependent upon the service indirectly. For purposes of this study, direct service benefit is defined as the total operating expenses of the railroads in connection with the ferry-related traffic. Indirect and induced benefits are defined as the value added in manufacturing and service industries which depend on the ferry service. The indirect and induced benefits are estimated by applying the average value added per worker to the number of workers affected as estimated in Chapter III.

The concept of value added is defined as the direct contribution made by a specific industrial activity to the total FOB value of shipments which are sold. Therefore, value added by manufacture is derived by subtracting the total cost of materials (including raw materials, semi-finished or finished components and accessories, supplies, fuel, electric energy, cost of resales) from the FOB plant and net selling value of shipments (including resales) and adjusting the resulting amount by the net change in finished products and work-in-process inventories. The value added figure avoids the duplication in the value of shipments figure which results from the inclusion of the intermediate

purchases in the shipments of establishments producing finished products. Therefore, even in cases where inter-industry transactions are significant (for example, sales of primary metals to transportation equipment either directly or through fabricated metals), no adjustment in published value added figures is necessary since such figures do not contain double counting. The following discussion outlines the concepts, methodology, and economic benefits for direct (railroad related), indirect (service related), and induced (multiplier related) impacts of the car ferry service.

Direct Benefits

Each day the ferry operates it contributes to the economy of the region in approximate accord with its expenditures in the area. Capital recovery costs (depreciation) are not included because they represent sunk costs rather than continuing economic activity. Table IV-1 lists the operating expenses of the ferry service for each railroad company according to the cost categories reported to the Interstate Commerce Commission. An additional figure was computed from other operating cost data[1] to separate fuel costs from the "operating floating equipment" figure in each case. The wide variation in fuel expense is due to the different fuel and engine types in the vessels.[2] When dividing the costs among the ports, it was assumed that equal expenditures for fuel were made at each side of the Lake. This assumption was made for lack of more specific information.

In addition to the operating expenses of the ferry boats, docks, and other ferry operations, both the Ann Arbor Railroad and the Green Bay and Western

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[1] Michigan Traffic Company, *Survey of Vessels and Docks of Ann Arbor Railroad, Chesapeake and Ohio Railroad, Grand Trunk Railroad and Mackinak Transportation Company*, December, 1975.

[2] AA-diesel, electric; C&O-coal, steam reciprocating; GTW-oil, steam reciprocating.

TABLE IV-1

VARIABLE OPERATING COSTS OF FERRIES
IN 1973 BY RAILROAD COMPANY
(thousand $)

Cost Item	Railroad			Total
	Ann Arbor	Chesapeake & Ohio	Grand Trunk Western	
Maintenance of Wharves and Docks	24	236	76	336
Maintenance of Floating Equipment	487	626	159	1,272
Operating Floating Equipment	1,601	5,066	1,022	7,689
Dining and Buffet	6	98	--	104
Port Salaries	307	689	160	1,156
ent for Floating Equipment	48	--	(47)	1
Unemployment Compensation Tax	41	128	26	195
TOTAL	2,514	6,843	1,396	10,753
Percent of Operating Costs of Floating Equipment for Fuel Expense[1]	38%	61%	54%	

Source: Harbridge House, Inc., *op. cit.*, Tables IV-23, IV-24, IV-27. This data is based on ICC R-1 reports for 1973.

[1]Adapted from data given in: Michigan Traffic Company, *op. cit.*

Railroad (GB&W) are dependent in large portion upon traffic interlined through the ferry. An estimate of the impact of this dependence on the overall level of operations of the Ann Arbor and the GB&W was discussed in Chapter III. Also discussed was the rationale for concluding that the C&O, GTW, and CNW Railroads would not be similarly affected. The same percents as found for employment effects on the Ann Arbor and the GB&W are applied to the total operating expenses of the non-ferry railroad direct benefits. Table IV-2 outlines the direct benefits by railroad company and region.

The regional breakdown of the direct benefits was obtained from port personnel data given in Table III-11, and the following assumptions concerning the disposition of the cost components listed in Table IV-1:

(a) All port employees are paid the same wage, computed as an average value per year.

(b) Fuel expense is divided equally between Michigan and Wisconsin ports.

(c) The C&O Wisconsin fuel expense is divided equally among the three Wisconsin ports.

(d) The crew and other operating expenses are incurred in the Michigan port city where the ferry is based.

(e) The non-ferry direct rail benefits accrue to the state in which the railroad is located.

From Table IV-1, total rail expenditures on car ferry service were $10.8 million. In addition, there were also $6.9 million in associated benefits from non-ferry railroad operations resulting in a total direct income benefit of

TABLE IV-2

DIRECT BENEFITS OF THE CAR FERRY SYSTEM
IN 1973 BY RAILROAD AND REGION

(Thousand $)

Region	Railroad				Total
	Ann Arbor	C&O	GTW	GB&W	
Michigan	5,141	5,231	1,022		11,394
Muskegon			1,022		1,022
Ludington		5,231			5,231
Frankfort	2,204				2,204
Wisconsin	310	1,612	374	4,008	6,304
Milwaukee		548	374		922
Manitowoc		544			544
Kewaunee	310	520			830
Ferry Operations[1]	2,514	6,843	1,396		10,753
Non-Ferry Rail Operations[2]	2,937	--	--	4,008	6,945
TOTAL	5,451	6,843	1,396	4,008	17,698

[1]See Table IV-1

[2]Interstate Commerce Commission, *Transport Statistics of the U.S., 1974 Part 1*, Section A-1. Operating expenses less water related expenses for AA times .28 for AA and .48 for GB&W to adjust for ferry related traffic. See Chapter III for discussion on ferry related traffic.

$17.7 million. The total benefits to the state are greater due to the dependency of certain manufacturing and tourist related activities on the ferry service and the further induced economic activity stemming from the primary direct and indirect benefits. The following discussion develops estimates of these values.

Indirect and Induced Income Benefits

The direct income benefit of the ferry service is the economic activity associated with the service itself as defined in the previous section. Indirect benefits are those benefits which accrue to the tourist industries by virtue of the passengers who use the ferry and those to the shippers who ship via the ferry. The benefit indicated here is not the savings to shippers in transportation costs (these cost savings were discussed in Chapter II), but the extent of economic activity made possible because the ferry service opens up larger markets to the Michigan and Wisconsin industries. The cost and time savings to shippers reflects itself in the competitiveness of these industries in markets across the Lake. The greater the competitive advantage, the higher the activity level. The amount of this benefit is defined as the indirect benefit of the car ferry service.

The computation of indirect earnings benefits is based on the indirect employment benefits discussed in Chapter III. The indirect employment benefits outlined in Table III-8 in Chapter III are converted to the value of economic activity benefiting indirectly from the service by finding the average amount of economic activity associated with each worker. This is done by computing

the value added per worker for the relevant industry classifications. Table IV-3 outlines the assumed values added per worker by industry and region. Explicit figures for value added by region together with number of employees is given in the U.S. Bureau of the Census, *1972 Census of Manufacturing*[3] for manufacturing industries. The value added is a measure of the value of the output of a manufacturing firm. It is found by pricing its total production for a period and subtracting the associated material, utility and service costs. What remains is the wages and the returns to capital, land, and entrepreneurship. The total of all of the values added in an economy is the gross product of the economy by definition.

No value added figure is available for the service or trade industries. The figures in Table IV-3 for Hotel-Motel, Restaurant, and the Average for all industries are calculated based on payroll data obtained from the Bureau of the Census.[4] The total payroll was divided by the total employees to obtain a wage estimate per employee. Since the denominator is large due to the presence of part-time employees, a full-time wage was computed by expanding the industry wage based on a comparison between the Census averages and Wisconsin unemployment insurance average data for wage rates. However, even expanded to full-time equivalents, the wage is an underestimate of the economic activity in an industry. The reason is that the returns to capital, land, and entrepreneurship are excluded from the total economic activity associated with each worker. In the wholesale

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[3] *1972 Census of Manufacturing, Area Series (Michigan and Wisconsin)*, U.S. Government Printing Office, Washington, D.C., 1975.

[4] Bureau of the Census, *1972 Census of Selected Services, Area Series (Michigan and Wisconsin)*; Bureau of the Census, *1972 Census of Retail Trade, Area Series, (Michigan and Wisconsin)*; Bureau of the Census, *1972 Census of Wholesale Trade, (Michigan and Wisconsin)*.

TABLE IV-3

ANNUAL VALUE ADDED PER WORKER
BY REGION AND INDUSTRY
(thousand $)

Region	Manufacturing	Service		Average (all industries)
		Hotel-Motel	Restaurant	
Michigan	21.7	4.5	3.6	15.7
Muskegon	17.7	4.6	3.4	13.8
Ludington	21.9	3.5	3.3	14.7
Frankfort	10.6	3.6	3.4	8.6
Wisconsin	18.9	4.3	3.1	13.2
Milwaukee	18.5	4.3	3.4	13.5
Manitowoc	14.6	3.5	3.3	11.7
Kewaunee	13.5	2.5	2.8	10.4

Source: Adapted from U.S. Bureau of the Census, *Census of Business*, (Manufacturing, Selected Services, Wholesale Trade and Retail Trade), Area Series (Michigan and Wisconsin). Adjusted by weekly wage data from State of Wisconsin (Employment Security Division) to compensate for part-time employees in non-manufacturing sectors. Michigan is assumed to have the same adjustment.

and retail trade industries, this component is probably not too large. In the service industries, this component varies greatly with the type of service. The capital per worker in the hotel and the restaurant business is not insignificant (buildings, cooking equipment, furnishings, etc.). The overall averages in the service industries is probably not as high as manufacturing, but its value is not ascertainable within the scope of this study.[5] Lacking specific information on value added in these industries, a conservative estimate was felt to be most appropriate so as not to raise the possibility that the benefits were inflated. The estimates made can be considered as a lower bound on the benefits. Table IV-4 outlines the total indirect benefits by region and industry.

Also listed in the Table are the induced benefits. Induced benefits are the values produced as a result of the demand generated by the incomes arising from the ferry service and its indirect benefits to industry. In Chapter III, a figure for induced employment benefits was calculated by using the employment multiplier. The amount of induced economic activity is calculated by extending the induced employment figures in Table III-11 to the total value associated with that employment by using the average values added per worker for all industries. The total average is appropriate because the direct and indirect primary benefits generate demands for the outputs of all industries. Because approximately one-half of this average is from non-manufacturing industries for which the Bureau of the Census did not compute value added, this overall average is understated for the same reasons as explained above.

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[5] In manufacturing, a comparison of wages to value added per worker reveals value added to be nearly twice the wage. Total receipts in service industries are about three times the payroll. Value added must be less than receipts and greater than the wage.

TABLE IV-4

VALUE OF INDIRECT AND INDUCED BENEFITS, 1973
(thousand $)

Region	Indirect				Induced
	Manufacturing	Hotel-Motel	Eating Places	Total	
Michigan	19,949	189	220	20,358	23,618
Muskegon	266	---	---	266	814
Ludington	44	175	149	368	6,071
Frankfort	---	14	71	85	1,488
Rest of State	19,639	---	---	19,639	15,245
Wisconsin	74,109	199	216	74,524	91,202
Milwaukee	22,848	90	85	23,023	27,986
Manitowoc	1,197	91	106	1,394	2,878
Kewaunee	149	18	25	192	489
Rest of State	49,915	---	---	49,915	59,849
Total	94,058	388	436	94,882	114,820

Source: Calculated from Table IV-3 and Table III-11.

Summary

The total value of the benefits of the car ferry service to the region is the dollar volume of economic activity dependent upon or associated with the service. Table IV-5 summarizes the benefits discussed in this chapter. The Lake Michigan car ferry service contributes to a total of $227 million in economic activity for Michigan and Wisconsin. The direct benefits to the Michigan and Wisconsin economies constitute 7.7 percent of the $227 million. The geographic distribution of benefits shows a heavier dependence of Wisconsin's economy on the service, three times as much as that of Michigan.

TABLE IV-5

TOTAL EARNINGS BY REGION
(thousand $)

Region	Direct	Indirect	Induced	Total
Michigan	11,394	20,358	23,618	55,370
Muskegon	1,022	266	814	2,102
Ludington	5,231	368	6,071	11,670
Frankfort	2,204	85	1,488	3,777
Wisconsin	6,304	74,524	91,202	172.030
Milwaukee	922	23,023	27,986	51.931
Manitowoc	544	1,394	2,878	4,816
Kewaunee	830	192	489	1,511
Total	17,698	94,882	114.820	227,400

Source: Table IV-2 and Table IV-4.

CHAPTER V: TAXES

State tax receipts are drawn from out of the income stream and sales generated by the economies of the two states. Chapter IV outlined the amount of earnings (income to the factors of production) which are dependent on the Lake Michigan car ferry service. This Chapter estimates the state tax revenues in turn dependent upon the car ferry dependent income.

Only income and sales tax impacts are estimated because:

(1) They are the most important sources of state revenue.

(2) They are most dependent upon the income stream which flows from the car ferry benefits and sales of those industries depending on the service.

The method chosen computes the ratio (percent) of dependent economic activity (value added or payroll) to the corresponding measure of total economic activity in order to find the ratio of dependent taxes to total taxes. In addition to the benefits calculated in Chapter IV, data needs for this computation are:

(1) Tax collections by region and tax base, given in Table V-1.

(2) A measure of total value added and payrolls corresponding to the benefit values computed in Chapter IV.

The second data requirement is met by taking state totals from the same basic data source which was used to calculate benefits - The Census of Business.[1] In this way, the ratio (percentage) of benefits to total activity is consistent

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[1] U.S. Bureau of the Census, *Census of Business, 1972* (Manufacturing, Wholesale Trade, Retail Trade, Selected Services) *Area Series* (Michigan and Wisconsin), U.S. Government Printing Office, 1974/5.

TABLE V-1

STATE TAX COLLECTIONS BY REGION AND TAX BASE
(thousand $)

Region	Business Income and Franchise Taxes	Personal Income Taxes	Sales and Use Taxes
Michigan	537,083	1,077,672	508,271
Muskegon	8,600	17,400	16,544
Ludington	1,000	1,600	2,660
Frankfort	180	390	949
Rest of State	527,303	1,058,282	488,118
Wisconsin	144,426	885,780	321,617
Milwaukee	42,129	229,325	93,363
Manitowoc	2,821	13,821	5,633
Kewaunee	440	2,882	1,081
Rest of State	99,036	639,752	271,540

Sources: Michigan: *Executive Budget, State of Michigan Fiscal Year Ending June 30, 1976*, Appendix (Average of 1973 and 1974 fiscal years), county data from Michigan Department of Commerce, Retail Sales Tax; Personal and Business Taxes are split proportional to values added and payrolls in the county.
Wisconsin: Wisconsin Department of Revenue, *Taxes, Aids and Shared Taxes in Wisconsin Municipalities, 1973*. Also, telephone communication with Wisconsin Department of Revenue.

and reliable. The use of another data base for the total, such as unemployment compensation based income data or federal or state tax based income data to estimate the totals (the denominator of the ratio) would result in a biased estimate because of variations in measurement and scope of economic activity covered. Because it is the ratio and not an absolute figure which is used, the limitations imposed by the scope and measurement problems of the Census, or any other data source are mitigated. The percentage of benefits to total economic activity by region and measure are given in Table V-2.

The ratio of dependent economic activity to total economic activity is computed by dividing the total income benefits (Table IV-5) for each region by the total value added in manufacturing, trade and services in that region. Another similar ratio is computed based on payroll benefits. Payroll benefits are less than total income benefits because it does not include all of the values added which is measured in the returns to all of the factors of production. Payroll benefits are the returns only to labor. These are important because certain tax collections are more nearly payroll dependent than value added dependent. The ratios thus computed (Table V-2) are used to apportion part of the tax receipts of the region to ferry dependent incomes. The value added ratio was applied to the business income tax receipts and the payroll ratio to the personal income tax and sales tax receipts to compute the figures given in Table V-3.

In Michigan, a total of $4.6 million revenue from income and sales tax is dependent upon the incomes benefiting from the ferry service. As the benefits

TABLE V-2

PERCENT OF ECONOMIC BENEFITS TO
COUNTY TOTALS FOR VALUE ADDED AND PAYROLL

Region	Value Added	Payroll
Michigan:		
Muskegon	0.46	0.46
Ludington	22.05	21.77
Frankfort	39.08	29.79
Rest of State	0.14	0.13
Wisconsin:		
Milwaukee	1.41	1.20
Manitowoc	2.17	2.08
Kewaunee	5.07	2.63
Rest of State	1.48	1.22

Source: Computed from data given in Table IV-5 and State and county totals from the U.S. Bureau of the Census, *Census of Business, 1972, Area Series (Michigan and Wisconsin).*

TABLE V-3

STATE SALES AND INCOME TAX RECEIPTS ARISING
FROM FERRY DEPENDENT INDUSTRY
(thousand $)

Region	Business Income and Franchise Taxes	Personal Income Taxes	Sales and Use Taxes	Total
Michigan	1,069	1,920	1,573	4,652
Muskegon	40	80	76	196
Ludington	221	348	579	1,148
Frankfort	70	116	283	469
Rest of State	738	1,376	635	2,749
Wisconsin	2,143	10,920	4,568	17,641
Milwaukee	594	2,752	1,120	4,466
Manitowoc	61	287	117	465
Kewaunee	22	76	28	126
Rest of State	1,466	7,805	3,313	12,584
TOTAL	3,212	12,840	6,151	22,203

Source: For business income and franchise rates, value added percentages of Table V-2 multiplied by tax collection data in Table V-1. For other rates appropriate entries in Table V-1 multiplied by payroll percentages in Table V-2.

of the ferry service are greater to the State of Wisconsin, the tax collections arising from these benefits are also greater. $17.6 million of revenues flow from benefits to Wisconsin. The importance, however, of the ferry service to the localities of Ludington and Frankfort is highlighted by the computations made in Table V-2. Earnings benefits measured as value added is 22 percent and 39 percent in Ludington and Frankfort, respectively. The payroll dependency on the ferry is 22 percent and 30 percent, respectively, to the two cities. This corresponds to the tax dependency for the counties in which these cities are located.[2]

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[2]See discussion on the relationship between benefits and losses due to termination in Chapter VI.

CHAPTER VI: SUMMARY BENEFITS OF THE CAR FERRY SERVICE

The benefits estimated in the preceding four Chapters are summarized in Table VI-1. As shown in the table, the Lake Michigan car ferry service in 1973 resulted in a total stream of benefits amounting to $16.7 million in terms of transportation cost savings to shippers, 14,500 employees, income in the manufacturing and service industries in excess of $227 million, and tax revenues of more than $22 million. These benefits are not additive since the units as well as the institutional entities to which they accrue are different. In terms of geographic distribution benefits to Wisconsin are considerably more than to Michigan, reflecting the greater dependence of Wisconsin to the car ferry service in reaching concentrated markets in the Eastern United States.

A detailed description characterizing the state and county economies in Michigan and Wisconsin is presented in Appendix G. When the benefits listed in Table VI-1 are viewed in relation to the county-specific economies, the following observations can be made:

(1) In Benzie County, Michigan, which includes Frankfort, the nonagricultural employment in 1972 was 1,165. The car ferry service, with an employment benefit of 347, represents 29.8 percent of the total employment in Benzie County. In terms of value added, the $3.8 million estimated as manufacturing and service industries' earnings represent 39.1 percent of the total 1972 nonagricultural value added estimate of $9.7 million (see Table G-7).

TABLE VI-1

SUMMARY OF CAR FERRY BENEFITS
BY REGION

Region	Transportation Cost Savings ($000)	Employment (number)	Earnings ($000)	Taxes ($000)
Michigan	4,653	3,238	55,370	4,562
Muskegon	-	118	2,102	196
Ludington	-	828	11,670	1,148
Frankfort	-	347	3,777	469
Rest of State	-	1,945	37,821	2,749
Wisconsin	4,413	11,284	172,030	17,641
Milwaukee	-	3,390	51,931	4,466
Manitowoc	-	402	4,816	465
Kewaunee	-	77	1,511	126
Rest of State	-	7,415	113,772	12,584
Subtotal	9,066	14,522	227,400	22,203
Other States in Immediate Hinterland	3,406	N/E	N/E	N/E
Other States in Extended Hinterland	4,279	N/E	N/E	N/E
TOTAL	16,752	14,522	227,400	22,203

N/E - Not Estimated.

Source: Tables III-11, IV-5, V-3, and Chapter II.

(2) For Mason County (Ludington), the employment and earnings benefits as a consequence of the car ferry service represent 21.8 percent of employment and 22.0 percent of earnings.

(3) For Muskegon County, the corresponding figures are 0.5 percent for both employment and earnings.

(4) The benefits in relation to county-specific economies in Ludington and Frankfort show that the car ferry service is the major business around which the local personal wealth and viability of business revolve. The car ferry service could be viewed as vital to the survival of all business activity in these two counties.

(5) On the Wisconsin side, the employment and manufacturing-service industry earnings as a consequence of the car ferry service in relation to county-specific employment and nonagricultural value added in 1972 (reported in Table G-15) are as follows:

	Percent Employment	Percent Value Added
Kewaunee	2.6	5.1
Manitowoc	2.1	2.2
Milwaukee	1.2	1.4

The greatest relative impact with respect to both employment and value added is in Kewaunee followed by Manitowoc and Milwaukee. The relative impacts at the three counties in Wisconsin are considerably smaller than Michigan's Benzie and Mason counties. This appears to be due to the facts that the counties in Michigan have a lower employment and value added base and that the direct benefits associated with railroad operations have a greater concentration in the port-based counties in Michigan than in Wisconsin. The latter reason is clearly reflected in the high estimate for the rest of state region in Wisconsin shown in Table VI-1.

It should be recognized that the benefits estimated in this study relate to a base year of operations which was assumed to be 1973 largely because a more extensive set of data was available to complete the analysis. The studies heretofore made by others on the Lake Michigan car ferry service were not very helpful for purposes of this study and, therefore, in a number of areas an attempt was made to undertake a complete analysis. The analyses are obviously constrained by the limited resources and the time period within which the work was completed. Therefore, the benefit estimates should be viewed in light of these limitations. However, as a first attempt, it is believed that the study establishes a reasonably accurate foundation for public policy analysis and evaluation of future options. To the extent that more resources and time be made available, the following improvements in the methodology and the analytic framework are suggested:

- A more detailed analysis of transportation cost savings to the shippers for the extended hinterland and a greater detail in commodities and regions in the immediate hinterland should be considered. Also, outlook for truck rates, transit time changes, and possible shifts from commodity to class rates in western territory rate-making should be analyzed with respect to service abandonment implications.

- The survey of shippers undertaken to estimate employment and earnings benefits should be expanded to include a greater representation of manufacturing and service establishments in Michigan and Wisconsin. The extended sample should allow a stratified analysis with respect to areas within the state as well as manufacturing sectors. This analysis would afford a more credible estimate of the dependency of business establishments in Michigan and Wisconsin to the favorable rail rates stemming from the car ferry service.

- In estimating the induced benefits, the Schenker methodology should be adapted to a more recent data set so that multiplier estimates would reflect current data.

- This study was mainly based on benefits of the existing ferry services, the conclusions of which do not linearly translate to costs or impacts if the service is abandoned. For example, the direct employment benefits estimated in this study as employment in associated railroads should not be interpreted as employment losses to the region if the service is abandoned. Due to the existing labor contracts service abandonment may lead to either immediate layoff, delayed layoff of other railroad employees through bumping rights, reassignment (either immediate or delayed) to other railroad jobs, and adequate severance compensation, either through Conrail or under provisions of the Railroad Retirement Act. Jobs lost in a specific region may partially or fully be offset by the regional or state economies, or some employees may drop out of the labor force due to retirement. All these avenues of adjustment indicate that benefits of the service as they existed in 1973 is within the framework of a static analysis not allowing the dynamics of local and regional adjustment through time. A detailed analysis is needed to characterize this adjustment process and its implications to the regional economies under conditions of abandonment.

The benefits estimated in this study consider the entire Lake Michigan car ferry service without regard to the service level and increment. Had the total car ferry service not existed in 1973, the benefits estimated provide a reasonable level of economic activity that would be absent in the region. If only one ferry service existed, the transportation cost savings to the shippers and the indirect benefits (because of dependency of manufacturing industries to favorable rates) would still exist. That portion of the induced benefits which is dependent upon the indirect benefits would also be unchanged if only one ferry route existed. Only port-based direct benefits and their resultant induced benefits would be affected by the presence or absence of a specific car ferry route.

The study provides data on the present benefits of the ferry service to both states and the six port counties. Although the results will be useful for the Bi-State Ferry Task Force deliberations, they will be far from fully satisfying the data needs to arrive at action recommedations. In addition to the benefit data, the following four areas can be identified for an in-depth analysis and study:

(1) Operations. To preserve the ferry service, an evaluation is needed to arrive at a ferry network connecting the East and West shores of Lake Michigan which will be responsive to the regional needs as well as future rail transportation system requirements. This component should address issues such as what routes, if any, should be eliminated, schedule, timing and scope of remaining operations, time phased plan of introducing changes in existing operations, future outlook (for the next ten years and beyond) for car ferry market potential, and other factors which impact upon the operational viability of the car ferry service.

(2) Technology. Vessels which are presently engaged in car ferry operations are obsolete and if the service is to be maintained in the future, replacement with modern vessels is inescapable. Given the character of the service to be maintained and the future market potential, what are the optimum design characteristics of the new car ferries to be introduced? Timing, subsidy, cost, and other issues related to the technical innovations for offshore as well as onshore facilities need also be addressed in this area.

(3) Organization/Administration. What would be the nature of the administrative framework to undertake car ferry operations in the future? Would private capital be attracted to a marine based operation linking two railroad networks on both sides? What would be the extent and nature of public investments, if any, needed to maintain the service? Would subsidies for equipment and operations be required? What are the financial implications of public assistance and private investment including timing, cash flow, and

phasing of capital recovery? What will be the administrative framework within which the public assistance program can be effectively delivered: an autonomous bi-state authority, a public corporation, a semi-autonomous bi-state authority reporting to each States' Transportation Department, etc?

(4) Legislation. Given the characteristics described above, what specific changes in the Wisconsin and Michigan legislation are needed to implement the action recommendations including a time phased implementation plan identifying what action should be taken when and how specific actions are interrelated. Also, Federal legislation impediments and constraints to the car ferry need to be evaluated.

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ECONOMIC BENEFITS OF

LAKE MICHIGAN CAR FERRY SERVICE

VOLUME II

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APPENDIX A

EVOLUTION OF CAR FERRIES

River Ferries

The car ferries started on the Great Lakes - St. Lawrence System more than 120 years ago. The first car ferries were designed to bring wide gauge Canadian rail cars (5'6") across river to Buffalo (the *International*, 1857) and the St. Lawrence River (the *John Counter*, 1853). The *International*, owned by the Buffalo and Lake Huron Railroad, was promoted by Buffalo businessmen with a view to sustaining the port's position as a major trans-shipment carrier to the East coast by tying the port to the rapidly expanding Canadian railroads. In the cross river service, ferries were merely substitutes for bridges and tunnels. No sooner than the completion of the Buffalo-Fort Erie international suspension bridge, the *International* was laid up.

Canadian railroads (the Great Western Railway) also used break-bulk ships and later car ferries (1866) to bridge the river at Windsor. The Grand Trunk utilized car ferries to bridge the St. Clair River between Port Huron and Sarnia in 1872. The first of these ships (the *Great Western*) was built in Scotland and assembled in Windsor. But the other Detroit-Windsor ferries were built in expanding Great Lake shipyards. For a time, the ferries were the largest and most sophisticated vessels on the lakes. They were also remarkably economical The Grand Trunk's three ferries, averaging more than 200' in length and 20 cars capacity, cost less than $200,000 each. They persisted in the cross river trades

long after bridges and tunnels had been completed. The *Lansdowne*, designed by the distinguished naval architect Frank E. Kirby in 1884, was a first class iceboat that remained in service for over 90 years.

The major contribution to breaking pack ice on the Detroit River, however, was made by the *Transfer*, built in Cleveland for the Michigan General Railroad in 1888. She had a steel hull and a huge propeller (9'6") that could be used to cut through pack ice while proceeding stern-first across the river. The most extensive Detroit River car ferry service occurred almost by serendipity. It had been originated by the Canada Southern Bridge Company as an interim expedient to a bridge that never proved necessary. The ferry was part of an overall strategy to provide the Vanderbilt interests with a direct link into the Chicago market. At their peak in 1905, the four ferry operators serving the Detroit-Windsor route carried an average 1,097 cars a day and were second only to New York Harbor ferries. Operations diminished after the opening of the New York Central Tunnel in 1910, but car ferries persisted in the Detroit-Windsor gateway trades.

Mackinac Straits

The Mackinac Straits car ferry had much in common with the short haul river crossing services to the East. It was initiated as a subsidiary of three relatively short line railroads, one converging on St. Ignace from the Upper Peninsula and two serving Mackinac and Michigan's Lower Peninsula. The Mackinac Transportation Company, formed in 1881, initiated some remarkable technological innovations moving

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from a break-bulk sterner to barges, to the most sophisticated ice breakers in the world within the first decade of service. The *St. Ignace*, designed by Frank Kirby and built by the Detroit Dry Dock in 1887, had a revolutionary bow propeller ten feet in diameter that became the key to the successful ice breaking industry in Finland and throughout the world.[1] It also had a spoon-shaped prow for rising on the ice sheets, ballast trimming tanks for lateral motion, and other pioneering ice features. The *St. Ignace* was followed by a succession of larger and more powerful ships, reaching the peak with the *Chief Wawatam*, a 4,500 horsepower ship capable of carrying 26 cars and built by the Toledo Ship Building Company in 1911.

The Mackinac Transportation Company had helped to overcome the most serious spatial isolation that existed in the lakes. The only other routes to Upper Peninsula from the rapidly growing Lower Peninsula were through Chicago by rail or from Detroit by water. But, at the peak of its rail passenger and freight traffic, three basic forces were set in motion that were to accelerate the MTC decline. The first was what even Hilton regards as a serious short-sightedness in company policy with respect to the rise of the automobile.[2] Instead of attempting to cultivate the new markets with the increase of tourism, hunting, fishing, and recreation in the Upper Peninsula, the Company treated the new market as a nuisance to railroad operations. It required, for instance, that automobiles be first loaded aboard flat cars before being allowed access to the ferry.

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[1] Alex Bornsdoff, a Finnish engineer, visited the *St. Ignace* in the winter of 1889 and took the concept back to Finland where it was put to use in the Baltic and enabled Wartsilla to become the world's leading producer of ice breakers. See "Ice Breaking in the Baltic," John L. Hazard, *Land Economics*, Fall, 1970.

[2] George W. Hilton, *The Great Lakes Car Ferries*, Howell-North, Berkeley, California, 1962, p. 63.

Gasoline tanks had to be drained before loading and refilled at the opposite terminal. The one-way charge was initially an exploitive $40 a car. What might have become a profitable sideline operation became a subsidized competitor in 1923. Public dissatisfaction with the Company's poor passenger accommodations and high rates led to the establishment of the Michigan State ferries at that date. The later disappearance of the rail passenger service, such as the Lake Superior Limited, virtually put the Company out of the passenger business. No attempt was made to accommodate potential truck traffic. For a time the Company persisted by chartering its ferries out as ice breakers to the Lake Carriers Association. The creation of the federally-subsidized Mackinac Straits Bridge in 1958 eliminated the economic viability of both ferry services.

The Bridge Strategy

Three other railroads entered cross-river car ferry operations at the Michigan-Ontario gateway in pursuit of new markets. The bridge strategy was first conceived by the Vanderbilt interests who were viewed mostly successful in extending the first integrated railroad from New York to Chicago. The idea of the bridge was to extend a similar integrated railroad service under single-line ownership between Chicago and a key Eastern point (usually Buffalo) through the short-line Ontario. It was attempted by the Buffalo and Lake Huron Railroad (ultimately the Grant Trunk of the Canadian National System) in the 1850's. The Vanderbilt's Canada Southern Railroad in 1873 (ultimately the Michigan Central Railroad), the Pere-

Marquette Railroad (ultimately the C&O Railway) in the early 1900's, the Canadian Pacific's Land Bridge to the Atlantic (St. John's/New Brunswick) in the 1890's, and the Wabash Railways later pushed to reach the Lehigh Valley and other railroads at Buffalo. It is interesting to note that the latter three (PM-C&O, CP, and Wabash) all established river ferry services across the Detroit-St. Clair River which have subsequently operated on reduced scale with the completion of bridges and tunnels at both Detroit and Windsor. Three of the railroads which attempted the bridge strategy using car ferries to Eastern points also attempted to bridge Lake Michigan by employing cross-lake car ferries to Western markets. The Pere-Marquette acquired a cross-lake car ferry service in 1900; the Grand Trunk initiated its own lake service in 1903; and the Wabash Railroad took over the Ann Arbor in 1925.

Cross-Lake Services

The cross-lake car ferry service differend in many respects from the cross-river services. They are obviously longer haul over stretches of water less susceptible to bridges or tunnels. They tend to offer direct line haul competition to parallel railroads and highways rather than serve as complementary short-haul extensions. Some alterations were required in ship design such the elimination of the forward propeller to cut through pack ice, improved accommodations for crew and passengers on the spar deck, ice breaking bow, and an open stern for aft loading.

It is not surprising that short-line railroads without interline connections through the Chicago hub initiated the cross-Lake Michigan services. The Toledo, Ann Arbor, and Lake Michigan (Frankfort) Railway, predecessor of the Ann Arbor Railroad, for instance, pioneered the car ferry service from Frankfort, Michigan to Wisconsin in 1892, the year the railroad reached Frankfort. The ferry lines were an integral part of the Ann Arbor Railroad consisting of over half the railroad's mileage and generating some 54 percent of its traffic. The Ann Arbor Railroad had to reach West for traffic because it was what some call an "unnecessary railroad"[3] with little traffic originating from on-line points. Similarly, on the Wisconsin side, the Green Bay and Western Railroad at Kewaunee depended upon the Ann Arbor ferries for more than its on-line traffic. Altogether, the route existed almost exclusively as a Chicago by-pass. This relationship started to come apart when the Wabash Railroad acquired the Ann Arbor (1925) and more conclusively when the Norfolk and Western took over the Wabash in 1964. Officials in Roanoke had little interest in the Ann Arbor. It provided a route looping far to the North of Chicago while the Wabash to the South carried the same traffic over twice the on-line distance to Chicago. No railroad is likely consciously to short haul itself. As a consequence, the Ann Arbor was traded off to the Detroit, Toledo, and Ironton Railroad. The DT&I authorized an expenditure of several million dollars to upgrade the *City of Green Bay* and bring the Ann Arbor No. 7 up to 21 mph speed and add bow thrusters to facilitate lateral movements and berthing.

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[3]George W. Hilton, "Great Lakes Car Ferries: An Endangered Species," *Trains*, January, 1975, Volume 35, No. 3, p. 47.

But in 1970 the DT&I was unable to raise the $17.7 million required for a new 23mph ship capable of carrying 35 cars, nor the $7 million required to improve Frankfort and Kewaunee port facilities. Unquestionably, the $17.7 million to replace somewhat smaller and slower ferries costing an overall $200-$260,000 in the 1890's and $800-$900,000 in the 1920's was an inordinately high price even taking account of inflated construction dollars. Two other circumstances appear to have hastened the demise of the Ann Arbor. One is the operational and service failure of the Penn-Central Railroad which had been the Ann Arbor's chief feeder and connection to the East. The other is the substantial improvements in rail carriage of automobiles diverting one of the chief items of Westbound haul from the car ferries to all-rail routes through Chicago.

The Pere Marquette - C&O

Two small railroads reaching for access to Western markets also initiated the car ferry service that was ultimately to become the largest on the lakes under Pere Marquette and later Chesapeake & Ohio Railroad management. Hilton suggests that they were motivated primarily by the disappearance of the lumber trades in the Lower Peninsula Michigan.[4] The Flint and Pere Marquette reached Ludington (then PM) in 1874, initiated break-bulk steamer service to Sheyboygan in 1875 primarily to tap the grain trade and 22 years later (1897) initiated car ferry service to Manitowoc. It initiated the ferry service in coordination with the independent Wisconsin-Central Railroad which was encouraged to extend its

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[4]George W. Hilton, *The Great Lakes Car Ferries*, Howell-North, Berkeley, California, 1962, p. 111.

tracks to Manitowoc. The service was aggressively opposed by Chicago and Northwestern Railroad which built a parallel ferry ship at Manitowoc as a competitive threat and refused initially to interchange rail cars with the ferry. The Detroit, Grand Rapids and Western Railroad initiated ferry service between Muskegon and Milwaukee in the same year (1897) using a leased car ferry and using the Chicago and Western Michigan's tracks to Muskegon and the Milwaukee Railroad as the interchange rail road on the Wisconsin side. The three small Michigan railroads were all absorbed by the PM Railroad in 1900. The PM was the latest version of the bridge concept (a continuous railroad from the Niagara frontier through the Ontario-Michigan gateway) on to the West. To penetrate Western markets, it utilized leased trackage rights to Chicago and car ferry services to Milwaukee, Manitowoc, and Kewaunee. The PM consolidated its car ferry service at Ludington and trade grew rapidly from 27,000 cars in 1900 to 75,000 cars in 1904, but probably reached a relative peak in the 1920's, and greatest absolute volume after World War II. The PM ships (Nos. 16-22) before turning to city names (*Saginaw, Flint, Midland*) and football team names (*Spartan* and *Badger*) reached the peak of aesthetic accomplishment in the 1920's. The Manitowoc shipbuilding design was considered handsomely proportioned, majestic, and impressive. They were also remarkably economic and functional. The ships, costing less than $1 million, were capable of carrying 30 rail cars at 14-knot speeds. Some traveled over 100,000 miles a year, a record exceeding ocean ships, and spent no more than two hours at each port of call.

In June, 1947, the Chesapeake & Ohio Railroad absorbed the PM Railway. Although the C&O had direct Chicago rail line connections, it tried at first to promote the car ferry service. The *Spartan* and the *Badger* were added to the service in 1952. The cost was $5 million each, about double the cost of the *City of Midland* (1941) and four times the cost of the *City of Saginaw* and the *City of Flint* (1931). All were ships of comparable speed (18 mph) and capacity 32-34 cars). But a basic mistake was made in the choice of motive power. The ships, like their predecessors, were coal burning, requiring larger crews and ultimately encountering environmental sanctions. By 1961, the C&O fleet was carrying 132,000 rail cars, 54,000 automobiles, and 153,000 passengers in what appeared to have been a profitable operation. Several factors appeared to have precipitated a decline of tonnage to about a quarter of the peak load. Westbound coal movements to Milwaukee declined in the face of growing coal substitutes. Rigorous environmental sanctions were applied to water carriers first covering sewage, garbage, and oil processing requiring disposal ashore, then covering water temperature differentials at the exhaust. The costs of car ferry operations and replacement were increasing. And finally, with some improvements in yard automation, the C&O simply turned more of its attention to the Chicago gateway and cut back on ferry promotion. On the Wisconsin side, the Wisconsin Central Railroad was absorbed by the Soo line. This meant that the three major lines on which the C&O relied for access to hinterland traffic also had longer haul connections by rail through Chicago.

The Grand Trunk

The route of the Grand Trunk car ferries had been in operation almost 50 years before the railroads entered car ferry operations in 1903. It had been operated first by break-bulk, paddle wheel ships in 1849, and then by the small Detroit and Milwaukee Railroad reaching Grand Haven in 1858 and after 1869, by a series of contract carriers. So, when the Grand Trunk took over the Detroit and Milwaukee Railroad and initiated car ferry service in 1903, it simply hired the president of the contracting carrier (E. G. Crosby) as president of the Grand Trunk car ferry line.

The Grand Trunk's late entry into the car ferry service appears to have been imitative in order to achieve the success of the Ann Arbor and the Pere Marquette. The Grand Trunk operation was never as successful as either, whether measured by traffic volume or profitability. Yet, it has shown remarkable ingenuity and persistence in the trade. When it suffered undue delays and damages at the constricted harbor at Grand Haven, it worked out a complex arrangement with other railroads to the more capacious harbor at Muskegon. When it was sued by a rival carrier for being in violation of the Cabotage Law (the Merchant Marine Act of 1920 requiring all services between American ports to be rendered by American made, owned, and operated vessels), it first arranged to transfer majority ownership to the Pennsylvania Railroad and then a "grandfather rights" exemption from the Act in 1937. When it encouraged resistance to switching service from the Milwaukee Railroad, it placed its own locomotives and yards in Milwaukee.

The Grand Trunk also made some mistakes. In order to collaborate with the Pennsylvania Railroad, it had to agree not to haul automobiles or trucks. Hence, when dairy shipments from Wisconsin to the East shifted from rail to truck, the ferry lost business. Shortly after this shift (1953), the Pennsylvania Railroad withdrew from the car ferry service. This left the Grand Trunk Railroad without the facilities to handle vehicles and without motor vehicle capacity, its passenger traffic was but a small fraction of these moving by C&O.

Why did the Grand Trunk persist in the trade until recently? In part, because as a highly antonomous division of the Canadian National Railway, it has been given a good deal of discretion. Secondly, the parent Canadian National Railroad is less securely attached to Chicago and is still pursuing the bridge concept, i.e., the Canadian Land Bridge to and from Eastern ports. Finally, the Grand Trunk has regarded the losses from the car ferry operation until recently to be fictitious or acceptable losses deriving from the arbitrary way by which through revenues are divided.

A number of reasons already viewed can be given for the proposed abandonment of the Grand Trunk car ferry service. But the primary cause appears to be the self-imposed inability to accommodate trucks and automobiles in a period of growing highway competition.

Other Car Ferries

A number of car ferry operations came into operation on the Lakes and most failed after some success. A listing of the operations and their difficulties and successes is of some interest.

The shortest lived of the car ferry operations was that of the Manistique, Marquette, and Northern Railroad. It came into existence in 1903 out of the desire of the Grand Rapids and Indiana Railroad to establish an alternative route to the Northern Peninsula. The route chosen was from Manistique to North Point (near Traverse City), a distance of 75 miles. The operation failed in five years, in part, because of the thin traffic density along the railroads at each end and the fact that it, in a large measure, duplicated the shorter ferry services of the Ann Arbor and the Mackinac Car Ferry Company. It can be written off as a poorly conceived business venture.

The Lake Michigan Car Ferry Transportation Company was a similarly short lived venture (1895-1908), but it was also innovative, in fact, far in advance of its time. Conceived by the Wisconsin and Michigan Railroad, it was to run from Peshtigo, a former lumber port in North Wisconsin to South Chicago. Service was to be offered by four barges and two tugs. The barges were remarkably economic, costing only $48,000 each, capable of handling 28 cars, and requiring a minimum crew. The problems were both natural and institutional. The institutional problem was that the other railroads looked upon the arrangement as an anathema, refusing not only to exchange cars, but even to publish joint rates. The Lake Michigan Car Ferry Transportation Company responded with vigorous rate cutting, reducing the rate on lumber from Menominee to Chicago to 5¢ a hundred weight in August, 1896. This was a battle that was bound to lose to the better financed Milwaukee and North Western Railroads. The natural problems derived from being

too far in advance of its time and not using modern day marine equipment, and navigation aides. Three of the four barges were lost in accidents before operations were discontinued in 1908.

The Erie Railroad maintained a tug-and-barge operation on the Chicago River for some 23 years. The objective was to gain an edge over other railroads by moving freight cars intact between South and North terminals and yards without having to enter the congested Chicago loop. The rise of the truck, the decline of the freight car, and the advent of the depression brought this unique ferry operation to a halt.

Several operators initiated Lake Erie car ferry operations. A total of five carriers transported rail cars between the Lake Erie coal ports (Sandusky, Ashtabula, and Conneaut) across the Lake to Canada and Michigan, starting with the U.S. and Ontario Navigation Company in 1895. The primary purpose was to carry coal moving in back-haul gondola car service to the secondary steel centers along Lake Erie to Canada, and to transport some Canadian timber, wood-pulp, and paper back to Ohio. Their dependence on the coal trade made them highly vulnerable to the coal industry's decline. By 1958, all of the services had been abandoned. In addition, their routes cut across the dominant East-West direction of highway travel limiting passenger potential. Harbors at Conneaut and Ashtabula were congested by bulk freighters. Three of the five Lake Erie car ferries were owned by the railroads from the beginning, and only one of those (the New York Central owing the Toronto, Hamilton, and Buffalo Navigation Company) could be conceived

of as competing with itself for the rail haul. The other two car ferries were initiated by independents, i.e., a coal dealer and a truckline. The former was displaced by the railroads in the first month and the latter was put out of business in two years. The truckline was the Morton Truck & Storage Company of Detroit. It initiated the Michigan and Ohio Car Ferry Company, operating barges between Detroit and Sandusky, Ohio, in 1897. The idea behind the operations was to attempt to break the monopolistic hold of the New York Central Railroad on Detroit. The insightful scheme involved hauling G&O coal cars from Sandusky to Detroit and whatever could be found in return. The scheme proved to be profitable the first year with demands running beyond barge capacity. The second year was disastrous. The owner could not acquire a full-sized, year-round car ferry, and the railroads turned increasingly hostile (both restricting interchange and increasing switching charges from $2 a car to other railroads to $5 for ferry-delivered cars). The truckline operation failed five years before its case came before the Interstate Commerce Commission for a hearing.

The Ontario Car Ferry Company was similar to most of the Lake Erie operations in that it depended heavily upon coal traffic, and when the production of coal around Pittsburgh began to decline, the car ferry service went with it. But it also differed. While it was established by the Grand Trunk and Buffalo, Rochester and Pittsburgh Railway in 1905, its car ferries were registered in Canada and were the only lake car ferries of Canadian registry. The other major difference is that it handled a thriving passenger trade covering up to 70,000

people, many connecting from specially scheduled boat trains. The decline started with the railroads retreat from passenger service. The Baltimore and Ohio, which took over the declining BR&P in the depression, cancelled the boat trains in 1942. Freight traffic then started to decline from the peak of 854,000 tons handled in 1945 (two-thirds of it was coal). But the crowning blow to the line, which remained profitable until 1945, was the inability of the aged ships to meet increasingly rigorous inspection standards without making investment in renovation.

Historical Trends

Coming out of the relative peak that car ferry services obtained in the 1920's, the Great Lakes fleet in 1931 totalled 38 car ferries, under ownership of eleven companies, five in Canada and six on the American side (Table A-1).

Over the next 45 years, as the transportation technology changed, costs rose and earnings declined. The number of ships dropped from 38 in 1931 to only 9 in 1976 (including a new Lake Superior rail ferry). Five companies survived in 1976, but of these, one was dormant, one was bankrupt, and two had applied for authority to abandon. (Tables A-2 and A-3.)

It is, unfortunately, not feasible to identify fully the corresponding decline of car ferry commerce through the Lake Michigan ferry ports, after 1960, and especially the sharp traffic declines of the last five years, as ships were retired and schedules greatly reduced. Up to 1960, car ferry commerce was tabulated as a separate factor in federal statistics; thereafter, car ferry traffic was included in general domestic Great Lakes commerce data.

Table A-4 shows car ferry commerce through Lake Michigan ports at five-year intervals, 1930 to 1960. The traffic peaked in 1950. At the two principal ports, traffic peaked at Milwaukee in 1950, and at Ludington in 1955. Value data was available until 1940; in 1935, car ferry commerce throughout the lakes had a value of $1,000 per ton, an impressive figure considering the price index in 1935, at the height of the 1930's depression.

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TABLE A-1

GREAT LAKES CAR FERRY FLEET AT PEAK (1931)
AND SUCCEEDING YEARS, TO 1976

Number of Ferries	Company or Line	Headquarters
6	Ann Arbor Railroad Company	Toledo, Ohio
1	Pennsylvania & Ontario Transportation Company	Cleveland, Ohio
11	Pere Marquette Railway Company	Detroit, Michigan
2	Mackinac Transportation Company	St. Ignace, Michigan
4	Grand Trunk-Milwaukee Car Ferry Company	Milwaukee, Wisconsin
5	Wabash Railroad Company	St. Louis, Missouri
2	Grand Trunk Railway System	Toronto, Ontario
2	Canadian Pacific Car & Passenger Transfer Company	Prescott, Ontario
1	Toronto, Hamilton & Buffalo Navigation Company	Hamilton, Ontario
2	Ontario Car Ferry Company	Toronto, Ontario
2	Marquette & Bessemer Dock and Navigation Company	Walkersville, Ontario

38 car ferries - 5 operating companies headquartered in Canada
6 operating companies headquartered in the United States

Source: Green's Marine Directory of the Great Lakes, Cleveland, Ohio, 1931 edition

Note: Reference is to rail car ferries, some of which might also carry passengers, automobiles, or trucks, but are rated primarily for their rail car function.

TABLE A-2

DOWNWARD PROGRESSION OF GREAT LAKES CAR FERRIES
1931-1976

Year	Number of Ferries Listed in Standard Marine Directories
1931	38 (11 operating companies, 5 in Canada, 6 in U.S.)
1935	36
1939	34
1946	29
1951	27
1955	27
1960	24
1964	23
1965	21
1970	18 (6 operating companies, 2 in Canada, 4 in U.S.)
1973	16
1976	9 (one new rail ferry on Lake Superior)

Sources: 1931-1964 - Green's Marine Directory of the Great Lakes, Cleveland, Ohio

1965-1976 - Greenwood's Guide to Great Lakes Shipping, Cleveland, Ohio

TABLE A-3

COMPOSITION OF GREAT LAKES CAR FERRY FLEET
1976

Ann Arbor Railroad Company		*Arthur K. Atkinson* *Viking*
Chesapeake & Ohio Railway Company		*Badger* *City of Midland* *Spartan*
Grand Trunk-Milwaukee Car Ferry Company		*City of Milwaukee* *Madison*
Incan Transportation Company	*Incan*	*Incan Superior*
Mackinac Transportation Company		*Chief Wawatam*

Total - 9 ships, 8 on Lake Michigan and 1 on Lake Superior

Total - 5 companies, 4 on Lake Michigan and 1 on Lake Superior

Source: Greenwood's Guide to Great Lakes Shipping, Cleveland, Ohio, 1976 edition.

TABLE A-4

CAR FERRY TRAFFIC AT PORTS ON THE GREAT LAKES

	1930 (000 net tons)	Value (million$)	1935 (000 net tons)	Value (million$)	1940 (000 net tons)	1945 (000 net tons)	1950 (000 net tons)	1955[1] (000 net tons)	1960[1] (000 net tons)
Total Domestic	8,472.5	844.3	6,156.9	699.5	-	-	-	-	-
Total Foreign	2,344.7	70.2	711.6	10.7	-	-	-	-	-
Manistique, Mi.	226.8	-	148.5	-	182.0	305.7	355.2	338.9	213.2
Menominee, Mi.	350.1	-	224.6	-	145.8	172.0	194.1	196.9	150.6
Kewaunee, Wis.	453.6	-	385.7	-	568.4	1,026.3	1,025.2	1,180.0	940.7
Manitowoc, Wis.	1,160.9	-	836.6	-	911.6	1,499.0	1,620.8	1,550.0	1,473.2
Milwaukee, Wis.	2,044.2	202.9	1,483.0	156.5	2,092.9	2,794.4	2,915.2	2,509.7	2,448.7
Grand Haven, Mi.	793.3	-	-	-	-	-	-	-	-
Ludington, Mi.	2,032.8	136.1	1,450.5	105.1	1,765.1	2,851.3	3,158.6	3,219.7	3,105.7
Muskegon, Wis.	-	-	601.3	-	1,026.9	1,140.4	1,001.1	767.7	712.8
Frankfort, Mi.	652.9	-	1,026.6	-	1,108.7	1,805.7	1,950.8	1,788.2	1,407.7
Total[2]	7,714.6	339.0	6,156.8	261.6	7,801.4	11,595.0	12,221.0	11,551.2	10,452.6

[1] Waterborne Commerce of the U.S., Calendar Years 1955, 1960, part 3, Great Lakes vs. Corps of Engineers (from individual ports).

[2] Total net tonnage would be half of the above total since tonnage from both origin and destination ports are included and results in double counting.

Source: Annual report, Chief of Engineers, U.S.A., Calendar Years 1931, 1936, 1941, 1946, 1951

APPENDIX B

1973 MOVEMENTS BY RAIL WITHIN THE IMMEDIATE HINTERLAND

TABLE B-1

TOTAL 1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
(ALL COMMODITIES)

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	26.64	5.57	3.97	.26	.59	6.09	10.26	55.13	94.87	203.38
ND	2.32	2.09	.82	-	-	.94	1.41	5.02	4.89	17.49
W1	10.79	.98	.89	2.94	3.16	.54	4.31	11.63	16.78	52.02
W2	17.41	2.44	4.70	.36	.18	1.32	6.34	20.66	12.06	65.47
W3	20.83	20.19	1.14	.81	.68	.90	2.87	19.34	30.93	97.69
M6	43.42	11.22	-	-	-	-	.47	3.70	1.57	60.38
TOTAL	124.41	42.49	11.52	4.37	4.61	9.79	25.66	115.48	161.10	496.43

NOTE: See Table II-1 of Chapter II for definition of regions.

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 20
Food and kindred products

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	12.39	2.31	1.70	.20	-	4.53	6.27	23.58	10.10	61.08
ND	1.75	-	-	-	-	.94	.85	2.81	2.49	8.84
W1	.43	-	.71	-	-	.34	1.25	3.58	2.69	9.00
W2	1.49	.65	1.03	-	-	.70	1.16	10.03	1.42	16.48
W3	12.59	2.20	.74	.40	-	.41	1.32	12.41	25.42	55.49
W6	-	-	-	-	-	-	-	-	-	-
TOTAL	28.65	5.16	4.18	.60	-	6.92	10.85	52.41	42.12	150.89

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 22
Textile mill products

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	.54	-	.32	.06	-	-	-	-	-	.92
ND	-	-	-	-	-	-	-	-	-	-
W1	-	-	-	-	-	-	-	-	-	-
W2	.05	-	-	-	-	-	.17	.05	.17	.44
W3	-	-	-	-	-	-	-	-	.30	.30
M5	-	-	-	-	-	-	-	-	-	-
TOTAL	.59	-	.32	.06	-	-	.17	.05	.47	1.66

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TFN THOUSAND TONS)
COMMODITY NUMBER 24
Lumber and wood products, except furniture

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	.93	.47	.15	-	-	-	.12	.66	1.02	3.35
ND	-	-	-	-	-	-	-	-	-	-
W1	.60	-	-	-	-	-	-	.98	.88	2.46
W2	.38	-	.18	-	-	.12	.30	.71	.37	2.06
W3	-	-	-	-	-	-	-	-	-	-
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	1.91	.47	.33	-	-	.12	.42	2.35	2.27	7.87

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)

COMMODITY NUMBER 26

Pulp, paper and allied products

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	4.84	.38	-	-	-	-	.35	1.31	2.06	8.94
ND	-	-	-	-	-	-	-	-	-	-
W1	5.11	.21	.18	.53	-	-	1.29	5.02	8.05	20.39
W2	14.98	1.79	2.96	.36	.18	.50	4.51	8.29	8.68	42.25
W3	-	-	-	-	-	-	-	-	-	-
W6	4.18	.39	-	-	-	-	.47	1.93	.65	7.62
TOTAL	29.11	2.77	3.14	.89	.18	.50	6.62	16.55	19.44	79.20

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 27
Printed matter

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	-	-	-	-	-	-	-	-	-	-
ND	-	-	-	-	-	-	-	-	-	-
W1	-	-	-	-	-	-	-	-	-	-
W2	-	-	-	-	-	-	-	.40	.54	.94
W3	-	-	-	-	-	-	-	-	-	-
W6	-	-	-	-	-	-	-	-	-	-
TOTAL	-	-	-	-	-	-	-	.40	.54	.94

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 28
Chemicals and allied products

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	1.02	-	-	-	-	-	-	-	-	1.02
ND	-	-	-	-	-	-	-	-	-	-
W1	.66	-	-	2.41	-	-	-	-	.50	3.57
W2	-	-	-	-	-	-	-	-	-	-
W3	-	-	.40	-	-	-	.34	.91	-	1.65
W6	-	-	-	-	-	-	-	-	-	-
TOTAL	1.68	-	.40	2.41	-	-	.34	.91	.50	6.24

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 29
Petroleum and coal products

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	-	1.17	1.42	-	-	-	-	-	-	2.59
ND	-	-	-	-	-	-	-	-	.43	.43
W1	-	-	-	-	-	-	-	-	-	-
W2	-	-	-	-	-	-	-	-	-	-
W3	-	1.24	-	.41	.68	-	-	-	-	2.33
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	-	2.41	1.42	.41	.68	-	-	-	.43	5.35

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 30
Rubber and miscellaneous plastics products

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	-	-	-	-	-	-	-	.33	-	.33
ND	-	-	-	-	-	-	-	-	-	-
W1	-	.68	-	-	-	.15	.18	-	.15	1.16
W2	-	-	-	-	-	-	-	.43	-	.43
W3	-	-	-	-	-	-	-	-	-	-
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	-	.68	-	-	-	.15	.18	.76	.15	1.92

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 32
Stone, clay, glass, and concrete products

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	-	-	-	-	-	-	-	-	1.00	1.00
ND	-	-	-	-	-	-	-	-	-	-
W1	1.10	-	-	-	-	-	-	.70	-	1.80
W2	-	-	-	-	-	-	-	-	-	-
W3	-	-	-	-	-	-	-	.50	-	.50
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	1.10	-	-	-	-	-	-	1.20	1.00	3.30

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 34
Fabricated metal products, except ordanance, machinery and transportation

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	-	-	-	-	-	-	-	-	-	-
ND	-	-	-	-	-	-	-	-	-	-
W1	1.19	.09	-	-	-	-	-	-	.11	1.39
W2	-	-	-	-	-	-	-	.07	.20	.27
W3	2.07	-	-	-	-	-	.06	.15	-	2.28
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	3.26	.09	-	-	-	-	.06	.22	.31	3.94

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 35
Machinery, except electrical

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	.34	-	-	-	-	-	-	.09	1.43	1.86
ND	-	1.08	-	-	-	-	-	-	-	1.08
WI	.12	-	-	-	-	.05	-	-	.12	.29
W2	-	-	-	-	-	-	.14	-	.53	.67
W3	.37	-	-	-	-	-	-	1.24	.20	1.81
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	.83	1.08	-	-	-	.05	.14	1.33	2.28	5.71

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 36
Electrical machinery, equipment and supplies

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	.09	-	.09	-	-	-	.19	.39	.66	1.42
ND	-	-	-	-	-	-	-	-	-	-
W1	-	-	-	-	-	-	-	-	.08	.08
W2	-	-	-	-	-	-	-	.13	-	.13
W3	.11	-	-	-	-	-	-	-	.37	.48
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	.20	-	.09	-	-	-	.19	.52	1.11	2.11

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)

COMMODITY NUMBER 37

Transportation equipment

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	.26	-	-	-	-	-	.13	.35	.46	1.20
ND	-	-	-	-	-	-	-	-	-	-
W1	-	-	-	-	-	-	-	-	-	-
W2	-	-	-	-	-	-	-	.23	-	.23
W3	4.89	16.23	-	-	-	.31	.65	2.07	1.61	25.76
Y6	-	-	-	-	-	-	-	-	-	-
TOTAL	5.15	16.23	-	-	-	.31	.78	2.65	2.07	27.19

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 39
Miscellaneous products of manufacturing

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	-	.25	-	-	-	-	-	-	-	.25
ND	-	-	-	-	-	-	-	-	-	-
WI	-	-	-	-	-	-	-	-	-	-
W2	-	-	-	-	-	-	-	-	-	-
W3	-	-	-	-	-	-	-	-	-	-
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	-	.25	-	-	-	-	-	-	-	.25

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 40
Waste and scrap materials

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	.97	-	-	-	-	-	.65	.56	-	2.18
ND	-	-	-	-	-	-	-	-	-	-
W1	-	-	-	-	-	-	-	-	-	-
W2	-	-	-	-	-	-	-	.32	-	.32
W3	-	-	-	-	-	-	-	.31	-	.31
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	.97	-	-	-	-	-	.65	1.19	-	2.81

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 41
Miscellaneous freight shipments

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	-	-	-	-	-	-	-	-	-	-
ND	-	-	-	-	-	-	-	-	-	-
W1	-	-	-	-	-	-	-	-	-	-
W2	-	-	-	-	-	-	-	-	-	-
W3	-	.32	-	-	-	.18	-	-	-	.50
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	-	.32	-	-	-	.18	-	-	-	.50

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 42
Containers, shipping, returned empty

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	-	-	-	-	-	-	-	-	-	-
ND	-	-	-	-	-	-	-	-	-	-
W1	-	-	-	-	-	-	-	-	-	-
W2	-	-	-	-	-	-	-	-	-	-
W3	.20	.20	-	-	-	-	-	-	-	.40
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	.20	.20	-	-	-	-	-	-	-	.40

TABLE B-1 (continued)

1973 EASTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
ALL OTHER COMMODITIES

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	5.26	.99	.29	-	.59	1.56	2.55	27.86	78.14	117.24
ND	.57	1.01	.82	-	-	-	.56	2.21	1.97	7.14
W1	1.58	-	-	-	3.16	-	1.59	1.35	4.20	11.88
W2	.51	-	.53	-	-	-	.06	-	.15	1.25
W3	.60	-	-	-	-	-	.50	1.75	3.03	5.88
W6	39.24	10.83	-	-	-	-	-	1.77	.92	52.76
TOTAL	47.76	12.83	1.64	-	3.75	1.56	5.26	34.94	88.41	196.15

TABLE B-2

TOTAL 1973 WESTBOUND MOVEMENTS BY RAIL
(TEN THOUSAND TONS)
(ALL COMMODITIES)

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	24.37	.09	12.82	14.35	25.04	45.95	122.62
M2	14.52	.50	1.51	2.42	18.25	2.49	39.69
M3	1.36	-	.90	.92	2.36	-	5.54
M4	9.98	1.27	7.85	3.98	3.84	-	26.92
M5	.64	-	2.49	1.98	1.02	.64	6.77
OH1	.36	.25	-	-	1.59	-	2.20
OH2	14.94	1.33	3.29	6.32	22.71	2.19	50.78
PA	14.19	.91	3.43	8.71	12.42	1.66	41.32
NY	7.66	.42	6.04	7.18	12.38	.68	34.36
TOTAL	88.02	4.77	38.33	45.86	99.61	53.61	330.2

NOTE: See Table II-1 of Chapter II for definition of regions.

1973 WESTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 20
Food and kindred products

FROM	TO MN	ND	W1	W2	W3	M6	TOTAL
M1	.40	-	.20	.67	1.87	-	3.14
M2	-	-	.20	.20	-	-	.40
M3	1.11	-	-	.42	-	-	1.53
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	-	-	-
OH2	-	-	-	-	-	-	-
PA	.84	-	-	-	-	-	.84
NY	.52	-	.52	-	1.15	-	2.19
TOTAL	2.87	-	.92	1.29	3.02	-	8.10

1973 WESTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 22
Textile mill products

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	-	-	-	-	-
M2	-	-	-	-	-	-	-
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	-	-	-
OH2	-	-	-	-	-	-	-
PA	.05	-	-	-	-	-	.05
NY	.29	-	-	-	-	-	.29
TOTAL	.34	-	-	-	-	-	.34

TABLE B-2 (continued)

1973 WESTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 24
Lumber and wood products, except furniture

FROM	TO MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	5.80	7.64	-	.39	13.83
M2	-	-	-	-	-	-	-
M3	-	-	-	-	-	-	-
M4	-	-	-	.36	-	-	.36
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	-	-	-
OH2	-	-	-	-	-	-	-
PA	-	-	-	-	.07	-	.07
NY	.06	-	.67	.20	-	-	.93
TOTAL	.06	-	6.47	8.20	.07	.39	15.19

1973 WESTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 26
Pulp, paper and allied products

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	.67	-	.89	1.07	1.31	-	3.94
M2	.53	-	.37	1.44	-	-	2.34
M3	-	-	.45	.50	-	-	.95
M4	.55	-	1.53	-	.90	-	2.98
M5	-	-	.41	-	.41	-	.82
OH1	-	-	-	-	-	-	-
OH2	-	-	-	.99	-	-	.99
PA	.21	-	.66	4.87	-	-	5.74
NY	1.96	-	1.83	1.29	1.84	.18	7.10
TOTAL	3.92	-	6.14	10.16	4.46	.18	24.86

1973 WESTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 28
Chemicals and allied products

FROM \ TO	MN	ND	W1	W2	W3	W6	TOTAL
M1	2.77	-	5.58	2.86	2.11	-	13.32
M2	2.27	.50	.94	.78	-	2.49	6.98
M3	-	-	-	-	-	-	-
M4	9.43	1.27	6.25	3.62	2.94	-	23.51
M5	.64	-	2.08	1.98	-	.64	5.34
OH1	-	-	-	-	-	-	-
OH2	1.66	-	.61	1.29	2.36	1.31	7.23
PA	-	-	.35	.81	-	-	1.16
NY	.70	-	.70	.38	2.06	-	3.84
TOTAL	17.47	1.77	16.51	11.72	9.47	4.44	61.38

TABLE B-2 (continued)

1973 WESTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)

COMMODITY NUMBER 29
Petroleum and coal products

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	-	-	-	-	-
M2	-	-	-	-	-	-	-
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	-	-	-
OH2	-	-	-	-	-	-	-
PA	1.65	-	-	-	-	.33	1.98
NY	-	-	-	-	-	-	-
TOTAL	1.65	-	-	-	-	.33	1.98

1973 WESTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 30
Rubber and miscellaneous plastics products

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	.12	-	-	-	.47	-	.59
M2	.08	-	-	-	-	-	.08
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	.17	-	.17
OH2	.15	-	-	-	.19	-	.34
PA	.10	-	.18	-	-	-	.28
NY	-	-	-	-	-	-	-
TOTAL	.45	-	.18	-	.83	-	1.46

1973 WESTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 32
Stone, clay, glass, and concrete products

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	.18	-	-	.66	-	.25	1.09
M2	-	-	-	-	-	-	-
M3	-	-	.45	-	-	-	.45
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	.25	-	-	-	-	.25
OH2	-	-	1.07	-	1.95	-	3.02
PA	.27	.21	-	.54	.45	1.33	2.80
NY	.40	-	-	-	.67	-	1.07
TOTAL	.85	.46	1.52	1.20	3.07	1.58	8.86

TABLE B-2 (continued)

1973 WESTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 34
Fabricated metal products, except ordanance, machinery and transportation

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	-	-	-	.70	.70
M2	-	-	-	-	-	-	-
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	.20	-	.20
OH2	.41	-	1.49	.65	.72	-	3.27
PA	3.68	.70	.31	.40	-	-	5.09
NY	.44	-	.21	-	.49	-	1.14
TOTAL	4.53	.70	2.01	1.05	1.41	.70	10.40

1973 WESTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 35
Machinery, except electrical

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	-	-	-	-	-
M2	-	-	-	-	.20	-	.20
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	-	-	-
OH2	.47	-	-	-	-	-	.47
PA	.37	-	.49	-	.06	-	.92
NYI	-	-	.31	-	-	-	.31
TOTAL	.84	-	.80	-	.26	-	1.90

1973 WESTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 36
Electrical machinery, equipment and supplies

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	-	-	-	-	-
M2	-	-	-	-	-	-	-
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	-	-	-
OH2	-	-	.12	.35	-	-	.47
PA	.05	-	-	-	-	-	.05
NY	-	-	-	-	.49	-	.49
TOTAL	.05	-	.12	.35	.49	-	1.01

1973 WESTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 37
Transportation equipment

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	18.81	-	-	-	16.32	-	35.13
M2	10.31	-	-	-	18.05	-	28.36
M3	.20	-	-	-	2.36	-	2.56
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	.36	-	-	-	.92	-	1.28
OH2	7.63	.18	-	-	3.58	-	11.39
PA	1.80	-	-	-	.10	-	1.90
NY	2.21	-	-	.25	1.97	-	4.43
TOTAL	41.32	.18	-	.25	43.30	-	85.05

1973 WESTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 39
Miscellaneous products of manufacturing

FROM \ TO	MN	ND	WI	W2	W3	M6	TOTAL
M1	-	-	-	-	-	-	-
M2	.59	-	-	-	-	-	.59
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	-	-	-
OH2	-	-	-	-	-	-	-
PA	.08	-	-	.06	-	-	.14
NY	-	-	-	.12	.19	-	.31
TOTAL	.67	-	-	.18	.19	-	1.04

TABLE B-2 (continued)

1973 WESTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)

COMMODITY NUMBER 40
Waste and scrap materials

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	.27	1.45	-	-	1.72
M2	-	-	-	-	-	-	-
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	.61	-	.61
OH1	-	-	-	-	-	-	-
OH2	-	-	-	.40	-	-	.40
PA	-	-	.40	.83	-	-	1.23
NY	.20	-	.30	.90	-	.50	1.90
TOTAL	.20	-	.97	3.58	.61	.50	5.86

1973 WESTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 41
Miscellaneous freight shipments

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	-	-	-	-	-
M2	-	-	-	-	-	-	-
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	.30	-	.30
OH2	-	-	-	-	-	-	-
PA	-	-	-	-	-	-	-
NY	-	-	-	-	.10	-	.10
TOTAL	-	-	-	-	.40	-	.40

1973 WESTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
COMMODITY NUMBER 42
Containers, shipping, returned empty

FROM \ TO	MN	ND	WL	W2	W3	M6	TOTAL
M1	-	-	-	-	-	-	-
M2	-	-	-	-	-	-	-
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	-	-	-
OH2	-	-	-	-	.17	-	.17
PA	.12	-	-	-	.34	-	.46
NY	-	-	-	-	.42	-	.42
TOTAL	.12	-	-	-	.93	-	1.05

1973 WESTBOUND MOVEMENTS BY RAIL (TEN THOUSAND TONS)
ALL OTHER COMMODITIES

FROM \ TO	MN	ND	W1	W2	W3	W6	TOTAL
M1	1.42	.09	.08	-	2.96	44.61	49.16
M2	.74	-	-	-	-	-	.74
M3	.05	-	-	-	-	-	.05
M4	-	-	.07	-	-	-	.07
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	-	-	-
OH2	4.62	1.15	-	2.64	13.74	.88	23.03
PA	4.97	-	1.04	1.20	11.40	-	18.61
NY	.88	.42	1.50	4.04	3.00	-	9.84
TOTAL	12.68	1.66	2.69	7.88	31.10	45.49	101.50

TABLE B-3

TOTAL REVENUE (MILLION $) FOR 1973 EASTBOUND MOVEMENTS BY RAIL
(ALL COMMODITIES)

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	4.25	.80	.77	.08	.06	.89	1.99	10.39	11.79	30.73
ND	.50	.90	.22	-	-	.22	.34	1.41	1.25	4.94
W1	1.43	.25	.09	.05	.19	.12	.60	2.48	3.30	8.51
W2	2.15	.35	.51	.32	.02	.17	1.14	4.57	2.70	12.12
W3	2.21	3.49	.07	.05	.04	.15	.42	3.74	5.64	15.81
M6	1.88	.44	-	-	-	-	.09	.76	.42	3.59
TOTAL	12.42	6.23	1.66	.50	.31	1.55	4.58	23.35	25.10	75.70

NOTE: See Table II-1 of Chapter II for definition of regions.

TABLE B-3 (continued)

REVENUE (MILLION $) FOR 1973 EASTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 20
Food and kindred products

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	1.80	.28	.22	.03	-	.61	1.05	4.99	2.08	11.06
ND	.34	-	-	-	-	.22	.18	.76	.71	2.21
W1	.07	-	.06	-	-	.04	.20	.72	.66	1.75
W2	.13	.08	.08	-	-	.08	.13	2.04	.27	2.81
W3	.97	.21	.05	.03	-	.05	.13	2.09	4.12	7.65
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	3.31	.57	.41	.06	-	1.00	1.69	10.60	7.84	25.18

TABLE B-3 (continued)

REVENUE (MILLION $) FOR 1973 EASTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 22
Textile mill products

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	.46	-	.24	.05	-	-	-	-	-	.75
ND	-	-	-	-	-	-	-	-	-	-
W1	-	-	-	-	-	-	-	-	-	-
W2	.03	-	-	-	-	-	.12	.05	.11	.31
W3	-	-	-	-	-	-	-	-	.19	.19
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	.49	-	.24	.05	-	-	.12	.05	.30	1.25

TABLE B-3 (continued)

REVENUE (MILLION $) FOR 1973 EASTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 24
Lumber and wood products, except furniture

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	.14	.13	.04	-	-	-	.04	.11	.31	.77
ND	-	-	-	-	-	-	-	-	-	-
W1	.06	-	-	-	-	-	-	.16	.10	.32
W2	.03	-	.03	-	-	.03	.03	.16	.12	.40
W3	-	-	-	-	-	-	-	-	-	-
M6	.02	-	-	-	-	-	-	-	-	.02
TOTAL	.25	.13	.07	-	-	.03	.07	.43	.53	1.51

TABLE B-3 (continued)

REVENUE (MILLION $) FOR 1973 EASTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 26
Pulp, paper and allied products

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	.73	.05	-	-	-	-	.07	.31	.48	1.64
ND	-	-	-	-	-	-	-	-	-	-
W1	.66	.04	.03	.05	-	-	.23	1.12	1.62	3.75
W2	1.89	.27	.37	.03	.02	.06	.78	1.91	1.87	7.20
W3	-	-	-	-	-	-	-	-	-	-
M6	.49	.05	-	-	-	-	.09	.40	.19	1.22
TOTAL	3.77	.41	.40	.08	.02	.06	1.17	3.74	4.16	13.81

TABLE B-3 (continued)

REVENUE (MILLION $) FOR 1973 EASTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 27
Printed matter

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	-	-	-	-	-	-	-	-	-	-
ND	-	-	-	-	-	-	-	-	-	-
WI	-	-	-	-	-	-	-	-	-	-
W2	-	-	-	-	-	-	-	-	-	-
W3	-	-	-	-	-	-	-	.13	.08	.21
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	-	-	-	-	-	-	-	.13	.08	.21

TABLE B-3 (continued)

REVENUE (MILLION $) FOR 1973 EASTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 28
Chemicals and allied products

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	.06	-	-	-	-	-	-	-	-	.06
ND	-	-	-	-	-	-	-	-	-	-
W1	.08	-	-	-	-	-	-	-	-	.08
W2	-	-	-	.29	-	-	-	-	.13	.42
W3	-	-	.02	-	-	-	.04	.14	-	.20
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	.14	-	.02	.29	-	-	.04	.14	.13	.76

TABLE B-3 (continued)

REVENUE (MILLION $).. FOR 1973 EASTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 29
Petroleum and coal products

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	-	.10	.16	-	-	-	-	-	-	.26
ND	-	-	-	-	-	-	-	-	.10	.10
W1	-	-	-	-	-	-	-	-	-	-
W2	-	-	-	-	-	-	-	-	-	-
W3	-	.08	-	.02	.04	-	-	-	-	.14
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	-	.18	.16	.02	.04	-	-	-	.10	.50

TABLE B-3 (continued)

REVENUE (MILLION $) FOR 1973 EASTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 30
Rubber and miscellaneous plastics products

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	-	-	-	-	-	-	-	.15	-	.15
ND	-	-	-	-	-	-	-	-	-	-
W1	-	.18	-	-	-	.05	.04	-	.08	.35
W2	-	-	-	-	-	-	-	.12	-	.12
W3	-	-	-	-	-	-	-	-	-	-
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	-	.18	-	-	-	.05	.04	.27	.08	.62

TABLE B-3 (continued)

REVENUE (MILLION $) FOR 1973 EASTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 32
Stone, clay, glass, and concrete products

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	-	-	-	-	-	-	-	-	.08	.08
ND	-	-	-	-	-	-	-	-	-	-
W1	.12	-	-	-	-	-	-	.12	-	.24
W2	-	-	-	-	-	-	-	-	-	-
W3	-	-	-	-	-	-	-	.05	-	.05
M6	.09	-	-	-	-	-	-	-	-	.09
TOTAL	.21	-	-	-	-	-	-	.17	.08	.46

TABLE B-3 (continued)

REVENUE (MILLION $) FOR 1973 EASTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 34
Fabricated metal products, except ordanance, machinery and transportation

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	-	-	-	-	-	-	-	-	-	-
ND	-	-	-	-	-	-	-	-	-	-
W1	.12	.03	-	-	-	-	-	-	.25	.40
W2	-	-	-	-	-	-	-	.07	.13	.20
W3	.23	-	-	-	-	-	.06	.07	-	.36
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	.35	.03	-	-	-	-	.06	.14	.38	.96

TABLE B-3 (continued)

REVENUE (MILLION $) FOR 1973 EASTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 35
Machinery, except electrical

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	.13	-	-	-	-	-	-	.07	.09	.29
ND	-	.70	-	-	-	-	-	-	-	.70
W1	.08	-	-	-	-	.03	-	-	.07	.18
W2	-	-	-	-	-	-	.05	-	.21	.26
W3	.09	-	-	-	-	-	-	.04	.07	.20
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	.30	.70	-	-	-	.03	.05	.11	.44	1.63

TABLE B-3 (continued)

REVENUE (MILLION $) FOR 1973 EASTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 36
Electrical machinery, equipment and supplies

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	.04	-	.04	-	-	-	.10	.30	.48	.96
ND	-	-	-	-	-	-	-	-	-	-
W1	-	-	-	-	-	-	-	-	.07	.07
W2	-	-	-	-	-	-	-	.07	-	.07
W3	.03	-	-	-	-	-	-	-	.13	.16
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	.07	-	.04	-	-	-	.10	.37	.68	1.26

TABLE B-3 (continued)

REVENUE (MILLION $) FOR 1973 EASTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 37
Transportation equipment

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	.05	-	-	-	-	-	.07	.09	.19	.40
ND	-	-	-	-	-	-	-	-	-	-
W1	-	-	-	-	-	-	-	-	-	-
W2	-	-	-	-	-	-	-	.07	-	.07
W3	.80	3.07	-	-	-	.06	.18	.89	.66	5.66
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	.85	3.07	-	-	-	.06	.25	1.05	.85	6.13

TABLE B-3 (continued)

REVENUE (MILLION $)) FOR 1973 EASTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 39
Miscellaneous products of manufacturing

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	-	.06	-	-	-	-	-	-	-	.06
ND	-	-	-	-	-	-	-	-	-	-
W1	-	-	-	-	-	-	-	-	-	-
W2	-	-	-	-	-	-	-	-	-	-
W3	-	-	-	-	-	-	-	-	-	-
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	-	.06	-	-	-	-	-	-	-	.06

TABLE B-3 (continued)

REVENUE (MILLION $) FOR 1973 EASTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 40
Waste and scrap materials

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	.12	-	-	-	-	-	.10	.10	-	.32
ND	-	-	-	-	-	-	-	-	-	-
W1	-	-	-	-	-	-	-	-	-	-
W2	-	-	-	-	-	-	-	.08	-	.08
W3	-	-	-	-	-	-	-	.06	-	.06
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	.12	-	-	-	-	-	.10	.24	-	.46

TABLE B-3 (continued)

REVENUE (MILLION $), FOR 1973 EASTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 41
Miscellaneous freight shipments

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	-	-	-	-	-	-	-	-	-	-
ND	-	-	-	-	-	-	-	-	-	-
W1	-	-	-	-	-	-	-	-	-	-
W2	-	-	-	-	-	-	-	-	-	-
W3	-	.10	-	-	-	.04	0	0	0	.14
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	-	.10	-	-	-	.04	-	-	-	.14

TABLE B-3 (continued)

REVENUE (MILLION $) FOR 1973 EASTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 42
Containers, shipping, returned empty

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	-	-	-	-	-	-	-	-	-	-
ND	-	-	-	-	-	-	-	-	-	-
W1	-	-	-	-	-	-	-	-	-	-
W2	-	-	-	-	-	-	-	-	-	-
W3	.03	.03	-	-	-	-	-	-	-	.06
M6	-	-	-	-	-	-	-	-	-	-
TOTAL	.03	.03	-	-	-	-	-	-	-	.06

TABLE B-3 (continued)

REVENUE (MILLION $) FOR 1973 EASTBOUND MOVEMENTS BY RAIL
ALL OTHER COMMODITIES

FROM \ TO	M1	M2	M3	M4	M5	OH1	OH2	PA	NY	TOTAL
MN	.72	.18	.07	-	.06	.28	.56	4.27	8.08	14.22
ND	.16	.20	.22	-	-	-	.16	.65	.54	1.93
W1	.24	-	-	-	.19	-	.13	.36	.45	1.37
W2	.07	-	.03	-	-	-	.03	-	.05	.18
W3	.06	-	-	-	-	-	.01	.27	.39	.73
M6	1.28	.39	-	-	-	-	-	.36	.23	2.26
TOTAL	2.53	.77	.32	-	.25	.28	.89	5.91	9.74	20.69

TABLE B-4

TOTAL REVENUE (MILLION $) FOR 1973 WESTBOUND MOVEMENTS BY RAIL
(ALL COMMODITIES)

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	6.44	.01	1.08	10.90	3.68	.81	22.94
M2	3.94	.12	.15	.58	3.45	.03	8.27
M3	.28	-	.06	.07	.50	-	.91
M4	.94	.12	.64	.30	.26	-	2.26
M5	.07	-	.33	-	.29	.06	.75
OH1	.13	.04	.04	.10	.69	-	1.00
OH2	3.98	.50	.89	2.35	1.59	.44	9.75
PA	3.45	.24	1.02	1.70	2.60	.51	9.52
NY	2.42	.22	1.09	1.17	2.82	.09	7.81
TOTAL	21.67	1.25	5.30	17.17	15.88	1.94	63.21

NOTE: See Table II-1 of Chapter II for definition of regions.

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TABLE B-4 (continued)

REVENUE (MILLION $) FOR 1973 WESTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 20
Food and kindred products

FROM	TO MN	ND	W1	W2	W3	M6	TOTAL
M1	.09	-	.03	.11	.16	-	.39
M2	-	-	.03	.03	-	-	.06
M3	.15	-	-	.03	-	-	.18
M4	-	-	-	.02	-	-	.02
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	-	-	-
OH2	-	-	-	-	-	-	-
PA	.27	-	-	-	.04	-	.31
NY	.16	-	.10	-	.18	-	.44
TOTAL	.67	-	.16	.19	.38	-	1.40

TABLE B-4 (continued)

REVENUE (MILLION $) FOR 1973 WESTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 22
Textile mill products

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	-	-	-	-	-
M2	-	-	-	-	-	-	-
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	-	-	-
OH2	-	-	-	-	-	-	-
PA	.06	-	-	-	-	-	.06
NY	.10	-	-	-	-	-	.10
TOTAL	.16	-	-	-	-	-	.16

TABLE B-4 (continued)

REVENUE (MILLION $) FOR 1973 WESTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 24
Lumber and wood products, except furniture

FROM	TO						
	MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	.22	.25	-	.02	.49
M2	-	-	-	-	-	-	-
M3	.04	-	-	-	-	-	.04
M4	-	-	-	.03	-	-	.03
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	-	-	-
OH2	-	-	-	-	-	-	-
PA	-	-	-	-	.05	-	.05
NY	.11	-	-	.12	.05	-	.28
TOTAL	.15	-	.22	.40	.10	.02	.89

TABLE B-4 (continued)

REVENUE (MILLION $) FOR 1973 WESTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 26
Pulp, paper and allied products

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	.10	-	.08	.13	.12	-	.43
M2	-	-	.05	.40	-	-	.45
M3	-	-	.03	.04	-	-	.07
M4	.06	-	.12	-	.06	-	.24
M5	-	-	.02	-	.16	-	.18
OH1	-	-	-	-	-	-	-
OH2	-	-	-	.04	-	-	.04
PA	.07	-	.12	.92	-	-	1.11
NY	.45	-	.31	.26	.34	.03	1.39
TOTAL	.68	-	.73	1.79	.68	.03	3.91

TABLE B-4 (continued)

REVENUE (MILLION $), FOR 1973 WESTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 28
Chemicals and allied products

FROM	TO MN	ND	W1	W2	W3	M6	TOTAL
M1	.31	-	.42	.29	.14	-	1.16
M2	.37	.12	.07	.15	-	.03	.74
M3	-	-	-	-	-	-	-
M4	.88	.12	.50	.25	.20	-	1.95
M5	.07	-	.31	-	.10	.06	.54
OH1	-	-	-	-	-	-	-
OH2	.33	-	.05	.20	.32	.18	1.08
PA	-	-	.09	-	.15	-	.24
NY	.16	-	.14	.06	.32	-	.68
TOTAL	2.12	.24	1.58	.95	1.23	.27	6.39

TABLE B-4 (continued)

REVENUE (MILLION $.) FOR 1973 WESTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 29
Petroleum and coal products

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	-	-	-	-	-
M2	-	-	-	-	-	-	-
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	-	-	-
OH2	-	-	-	-	-	-	-
PA	.28	-	-	.17	.06	.09	.60
NY	-	-	-	-	-	-	-
TOTAL	.28	-	-	.17	.06	.09	.60

TABLE B-4 (continued)

REVENUE (MILLION $)) FOR 1973 WESTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 30
Rubber and miscellaneous plastics products

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	.05	-	-	-	.10	-	.15
M2	.03	-	-	-	-	-	.03
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	.04	-	.04
OH2	.05	-	-	-	.05	-	.10
PA	.11	-	.05	-	-	-	.16
NY	-	-	-	-	-	-	-
TOTAL	.24	-	.05	-	.19	-	.48

TABLE B-4 (continued)

REVENUE (MILLION $) FOR 1973 WESTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 32
Stone, clay, glass, and concrete products

FROM	TO MN	ND	W1	W2	W3	M6	TOTAL
M1	.04	-	-	.06	-	-	.10
M2	-	-	-	-	-	-	-
M3	-	-	.03	-	-	-	.03
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	.04	-	-	.30	-	.34
OH2	-	-	.11	-	-	-	.11
PA	.12	-	-	.06	.08	.42	.68
NY	.10	-	-	-	-	-	.10
TOTAL	.26	.04	.14	.12	.38	.42	1.36

TABLE B-4 (continued)

REVENUE (MILLION $) FOR 1973 WESTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 34
Fabricated metal products, except ordanance, machinery and transportation

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	-	-	-	.07	.07
M2	-	-	-	-	-	-	-
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	.11	-	.11
OH2	.09	-	.25	.13	.14	-	.61
PA	.98	.24	.18	.11	-	-	1.51
NY	.10	-	.11	-	.13	-	.34
TOTAL	1.17	.24	.54	.24	.38	.07	2.64

TABLE B-4 (continued)

REVENUE (MILLION $) FOR 1973 WESTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 35
Machinery, except electrical

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	-	-	-	-	-
M2	-	-	-	-	.03	-	.03
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	-	-	-
OH2	.17	-	-	-	-	-	.17
PA	.20	-	.28	-	.03	-	.51
NY	-	-	.15	-	-	-	.15
TOTAL	.37	-	.43	-	.06	-	.86

TABLE B-4 (continued)

REVENUE (MILLION $) FOR 1973 WESTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 36
Electrical machinery, equipment and supplies

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	-	-	-	-	-
M2	-	-	-	-	-	-	-
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	.04	.10	-	-	.14
OH2	-	-	-	-	-	-	-
PA	.06	-	-	-	-	-	.06
NY	-	-	-	-	.31	-	.31
TOTAL	.06	-	.04	.10	.31	-	.51

REVENUE (MILLION $) FOR 1973 WESTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 37
Transportation equipment

FROM \ TO	MN	ND	WI	W2	W3	M6	TOTAL
M1	5.54	-	-	-	3.16	-	8.70
M2	3.25	-	-	-	3.42	-	6.67
M3	.06	-	-	-	.50	-	.56
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	.13	-	-	-	.15	-	.28
OH2	2.38	.12	-	-	1.06	-	3.56
PA	.23	-	-	-	.05	-	.28
NY	.95	-	-	.01	.73	-	1.69
TOTAL	12.54	.12	-	.01	9.07	-	21.74

TABLE B-4 (continued)

REVENUE (MILLION $) FOR 1973 WESTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 39
Miscellaneous products of manufacturing

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	-	-	-	-	-
M2	.17	-	-	-	-	-	.17
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	-	-	-
OH2	-	-	-	-	-	-	-
PA	-	-	-	.04	-	-	.04
NY	-	-	-	.05	.12	-	.17
TOTAL	.17	-	-	.09	.12	-	.38

TABLE B-4 (continued)

REVENUE (MILLION $), FOR 1973 WESTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 40
Waste and scrap materials

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	.04	.13	-	-	.17
M2	-	-	-	-	-	-	-
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	.03	-	.03
OH1	-	-	-	-	-	-	-
OH2	-	-	-	.04	-	-	.04
PA	-	-	.07	.13	-	-	.20
NY	.04	-	.06	.14	-	.06	.30
TOTAL	.04	-	.17	.44	.03	.06	.74

TABLE B-4 (continued)

REVENUE (MILLION $) FOR 1973 WESTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 41
Miscellaneous freight shipments

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	-	-	-	-	-
M2	-	-	-	-	-	-	-
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	.09	-	.09
OH2	-	-	-	-	-	-	-
PA	-	-	-	-	-	-	-
NY	-	-	-	-	.04	-	.04
TOTAL	-	-	-	-	.13	-	.13

TABLE B-4 (continued)

REVENUE (MILLION $) FOR 1973 WESTBOUND MOVEMENTS BY RAIL
COMMODITY NUMBER 42
Containers, shipping, returned empty

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	-	-	-	-	-	-	-
M2	-	-	-	-	-	-	-
M3	-	-	-	-	-	-	-
M4	-	-	-	-	-	-	-
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	-	-	-
OH2	-	-	-	-	.02	-	.02
PA	.05	-	-	-	.07	-	.12
NY	-	-	-	-	.07	-	.07
TOTAL	.05	-	-	-	.16	-	.21

TABLE B-4 (continued)

REVENUE (MILLION $) FOR 1973 WESTBOUND MOVEMENTS BY RAIL
ALL OTHER COMMODITIES

FROM \ TO	MN	ND	W1	W2	W3	M6	TOTAL
M1	.34	.01	.29	9.93	-	.72	11.29
M2	.12	-	-	-	-	-	.12
M3	.03	-	-	-	-	-	.03
M4	-	-	.02	-	-	-	.02
M5	-	-	-	-	-	-	-
OH1	-	-	-	-	-	-	-
OH2	.96	.38	.48	1.94	-	.26	4.02
PA	1.02	-	.23	.27	2.07	-	3.59
NY	.25	.22	.22	.53	.53	-	1.75
TOTAL	2.72	.61	1.24	12.67	2.60	.98	20.82

APPENDIX C

ANTICIPATED RAIL RATE INCREASES

TABLE C-1

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Parts, Army Tractor Tank, Iron or Steel, NOIBN, 64100, STCC 19, Carload Minimum Weight - 24,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	7	19	13	7	16
Grand Rapids, Mi.	18	32	30	13	29
Lansing, Mi.	11	21	23	22	19
Muskegon, Mi.	22	34	53	18	32
Traverse City, Mi.	35	75	32	29	60
Akron, Oh.	--	6	2	--	4
Cleveland, Oh.	3	6	3	2	4
Toledo, Oh.	2	8	3	2	6
Buffalo, N.Y.	11	19	11	7	16
Pittsburgh, Pa.	2	6	3	--	2

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C-2

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Pallets, Platforms or Skids for Lift Trucks, Iron Steel or Wood, 75225, STCC 42, Carload Minimum Weight - 24,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	7	18	11	8	19
Grand Rapids, Mi.	19	32	44	11	28
Lansing, Mi.	10	37	11	21	19
Muskegon, Mi.	21	35	54	17	31
Traverse City, Mi.	33	73	32	30	60
Akron, Oh.	--	7	1	--	5
Cleveland, Oh.	2	7	3	1	4
Toledo, Oh.	3	8	13	2	7
Buffalo, N.Y.	11	19	11	6	16
Pittsburgh, Pa.	1	6	3	--	2

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C-3

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Grading or Roadmaking Implement Parts I/S 62240, STCC 41, Carload Minimum Weight - 60,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	8	18	11	6	16
Grand Rapids, Mi.	14	35	43	13	32
Lansing, Mi.	8	23	24	21	20
Muskegon, Mi.	19	38	49	17	26
Traverse City, Mi.	35	65	24	27	58
Akron, Oh.	--	6	5	--	4
Cleveland, Oh.	1	4	2	1	3
Toledo, Oh.	11	19	--	1	6
Buffalo, N.Y.	11	18	13	5	16
Pittsburgh, Pa.	1	4	--	--	1

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C-4

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Iron or Steel Scrap (Eastbound Only) 54820, STCC 40, Carload Minimum Weight - 112,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	4	21	8	6	18
Grand Rapids, Mi.	18	17	4	10	13
Lansing, Mi.	11	16	6	13	16
Muskegon, Mi.	22	17	4	16	13
Traverse City, Mi.	32	34	17	21	32
Akron, Oh.	--	4	3	--	3
Cleveland, Oh.	1	4	2	1	3
Toledo, Oh.	1	8	--	2	5
Buffalo, N.Y.	6	12	13	4	11
Pittsburgh, Pa.	1	4	1	--	2

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C-5

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Fire Extinguishers, Chemical, Hand, 38280, STCC 39, Carload Minimum Weight - 30,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	6	17	14	8	14
Grand Rapids, Mi.	18	30	34	13	27
Lansing, Mi.	11	34	23	22	19
Muskegon, Mi.	21	35	28	18	32
Traverse City, Mi.	32	76	30	29	61
Akron, Oh.	--	6	2	--	6
Cleveland, Oh.	2	6	3	1	4
Toledo, Oh.	3	8	3	2	5
Buffalo, N.Y.	11	19	9	7	16
Pittsburgh, Pa.	5	6	3	--	2

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C-6

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Automobile Parts, NOIBN, Iron or Steel, 8910, STCC 37, Minimum Carload Weight - 50,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	5	23	9	10	20
Grand Rapids, Mi.	26	32	52	12	26
Lansing, Mi.	13	22	23	21	21
Muskegon, Mi.	27	39	64	19	32
Traverse City, Mi.	39	89	31	31	70
Akron, Oh.	--	4	2	--	4
Cleveland, Oh.	3	7	5	2	4
Toledo, Oh.	3	10	1	2	6
Buffalo, N.Y.	9	20	11	8	17
Pittsburgh, Pa.	2	7	3	--	2

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C-7

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Reducing Machines, Gear or Speed, 64910, STCC 36, Carload Minimum Weight - 30,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	7	19	12	8	16
Grand Rapids, Mi.	19	31	40	13	28
Lansing, Mi.	11	21	24	21	17
Muskegon, Mi.	34	36	53	19	33
Traverse City, Mi.	45	72	34	28	61
Akron, Oh.	--	7	1	--	4
Cleveland, Oh.	2	7	1	1	4
Toledo, Oh.	3	6	3	2	3
Buffalo, N.Y.	10	20	13	5	16
Pittsburgh, Pa.	2	6	7	--	1

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C-8

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Machinery or Machines, NOI, 63220, STCC 35
Carload Minimum Weight - 24,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	7	18	13	7	16
Grand Rapids, Mi.	18	32	42	14	29
Lansing, Mi.	11	21	20	21	19
Muskegon, Mi.	22	34	52	18	32
Traverse City, Mi.	35	75	32	29	60
Akron, Oh.	--	6	2	--	4
Cleveland, Oh.	3	6	3	2	4
Toledo, Oh.	2	8	3	2	6
Buffalo, N.Y.	11	19	11	7	16
Pittsburgh, Pa.	2	6	2	--	2

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C-9

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Doors, Garage, Overhead, Iron or Steel, 16260, STCC 34, Carload Minimum Weight - 30,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	7	18	11	8	19
Grand Rapids, Mi.	19	32	44	11	28
Lansing, Mi.	10	37	11	21	19
Muskegon, Mi.	21	35	54	17	31
Traverse City, Mi.	29	73	32	30	61
Akron, Oh.	--	7	1	--	5
Cleveland, Oh.	2	7	3	1	4
Toledo, Oh.	3	8	13	2	7
Buffalo, N.Y.	11	19	11	6	16
Pittsburgh, Pa.	1	6	3	--	2

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C-10

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Glass Flat, NOIBN, Not Bent 220 UI or less, 45959, STCC 32, Carload Minimum Weight - 70,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	14	26	17	6	24
Grand Rapids, Mi.	27	51	71	25	45
Lansing, Mi.	7	33	38	34	25
Muskegon, Mi.	34	53	76	29	47
Traverse City, Mi.	61	128	54	44	100
Akron, Oh.	--	15	1	--	4
Cleveland, Oh.	2	10	5	1	8
Toledo, Oh.	2	10	5	1	9
Buffalo, N.Y.	42	28	20	16	25
Pittsburgh, Pa.	3	5	2	--	1

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C-11

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Plastic Sheeting Not Woven, Not Printed, Not Cellular, Not further Processed, Then Cut to Length, 77835, STCC 30, Carload Minimum Weight - 50,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	3	25	16	10	17
Grand Rapids, Mi.	28	44	50	14	40
Lansing, Mi.	16	27	30	9	30
Muskegon, Mi.	27	44	69	20	40
Traverse City, Mi.	36	102	44	31	87
Akron, Oh.	--	11	4	--	2
Cleveland, Oh.	1	4	2	2	3
Toledo, Oh.	1	11	7	7	7
Buffalo, N.Y.	9	17	7	8	16
Pittsburgh, Pa.	2	10	1	--	7

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C-12

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Pipe Line Coating, 74990, STCC 29
Carload Minimum Weight - 50,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	10.5	18	13.6	5.4	16.4
Grand Rapids, Mi.	23.7	26.4	43	15	25
Lansing, Mi.	6	18	16	22	16
Muskegon, Mi.	28	31	53	18	30
Traverse City, Mi.	35	81	28	21	55
Akron, Oh.	--	2	2	--	--
Cleveland, Oh.	2	5	4	1.2	2
Toledo, Oh.	3	7	5	--	9
Buffalo, N.Y.	13	20	13	5	16
Pittsburgh, Pa.	2	4	4	--	1

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C-13

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Drugs, Chemicals or Toilet Preparations, 33800, STCC 28, VNX .50 per lb., Carload Minimum Weight - 80,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	7	26	14	6	16
Grand Rapids, Mi.	23	24	52	17	27
Lansing, Mi.	14	22	35	23	22
Muskegon, Mi.	26	49	71	22	44
Traverse City, Mi.	48	119	33	35	84
Akron, Oh.	--	5	3	--	2
Cleveland, Oh.	1	7	3	4	4
Toledo, Oh.	2	12	3	3	10
Buffalo, N.Y.	17	18	17	9	18
Pittsburgh, Pa.	2	6	3	--	3

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C-14

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Pads or Tablets or Blank Books, 76650, STCC 27, Carload Minimum Weight - 70,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	4.7	16.7	28.4	8.9	15.5
Grand Rapids, Mi.	17.4	40.3	39.6	14.4	38.7
Lansing, Mi.	15.2	34.8	32.7	16	32.8
Muskegon, Mi.	16.8	40.3	78.4	20.6	38.7
Traverse City, Mi.	33.3	94.2	40.3	28.4	88.5
Akron, Oh.	--	7.9	3.2	--	4.9
Cleveland, Oh.	1.7	8.2	3.4	4.9	8.2
Toledo, Oh.	--	9.2	5.1	.08	5.7
Buffalo, N.Y.	12.3	15	10.9	6.6	15.1
Pittsburgh, Pa.	2.3	4.4	--	--	8

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C- 15

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Paper, Pulpboard of Fibreboard O/T Corrugated, 75585, STCC 26, Carload Minimum Weight - 50,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	6	22	12	11	18
Grand Rapids, Mi.	23	47	54	13	41
Lansing, Mi.	13	21	31	22	18
Muskegon, Mi.	24	49	72	19	43
Traverse City, Mi.	34	97	47	33	81
Akron, Oh.	--	7	3	--	2
Cleveland, Oh.	2	4	5	2	3
Toledo, Oh.	--	9	6	3	6
Buffalo, N.Y.	3	22	8	6	22
Pittsburgh, Pa.	1	11	--	--	3

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C-16

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Plywood NOIBN, 58410, STCC 24
Carload Minimum Weight - 60,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	4	19	23	10	13
Grand Rapids, Mi.	20	30	43	19	25
Lansing, Mi.	22	24	16	18	21
Muskegon, Mi.	23	32	45	27	27
Traverse City, Mi.	36	12	38	34	52
Akron, Oh.	--	8	4	--	7
Cleveland, Oh.	6	10	3	2	9
Toledo, Oh.	1	7	10	--	2
Buffalo, N.Y.	18	15	9	9	14
Pittsburgh, Pa.	6	7	1	--	--

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C- 17

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Clothing, Breeches, Coveralls, etc. Cotton, 28520, STCC 23, Carload Minimum Weight - 24,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	7	20	14	8	17
Grand Rapids, Mi.	14	32	40	14	27
Lansing, Mi.	14	22	18	22	20
Muskegon, Mi.	22	37	52	17	35
Traverse City, Mi.	36	72	30	29	57
Akron, Oh.	--	7	2	--	6
Cleveland, Oh.	2	7	1	5	3
Toledo, Oh.	4	5	8	2	4
Buffalo, N.Y.	10	19	13	7	14
Pittsburgh, Pa.	2	3	2	--	2

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C-18

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Carpet or Rug Cushions, Cushioning or Lining, 38892, STCC 22, NOIBN, Carload Minimum Weight - 24,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	5	21	13	8	19
Grand Rapids, Mi.	18	30	46	12	28
Lansing, Mi.	10	23	21	8	17
Muskegon, Mi.	25	35	52	16	34
Traverse City, Mi.	35	73	34	28	63
Akron, Oh.	--	5	--	--	3
Cleveland, Oh.	3	6	5	1	5
Toledo, Oh.	2	9	3	1	7
Buffalo, N.Y.	9	16	10	6	16
Pittsburgh, Pa.	1	5	2	--	1

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C-19

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Liquors, Malt; Beer (Eastbound Only), 56850, STCC 20, Carload Minimum Weight - 100,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	2	10	19	9	9
Grand Rapids, Mi.	10	25	39	10	26
Lansing, Mi.	14	24	14	16	25
Muskegon, Mi.	10	29	49	17	29
Traverse City, Mi.	20	53	25	25	51
Akron, Oh.	--	9	6	--	7
Cleveland, Oh.	1	7	--	5	7
Toledo, Oh.	--	8	10	2	2
Buffalo, N.Y.	5	16	9	9	16
Pittsburgh, Pa.	--	9	--	--	2

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

TABLE C-20

ANTICIPATED RAIL RATE INCREASE (PERCENT) AS A CONSEQUENCE OF LAKE MICHIGAN CAR FERRY SERVICE ABANDONMENT

Commodity: Boots, Shoes, Parts, viz: Counters, Heels, Shanks, Soles, etc., 13520 STCC 31, Carload Minimum Weight - 30,000 pounds

BETWEEN	Eau Claire, Wisconsin	Green Bay, Wisconsin	Milwaukee, Wisconsin	Minneapolis/ St. Paul, Minnesota	Oshkosh, Wisconsin
Detroit, Mi.	7	18	11	8	19
Grand Rapids, Mi.	19	32	44	11	28
Lansing, Mi.	10	37	11	21	19
Muskegon, Mi.	21	35	54	17	31
Traverse City, Mi.	33	73	32	30	60
Akron, Oh.	--	7	1	--	4.6
Cleveland, Oh.	2	7	3	1	4
Toledo, Oh.	3	8	13	2	7
Buffalo, N.Y.	11	19	11	6	16
Pittsburgh, Pa.	1	6	3	--	2

Source: Freight Traffic Service Company, Inc., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

APPENDIX D

ESTIMATED RAIL RATE INCREASE WITHOUT THE FERRY SERVICE FOR RAIL SHIPMENTS ON THE ANN ARBOR RAILROAD, 1973

Sources: (a) Traffic flow data were obtained from a tape of all Ann Arbor waybills for 1973 at the Michigan Department of State Highways and Transportation.

(b) Anticipated rail rate changes were obtained from Michigan Freight Traffic Service Co., *Rail Rate Comparison Report*, prepared for the Michigan Department of State Highways and Transportation, Livonia, Michigan, November, 1975.

ORIGIN: AREA 1

Commodity Group (STCC)	Destination Region 10	Region 11	Region 12	Region 13
		(Dollars)		
20	12	-	-	389
24	-	558	-	-
26	-	2,476	-	171
28	10,284	19,283	9,041	31,222
29	-	-	347	53
30	-	67	-	-
32	-	-	95	689
35	-	-	719	4,070
37	-	-	5,168	175,037
40	-	247	-	-
42	-	-	201	80
TOTAL	10,296	22,631	15,571	211,711

ORIGIN: AREA 2

Commodity Group (STCC)	Destination Region 10	Region 11	Region 12	Region 13
		(Dollars)		
20	-	94	-	-
26	-	557	-	-
28	10,776	13,178	-	481
30	-	162	-	-
36	-	-	443	-
37	-	-	19,339	97
40	-	-	66	-
TOTAL	10,776	13,991	19,848	578

ORIGIN: AREA 3

Commodity Group (STCC)	Destination Region 10	Region 11	Region 12	Region 13
		(Dollars)		
40	-	726	28	-
TOTAL	-	726	28	-

ORIGIN: AREA 4

Commodity Group (STCC)	Destination Region 10	Region 11	Region 12	Region 13
		(Dollars)		
20	-	-	1,368	533
24	-	-	-	135
26	-	2,855	26,007	1,190
28	15,376	47,493	38,940	93,594
40	-	-	1,063	-
41	-	-	275	111
TOTAL	15,376	50,348	67,653	95,563

ORIGIN: AREA 5

Commodity Group (STCC)	Destination Region 10	Region 11	Region 12	Region 13
		(Dollars)		
26	-	216	-	-
28	-	1,270	-	-
34	-	-	-	85
TOTAL	-	1,486	-	85

ORIGIN: AREA 6

Commodity Group (STCC)	Destination Region 10	Region 11	Region 12	Region 13
		(Dollars)		
20	-	-	-	27
28	-	775	-	-
37	-	-	927	1,752
TOTAL	-	775	927	1,779

ORIGIN: AREA 7

Commodity Group (STCC)	Destination Region 10	Region 11	Region 12	Region 13
		(Dollars)		
28	-	434	-	-
29	-	-	-	57
30	-	-	-	69
32	29	914	-	3
40	-	371	-	-
TOTAL	29	1,719	-	129

ORIGIN: AREA 8

Commodity Group (STCC)	Destination Region 10	Region 11	Region 12	Region 13
		(Dollars)		
24	-	186	-	-
26	24	-	-	-
34	-	130	-	-
42	16	30	-	-
TOTAL	40	346	-	-

ORIGIN: AREA 9

Commodity Group (STCC)	Destination Region 10	Region 11	Region 12	Region 13
		(Dollars)		
32	-	101	-	-
TOTAL	-	101	-	-

ORIGIN: AREA 10

Commodity Group (STCC)	Destination Region 1	Region 2	Region 3	Region 6	Region 7
			(Dollars)		
20	98	-	44	-	8
24	213	155	-	6	1,714
26	14,343	324	-	-	571
28	2,924	81	-	-	11
30	88	1,122	-	-	-
32	3,292	-	-	-	880
34	32	-	-	14	-
36	79	-	-	-	-
TOTAL	21,069	1,682	44	20	3,184

ORIGIN: AREA 11

Commodity Group (STCC)	Destination Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7	Region 8	Region 9
	(Dollars)								
20	1,377	900	722	153	798	97	603	-	-
24	5,976	70	380	-	-	-	59	-	-
26	38,408	7,487	10,325	639	2,272	2,797	12,318	-	-
30	2,764	-	684	-	-	-	51	-	-
32	4,893	-	-	-	-	-	-	-	-
34	303	-	110	-	-	126	167	44	962
35	112	44	-	-	-	-	-	17	-
39	479	-	-	-	-	-	-	64	-
40	111	-	-	-	-	-	-	-	162
TOTAL	54,423	8,501	12,221	792	3,070	3,020	13,262	61	1,124

ORIGIN: AREA 12

Commodity Group (STCC)	Destination Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7	Region 8	Region 9
	(Dollars								
20	730	-	-	-	-	678	134	-	29
26	2,793	-	-	-	-	-	-	-	-
28	110	-	-	-	84	-	-	-	-
29	-	-	-	-	1,209	-	-	-	-
32	1,048	-	-	-	-	-	-	-	-
35	2,442	-	-	-	-	129	-	-	-
37	-	-	-	-	-	444	-	105	-
41	-	2,245	-	-	-	-	-	-	-
TOTAL	7,123	2,245	-	-	1,293	1,261	134	105	29

ORIGIN: AREA 13

Commodity Group (STCC)	Destination						
	Region 1	Region 2	Region 3	Region 4	Region 5	Region 6	Region 7
	(Dollars)						
20	1,646	-	-	-	-	3,734	1,659
22	109	-	-	-	-	-	-
24	-	-	-	-	-	-	12
26	156	-	-	-	-	42	542
28	73	-	186	-	-	-	61
29	2,134	-	-	-	-	-	-
34	36	-	-	-	-	-	-
36	-	-	-	-	-	-	41
39	128	-	-	-	-	-	-
42	323	-	-	-	-	-	-
TOTAL	4,605	-	186	-	-	3,776	2,315

APPENDIX E

CAR FERRY TRAFFIC BY ORIGIN AND DESTINATION STATES

TABLE E-1

EASTBOUND CAR FERRY TRAFFIC IN 1973 BY ORIGINATING STATES OUTSIDE THE IMMEDIATE HINTERLAND

State/Province	TOTAL REVENUE ($000) GTW	C&O Kewaunee	C&O Manitowoc	C&O Milwaukee	C&O AA	Total	Percent Savings	Amount ($)
Alaska			.7			.7	0	0
Alberta	2.4	67.9	281.9		293.4	645.6	1	6,456
Arizona	2.3					2.3	1	23
Arkansas	3.7				3.1	6.8	0	0
British Columbia	34.0	785.8	784.9	105.7	2,610.4	4,320.8	1	43,208
California	241.9	160.4	52.4	75.4	705.2	1,235.4	1	12,354
Colorado	.6	.7	.6		6.8	8.7	2	174
Idaho	112.0	298.6	38.7	79.4	909.4	1,438.1	2	28,762
Illinois	64.4	1.0	33.1	87.4	15.7	201.6	0	0
Iowa	28.0	2.2	.8	33.2	6.7	70.9	3	2,127
Kansas	4.5				.4	4.9	2	98
Louisiana	7.3			1.4	9.3	18.0	0	0
Manitoba		2.1	20.4		69.9	92.4	2	1,848
Missouri	6.3	3.1	.5	2.5	1.2	13.6	0	0
Montana	28.6	399.4	32.1	22.1	463.7	945.9	3	28,377
Nebraska	11.3	7.2	.8	9.5	14.4	43.2	3	1,296
Nevada	29.1				4.5	33.6	1	336
New Mexico	5.8					5.8	1	58
Oklahoma	2.0				8.8	10.8	1	108
Oregon	108.1	654.1	128.6	151.2	1,548.6	2,590.6	1	25,906
South Dakota	2.8	.7	9.0	20.4	74.0	106.9	3	3,207
Saskatchewan	177.1	253.1	379.0		2,586.4	3,390.6	1	33,906
Texas	14.5		3.0	1.3	2.4	21.2	0	0
Utah				2.0	4.2	6.2	0	0
Washington	64.1	917.6	68.7	91.7	1,572.3	2,714.4	1	27,144
Wyoming	9.1	2.7	28.3	46.7	925.6	1,012.4	2	20,248
Other States	150.5	88.2	127.8	29.3		395.8	0	0
Subtotal	1,120.8	3,644.5	1,991.4	816.4	11,836.4	19,410.4		
States in Immediate Hinterland(*)	884.8	4,075.0	1,937.2	3,467.0	5,081.2	15,445.2		
TOTAL TRAFFIC	2,005.6	7,719.5	3,928.6	4,283.4	16,917.6	34,855.6		235,636
Percent Originating from Outside Hinterland	55.9	47.2	50.7	19.1	70.0	55.7		

(*) Michigan, Minnesota, New York, North Dakota, Ohio, Pennsylvania, Wisconsin
Source: Interstate Commerce Commission, Office of Proceedings, letter dated August 6, 1976 and attachments.

TABLE E-2

WESTBOUND CAR FERRY TRAFFIC IN 1973 BY ORIGINATING STATES OUTSIDE THE IMMEDIATE HINTERLAND

State/Province	TOTAL REVENUE ($000) GTW	C&O Kewaunee	C&O Manitowoc	C&O Milwaukee	C&O AA	Total	Percent Savings	Amount ($)
Alabama		40.6		2.0	12.6	55.2	0	0
Connecticut	4.7	4.1	6.6	.7	6.7	22.8	1	228
District of Columbia		8.0			30.2	38.2	1	382
Delaware				5.6	13.9	19.5	1	195
Florida		126.0	3.3	21.8	85.6	236.7	0	0
Georgia		95.4	181.2	5.4	1,175.2	1,457.2	0	0
Indiana		8.8	32.6	.6	13.4	55.4	0	0
Kentucky	.6	20.3	4.7	46.1	12.8	84.5	0	0
Massachusetts	9.9	11.0	38.0	37.1	31.9	127.9	1	1,279
Maritime Province	123.3				90.5	213.8	1	2,138
Maryland		7.8	3.8	1.0	21.4	34.0	1	340
Maine	118.6	.9	271.6	315.0	224.2	930.3	1	9,303
Mississippi			2.3	1.3	.5	4.1	0	0
New Hampshire		6.5		5.0	16.9	28.4	1	284
New Jersey	2.4	27.0	7.8	6.8	71.9	115.9	1	1,159
North Carolina		36.1	17.3	41.3	51.0	145.7	1	1,457
Ontario	609.2	67.6	221.4	91.3	404.2	1,393.7	2	27,874
Quebec	1,222.8	95.3	175.0	224.1	276.7	1,993.9	2	39,878
Rhode Island			.6	1.4	.7	2.7	1	27
South Carolina		14.6	11.9	12.4	121.8	160.7	0	0
Virginia		16.0	40.6	44.2	72.7	173.5	1	1,735
Vermont	14.2	16.8	1.2	10.3	20.7	63.2	1	632
West Virginia	.6	3.5	4.4	43.7	11.7	63.9	0	0
Other States	454.0	6.4	21.0	3.2	2.4	487.0	0	0
Subtotal	2,577.8	612.6	1,089.5	923.7	2,769.6	7,973.2		
States in Immediate Hinterland(*)	102.2	1,508.7	2,768.5	2,652.6	5,288.4	12,320.4		
TOTAL TRAFFIC	2,680.0	2,121.3	3,858.0	3,576.3	8,058.0	20,293.6		86,911
Percent Originating from Outside Hinterland	96.2	28.9	28.0	25.8	34.4	39.3		

(*) Michigan, Minnesota, New York, North Dakota, Ohio, Pennsylvania, Wisconsin
Source: Interstate Commerce Commission, Office of Proceedings, letter dated August 6, 1976 and attachments.

TABLE E-3

EASTBOUND CAR FERRY TRAFFIC IN 1973 BY TERMINATING STATES OUTSIDE THE IMMEDIATE HINTERLAND

State/Province	TOTAL REVENUE ($000) GTW	C&O Kewaunee	C&O Manitowoc	C&O Milwaukee	C&O AA	Total	Percent Savings	Amount ($)
Alabama		20.8	3.0	1.1	25.2	50.1	0	0
Connecticut	57.3	223.4	43.4	74.0	553.5	951.6	1	9,516
District of Columbia		25.5	1.9		26.9	54.3	1	543
Delaware		26.0	1.4	4.2	116.1	147.7	1	1,477
Florida	2.3	201.6	138.5	92.9	55.0	490.3	0	0
Georgia		79.3	29.7	6.8	26.1	141.9	0	0
Indiana	.8	50.7	23.1	15.0	154.3	243.9	0	0
Kentucky		99.7	24.9	39.6	219.2	383.4	0	0
Massachusetts	60.9	324.0	127.6	112.2	753.2	1,377.9	1	13,779
Maritime Province	59.6			1.1	275.6	336.3	1	3,363
Maryland	4.9	322.0	22.6	173.8	410.4	933.7	1	3,363
Maine	24.7	91.0	15.2	77.8	190.3	399.0	1	3,990
Mississippi		.4				0.4	0	0
New Hampshire	26.9	72.1	30.6	107.0	96.3	332.9	1	3,329
New Jersey	26.2	562.9	173.2	202.2	818.2	1,782.7	1	17,827
North Carolina	23.0	115.7	72.1	33.6	33.6	278.0	1	2,780
Ontario	25.8	20.3	45.6	179.5	256.4	527.6	2	10,552
Quebec	175.1	13.4	69.0	80.6	189.9	528.0	2	10,560
Rhode Island	3.3	23.6	2.2	12.4	77.8	119.3	1	1,193
South Carolina		38.8	48.7	12.7	19.1	119.3	0	0
Tennessee		65.4	25.0	2.9	83.9	177.2	0	0
Virginia		259.4	247.8	283.0	391.1	1,181.3	1	11,813
Vermont	42.9	30.7	35.8	97.0	110.2	316.6	1	3,166
West Virginia	1.2	117.0	32.5	39.6	77.9	268.2	0	0
Other States	12.9	20.4	7.0	2.7		43.0	0	0
Subtotal	1,562.0	2,804.1	1,220.6	1,651.8	4,960.2	12,198.5		
States in Immediate Hinterland(*)	443.6	4,915.6	2,708.0	2,632.5	16,354.6	27,054.3		
TOTAL TRAFFIC	2,005.6	7,719.7	3,923.6	4,284.3	21,314.8	39,252.8		103,225
Percent Terminating in Outside Hinterland	77.9	36.3	31.1	38.6	23.3	31.1		

(*) Michigan, Minnesota, New York, North Dakota, Ohio, Pennsylvania, Wisconsin

Source: Interstate Commerce Commission, Office of Proceedings, letter dated August 6, 1976 and attachments.

TABLE E-4

WESTBOUND CAR FERRY TRAFFIC IN 1973 BY TERMINATING STATES OUTSIDE THE IMMEDIATE HINTERLAND

State/Province	TOTAL REVENUE ($000) GTW	C&O Kewaunee	C&O Manitowoc	C&O Milwaukee	C&O AA	Total	Percent Savings	Amount ($)
Alaska				1.6		1.6	0	0
Alberta		17.7	295.2	10.7		323.6	1	3,236
Arizona	3.9				15.7	19.6	1	196
Arkansas							0	0
British Columbia		10.5	128.5	4.4	61.3	204.7	1	2,047
California	70.9	5.7	16.7	81.1	549.4	723.8	1	7,238
Colorado	1.3	7.0	4.5	50.0	13.4	76.2	2	1,524
Idaho	.6			12.4	19.8	32.8	2	656
Illinois	749.9		10.8	496.9	52.1	1,309.7	0	0
Iowa	22.9	.5	8.9	313.3	9.2	354.8	3	10,644
Kansas	14.1	1.7		14.1	.9	30.8	2	616
Louisiana				4.6		4.6	0	0
Manitoba		2.3	100.5	3.1	30.4	136.3	2	2,726
Missouri	5.2			46.9	3.1	55.2	0	0
Montana	6.5	1.2	7.9	14.3	164.8	194.7	3	5,841
Nebraska	17.0	10.7	.7	18.4	9.0	55.8	3	1,674
Nevada	14.9			6.4		21.3	1	213
New Mexico				1.2	4.1	5.3	1	53
Oklahoma	2.1	.8		6.6		9.5	1	95
Oregon	30.4	52.3	71.6	26.2	483.0	663.5	1	6,635
South Dakota	10.3	17.9	2.9	8.3	30.0	69.4	3	2,082
Saskatchewan		15.7	133.4	7.8	32.8	189.7	1	1,897
Texas	23.4		.6	65.9	2.4	92.3	0	0
Utah	31.3	8.9		37.0	11.0	88.2	0	0
Washington	27.3	57.1	60.6	45.4	407.7	598.1	1	5,981
Wyoming			.7	4.7	3.3	8.7	2	174
Other States	23.7	6.8	277.3	83.7		391.5	0	0
Subtotal	1,055.7	217.1	1,120.9	1,365.2	1,903.4	3,758.9		
States in Immediate Hinterland(*)	1,624.2	1,904.2	2,737.1	2,211.1	4,761.9	13,238.5		
TOTAL TRAFFIC	2,679.9	2,121.3	3,858.0	3,576.3	6,665.3	16,997.4		53,528
Percent Terminating in Outside Hinterland	39.4	10.2	29.1	38.2	28.6	22.1		

(*) Michigan, Minnesota, New York, North Dakota, Ohio, Pennsylvania, Wisconsin
Source: Interstate Commerce Commission, Office of Proceedings, letter dated August 6, 1976 and attachments.

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APPENDIX F

AN ESTIMATION OF THE QUANTITATIVE IMPACT OF THE ST. LAWRENCE SEAWAY ON THE HINTERLAND'S ECONOMY

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AN ESTIMATION OF THE QUANTITATIVE IMPACT OF THE ST. LAWRENCE SEAWAY ON THE HINTERLAND'S ECONOMY [1]

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Abstract. Economists are in agreement that the opening of the St. Lawrence Seaway for commercial navigation has benefited the region's economy. In terms of total population and employment, the region has experienced growth since 1958. This study analyzes the Seaway's contribution to the regional economic growth process.

The approach used in the study relies on total employment data, with a view to isolating factors responsible for producing changes in total employment. The analysis takes as a working hypothesis that an increase in "non-localized" or export employment will increase localized employment by an amount greater than the initial increase. First, one must classify industries as localized (i.e., those serving the area under investigation) or non-localized, and then separate their total employment into localized and non-localized sectors. Secondly, a linear regression is done in order to estimate the influence of non-localized on localized employment. From this estimate the income-employment multiplier is derived.

The investigation showed that the employment-income multipliers of the six states in the Great Lakes region covered by this study ranged between 1.8756 and 2.6380. The revenue earned at the lake ports from Seaway cargo is non-localized income which generates secondary income and employment. Applying the income multipliers to this primary income yields an estimate of nearly $643 million for the total Seaway-cargo generated income in the Great Lakes hinterland. This is an approximation of the primary income earned at the ports plus secondary income derived therefrom, but only a part of the total economic impact of the Seaway. The size of this partial impact lends support to the thesis that the Seaway has had an important positive effect upon the economy of the Great Lakes region. (Key words: Economy; Seaway.)

INTRODUCTION

The St. Lawrence Seaway has been a significant stimulus to the economic expansion of the Great Lakes region.[2] The Seaway provides three types of economic benefits: 1) it reduces transportation costs for mid-American foreign commerce; 2) it generates increased economic activity at the lake ports; and 3) extends the range of mid-American manufacturers' marketing possibilities.

In light of the third point above, economists recognize that an increase in a region's export industries generates an increase in total non-localized employment.[3] This in turn increases a locality's income, which when spent induces a

[1]The authors wish to express their gratitude to the National Science Foundation Sea Grant Program and the University of Wisconsin-Milwaukee Graduate School for facilitating this study.

[2]The Great Lakes region is generally understood to comprise the following states: Wisconsin, Illinois, Indiana, Michigan, Ohio and Minnesota. To these can be added the states of New York and Pennsylvania, which directly border the St. Lawrence Seaway. Nine other states can be regarded as potential Seaway users. They are Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas, Montana, Wyoming and Colorado.

[3]The term "non-localized" employment means employment sustained by an inflow of external receipts. This term is used by Thompson (1959). See also Hildebrand and Mace (1950). "Non-localized" and "localized" are synonymous with "basic" and "non-basic" respectively.

derived and calculable growth in localized employment. The local income-employment multiplier relates the change in the principal exogenous variable, export income, to the derivative change in the locality's income and employment. In order to compute this multiplier one must isolate the region's primary export industries and then analyze the relationship between the change in total regional income and employment as a result of changes in the region's export-industry base.

This study considers the St. Lawrence Seaway to be one of the most important factors in an increased mid-American export trade. Hence the calculation of the regional income-employment multipliers is a rough approximation of the economic impact that the Seaway has on its hinterland's economy. Realizing that these multipliers are, at best, an indirect approximation of the Seaway's economic impact, this paper applies the multipliers to dollar income per ton of Seaway cargo traffic handled at the lake ports to estimate the annual impact of the Seaway upon regional income and employment (Schenker, 1970).

THE INCOME-EMPLOYMENT MULTIPLIER HYPOTHESIS

The Keynesian analytical framework recognizes four principal types of income-generating activities: a) Production of goods and services for consumption; b) Private and public investment in real capital; c) Local government expenditures on current account; and d) Exports of goods and services.

Hence the familiar national income equation of $Y = C+I+G+(X-M)$, where

Y = total national income,

C = consumption expenditure,

I = investment expenditure,

G = government expenditure, and

$(X-M)$ = export earnings.

Keynesian analysis sees both investment and exports as exogenous, income-determining forces, but the United States' high degree of self-sufficiency results in fluctuations in investment expenditures which outweigh the amplitude of change due to exports (Thompson, 1965). Multipliers are computed to estimate the change in incoming resulting from changes in exogenous variables.

The economic base theory is an application of Keynesian economics to the small area, open economy, differing chiefly in that the principal exogenous variable is now exports (Schenker, 1967). A distinction is made between basic industries that provide export goods and services and service industries that provide goods and services to regional residents. Such a classification assumes regions grow primarily because of their export industries.

One may now rewrite the Keynesian income equation, applied to regional analysis, as:

$$Y = aC + bI + cG + g(X-M)$$

where the parameters a, b, c, and g represent the regional income generated for each amount of expenditure in each category. Setting consumption as a function of income

$$C = kY$$

where k equals the regional propensity to consume, the equation for income

may be rewritten as

$$Y = akY + gX$$

where investment and current government expenditures are autonomously determined. Solving for Y we find

$$Y = \frac{gX}{(1-ak)}$$

where the factor $\frac{1}{(1-ak)}$ is the regional multiplier (Schenker, 1967).

This is a short run static equation which can be dynamized to account for such leakages as (a) induced regional imports, (b) savings from the increment of income, (c) decrease in public relief expenditure associated with an increase in total employment and (d) increased tax payments to external fiscal bodies. The relationship in the long run becomes

$$Y = \frac{gX}{(1-ak-bk'-ck'')}$$

where the long run multiplier is

$$\frac{1}{(1-ak-bk'-ck'')}$$

where k' equals the propensity to invest and k'' equals the propensity of regional government to spend (Schenker, 1967).

Deriving the income-employment multiplier, as Thompson (1959, p. 66) has pointed out, is complicated by estimating the induced leakages. Secondly, in assuming the equality of the income and employment multiplier, we are in fact referring to a short run analysis (Keynes, 1936; Hansen, 1953).

Tables 1 and 2 indicate relevant aggregate population and employment data for the Great Lakes region for the period under investigation. However, the aggregate data are of limited use in this investigation. In order to derive the income-employment multiplier one must have detailed statistical information relating to regional income, expenditures and money flows. Since these data are scanty, another line of analysis is adopted.

First, a region's industries are divided into two categories: those primarily serving the community itself and those producing for external markets. Secondly, it was necessary to separate non-localized employment from localized employment. Lastly, changes in non-localized employment were correlated to changes in localized employment to derive the income-employment multiplier for the export industries in a given region.

TECHNIQUES OF ISOLATING LOCALIZED EMPLOYMENT FROM NON-LOCALIZED EMPLOYMENT BY INDUSTRY

The statistical technique of separating non-localized employment from localized employment is far from perfect, especially when analyzing a large area over a long period of time. First one must classify industries as non-localized and localized, then isolate the total employment associated with each industry. In this manner one can analyze the change in local income and employment as influenced by changes in the non-localized sector.

For example, this method seeks to identify the amount of employment associated with goods and services produced in a given region and marketed

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TABLE 1. Estimated population and employment (in thousands) 1958-1966.*

	WISCONSIN			MICHIGAN			ILLINOIS			OHIO			INDIANA			MINNESOTA		
Year	Population	Average monthly employment	%	Population	Average monthly employment	%	Population	Average monthly employment	%	Population	Average monthly employment	%	Population	Average monthly employment	%	Population	Average monthly employment	%
1958	3,843	1423.9	37.1	7,667	2436.2	31.8	9,886	3677.5	37.2	9,599	3272.1	34.1	4,583	1566.0	34.2	3,313	1190.6	35.9
1959	3,891	1465.0	37.7	7,767	2526.4	32.5	9,986	3756.0	37.6	9,671	3372.5	34.9	4,613	1625.0	35.2	3,366	1208.6	35.9
1960	3,959	1473.9	37.2	7,833	2570.7	32.8	10,084	3771.0	37.4	9,737	3397.2	34.9	4,673	1650.4	35.3	3,422	1225.8	35.8
1961	3,989	1452.9	36.4	7,885	2463.9	31.2	10,115	3733.4	36.9	9,871	3286.3	33.3	4,724	1621.4	34.3	3,458	1220.0	35.3
1962	4,014	1473.2	36.7	7,923	2543.0	32.1	10,260	3798.0	37.0	9,951	3325.2	33.4	4,725	1667.3	35.3	3,493	1246.6	35.7
1963	4,059	1491.5	36.8	8,036	2618.4	32.6	10,369	3834.0	37.0	10,020	3360.6	33.5	4,780	1697.7	35.5	3,507	1258.8	35.9
1964	4,100	1516.9	37.0	8,161	2711.1	33.2	10,538	3913.4	37.1	10,124	3415.1	33.7	4,832	1730.7	35.8	3,529	1277.1	36.2
1965	4,140	1562.7	37.8	8,317	2844.9	34.2	10,641	4049.4	38.2	10,241	3541.4	34.6	4,893	1798.1	36.7	3,562	1309.7	36.8
1966	4,161	1607.2	38.6	8,374	2964.5	35.4	10,722	4255.8	39.7	10,305	3697.7	35.9	4,918	1886.0	38.3	3,576	1354.8	37.9
Annual pop. growth rate:	0.8%			1.1%			0.3%			1.4%			0.2%			0.8%		
Annual employment rate of increase:	1.0%			1.6%			1.4%			1.2%			1.5%			1.0%		

*Sources: 1. Statistical Abstract of the United States.
2. Agricultural Statistics of the United States.
3. Employment and Earnings Statistics for States and Areas 1939-1966.

TABLE 2. United States (average monthly employment in thousands) by industry, 1958-1966.

Industry	1958	1959	1960	1961	1962	1963	1964	1965	1966
MANUFACTURING:									
Ordnance and accessories*	158.1	203.4	220.0	244.2	264.2	265.5	243.9	226.0	255.6
Lumber and wood products	615.0	658.8	626.8	582.9	589.3	592.6	604.2	610.1	621.8
Furniture and fixtures	360.8	385.0	383.0	367.5	385.1	389.9	405.9	429.1	456.2
Stone, clay and glass products	562.4	604.0	604.0	582.0	592.0	600.8	613.8	627.4	641.3
Primary metal industries	1,153.5	1,182.6	1,231.2	1,142.7	1,165.6	1,172.2	1,233.2	1,295.6	1,326.4
Fabricated metal products	1,076.9	1,122.5	1,135.3	1,084.5	1,127.7	1,150.1	1,189.2	1,268.3	1,351.5
Machinery	1,362.4	1,452.1	1,479.0	1,418.6	1,493.2	1,529.3	1,609.6	1,725.8	1,867.7
Electrical equipment and supplies	1,249.0	1,396.4	1,467.1	1,473.3	1,567.0	1,553.9	1,554.3	1,658.1	1,892.9
Transportation equipment	1,594.6	1,635.0	1,568.9	1,448.6	1,547.0	1,609.7	1,604.3	1,737.9	1,905.8
Instruments and related products	323.8	345.3	354.3	347.4	358.7	364.8	369.9	386.8	426.5
Miscellaneous manufacturing	373.0	387.7	389.9	378.2	389.6	386.8	397.6	421.2	440.2
Food and kindred products	1,772.8	1,789.6	1,790.0	1,775.2	1,763.0	1,752.0	1,750.4	1,752.0	1,760.8
Tobacco manufacturing	94.5	94.5	94.0	90.7	90.5	88.6	90.2	86.6	83.7
Textile mill products	918.8	945.7	924.4	893.4	902.3	885.4	892.0	921.3	950.7
Apparel and related products	1,171.8	1,225.9	1,233.2	1,214.5	1,263.7	1,282.8	1,302.5	1,353.6	1,395.6
Paper and allied products	564.1	587.2	601.1	601.3	614.4	618.5	625.5	640.0	670.7
Printing, publishing and allied industries	872.6	888.5	911.3	917.3	926.4	930.6	951.5	981.0	1,026.2
Chemicals and allied products	794.1	809.2	828.2	828.2	848.5	865.3	878.6	906.4	954.4
Petroleum refining and related industries	223.8	215.5	211.9	201.9	195.3	188.7	183.9	182.0	182.8
Rubber and miscellaneous plastic products	344.3	372.7	379.0	375.3	408.4	418.5	436.0	471.5	513.4
Leather and leather products	359.2	374.0	363.4	358.2	360.7	349.2	347.6	350.9	357.2

Table 2 continued

NON-MANUFACTURING									
Contract construction	2,778	2,960	2,885	2,816	2,902	2,963	3,050	3,181	3,281
Transportation, communication and public utilities	3,976	4,011	4,004	3,903	3,906	3,903	3,951	4,033	4,137
Wholesale trade	2,848	2,946	3,004	2,993	3,056	3,104	3,189	3,317	3,459
Retail trade	7,902	8,182	8,388	8,344	8,511	8,675	8,971	9,366	9,761
Services and miscellaneous	6,806	7,130	7,423	7,664	8,028	8,325	8,709	9,098	9,562
Finance, insurance and real estate	2,519	2,594	2,669	2,731	2,800	2,877	2,957	3,019	3,086
Government	7,839	8,083	8,353	8,594	8,890	9,225	9,596	10,091	10,850
SUB-TOTAL	50,612	52,581	53,522	53,570	54,946	56,067	57,698	60,138	63,236
MINING	751	732	712	672	650	635	634	632	628
SUB-TOTAL	51,363	53,313	54,234	54,042	55,596	56,702	58,332	60,770	63,864
FARM	7,503	7,342	7,057	6,919	6,700	6,518	6,110	5,610	5,259
GRAND TOTAL	58,866	60,655	61,291	60,961	62,296	63,220	64,442	66,380	69,123

*Including miscellaneous manufacturing

outside. This is done by treating export sales as a percentage of total sales. Thus, if an industry's total employment is 100 and its export sales for a given period (e.g. a month or a year) are 40% of total sales of that period, then it is inferred that basic employment for that industry is 40% and non-basic employment is 60%. Similar observations are made for each industry in a region so that consequently basic employment and non-basic employment aggregates can be obtained. Setting the employment multiplier as 1/Basic Employment/Total Employment, we get a value which represents the multiplier coefficient. This method has the advantage of being simple and useful for analysis of short periods (Schenker, 1967; Gadzikowski, 1963).

A second approach modifies an earlier one adopted by Daly (1940) and is used by Hildebrand and Mace (1950) in their estimation of the employment-multiplier for Los Angeles County. In order to isolate the export from localized industries, they analyzed the marketing areas of each industry. This was accomplished by calculating a location quotient which ". . . is a measure of the relative concentration of employment in a given industry in one area (the subject economy) compared with another area (the benchmark economy)" (Hildebrand and Mace, 1950, p.243). They go on to say: "The location quotient is the numerical equivalent of a fraction whose numerator is employment in a given industry in the subject economy relative to total employment in the subject economy and whose denominator is employment in the given industry in the benchmark economy relative to total employment in the benchmark economy" (p. 243). The algebraic statement of the location quotient is:

$$q = \frac{ns}{Ns} \div \frac{nB - ns}{NB - Ns}$$

where q = location quotient,

ns = a given industry's employment in the subject economy,

nB = the same industry's employment in the benchmark economy,

NB = total employment in the benchmark economy, and

Ns = total employment in the subject economy.

A location quotient of 1.00 means no greater relative specialization in the benchmark economy. Values below 1.00 indicate specialization in the benchmark economy; those above 1.00 indicate specialization in the subject economy.

Hildebrand and Mace (1950) selected Los Angeles County as the subject economy. Four benchmark economies were used: 1) Los Angeles County itself, 2) Southern California, 3) the West, and 4) the United States as a whole. Each benchmark economy represented a market area. Thus, for an industry in the subject economy to be classed as serving the United States market, the three location quotients using respectively 2), 3) and 4) as benchmark economies must all show values exceeding 1.00. By this approach it was possible to tentatively group an industry as non-localized if any one, two, or all three external markets were being served. Industries having 1.00 or less than 1.00 for their location quotients were ranked in accordance with their respective logarithmic equivalents. Hildebrand and Mace (1950) used the numerical equivalent of 1.508 as a final line of separation, so that industries appearing below 1.508 would come under the localized groups.

The third approach prescribed by Thompson (1959) is an adaptation of Daly's (1940) and Hildebrand and Mace's (1950). Thompson considered Lancaster County, Nebraska, as the subject economy relative to 1) the 13 counties of Southeast Nebraska, 2) the state of Nebraska, and 3) the United States.

TABLE 3. Six Great Lakes states* (average monthly employment in thousands) by industry, 1958-1966.

Industry	1958	1959	1960	1961	1962	1963	1964	1965	1966
MANUFACTURING:									
Ordnance and accessories	26.5	24.4	22.8	23.6	26.8	28.0	26.8	26.7	31.8
Lumber and wood products	67.0	71.1	68.2	62.8	64.1	64.5	66.3	68.4	71.2
Furniture and fixtures	100.2	103.0	100.8	96.1	98.5	97.8	98.5	103.4	109.9
Stone, clay and glass products	150.4	157.1	149.0	142.4	142.5	143.0	144.3	147.1	151.4
Primary metal industries	444.8	473.9	486.7	449.9	467.5	474.3	501.8	533.1	548.4
Fabricated metal products	425.9	456.8	462.5	427.2	452.3	468.4	489.7	526.3	556.5
Machinery	613.8	666.2	665.2	626.5	665.7	690.8	732.4	789.4	855.0
Electrical equipment and supplies	440.4	487.7	491.6	501.8	492.7	501.2	520.6	586.6	616.9
Transporation equipment	592.7	648.9	641.7	575.0	618.4	642.6	680.9	719.7	787.3
Instruments and related products	52.5	55.9	58.7	56.4	58.0	58.8	59.7	62.8	70.1
Miscellaneous manufacturing	126.7	132.2	133.2	127.1	129.1	129.2	132.2	133.5	145.1
Food and kindred products	455.9	448.3	445.4	436.4	430.2	425.2	425.3	428.6	426.4
Tobacco manufacturing	—	—	—	—	—	—	—	—	—
Textile mill products Apparel and related products	135.7	142.3	140.4	133.6	136.0	135.4	135.6	140.4	140.9
Paper and allied products	157.2	161.9	175.2	175.3	180.2	182.9	185.9	190.9	196.2
Printing, publishing and allied industries	244.8	246.4	251.7	252.7	252.7	255.7	261.3	270.8	283.3
Chemicals and allied products Petroleum refining and related industries	211.2	211.9	212.6	208.6	209.5	209.9	213.4	219.5	233.3
Rubber and miscellaneous plastics products	128.7	138.2	136.7	130.4	141.1	145.9	152.3	164.3	175.4
Leather and leather products	48.4	49.4	47.9	46.3	45.7	44.2	43.5	43.5	43.2
NON-MANUFACTURING:									
Contract construction	587.3	586.9	583.8	556.9	537.2	543.9	567.4	612.6	647.2
Transportation, communication and public utilities	882.4	885.0	886.8	841.3	840.8	836.7	840.2	859.6	881.7
Wholesale trade	625.0	639.5	653.3	651.6	660.8	670.0	685.8	711.3	741.8
Retail trade	1,823.7	1,876.1	1,857.9	1,896.4	1,919.0	1,950.8	2,019.0	2,119.9	2,227.8
Services and miscellaneous	1,436.4	1,494.3	1,541.6	1,571.7	1,629.5	1,681.9	1,748.0	1,834.0	1,930.3
Finance, insurance and real estate	507.1	521.3	539.0	504.7	563.9	573.0	583.1	595.6	610.7
Government	1,566.7	1,599.5	1,650.0	1,701.7	1,753.2	1,813.5	1,877.0	1,974.2	2,109.4
MINING	96.9	92.9	96.1	88.6	86.3	82.8	83.3	83.5	82.1
FARM	1,587.0	1,548.0	1,486.0	1,453.0	1,406.0	1,371.0	1,292.0	1,180.0	1,099.0
	13,566.3	13,953.5	14,089.0	13,777.9	14,053.3	14,261.0	14,564.9	15,106.2	15,766.0

*Wisconsin, Michigan, Illinois, Ohio, Indiana and Minnesota

Accordingly, three location quotients, q_1, q_2, and q_3 were computed. If q_1 was higher than q_2 and q_3, then the 13 counties of Southern Nebraska were regarded as the benchmark economy. Or, where q_2 possessed the highest value, the state of Nebraska was taken as the benchmark for that industry classification.

Thompson's method now differed from that of Hildebrand and Mace. In order to estimate the percentage of employment in every industry classification which was sustained by receipts from a source external to the subject economy, Lancaster County, he devised a specialization ratio whereby total employment in an industry could be divided into two components: a) employment sustained by external receipts, and b) employment expected in that industry if it were self-sufficient relative to the benchmark economy. The specialization ratio stated mathematically is:

$$\text{specialization ratio} = \frac{ns - \frac{nB + ns}{NB + Ns}(Ns)}{ns}$$

where Ns and NB refer to total employment in the subject and benchmark economies, respectively, and ns and nB refer to industry employment in the subject and benchmark economies. The use of this method produced specialization ratios for each of the industries included in the investigation. The ratios were then used to separate monthly employment estimates provided by the 1950 Census data, from 1953 through 1955, into the localized and non-localized categories by industry.

The Thompson approach has been adopted for our analysis (Tables 3 through 9). First, two sets of location quotients for each state in the Great Lakes region were computed: the first set (q_1) used the United States as the benchmark economy; the second set (q_2) used the Great Lakes states as the benchmark economy. The results showed that the first set of quotients (q_1) gave superior results. Only for some Wisconsin industries did the second set of location quotients (q_2) improve upon the first. Therefore the primary market orientation of each state's industries was taken as the United States. Table 3 gives U. S. average monthly employment data for the period under investigation.

A location quotient exceeding the value of 1.00 indicated that the industry was an export industry whose market area was the national market. *A priori* heavy equipment industries were thought to produce for a national market. The computation of their location quotients revealed that this indeed was the case. It was also found that the location quotients in the non-manufacturing sector hovered about the value 1.00. Due to a lack of consistent data it was not possible to compute a set of location quotients for this sector. Given these circumstances, attention was focused on the manufacturing sector alone.

The next step was to compute the specialization ratio from the location quotient. A location quotient of 1.00 or less would yield a specialization ratio of 0.000. Such a specialization ratio implies that employment was of a localized nature. A specialization ratio of 0.50 would mean that 50% of the industry's total employment was sustained by external receipts. The specialization ratios, computed for each state's manufacturing industries, were used to separate total employment into localized employment (Y_{LOC}) and non-localized employment (Y_{NL}). These estimates were then used to analyze changes in localized and non-localized employment for a nine-year period, 1958-1966.

For example, the estimates of localized and non-localized employment, plus the data used for computing the multiplier, are shown for Wisconsin in Tables 4-9 for the period in question. Relating Y_{LOC} to Y_{NL} by simple, classical linear regression technique, the value b_{yx} represents the regression

TABLE 4. Wisconsin (average monthly employment in thousands) by industry 1958-1966.

Industry	1958	1959	1960	1961	1962	1963	1964	1965	1966
MANUFACTURING:									
Ordnance and accessories	11.6	9.6	8.1	8.5	9.3	10.0	9.9	10.1	10.8
Lumber and wood products	16.5	17.4	16.3	15.1	15.5	16.0	16.6	16.8	17.2
Furniture and fixtures	9.1	9.2	8.2	7.2	7.1	6.8	7.0	7.3	7.9
Stone, clay and glass products	6.1	6.4	6.5	6.6	6.6	6.7	6.9	7.1	7.7
Primary metal industries	23.5	26.4	24.6	23.7	25.4	25.6	26.7	29.0	31.4
Fabricated metal products	30.8	33.1	33.8	32.3	34.1	34.6	35.7	38.7	40.5
Machinery	83.6	87.7	86.5	82.0	87.4	92.0	97.5	106.2	113.6
Electrical equipment and supplies	44.5	51.3	54.9	53.2	55.1	53.4	53.5	55.5	58.0
Transportation equipment	34.5	45.2	48.4	39.0	44.7	46.7	43.6	45.6	49.7
Instruments and related products	4.8	4.9	4.4	4.2	4.3	5.0	5.9	6.1	6.8
Miscellaneous manufacturing (durables)	—	—	—	—	—	—	—	—	—
Food and kindred products	62.9	61.9	62.1	61.0	59.4	58.6	58.2	58.3	58.5
Tobacco manufacturing	—	—	—	—	—	—	—	—	—
Textile mill products	6.6	7.2	6.9	6.5	6.5	6.3	6.5	6.7	6.7
Apparel and related products	6.8	7.1	7.2	7.1	7.7	7.6	7.6	8.1	8.1
Paper and allied products	38.9	39.5	39.9	40.6	41.0	41.0	41.3	41.6	42.6
Printing, publishing and allied industries	21.1	21.3	21.8	22.0	21.6	21.8	22.4	22.9	24.2
Chemicals and allied industries	6.0	6.1	6.4	6.4	6.5	6.6	6.6	6.8	8.1
Petroleum refining and related industries	—	—	—	—	—	—	—	—	—
Rubber and miscellaneous plastics products	6.8	7.5	6.9	6.6	7.2	6.8	7.6	8.7	9.6
Leather and leather products	17.1	17.4	17.1	16.3	15.9	15.4	15.5	15.7	15.7
Other nondurables	0.6	0.6	0.4	0.6	0.5	0.4	0.5	0.6	0.4
NON-MANUFACTURING:									
Contract construction	52.0	53.4	56.0	55.7	53.6	55.0	56.7	59.6	64.6
Transportation, communication and public utilities	73.9	74.3	74.5	71.8	71.7	72.2	73.4	74.9	76.5
Wholesale trade	51.5	53.3	54.8	55.1	55.4	56.5	58.6	60.4	63.7
Retail trade	177.3	183.4	189.1	189.6	191.0	194.8	201.9	212.6	224.2
Services and miscellaneous	133.5	139.8	144.3	148.0	154.0	160.5	167.5	177.1	187.6
Finance, insurance and real estate	41.7	43.6	45.7	47.1	47.9	48.9	50.1	51.5	53.1
Government	149.7	155.0	163.2	170.4	174.6	181.7	190.4	201.0	215.2
SUB-TOTAL	1,111.3	1,162.5	1,188.1	1,176.5	1,204.1	1,230.9	1,268.2	1,328.9	1,392.5
MINING	3.6	3.5	3.8	3.4	3.1	2.6	2.7	2.8	2.7
SUB-TOTAL	1,114.9	1,166.0	1,191.9	1,179.9	1,207.2	1,233.5	1,270.9	1,331.7	1,395.2
FARM	309	299	282	273	266	258	246	231	212
GRAND TOTAL	1,423.9	1,465.0	1,473.9	1,452.9	1,473.2	1,491.5	1,516.9	1,562.7	1,607.2

TABLE 5. Wisconsin: Location quotients (q_i) by industry, 1958-1966.

Industry	1958	1959	1960	1961	1962	1963	1964	1965	1966
MANUFACTURING:									
Ordnance and accessories	0.888	0.666	0.555	0.500	0.600	0.600	0.600	0.666	0.600
Lumber and wood products	1.100	1.100	1.100	1.111	1.111	1.111	1.111	1.111	1.250
Furniture and fixtures	1.000	1.000	0.833	0.666	0.666	0.666	0.666	0.666	0.666
Stone, clay and glass products	0.444	0.400	0.444	0.444	0.444	0.444	0.444	0.444	0.444
Primary metal industries	0.842	0.947	0.800	0.888	0.944	0.944	0.894	0.947	1.000
Fabricated metal products	1.166	1.222	1.222	1.294	1.352	1.277	1.277	1.333	1.315
Machinery	2.636	2.565	2.521	2.545	2.565	2.652	2.666	2.791	2.800
Electrical equipment and supplies	1.550	1.590	1.608	1.565	1.541	1.458	1.521	1.458	1.333
Transportation equipment	0.888	1.153	1.280	1.130	1.250	1.240	1.166	1.115	1.115
Instruments and related products	0.600	0.600	0.400	0.400	0.333	0.600	0.600	0.600	0.666
Miscellaneous manufacturing	—	—	—	—	—	—	—	—	—
Food and kindred products	1.517	1.448	1.500	1.464	1.428	1.444	1.461	1.423	1.440
Tobacco manufacturing	—	—	—	—	—	—	—	—	—
Textile mill products	0.266	0.266	0.266	0.285	0.285	0.285	0.285	0.285	0.307
Apparel and related products	0.200	0.200	0.200	0.200	0.250	0.250	0.250	0.250	0.250
Paper and allied products	3.000	2.888	3.000	3.000	3.000	3.000	3.000	2.888	2.888
Printing, publishing and allied industries	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.071
Chemicals and allied products	0.307	0.307	0.307	0.307	0.307	0.307	0.307	0.307	0.357
Petroleum, refining and related industries	—	—	—	—	—	—	—	—	—
Rubber and miscellaneous plastics products	0.800	0.833	0.666	0.666	0.666	0.666	0.833	0.714	0.714
Leather and leather products	2.400	1.833	2.200	2.200	2.000	2.000	2.000	2.000	1.800
NON-MANUFACTURING									
Contract construction	0.765	0.734	0.787	0.826	0.800	0.765	0.787	0.791	0.851
Transportation, communication and public utilities	0.761	0.757	0.769	0.765	0.761	0.774	0.785	0.770	0.783
Wholesale trade	0.750	0.750	0.755	0.755	0.755	0.755	0.775	0.760	0.780
Retail trade	0.935	0.925	0.934	0.948	0.948	0.948	0.956	0.964	0.985
Services and miscellaneous	0.801	0.805	0.801	0.801	0.806	0.810	0.814	0.824	0.834
Finance, insurance and real estate	0.674	0.674	0.720	0.711	0.711	0.711	0.717	0.711	0.733
Government	0.789	0.789	0.808	0.829	0.825	0.828	0.838	0.842	0.847
MINING	0.153	0.166	0.181	0.181	0.200	0.100	0.100	0.111	0.111
FARM	1.736	1.728	1.690	1.684	1.714	1.702	1.741	1.792	1.770

TABLE 6. Wisconsin location quotients (q_2) by industry, 1958-1966.

Industry	1958	1959	1960	1961	1962	1963	1964	1965	1966
MANUFACTURING:									
Ordnance and accessories	6.672	5.551	4.733	4.795	4.482	4.785	5.054	5.295	4.534
Lumber and wood products	2.790	2.767	2.689	2.685	2.725	2.828	2.879	2.829	2.808
Furniture and fixtures	0.852	0.835	0.757	0.687	0.663	0.639	0.658	0.660	0.682
Stone, clay and glass products	0.360	0.362	0.391	0.412	0.415	0.421	0.431	0.440	0.472
Primary metal industries	0.476	0.503	0.457	0.472	0.491	0.488	0.483	0.499	0.535
Fabricated metal products	0.665	0.666	0.675	0.694	0.696	0.683	0.676	0.688	0.691
Machinery	1.345	1.292	1.279	1.278	1.291	1.315	1.321	1.348	1.350
Electrical equipment and supplies	0.959	1.002	1.076	1.006	1.076	1.021	0.985	0.928	0.914
Transportation equipment	0.527	0.638	0.698	0.617	0.665	0.671	0.588	0.587	0.594
Instruments and related products	0.860	0.819	0.693	0.683	0.683	0.796	0.942	0.933	0.846
Miscellaneous manufacturing	—	—	—	—	—	—	—	—	—
Food and kindred products	1.365	1.366	1.387	1.379	1.368	1.369	1.364	1.366	1.401
Tobacco manufacturing	—	—	—	—	—	—	—	—	—
Textile mill products	0.934	0.953	0.955	0.962	0.995	0.980	0.998	1.023	1.034
Apparel and related products									
Paper and allied products	2.804	2.751	2.525	2.559	2.516	2.473	2.457	2.418	2.445
Printing, publishing and allied industries	0.804	0.806	0.812	0.809	0.798	0.798	0.806	0.801	0.823
Chemicals and allied products	0.249	0.253	0.266	0.268	0.273	0.278	0.275	0.277	0.316
Petroleum, refining and related industries									
Rubber and miscellaneous plastics products	0.476	0.489	0.455	0.452	0.459	0.418	0.452	0.488	0.510
Leather and leather products	4.670	4.637	4.754	4.613	4.572	4.587	4.771	4.898	5.031
NON-MANUFACTURING									
Contract construction	0.828	0.853	0.908	0.942	0.946	0.963	0.955	0.935	0.977
Transportation, communication and public utilities	0.779	0.781	0.785	0.791	0.796	0.809	0.823	0.828	0.837
Wholesale trade	0.766	0.775	0.784	0.774	0.782	0.788	0.804	0.805	0.843
Retail trade	0.918	0.924	1.031	0.942	0.943	0.950	0.987	0.967	0.986
Services and miscellaneous	0.874	0.880	0.884	0.882	0.891	0.903	0.912	0.927	0.948
Finance, insurance and real estate	0.764	0.778	0.793	0.773	0.793	0.799	0.808	0.821	0.839
Government	0.901	0.915	0.939	0.944	0.944	0.953	0.971	0.983	1.000
MINING	0.329	0.334	0.352	0.338	0.318	0.278	0.288	0.301	0.299
FARM	2.063	2.041	2.005	2.193	1.993	1.984	2.022	2.111	2.105

TABLE 7. Wisconsin location quotients (q_3) by industry, 1958-1966.

Industry	1958	1959	1960	1961	1962	1963	1964	1965	1966
MANUFACTURING:									
Ordnance and accessories	1.100	0.942	0.810	0.832	0.804	0.836	0.889	0.880	0.737
Lumber and wood products	1.911	1.788	1.705	1.652	1.626	1.686	1.723	1.639	1.629
Furniture and fixtures	0.513	0.493	0.433	0.377	0.366	0.353	0.353	0.341	0.349
Stone, clay and glass products	0.264	0.265	0.279	0.290	0.307	0.312	0.318	0.323	0.349
Primary metal industries	0.293	0.336	0.289	0.292	0.307	0.308	0.302	0.309	0.329
Fabricated metal products	0.906	0.902	0.908	0.904	0.919	0.867	0.861	0.884	0.896
Machinery	1.928	1.808	1.817	1.856	1.860	1.890	1.900	1.952	1.926
Electrical equipment and supplies	0.644	0.662	0.703	0.703	0.656	0.628	0.595	0.547	0.525
Transportation equipment	0.471	0.548	0.614	0.553	0.585	0.600	0.578	0.568	0.590
Instruments and related products	1.428	1.325	1.072	1.000	0.973	1.117	1.347	1.434	1.505
Miscellaneous manufacturing	—	—	—	—	—	—	—	—	—
Food and kindred products	1.426	1.413	1.405	1.401	1.404	1.401	1.410	1.421	1.532
Tobacco manufacturing	—	—	—	—	—	—	—	—	—
Textile mill products	1.054	1.057	1.074	1.092	1.132	1.106	1.117	1.175	1.150
Apparel and related products									
Paper and allied products	3.757	3.653	3.466	3.488	3.415	3.431	3.415	3.303	3.424
Printing, publishing and allied industries	1.154	1.163	1.147	1.111	1.068	1.065	1.065	1.054	1.064
Chemicals and allied products	0.193	0.202	0.213	0.218	0.225	0.230	0.233	0.240	0.286
Petroleum refining and related industries									
Rubber and miscellaneous plastics products	0.437	0.437	0.409	0.396	0.370	0.336	0.358	0.373	0.390
Leather and leather products	—	—	—	—	—	—	—	—	—
NON-MANUFACTURING									
Contract construction	0.874	0.977	1.105	1.036	1.061	1.030	0.940	0.929	0.958
Transportation, communication and public utilities	0.871	0.871	0.882	0.890	0.907	0.921	0.937	0.929	0.942
Wholesale trade	0.965	0.992	1.004	0.992	0.992	1.005	1.022	1.031	1.063
Retail trade	0.930	0.942	0.952	0.957	0.953	0.952	0.970	0.987	1.007
Services and miscellaneous	1.201	1.137	1.150	1.141	1.150	1.167	1.175	1.193	1.229
Finance, insurance and real estate	0.903	0.879	0.899	0.894	0.895	0.896	0.901	0.917	0.938
Government	0.941	0.953	0.969	0.980	0.981	0.986	0.991	0.996	0.991
MINING	0.403	0.391	0.438	0.395	0.373	0.325	0.357	0.408	0.421
FARM	1.459	1.455	1.442	1.430	1.461	1.476	1.517	1.592	1.595

TABLE 8. Wisconsin: Specialization ratios of selected industries.

Industry	Benchmark Economy	Specialization ratios								
		1958	1959	1960	1961	1962	1963	1964	1965	1966
MANUFACTURING:										
Ordnance and accessories	6 Gt. Lakes States	0.761	0.734	0.707	0.707	0.699	0.708	0.718	0.728	0.701
Lumber and wood products	6 Gt. Lakes States	0.575	0.571	0.562	0.562	0.567	0.580	0.584	0.580	0.579
Furniture and fixtures	United States	0.042	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Stone, clay and glass products	United States	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Primary metal industry	United States	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.018
Fabricated metal products	United States	0.159	0.181	0.193	0.204	0.217	0.220	0.218	0.229	0.226
Machinery	United States	0.607	0.601	0.589	0.589	0.597	0.609	0.613	0.619	0.618
Electrical equipment and supplies	United States	0.321	0.343	0.348	0.349	0.329	0.316	0.317	0.299	0.244
Transportation equipment	United States	0.000	0.128	0.223	0.117	0.183	0.189	0.137	0.106	0.111
Instruments and related products	6 Gt. Lakes States	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Miscellaneous manufacturing	—	—	—	—	—	—	—	—	—	—
Food and kindred products	United States	0.319	0.302	0.307	0.307	0.298	0.295	0.294	0.295	0.302
Tobacco manufacturing	—	—	—	—	—	—	—	—	—	—
Textile mills products Apparel and related products	6 Gt. Lakes States	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.285	0.035
Paper and allied products	6 Gt. Lakes States	0.645	0.637	0.605	0.610	0.605	0.596	0.596	0.587	0.593
Printing, publishing and allied products	6 Gt. Lakes States	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Chemicals and allied products Petroleum refining and related industries	6 Gt. Lakes States	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Rubber and miscellaneous plastics products	United States	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Leather and leather products	6 Gt. Lakes States	0.704	0.702	0.709	0.701	0.699	0.701	0.708	0.714	0.720
NON-MANUFACTURING										
Wholesale trade	Indiana	0.000	0.000	0.004	0.000	0.000	0.005	0.022	0.030	0.059
Services and miscellaneous	Indiana	0.167	0.120	0.130	0.124	0.131	0.143	0.149	0.162	0.186

TABLE 9. Estimated localized and non-localized employment in Wisconsin, 1958-1966 (in thousands) (families).

Year	Y_{LOC}	X_{NL}	YX	X^2	Y^2
1958	281.9	149.9	42256.81	22470.01	79467.61
1959	300.5	159.3	47869.65	25376.49	90300.25
1960	293.1	167.3	49035.63	27989.29	85907.61
1961	289.6	149.3	43237.28	22290.49	83868.16
1962	299.6	156.2	46797.52	24398.44	89760.16
1963	301.2	160.1	48222.12	25632.01	90721.44
1964	306.7	162.8	49930.76	26503.84	94064.89
1965	322.5	169.3	54599.25	28662.49	104006.25
1966	333.6	175.8	58646.88	30905.64	111288.96
	2728.7	1450.0	44095.90	234228.70	829385.33

coefficient, in this case equal to 1.5738. This means that for a given change in non-localized employment, localized employment changed by 1.5738 times that amount. For every change in non-localized employment of 100, a change in localized employment of 157 in the same direction is found to occur. Therefore, this indicates a multiplier coefficient of approximately 2.57, for the ratio of the change in total employment to the change in non-localized employment equals 2.57 (257/100 = 2.57). The correlation coefficient, r, was equal to 0.8589. The relative amount of variation in the dependent variable Y_{LOC} which has been explained by the estimating equation was over 75% (r^2 = 0.7579). The results of this investigation are shown in Table 10.

TABLE 10. Summary of multipliers for Great Lakes states.

State	Estimate of employment multiplier	Correlation coefficient	r^2
Illinois	2.6380	0.9494	0.9014
Indiana	2.0242	0.9923	0.9845
Michigan	1.9962	0.9441	0.8913
Minnesota	1.8993	0.8756	0.7683
Ohio	2.2323	0.9466	0.8961
Wisconsin	2.5738	0.8589	0.7579

It is instructive to compare the multiplier computed in this study with those of other investigations. For example, Table 10 gives the estimates of localized and non-localized employment for the period of 1958-1966 for Illinois. The regression coefficient b_{yx} was computed to be 1.6380, while the correlation coefficient r was 0.9494. In this instance, the amount of explained variations in the estimating equation was nearly 90%.

Using input-output models involving a 50-industry breakdown in a study of the Chicago region, Hoch (1959) reported that a one dollar increase in final demand of any industry generates somewhere around 3.3 dollars in household income. The range of household expansion is $2.82 to $3.81 in his study. It is interesting to note that the multiplier effect on household activity of a dollar increase in final demand on Transport Industry was shown as follows (Hoch, 1959, Table 8, p. 250):

23.	Railroads.	3.266
24.	Trucking	3.419
26.	Water Transport. . .	2.905
27.	Air Transport. . . .	3.089
28.	Pipe Lines.	3.032

It is true that Hoch's study was confined to the Chicago region. But a multiplier averaging 3.3 was significant in comparison with that of 2.6380. The inclusion of the non-manufacturing sector seemed to produce a larger multiplier. This was the case of the multiplier estimated for Michigan—2.519 including certain service industries and agriculture, as compared with 1.996 in excluding them.

Also, it was found that in the case of Michigan b_{yx} = 0.9962, so that the multiplier coefficient approximately equals 2. The correlation coefficient, r, is equal to 0.9441; thus over 88% of the total variation in the estimating equation has been explained. Gadzikowski's (1963) estimate of the Michigan employment multiplier, using 1956 data provided by the Research and Statistics Division, Michigan Employment Security Commission, was 2.519. The difference was probably due to the fact that Gadzikowski took into account the non-manufacturing and the agricultural sectors. Using the same data, an analysis of the manufacturing sector yields a multiplier of 2.02. This compares well with the multiplier of 2.00 estimated here.

The regional multipliers are useful for determining the gross effects of changes in exports on income and employment within the region. Regions with large multipliers tend to be less stable economically, since small changes in exports produce large swings in total regional income and employment. More stable regions are characterized by smaller multipliers (Schenker, 1968). Yet our purpose is not merely to compute the multiplier in and for itself. Ultimately we want to estimate the increased economic activity that Seaway traffic generates in the Great Lakes region. In order to compute this estimate the multipliers are applied to the dollar income generated per ton of cargo traffic handled at the lake ports.

ESTIMATES OF INCOME AND EMPLOYMENT GENERATED BY ST. LAWRENCE SEAWAY CARGO

As has been pointed out, the St. Lawrence Seaway produces three types of economic benefits: 1) it reduces transportation costs for mid-American foreign commerce; 2) it generates increased economic activity at the lake ports; and 3) it extends the range of mid-American manufacturers' marketing possibilities. Estimation of the total income and employment effects of Seaway traffic is now possible through the application to Seaway traffic data of the regional multipliers developed in the last section. The direct income generated by this traffic includes wharfage and terminal charges, payments for supplies, for labor services, and auxiliary port operation services, rail and trucking charges, etc. Secondary income is that increase in regional income attributable to the exogenous increase in the region's income.

Numerous reports prepared for various port agencies estimate that the direct income generated by an average ton of general cargo ranged between $18 and $30 and from $1 to $8 for a ton of bulk cargo (Weir and McFarland, 1965). Given these estimates and a rising price level, the income estimates developed here employ $5 and $24 per ton as the average direct income per ton produced from servicing bulk and general cargo respectively at the Great Lakes ports (Schenker, 1967).

TABLE 11. Seaway traffic handled at major U. S. ports of the Great Lakes, 1968 (1000 tons).

State	Bulk cargo[1]	General cargo[2]
Minnesota[a]	4,634	148
Wisconsin[a]	401	445
Illinois[b]	2,984	2,549
Michigan	1,806	2,279
Ohio[b]	13,800	1,459
Totals	23,625	6,880

[1]Includes wheat, corn, soybeans, barley and rye, and both shipments and receipts of iron ore.
[2]Includes iron and steel imports.
[a]Duluth-Superior cargo included in Minnesota figures.
[b]Indiana's general cargo and much of its bulk cargo moves through Illinois and Ohio ports.

Table 11 lists the total Seaway traffic moving through the ports of the five Great Lakes states which handle most of the Seaway trade. The average direct port income per ton is applied to these totals to obtain the direct income generated by Seaway traffic in each state (Table 12). The regional income multipliers (Table 13) are then applied to this direct income to produce an estimate of the total dollar impact of Seaway traffic upon the economy of the Great Lakes region (Table 14). It is estimated that in 1968 Seaway shipping accounted for approximately $283 million of primary income and, with the addition of the secondary income, for nearly $643 million of total income for the Great Lakes states. The total personal income of the Great Lakes region in 1967 was $144 billion. Since the $643 million is probably a conservative estimate, it would not be an overstatement to estimate that the Seaway accounts for approximately 1% of the total income of the five Great Lakes states (Schenker, 1970).

TABLE 12. Direct income generated by major U. S. port seaway traffic, 1968 (1000 dollars).*

State	Bulk cargo	General cargo	Total
Minnesota	23,170	3,552	26,722
Wisconsin	2,005	10,680	12,685
Illinois	14,920	61,176	76,096
Michigan	9,030	54,696	63,726
Ohio	69,000	35,016	104,016
Totals	118,125	165,120	283,245

*Source: St. Lawrence Seaway Authority, *Traffic Report of the St. Lawrence Seaway*, 1968 (Queen's Printer, Ottawa, Canada).

TABLE 13. Estimated income multipliers for the Great Lakes states.

State	Estimate of multiplier
Wisconsin	2.5738
Michigan	1.9962
Illinois	2.6380
Ohio	2.2323
Minnesota	1.8993

TABLE 14. Direct and secondary income generated by seaway traffic in the Great Lakes states, 1968 (1000 dollars).

State	Total direct income	Income multiplier	Total income
Minnesota	26,722	1.89	50,505
Wisconsin	12,685	2.57	32,600
Illinois	76,096	2.64	200,893
Michigan	63,726	1.99	126,815
Ohio	104,016	2.23	231,955
Total	283,245		642,768

Another measure of the impact of the Seaway is the employment generated by the Seaway traffic. Median family income in the North Central region of the United States was $7,267 in 1965, the latest year for which these data are available (U. S. Dept. of Commerce, 1967). Using $7,500 as an approximation of the 1968

median income, Seaway cargo directly provided income for 37,770 families in the Great Lakes region (Table 15). Adding the secondary income produces a total of approximately 85,710 families employed either directly or indirectly because of the existence of the St. Lawrence Seaway.

TABLE 15. Estimated employment generated by seaway traffic, 1968 (families).

State	Direct employment	Total employment
Minnesota	3,560	6,730
Wisconsin	1,690	4,350
Illinois	10,150	26,790
Michigan	8,500	16,910
Ohio	13,870	30,930
Total	37,770	85,710

These income and employment estimates are rough approximations of only part of the Seaway's economic impact—the portion attributable to the Seaway-induced port activity. Of perhaps greater significance has been the effect the Seaway has had upon the cost of transporting the Midwest's commerce. The introduction of this low cost transportation route plus the substantial rate reductions instituted by the eastern and southern railroads as a consequence of the new competition represented by the Seaway, have opened new export markets for Midwestern agricultural and manufactured goods. The resulting growth in exports from the Great Lakes states means increased export income which is multiplied into an even greater expansion of the region's total income. This income growth has never been estimated, but it is surely many times greater than the port-related income estimated in this study (Schenker, 1967).

CONCLUSION

The investigation had a two-fold purpose. First, it was decided to estimate regional multipliers for the six-state Great Lakes region. The investigation indicated that the income-employment multipliers of the six states under consideration ranged between 1.8756 and 2.6380. It is necessary to exercise caution in interpreting these results. If the non-manufacturing sector (including agriculture) had been included in the investigation, the resulting multipliers would undoubtedly have been higher. However, the procedure of isolating the localized and non-localized sources of employment from the given aggregate data would have been both more complicated and more costly. As pointed out, this would have necessitated the computation of three location quotients, using the United States, the Great Lakes region, and the nine other states which are potential Seaway users as respective benchmark economies. An exhaustive study would need to calculate a fourth location quotient using the six Great Lakes states plus the nine states as the benchmark economy. Limited by the quality and quantity of aggregate employment data available, it was thought that the resulting estimates, although somewhat tenuous, were close approximations to the situation that actually exists in the Great Lakes region.

The other objective of this investigation was to estimate the income and employment generated by Seaway traffic. Applying the multipliers to Seaway cargo data, it was possible to obtain an estimate of money generated by Seaway-related port operations. The revenue earned at the lake ports from Seaway cargo is non-localized income which generates a multiplier increase in regional income and employment. Applying the income multipliers to direct port-related income yields an estimate of approximately $643 million for the total Seaway-cargo generated income in the Great Lakes hinterland. Add to this the effect the Seaway has had upon the reduced cost of transportation to the Midwest and one can see the importance of the Seaway system on the economy of the hinter-

land. The size of this impact supports the thesis that the Seaway has a substantial positive effect upon the economy of the Great Lakes region.

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APPENDIX G

OVERVIEW OF MICHIGAN AND WISCONSIN ECONOMIES

Michigan[1]

Population

Table G-1 lists the population of each of the three port Counties connecting ferry traffic to or from the Eastern shore of Lake Michigan. Since 1970, population growth in Benzie County (port of Frankfort) has kept pace with the growth rate for the State of Michigan (approximately 0.87 percent annual increase) while Mason County (port of Ludington) population growth (2.6 percent annually) exceeded the State's, and Muskegon County (port of Muskegon) grew barely at all in total population (0.016 percent annually). The degree of urbanization varies greatly between the Counties as may be seen by comparing the population densities: 28.4 persons per square mile in Benzie County, 52.5 in Mason County, and 314.5 in Muskegon County.

Employment and Production

Employment in manufacturing exceeds employment in any of the other activities listed in Table G-2 in each of the Counties, though the plurality changes greatly from a 51 percent dependency on manufacturing in Muskegon County and a 47 percent dependency in Mason County to a 29 percent dependency in Benzie County. This compares to the Statewide average of 40.7 percent.

Table G-2 displays the average employment by industry for the summer of 1974. Employment fluctuates seasonally as well as over time. This figure is

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[1]All information for the Counties of Benzie, Mason, and Muskegon in Michigan are taken from *Economic Profile*, Office of Economic Expansion, Michigan Department of Commerce, Lansing, Michigan, except as otherwise noted. Tables are footnoted to primary source.

used because it is the latest available. The table shows the relative importance of various industries to the local economies of the port Counties.

The smaller scope of the manufacturing sector in Benzie County is made up by large proportions in construction, services, and retail trade. The principle manufacturing activities in Muskegon County are in the primary metal industries and the manufacture of machinery (except electrical). Other activities in which some large plants can be found in Muskegon are food and kindred products, furniture and fixtures, paper and allied products, chemicals, and transportation equipment. The largest plant in Mason County is a chemical plant (more than 250 employees). The greatest number of plants are found in the manufacture of non-electric machinery. Other significant industries in Mason County are food and kindred products, primary and fabricated metal products, stone, clay, glass and concrete products, and professional scientific and controlling instruments. Benzie County has no plants with employment over 250, but there are three plants having employment of 100 or greater. These are in food and kindred products, apparel and other finished textile products, and electrical machinery.

Comparison of the *1972 Census of Manufacturing* with the 1967 Census reveals a stabilization or decline in manufacturing employment in each of the three Counties. Manufacturing production levels as measured by the value of shipments actually declined in Muskegon while the 6.5 to 6.7 annual average growth rate in the value of production in Mason and Benzie Counties has probably not even kept pace with inflation, indicating possibly a decline in real production. (Actual figures on price rises in the relevant industries is unavailable.) Table G-3 lists the Census of Manufacturing data on the three Counties.

Tables G-4 through G-6 represent summaries of the Census of Business in Retail Trade, Wholesale Trade, and Selected Services for the years 1967 and 1972.

Although there is a problem in strict comparability between the Census of 1967 and the Census of 1972 in the categorization and the scope of industries covered, it is reasonable to say that a larger growth rate existed in these industries than in manufacturing in the period. In no county is the rate of growth in the output of wholesale, retail and service industries lower than the growth in the value of shipments in manufacturing.

Certain calculations in this report make use of measures of total economic activity in the County. Census figures fall short of the total by the industries, construction, mining, etc., which are omitted. However, only census values permit valid comparisons between different measures. Table G-7 lists the Census base data used.

There was a decline both in the number of farms and the total acreage under cultivation from 1964 to 1969. The value of agricultural output declined significantly in Benzie County, remains nearly the same in Mason County, and increased by 24 percent in the most urban County, Muskegon. This latter effect is due to a shift toward higher valued crops or other agricultural activities which yield more value per acre. Table G-8 summarizes the Census of Agriculture data for the three port Counties in Michigan.

TABLE G-1

MICHIGAN - POPULATION AND AREA

	Benzie County		Mason County		Muskegon County	
	1970(a)	1975(b)	1970(a)	1975(b)	1970(a)	1975(b)
Total Population	8,593	8,973	22,612	25,713	157,426	157,555
Percent of State	.10	.10	.25	.28	1.77	1.73
Land Area (sq.mile)	316		490		501	

Sources: (a) U.S. Census of Population, 1970, Michigan, *General Population Characteristics and Number of Inhabitants.*

(b) *Population Projections of the Counties of Michigan, 1970-1990*, Bureau of the Budget, State of Michigan, rev. October 1974.

TABLE G-2

EMPLOYMENT-BY PLACE OF EMPLOYMENT
SUMMER 1974

Classification*	Number of Employees							
	Benzie	Percent	Mason	Percent	Muskegon	Percent	State (000)	Percent
Construction	230	13.9	409	6.9	2,199	4.9	136.3	5.0
Manufacturing(total)	484	29.2	2,794	47.0	22,867	50.7	1,121.3	40.7
Transportation and Utilities	35	2.1	261	4.4	2,784	6.2	157.1	5.7
Wholesale Trade	58	3.5	202	3.4	2,258	5.0	152.6	5.5
Retail Trade	380	22.9	1,193	20.1	6,866	15.2	525.5	19.1
Finance Insurance and Real Estate	53	3.2	234	3.9	1,287	2.8	133.0	4.8
Business, Personal and Professional Services	417	25.2	851	14.3	6,858	15.2	528.4	19.2
TOTAL	1,657	100	5,944	100	45,119	100	2,754.2	100

*Excludes agricultural and self employed.

Source: Michigan Employment Securities Commission

TABLE G-3

SUMMARY OF MANUFACTURING ESTABLISHMENTS

	Benzie County			Muskegon County			Mason County		
	1967	1972	% Change	1967	1972	% Change	1967	1972	% Change
Number of Establishments	18	21	16.7	245	234	-4.5	52	52	0.0
Total Employment	700	700	0.0	28,500	22,100	-22.5	2,400	2,100	-12.5
Payroll(thousand $)	2,900	4,100	41.4	213,300	222,800	4.5	13,700	17,700	29.2
Shipments(thousand $)	14,600	20,200	38.4	715,300	709,100	-0.9	60,100	82,500	37.3
Value Added(thousand $)	6,800	7,400	8.8	384,900	392,300	1.9	31,900	44,500	39.5

Source: Compiled from individual *Economic Profile* papers, Michigan Department of Commerce, Lansing, Michigan.

Original Source: U.S. Bureau of the Census, *Census of Manufactures 1972.*

TABLE G-4

RETAIL TRADE[a]

	Benzie County			Muskegon County			Mason County		
	1967	1972	% Change	1967	1972	% Change	1967	1972	% Change
Sales (thousand $)	11,503	19,404	68.7	235,035	333,467	41.9	34,774	59,145	70.1
Number of Stores	123	151	22.8	1,119	1,182	5.6	248	283	14.1
Payrolls of Establishments with Payrolls	968	1,837	89.8	24,798	36,455	47.0	3,225	5,696	76.6
Kind of Business Group	Sales (thousand $)[b]								
Building materials, hardware and farm equipment	1,944	2,533	30.3	13,490	26,549	96.8	2,293	5,610	144.7
General Merchandise	633	397	-37.3	29,004	(d)	-	4,673	7,528	61.1
Food Stores	3,147	5,124	62.8	64,730	90,945	40.5	9,635	15,530	61.2
Automotive Dealers	2,265	4,031	78.0	45,423	62,619	37.9	6,946	11,576	66.7
Gas Service Stations	930	2,190	135.5	18,021	25,512	41.6	2,683	4,198	56.5
Apparel & Accessory Stores	276	690	150.0	9,404	9,763	3.8	929	1,387	49.3
Furniture, home furnishings and equipment	189	485	156.6	13,510	18,040	33.5	1,107	1,415	27.8
Eating & drinking places	1,045	1,835	75.6	16,387	23,654	44.4	2,330	4,921	111.2
Drug Stores & Proprietary	574	943	64.3	8,841	11,970	35.4	1,097	1,930	75.9
Misc. Retail Stores	500	1,176	135.2	11,609	(d)	-	(d)	5,050	-

Source: Compiled from individual *Economic Profile* papers, Michican Department of Commerce
Original Source: U.S. Bureau of the Census, *Census of Retail Trade*
(a) U.S. Census of Business, 1967 and 1972, Retail Trade, Michigan; (b) Includes non-store retailers;
(d) Withheld to avoid disclosing figures for individual companies

TABLE G-5

WHOLESALE TRADE[a]

	Benzie County			Muskegon County			Mason County		
	1967	1972	% Change	1967	1972	% Change	1967	1972	% Change
Sales (thousand $)	2,700	(d)	-	122,085	196,931	61.3	8,526	16,150	89.4
Number of Stores	7	8	14.3	174	194	11.5	28	32	14.3
Payrolls of Establishments with Payrolls	95	(d)	-	10,491	17,131	63.3	533	1,165	118.3

(a) U.S. Census of Business, 1967 and 1972, Wholesale Trade, Michigan.

(d) Withheld to avoid disclosing figures for individual companies.

TABLE G-6

SELECTED SERVICES

Kind of Business Group	Number of Establishments Benzie County 1967	Benzie County 1972	Benzie County % Change	Mason County 1967	Mason County 1972	Mason County % Change	Muskegon County 1967	Muskegon County 1972	Muskegon County % Change
Hotels, Motels, Courts	33	31	-6.1	44	42	-4.5	53	57	7.5
Personal Services	19	N/A	-	56	N/A	-	358	344	-3.9
Misc. Business Services	2	N/A	-	15	N/A	-	106	136	28.3
Auto Repair, Services	9	5	-44.4	9	11	22.2	82	106	29.3
Misc. Repair Services	3	9	200.0	15	21	40.0	90	75	-16.7
Motion Pictures*	3	N/A	-	3	N/A	-	6	10	66.7
Other Amusements, Recreation*	6	15	N/A	8	22	N/A	56	87	55.4
Legal Services	(a)	4	-	(a)	6	-	(a)	51	-
Receipts (in thousands)	$1,469	$2,258	53.7	$2,456	$6,415	161.2	$25,175	$37,498	48.9

Source: U.S. Census of Business, 1967 and 1972, Selected Services, Michigan.

*Combined for 1972 Census (Benzie and Mason Counties).

(a) Not reported in 1967 Census.

N/A - not available

TABLE G-7

Census Base Estimates of Total Non Agricultural Economic Activity by County

Michigan

County	Value Added[1] ($000)	Payroll ($000)	Employment (No.)
Muskegon	456,032	286,532	33,700
Mason	52,919	26,119	3,804
Benzie	9,665	6,365	1,165
Total State	28,380,127	17,744,127	1,842,800

[1] Equals value added in manufacture plus payroll in services, wholesale and retail trade.

Sources: U. S. Bureau of the Census, 1972 Census of Manufacturing, Area Series, Michigan, U. S. Government Printing Office, 1975.

_____, 1972 Census of Wholesale Trade, . . .

_____, 1972 Census of Retail Trade, . . .

_____, 1972 Census of Selected Services, . . .

TABLE G-8

AGRICULTURE

	Benzie County			Mason County			Muskegon County		
	1969	1964	% Change	1969	1964	% Change	1969	1964	% Change
Number of Farms	231	307	-24.8	608	881	-31.0	578	731	-20.9
Average Size of Farms (acres)	167.8	152.3	9.9	157.5	134.1	17.9	123.8	123.1	0.6
Total Value of Land and Buildings (in thousands)	$9,793	N/A	-	$20,068	N/A	-	$22,157	N/A	-
Average Value of Farms (in thousands)	$42	$27	58.2	$33	$21	57.4	$38	$28	36.2
Average Value Per Acre	$252	$159	58.5	$209	$159	31.4	$310	$235	31.9
Sales of all Farm Products (in thousands)	$1,703	$2,053	-17.1	$5,487	$5,163	6.3	$7,770	$6,267	24.0

Source: U.S. Census of Agriculture, 1969 and 1964, Michigan

N/A - not available

Wisconsin[2]

Population

In 1970, the combined population of Manitowoc, Milwaukee, and Kewaunee Counties was 1,155,504, which represented 26.16 percent of the total population of the State of Wisconsin. In the 1960-70 period, Manitowoc County experienced an increase in population of 9.4 percent which was slightly below the State's average of 11.8 percent. However, Milwaukee and Manitowoc Counties had low percentage increases of 1.8 and 3.7, respectively. For Milwaukee, this can be explained by the suburban explosion of the City of Milwaukee, which is the 12th largest in the nation in terms of population. Net out-migration from Milwaukee County was over 100,000. Out-migration from Manitowoc County (3,835) also explains its low growth rate. Milwaukee is clearly the most urbanized of the Counties with a density of 4410 persons per square mile compared to 320 and 57 persons per square mile in Manitowoc and Kewaunee Counties, respectively. Wisconsin's population data is given in Table G-9.

Employment and Production

The number of employees in industries covered by unemployment compensation can be seen in Table G-10. The greatest single category of employment is manufacturing in each of the Counties. Table G-10 is based on the number of employees who work in the County and who are covered by unemployment compensation. A

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[2]All information in this section is taken from *Economic Profile* (Kewaunee, Manitowic, Milwaukee Counties), Department of Business Development, Madison, Wisconsin, except as otherwise noted. Primary sources are noted in the tables.

different, more complete view obtained from data is given in Table G-11, which outlines the employment picture from the 1970 Census. In it, manufacturing claims still a high proportion of employment, but "Other Services" has the greatest proportion in all but Manitowoc County. Other Services is a more inclusive category than any of the service categories in Table G-10. The important thing to note is the relative importance of manufacturing in each of these Counties to the State of Wisconsin.

The kinds of manufacturing found in these cities are listed in Table G-12. The annual growth rates for value added implied by the percent changes given in Table G-13 for manufacturing are 5.8 percent in Manitowoc, 3.6 percent in Milwaukee, and 5.0 percent in Kewaunee. These growth rates probably represent a real decline in production after adjustment for inflation. This judgment is further reinforced by observing the decline in employment in two of the three Counties from 1967 to 1972.

If manufacturing activity is declining in the area, it has yet to affect a similar decline in trade or service industries. Table G-14 outlines the sales and receipts data from the 1967 and 1972 Censuses of Wholesale Trade, Retail Trade, and Selected Services. All of the growth rates in these industries, as measured by revenues, are significantly greater than those found in Manufacturing. Except for Wholesale Trade in Milwaukee, all growth rates appear in excess of applicable inflation rates.

Table G-15 outlines the value added, payroll and employment data from the 1972 Census of Business. These values are important because they provide a consistent set of figures for various comparative analyses done in the text.

Data from the 1969 and the 1964 Censuses of Agriculture are shown in Table G-16. Agricultural output declined in Milwaukee from 1964 to 1969 due most probably to increasing urbanization. There was a 32.2 percent decrease in the land area under cultivation in this County. The land area under cultivation in Manitowoc and Kewaunee Counties also declined, but not as much. Output in terms of the value of all products sold rose by 21.8 percent in Manitowoc and 42.2 percent in Kewaunee. 1964 to 1969 was not a high inflation period for the nation, yet it is conceivable that the annual growth rate of four percent for agricultural sales in Manitowoc represents more price change than production change, while the 7.2 percent increase in Kewaunee probably represents either increased yields or shifts to higher valued crops and thus a real output increase.

TABLE G-9

POPULATION

	1970	% of State	1960-70 Change(%)	State Avg. (%)	Density (per sq. mile)	Net Migration 1950-60	Net Migration 1960-70
Manitowoc County	82,294	1.86	9.4	11.8	139.7	3,835out	1,714out
Milwaukee County	1,054,249	23.87	1.8	11.8	4,410.3	14,842in	104,465out
Kewaunee County	18,961	.43	3.7	11.8	57.3	2,086out	1,191out
TOTAL	1,155,504	26.16					

Source: Compiled from individual *Economic Profile* papers, Department of Business Development, Madison, Wisconsin.

Primary Source: U. S. Bureau of the Census, *Census of population, 1970.*

TABLE G-10

EMPLOYEES COVERED BY OASI MID-MARCH, 1970

	Manitowoc County			Milwaukee County			Kewaunee County		
	Employees	Jan-Mar Payroll (000)	Businesses	Employees	Jan-Mar Payroll (000)	Businesses	Employees	Jan-Mar Payroll (000)	Businesses
Construction	1,713	$ 4,800	138	14,669	$36,996	1,324	133	$ 194	40
Manufacturing	13,222	23,324	162	180,263	391,394	1,759	2,308	3,602	45
Transportation, Utilities	758	1,064	70	24,732	52,787	460	N/A	N/A	9
Wholesale Trade	980	1,367	84	27,700	60,213	1,782	49	70	15
Retail Trade	4,256	3,832	501	74,629	76,343	4,558	700	588	128
Finance, Insurance, etc.	486	632	104	26,651	45,973	1,909	81	113	19
Services	2,693	2,479	332	74,279	93,022	5,535	541	400	67
TOTAL	24,250	$37,648	1,417	424,026	$757,897	17,527	3,882	$5,069	327

Source: Compiled from individual *Economic Profile* papers, Department of Business Development, Madison, Wisconsin

Primary Source: Division of Unemployment Compensation, State of Wisconsin.

TABLE G-11

EMPLOYMENT TRENDS
(RESIDENTS)

	Manitowoc County			Milwaukee County			Kewaunee County			% Distribution for all of Wisconsin
	1960	1970	1970 % Distribution	1960	1970	1970 % Distribution	1960	1970	1970 % Distribution	
Agriculture, Forestry	3,754	2,446	7.6	1,766	2,126	0.5	2,475	1,427	19.1	6.5
Mining	37	54	0.2	193	302	0.1	12	26	0.3	0.2
Construction	1,297	1,812	5.6	17,050	16,323	3.7	307	560	7.5	5.0
Manufacturing	12,453	13,621	42.3	169,598	151,597	34.7	2,090	2,846	38.0	31.0
Transportation, Utilities	1,109	1,226	3.8	26,242	25,885	5.9	180	174	2.3	5.2
Other Services	9,968	13,076	40.6	199,381	240,974	55.1	2,147	2,455	32.8	52.0

Source: Compiled from individual *Economic Profile* papers, Department of Business Development, Madison, Wisconsin.

Primary Source: U.S. Bureau of the Census, *Census of Population, 1970.*

TABLE G-12

MANUFACTURING ACTIVITIES BY COUNTY

County	Products manufactured by firms with significant employment in area
Milwaukee	Pipe fittings, drop forgings, etc.
	Air-cooled gasoline engines
	Tractors, industrial and construction equipment, heavy electrical machinery, etc.
	Truck and crawler cranes
	Electrical control equipment
	Missile guidance equipment and electronic products
	Automobile bodies
	Auto frames and industrial machinery
Manitowoc	Aluminum cooking utensils, rolling mill
	Power cranes, excavators
	Laboratory furnishings
Kewaunee	Wood panels, doors, etc.
	Aluminum utensils
	Steel fabrication, ship repair

Source: Adapted from Unemployment Compensation data.

TABLE G-13

MANUFACTURING INDUSTRIES DATA BY
CENSUS YEAR AND COUNTY

	Manitowoc County			Milwaukee County			Kewaunee County		
	1967	1972	%Change	1967	1972	%Change	1967	1972	%Change
Number of Establishments	170	164	-5.5	1,838	1,762	-4.1	46	46	0.0
Employees	13,100	13,300	+1.5	181,100	159,200	-12.1	2,400	1,900	-20.8
Value Added in Manufacture	$147,000	$194,700	+32.5	$2,464,600	$2,940,000	+19.3	$20,100	$25,700	+27.9

Source: 1967 compiled from individual *Economic Profile* papers, Department of Business Development, State of Wisconsin. (Primary Source for Economic Profiles is *1967 Census of Business*)
1972 data from U. S. Bureau of the Census, *1972 Census of Manufacturing, Area Series*, Wisconsin.

TABLE G-14

RECEIPTS OR SALES IN NON-MANUFACTURING INDUSTRIES
BY CENSUS YEAR AND COUNTY

Industry	Manitowoc County			Milwaukee County			Kewaunee County		
	1967	1972 ($000)	%Change	1967	1972 ($000)	%Change	1967	1972 ($000)	%Change
Wholesale Trade	57,550	103,179	+79.2	3,665,228	4,549,899	+24.1	9,099	13,375	+47.0
Retail Trade	107,940	140,834	+30.5	1,758,864	2,334,072	+32.7	20,756	27,023	+30.2
Selected Services	9,211	16,335	+77.3	347,926	622,140	+78.8	1,465	2,596	+77.2

Source: Compiled from individual *Economic Profile* papers, Department of Business Development and U.S. Bureau of the Census, *Census of Retail Trade 1972, Census of Wholesale Trade 1972,* and *Census of Selected Services 1972, Area Series.*

Primary Source for Economic Profiles is *1967 Census of Business.*

TABLE G-15

Census Base Estimates of Total Non Agricultural Economic Activity by County

Wisconsin

County	Value Added[1] ($000)	Payroll[1] ($000)	Employment (No.)
Milwaukee	3,691,391	2,395,891	283,501
Manitowoc	222,429	138,129	19,366
Kewaunee	29,775	17,875	2,927
Total State	11,696,375	6,973,475	915,737

[1]Equals value added in manufacture plus payroll in services, wholesale and retail trade.

Sources: U. S. Bureau of the Census, 1972 Census of Manufacturing, Area Series, Michigan, U. S. Government Printing Office, 1975.

_____, 1972 Census of Wholesale Trade, . . .

_____, 1972 Census of Retail Trade, . . .

_____, 1972 Census of Selected Services, . . .

TABLE G-16

AGRICULTURE

	Manitowoc County			Milwaukee County			Kewaunee County		
	1969	1964	% Change	1969	1964	% Change	1969	1964	% Change
Number of Farms	2,281	2,610	-12.6	245	409	-40.1	1,378	1,577	-12.6
Class 1-5 Farms*	1,788	2,023	-11.6	116	231	-49.8	1,144	1,302	-12.1
Land in Farms (acres)	303,599	315,015	- 3.6	17,412	25,670	-32.2	191,568	200,985	- 4.7
% of Land in Farms	80.5	83.5	- 3.6	11.5	16.7	-31.1	90.8	94.8	- 4.2
Average Size of Farms (acres)	133.0	120.7	10.2	71.0	62.8	13.1	130.9	127.4	2.7
Value of Land and Buildings, per farm	$33,965	$24,848	36.7	$131,994	$78,951	67.2	$34,923	$24,630	41.8
Crops Sold	$ 2,982	$ 2,530	17.9	$ 3,778	$ 4,269	-11.5	$ 1,057	$ 1,064	- 0.7
Forest Products	$ 54	$ 54	0	$ 1	$ 2	-100.0	$ 105	$ 63	66.6
Livestock, poultry and their products	$26,587	$19,247	38.1	$ 643	$ 994	-35.3	$16,066	$10,989	46.2
Dairy Products	$19,448*	$14,289	36.1	$ 170*	$ 398	-57.3	$12,942*	$ 9,032	43.3
Total Products Sold (to nearest thousand)	$29,622	$21,859	21.8	$4,423	$5,292	-16.4	$17,228	$12,118	42.2

* Farms with total sales of $2,500 and over compiled from individual *Economic Profile* papers, Department of Business Development, Madison, Wisconsin

APPENDIX H

LIST OF PARTICIPATING COMPANIES TO THE MANUFACTURERS SURVEY

LIST OF FIRMS CONTACTED IN MICHIGAN(*)

Abitibi Corp., Alpena
Agrico Chemical Co., Kaleva
Alden Lumber, Alden
Alpena Wholesale Grocery Co., Alpena
American Asbestos Products (Industrial Fiber), Utica
Arco Lumber Co., Central Lake
Brader Milling Co., Mt. Pleasant
Baldwin Lumber Co., Baldwin
Bark Calvert & Equipment Co.
Basf Wyandotte, Wyandotte
Bellaire Log Cabins, Bellaire
Belle-Sonners Fruit, Fremont
Beulah Lumber Co., Beulah
Boyne Falls Log Homes, Boyne Falls
Brill Manufacturing, Ludington
Brown Lumber, Traverse City
Building Products, Inc., Petoskey
Cadillac Malleable Iron, Cadillac
Cadillac Metal Casters, Cadillac
Cadillac Rubber & Plastics, Cadillac
Camp Lumber & Building Supply, Shephard
Cedar Springs Tractor & Equipment Co., Cedar Springs
Central Beverage, Cadillac
Charlevoix Lumber, Charlevoix
Cliffs Forest Products Co.
Coral Elevator Co., Coral
Diamond Crystal Salt & Co., Pt. Huron
Dixon Distribution Co., Inc., Traverse City
DOW Chemical, Midland
Dresser Maecobar, Kalkaska
East Jordan Iron Works, East Jordan
East Jordan Lumber, East Jordan
East Jordan Plastics, East Jordan
Ellsworth Farmer Exchange, Ellsworth
Escanaba Feed Store
Evans-Retting Lumber Co., Cadillac
Evart Products (American Motors), Evart
F.O. Barder & Son, Inc., Boyne Falls
Falmouth Coop, McBain
Farm Bureau Services, Inc., Traverse City, Pinconning
Farmer Supply Co.
Fingerle-Hollister Wood Lumber Co., Ann Arbor
Firestone Steel, Wyandotte
Ford Motor Co., Dearborn

(*)Some firms contacted chose not to respond.

List of firms in Michigan-continued

Fotchman Motor Co., Petoskey
Freedman Aircraft Engineering Corp., Charlevoix
Freemont Co-op, Freemont
Frito Lay, Allen Park
Gerber Baby Food, Freemont
Grand Rapids Shash & Door, Traverse City
Great Lakes Steel, Ecorse
Halliburton Services, Kalbaska
Hankey Lumber, Petosky
Hardy Salt Co., Manistee
Harnischfeger Corp., Escenaba
Harris Farm & Auto Supply
Hoerner-Waldorf, Ontonogon
Honor Hardware & Building Supply, Honor
Ithaca Roller Mills, Ithaca
Imco Service, Kalkaska
J. Hofert Co., Cadillac
Jackson Vibrators, Inc., Ludington
Johnson Lumber Co., Cedar Springs
Kellog Wholesale Building Supply, Traverse City
Kellogs Cereals, Battle Creek
Kimberly Clark Corp.
Kit Carson Lumber Co.,Charlevoix
L.A. Hawley & Sons, Ludington
L.L. Woodard & Sons, Owosso
Lakeview Builder Supply Co., Lakeview
Leelanaw Fruit Co., Suttons Bay
Lori Feed & Supply
Luedtke Engineering Co., Frankfort
Ludington Concrete Products, Ludington
M. Walter Co., Copemish
Marion Grain Co., Marion
Marion Lumberyard, Marion
Martin-Marietta, Sand Lake, East Lake
McClouth Steel, Trenton
McDowell Hay & Straw
McGutherie Lumber Co., Detroit
Mead Corp., The,
Meeder Lumber Co., Mancelona
Meijer, Inc., Lansing
Michigan Cigar Co., Big Rapids
Mid-State Fruit, Cadillac
Midwest Fertilizer Co.
Morton Salt Co., Manistee
National Fruit Products

List of firms in Michigan-continued

North Star Elevator, North Star
Northern Lumber Co., Suttons Bay
Northern Michigan Electric, Boyne City
Northern Propane Gas Co., Cadillac
Ottawa Lumber Co., Harbor Springs
Ossineke Building Supply, Ossineke
Packaging Corporation of America, Filer City
Packing Material Co., Baldwin
Panel Processing, Alpena
Penn-Dixie, Petoskey
Penwalt Corp., Wyandotte
Pet, Inc., Frankfort
Petoskey Beverage Co., Inc., Petoskey
Phillips Beverage, Inc., Flat Rock
Pleiness Lumber & Building Supply, Scottville
Port Huron Paper, Port Huron
Procter & Gamble Products Co., Cheboygan
Red Mill Lumber Co., Traverse City
Richter Vineager Corp., Scottville
Rosebush Lumber Co., Rosebush
Sumerix Implement Sales, Lachine
Sani Products, Petosky
Saturn Tire & Rubber, Cedar Springs
Steele Lumber Co., Clare
Shultz, Snyder & Steele Lumber Co., Bates
Sohigio Service, Rosebush
Sonsel Lumber Co.
Stephenson Marketing Association
Stokely-Van Camp, Scottville
Stone & Sons, Benquonia
Super Food, Vassar
Taylor Building Products, West Branch
Thompson Cabinet Co., Ludington
Toisch's Implement Sales, Hillman
Traverse City Lumber Co., Traverse City
Triple "D" Orchards, Empire
Tustin Elevator & Lumber Co., Tustin
U.S. Plywood, Gaylord
Vacation Land Homes, Bellaire
Vandrie Furniture, Cadillac
Van's Lumber, Lake City
Weather Shield Sports Equipment, Charlevoix
Wickes Agriculture, Shepherd
Wickes Corp., Grawn, Petoskey
Wickes Lumber, Alma, Scottville, Gaylord
Wilde Manufacturing Co.
Will Flow Corp., Charlevoix
Wolverine World Wide, Inc., Rockford

LIST OF FIRMS CONTACTED IN WISCONSIN(*)

Algoma Industries, Algoma
Allis Chalmers Corp., Milwaukee
Ambrosia Chocolate Co., Milwaukee
American Can Co., Menasha
American Motors Corp., Kenosha
American Motors Corp., Milwaukee
A.O. Smith, Milwaukee
Appleton Machine Co., Appleton
Appleton Marble & Granite Works, Appleton
Appleton Papers, Inc., Appleton
Babcock & Wilcox Co., Milwaukee
Badger Paper Mills, Peshtigo
Bay West Paper Co., Green Bay
Briggs & Stratton, Milwaukee
Buchyrus Erie Co., South Milwaukee
Charmin Paper Products, Green Bay
Columbia Art Works, Inc., Milwaukee
Conner Forest Industry, Wausau
Consolidated Papers, Inc., Wisconsin Rapids
Evenrude Motors Div., OMC., Milwaukee
Folk Corp., Milwaukee
Foremost Foods Co., Appleton
Fort Howard Paper Co., Green Bay
Froedtert Malt Corp., Milwaukee
F.W.D. Corp., Clintonville
General Motors, AC Spark Plug Div., Oak Creek
George Banta Co., Menasha
Great Northern Corp., Appleton
Green Bay Packaging Co., Green Bay
Green Giant Corp., Beaver Dam
Gueder, Paeschhe & Frey, Milwaukee
Harley-Davidson Motor Co., Milwaukee
Harnischfeger Corp., Brookfield
Heil Company, The, Milwaukee
Highway Manufacturing Company, Eagerton
Hotpoint Div. of G.E., Milwaukee
INRY CO., Inc., Milwaukee
Joseph Schlitz Brewing Co., Milwaukee
Kimberly Clark, Neenah
Koehring Company, Milwaukee
Koehring Farm Div.-Fox Operation, Appleton
Kraft Foods, Antigo
Krause Milling Co., Milwaukee

(*) Some firms contacted chose not to respond.

List of Firms in Wisconsin - continued

Kurth Malting Corp., Milwaukee
Ladish Co., Cudahy
Ladish Malting Co., Milwaukee
Lakeside Bridge & Steel Co., Milwaukee
Larson Co., Green Bay
Libby McNeil & Libby, Hartford
Mammoth Spring Canning Corp., Sussex
Miller Brewing Co., Milwaukee
Milwaukee Electric Tools, Brookfield
Milwaukee Solvay Coke Co., Milwaukee
Mosinee Paper Mills, Mosinee
Nekoosa Papers, Inc., Port Edwards
Nestle Co., Burlington
Newspapers, Inc., Milwaukee
Oconomowoc Canning Co., Oconomowoc
Pabst Brewing Co., Milwaukee
Presto Products, Appleton
Rexnord, Inc., Milwaukee
Stokely-Van Camp, Columbus
Thilmany Pulp & Paper Co., Kaukauna
Trane Co., La Crosse
UNIROYAL, Inc., Eau Claire
U.S. Paper Mills, Fort Howard
U.S. Plywood, Algoma
Valley Packaging Supply, De Pere
Voith-Allis, Inc., Appleton
Wausau Paper Mills, Brokaw