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PULPWOOD TRANSPORTATION FROM MICHIGAN'S UPPER PENINSULA

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ABSTRACT

PULPWOOD TRANSPORTATION FROM MICHIGAN'S UPPER PENINSULA

By William R. Wynd

Michigan's Upper Peninsula is a pulpwood supply area for pulp mills in northern and central Wisconsin. In 1966, almost 80 percent of the pulpwood produced in the Peninsula was shipped to Wisconsin, while the remaining 20 percent was consumed by five pulp mills within the Peninsula.

Secondary transportation, which may consist of several stages, represents a sizable portion of the total delivered cost of a unit of pulpwood. If the cost of secondary transportation can be reduced, a pulpwood supply area such as the Upper Peninsula may be able to compete more effectively with adjacent supply areas.

The primary purpose of this study is to examine possible changes in pulpwood transportation methods that would stimulate more efficient raw material flow between selected producing locations in Upper Michigan and major pulping centers in Wisconsin, given current transportation facilities. The specific objectives are: (1) to inventory current transportation facilities within the entire Peninsula, (2) to determine the current pattern and costs of transporting pulpwood from five selected counties in the Upper Peninsula to five major pulping centers in Wisconsin, and (3) to determine if possible concentration of volume or better allocation between

origins and destinations would reduce the cost of secondary transportation.

Five counties in the Upper Peninsula producing the greatest volume of pulpwood in 1966 were selected for detailed analysis of pulpwood movement and costs. During that year, these five study counties accounted for 49 percent of the pulpwood produced by the Upper Peninsula. Eighty-five percent of the pulpwood produced in these counties was exported to Wisconsin.

Seventeen pulp mills received 92 percent of the pulpwood exported from the study area. These mills were grouped into five "pulping centers" and designated as destinations for pulpwood exported from the study area.

Railways are the chief mode of transportation for pulpwood exported from the study counties. One rail loading point occurs about every seven miles in the study area; but, 80 percent of the wood is shipped from 10 to 12 loading points in each county. Pulpwood moving to domestic mills is shipped almost exclusively by truck.

Applying 1968 transportation rates, the total cost of exporting pulpwood from multiple rail loading points within the study counties amounts to nearly $10 per cord. Concentrating pulpwood in single loading points per county would lower rail transportation costs, but it would increase trucking costs necessary to reach these points such that the total cost per cord would increase to over $11.

A linear program was employed to allocate pulpwood volume from multiple rail loading points to destinations in Wisconsin

in order to achieve the lowest theoretical transportation cost. The program indicates a savings of only $0.07 per cord over current methods. Thus, the cost of 1966 transportation methods were surprisingly close to the theoretical minimum.

ACKNOWLEDGEMENTS

Sincere appreciation is expressed for the cordial cooperation and information supplied by major shippers and carriers of forest products in the Upper Peninsula. In particular, thanks are expressed to the North Central Forest Experiment Station for supplying certain essential data and the funds necessary to conduct this research. In addition, I am deeply indebted to my major professor, Dr. Robert S. Manthy, and to Dr. Lee M. James and the other members of my committee for their encouragement and constructive criticism in the conduct of this research. Lastly, thanks are expressed to my dear wife for the encouragement she has given and for the self-sacrifice she has so willingly endured in the typing and preparation which culminated in the presentation of this thesis.

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CHAPTER I

INTRODUCTION

Wisconsin is a major market for pulpwood produced in Upper Michigan. In 1966, nearly 80 percent of the pulpwood cut within the Peninsula was exported to Wisconsin mills (Blyth, 1966). The remaining 20 percent is consumed by five mills in the Upper Peninsula.

Transportation is an important cost element in harvesting pulpwood. The transportation of pulpwood occurs twice in the pulpwood harvesting process: (1) primary transportation which consists of skidding or otherwise moving individual units to a concentration point, and (2) secondary transport which is the movement of raw material from the concentration point to market destinations. Secondary transportation, which may have several stages, represents a sizable portion of the total cost, man-days, and mechanical energy attributed to logging. Gardner (1966) reports that in a typical Lake States logging operation, 33 percent of the total cost, 40 percent of the man-days, and 90 percent of the mechanical energy are accounted for by secondary transportation.

Purpose and Objectives

The purpose of this study is to examine changes in secondary pulpwood transportation methods that would stimulate more efficient raw material flow between selected producing locations in Upper Michigan and major pulping

centers in Wisconsin, given existing transportation facilities. The specific objectives are : (1) to inventory current transportation facilities within the entire Peninsula, (2) to determine the current pattern and costs of transporting pulpwood from five selected counties in the Upper Peninsula to five major pulping centers in Wisconsin, and (3) to determine if possible concentration of volume or better allocation between origins and destinations would reduce the cost of secondary transportation. Transportation facilities are examined on the basis of their ability to handle current demands, and their capability to transport a substantially increased volume. The current pattern and cost of pulpwood movement serves as a basis for highlighting apparent inefficiencies in secondary transportation.

Study Area

Michigan's Upper Peninsula is an area of 10.6 million acres forming roughly the southern boundary of Lake Superior and the northern boundary of Lake Michigan. Transportation facilities in the entire area are inventoried.

Although nearly 80 percent of the pulpwood produced in the Peninsula was exported to Wisconsin in 1966, the amount of wood exported varies among counties. In order to contain the study within managable proportions, five counties producing and exporting the greatest volume of pulpwood in 1966 were selected for detailed analysis of pulpwood movement and transportation costs. These five counties are Menominee,

Iron, Marquette, Dickinson, and Delta. About 90 percent of the pulpwood produced by these counties in 1966 was exported to Wisconsin.

Pulpwood exported to Wisconsin is composed of seven separate species and a group of miscellaneous hardwoods. Three of these separate species were produced in small quanties and are not considered. The volume of aspen, balsam fir, hemlock, pine and miscellaneous hardwoods represents 90 percent of the volume of pulpwood exported to Wisconsin from the study counties and is used in the analysis.

Forty-two wood pulp mills in Wisconsin are potential destinations for pulpwood produced in the five study counties. But not all mills consume pulpwood originating in the five county study area. On the basis of confidential information from the North Central Forest Experiment Station, seventeen wood pulp mills consuming a substantial volume of pulpwood produced in the study area were grouped into five separate "pulping centers" having average radii of 10 miles each. These five pulping centers were the market destination for over 90 percent of the pulpwood exported from the five county study area in 1966. The Upper Peninsula and the five study counties in relation to the five major Wisconsin pulping centers are shown in Figure 1.

Procedure

The extent of transport facilities within the Upper Peninsula are well documented by the Michigan State Department

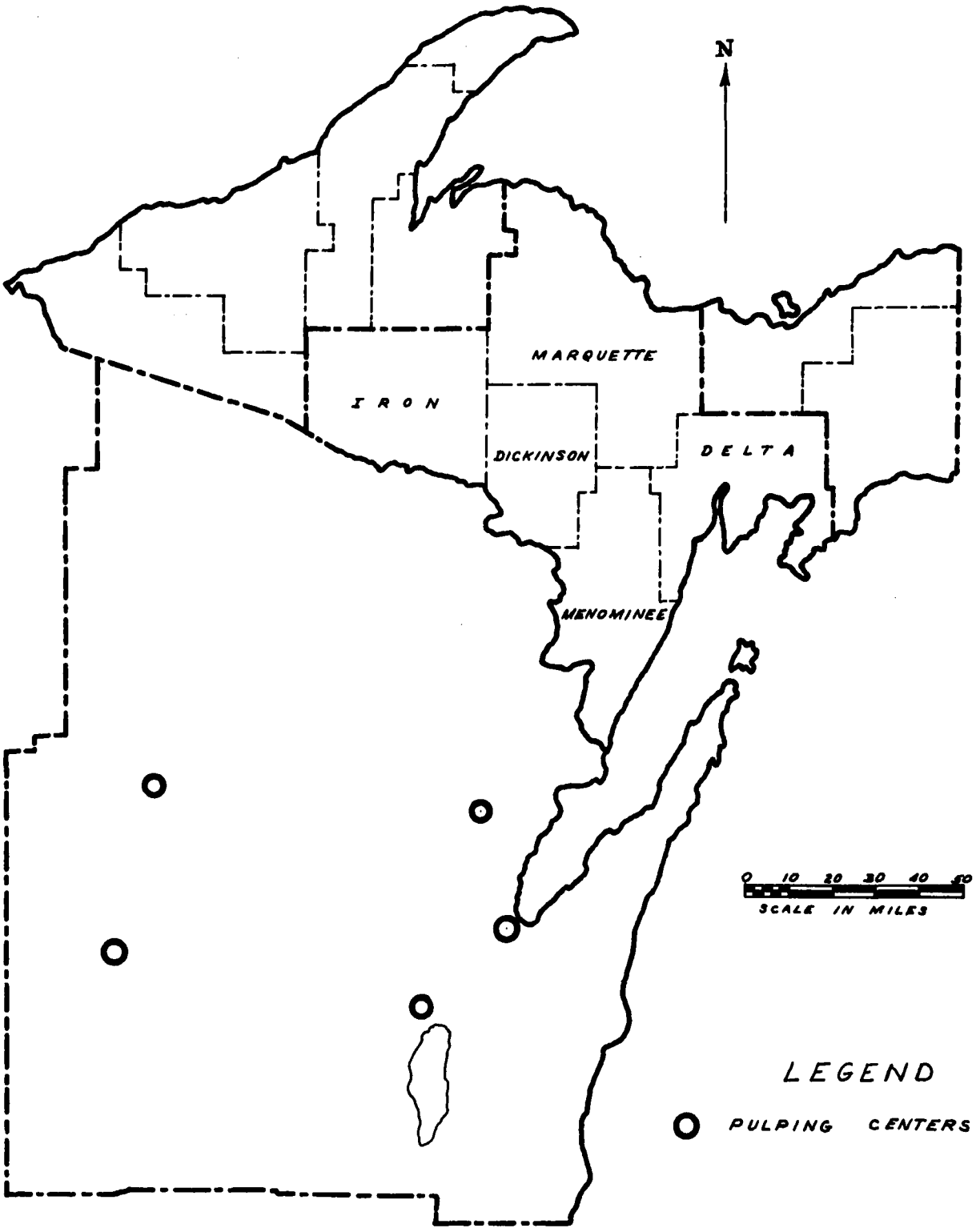

Figure 1. Five study counties in the Upper Peninsula in relation to five pulping centers in Wisconsin.

of Commerce. Opinions concerning the adequacy of the rail and road network to handle current and additional demands were obtained by structured personal interview with eight major shippers of forest products in the Upper Peninsula during the summer of 1966.

Pulpwood is most frequently transported to Wisconsin by truck to a rail loading point, and then by rail to destinations. The number of potential rail loading points in individual study counties vary from 20 to 50. In order to reduce the number of potential rail loading points to managable proportions, representatives of the three major railroads serving the study counties and four major pulpwood shippers were sent a questionnaire asking them to indicate those loading points within each county which accounted for 80 percent of the wood exported. In addition, they were asked to select the best loading point within each county to concentrate and trans-ship pulpwood by rail to Wisconsin.

Rail rates from selected loading points to each of the five pulping centers are rates effective in November, 1968. Rates for all railroads were graciously supplied by the Soo Line Railroad.

The cost of trucking pulpwood to rail loading points and directly to pulping centers, where applicable, are obtained by calculating the average distance traveled over each class of road to reach rail loading points and applying appropriate 1968 Forest Service trucking cost estimates. Average size of vehicle and cordwood capacity per load were obtained from Timber Sale Officers in both the Ottawa and Hiawatha National

Forests.

Transportation costs for moving pulpwood from origins in the five counties to pulping center destinations in Wisconsin are obtained by (1) calculating the cost of moving pulpwood by truck direct to pulping centers, where appropriate, and (2) calculating the cost of trucking wood to rail loading points and the cost of moving wood by rail from respective rail loading points to pulping center destinations. The total average cost per cord, for moving the volume of pulpwood under consideration (90 percent of exports) from the five counties to Wisconsin pulping centers in 1966, results from adding the weighted average cost of direct trucking and the weighted average cost of truck-rail shipments to pulping centers. Total costs per cord are compared for movement from multiple and from single rail loading points in each county.

A standard linear program transportation model was used to vary the volume of pulpwood moving over existing transportation facilities in an effort to reduce the total transportation cost per cord. Through a progressive series of mathematical calculations, the program determines the combination of volumes available at selected multiple rail loading points in the study counties that would satisfy requirements at pulping center destinations at the lowest total cost per cord.

CHAPTER II

REVIEW OF LITERATURE

Transportation is an important factor in the successful operation of almost every business. In recognition of this importance many books are devoted almost entirely to describing the operation of our nation's private and regulated transportation. But only a limited number of forestry references discuss the transportation of forest products in any detail. The importance and relation of transportation in the movement of various forest products has been reported in two broad ways: (1) studies aimed at the location and development of wood-using industries in a particular geographical region and, (2) studies reporting existing marketing methods. The first two sections of this literature review are devoted to these two broad catagories. The third and final section deals with studies pertaining directly to the Upper Peninsula of Michigan.

Industry Location and Development

The initial location or expansion of industries is particularly important to the economic health of an area. And for a region endowed with an abundant supply of timber it is appropriate that it seek to expand the utilization of its native resource. Studies seeking to supply information necessary for the decision to locate or expand a forest-based industry have emphasized the transportation factor in varying degrees.

Studies by Hughes (1962), Spindletop (1964), Macdonald (1963), and the New Hampshire Agriculture Experiment Station (1966) are examples of reports designed to supply almost all information pertinent in the location decision. But most of these studies are too limited in scope to provide all the information necessary for the location decision. Generally speaking the most detailed analysis is given to one or more of the variables considered most important. With forest-based industries the location and extent of raw material resources is usually considered the most important variable.

In a study by the Rocky Mountain Forest and Range Experiment Station, Hughes elaborated on pulp and paper making opportunities in west central Colorado. Statistics concerning the raw material resource and proposed market advantage constituted the bulk of the report. Transportation, which definitely affects market advantage, was treated only nominally.

Spindletop's Research, in contrast to Hughes, placed much more emphasis upon the transportation factor. In a contract with the Area Redevelopment Administration, Spindletop considered a pulp and paper mill location in western Kentucky. Costs of transporting raw materials and finished products by rail, truck, and barge were presented in an effort to facilitate comparison. The detailed transportation information developed in this report stimulates a more realistic examination of the transportation function in the location decision.

In two separate reports for the Area Redevelopment Administration, Macdonald Associates, Inc., and the New

Hampshire Agricultural Experiment Station analyzed several different forest products industries. Macdonald Associates developed an integrated forest products manufacturing and marketing complex for eastern Kentucky. This study recognized the importance of freight rates and gave them considerable attention in the report. Furthermore, the authors presented a detailed organizational design including plant layouts, financial operating data, and corporate organization structure. This is probably one of the most comprehensive and detailed studies of its kind.

The New Hampshire study was similar in many respects to the work of Macdonald Associates. The New Hampshire report, however, did not formally propose an integrated complex for the industries considered profitable for the study area. Freight rate levels for transporting forest products from the study area were presented as being competitive.

Another group of studies is less comprehensive than those previously mentioned. These reports concentrate more on information concerning the transportation function.

Hagenstein (1964) identified the importance of transportation as a factor in the location decision of four selected wood-using industries in the northern Appalachians. Concentrating on the production side of the overall location decision the author found that the costs of wood, labor, and transportation were the most important factors affecting the choice of location in the four industries examined--lumber, particle board, woodpulp, and furniture. The study showed the relative importance of each factor varies with the

particular industry. It is significant to note that the cost of transportation rated second only to the cost of wood as the most important factor in both the lumber and woodpulp industries. Transportation cost rated third in importance behind labor and wood in the location decision for the particle board and furniture industries. Other factors such as state and local taxes, local financial assistance, and the cost of industrial sites were indicated as being relatively unimportant to the wood-using industries. But Hagenstein indicated that these "other" factors have been stressed in the past by development agencies. Thus the author concluded that development agencies should concentrate on providing potential firms with information organized in terms of the most important requirement of each industry.

Carpenter (1964) also recognized transportation as one of the most important factors affecting the location decision for wood-using industries. His study investigated the transportation resources of five-northeastern Minnesota counties in relation to the potential for expanding their forest-based industries.

Carpenter presented the extent and direction of commodity flows in and out of the study area. He described the rail and highway system and the services provided by railroads and truckers. In addition the services of the harbor at Duluth and the potential for ocean shipping was also discussed briefly. The author concluded that the growing population of the nation and the midwest coupled with the application of technological advances as they became feasible, gave the five

county study area a good opportunity to expand its wood-using industries. The area's transportation facilities are considered adequate in most respects with minor deficiencies being solved as product shipments expand.

Another recent study in the upper Great Lakes also concentrated on transportation. In a report prepared for the Area Redevelopment Administration, W. B. Saunders and Company (1964) identified transportation and distribution disabilities for selected industries in northeast Minnesota and northern Wisconsin. One of the industries selected for the study was timber and forest products; the other two were taconite and agricultural products.

The Saunders study included the area studied by Carpenter, although it took a slightly different approach. Whereas Carpenter reported transportation facilities and rates in general, Saunders concentrated on the development of wood chipping as a means of improving transportation efficiency. Their study indicated that the use of chips: (1) expedited loading and unloading, (2) improved handling at all stages in the transportation process, and (3) improved logging efficiency through utilization of ends and limbs. A cost analysis was developed to illustrate savings in chipping at woods locations and movement to mills via pneumatically loaded rail cars as opposed to the conventional roundwood system presently in use.

While chipping has definite bulk handling economies, the Saunders study did not consider the price stability per cord of chipped wood, nor the volume necessary to justify interme-

diate hauling equipment. The authors also failed to realize that some method must be found for removing bark or tolerating a higher percentage in the pulping process before significant use can be made of limbs.

Campbell (1965) focused his attention on freight rates as a factor in the development of wood-products industries in West Virginia. His study stressed the development of additional traffic rather than shifting traffic from one carrier to another.

He concluded that negotiations with carriers should be a continuous process, without attempting to develop a rigid or formalized rate structure. This allows greater flexibility in adjusting rates to reflect changes such as lower rates for competing areas, greater volumes available for shipment, and improved facilities and equipment.

Campbell also recommended three other actions which "seem to be justified beyond question." First, that a traffic manager be engaged to serve the small wood-products industries within the state. An individual familiar with the problems of both carriers and shippers, he concluded, could bring his professional knowledge to bear in the solution of transportation problems. Second, special emphasis should be placed on improved roads and highways throughout the state and especially in the timber-producing regions. Third, the author recommended further study of the transportation costs of various wood products including freight rates charged by railroad and truck companies.

Harper (1961) lends strength to Campbell's recommendation

concerning the hiring of a traffic manager by reporting how small manufacturing firms in Minnesota plan and organize their transportation expenditures. Harper experienced "considerable difficulty" in attempting to secure information because respondents had little or no idea of what their transportation costs were. He concluded that someone within the organization should be given the responsibility for transportation-related activities in order to insure economic utilization. A traffic manager for example could be responsible for his company's planning, direction, selection, purchase, and use of transportation and transportation service.

Methods of Movement

There are five possible methods for transporting semi-finished and finished forest products: rail, truck, water, pipeline, and air. The method used depends largely on the value, volume, and handling characteristics of the product being moved. Most forest products move by truck and rail, although a large volume of bulk commodities such as lumber and woodpulp move by water where facilities are available. In addition a small volume of forest products with a high value-weight ratio may be transported by air, where speed is essential. There is also a growing interest in the transportation of wood chips by pipeline.

Wackerman (1966) indicates that the method of transportation is an important factor in planning the timber harvesting operation. Methods for bucking, skidding, and loading cannot

be determined unless the type of transportation has been selected. Thus the first decision in planning the harvesting operation is the selection of the transportation method.

Although transportation cost often represents the most important single cost factor in the harvesting operation, estimates of the proportion of transportation cost to total cost vary with local conditions. James and Lewis (1960) reported that hauling costs to pulpwood shippers in Lower Michigan commonly range from one-fifth to more than a third of the total costs of delivered wood. Moreover, Manthy and James (1964) estimated that secondary pulpwood hauling costs in the North Central region ranged from 12 to 35 percent of the delivered price of wood. In the United States Wackerman estimated that, in general, total transportation costs average approximately 40 percent of the direct cost of logs or pulpwood delivered to the mill. Thus there is little doubt that transportation costs are important to the harvesting operation. But the exact costs are somewhat difficult to generalize because of differing local conditions.

James and Lewis (1960), Manthy and James (1964), and Wackerman (1966) suggest that the intensity of forest management practiced depends to a large extent on transportation costs. In general, the higher the percentage of transportation costs to total costs the less return on stumpage. Thus the costs of transportation directly affect the value of the stumpage and, indirectly, the management practices designed to increase that value. Indeed, transportation costs strongly influence whether or not the timber will be harvested

at all.

Pulpwood movement to mills in the Lake States is mostly by truck. James (1957) reported that in 1954 about 53 percent of the pulpwood volume used in Michigan mills moved by truck, 24 percent by rail, and 23 percent by water. By 1957 this percentage, as reported by James and Lewis (1960), had changed to 61 percent by truck, 17 percent by railroad, and 22 percent by water. In an even later survey, Manthy and James (1964) reported that 67 percent of Michigan's pulpwood was transported by truck and 23 percent by rail. The later study also reported that the percent of pulpwood volume delivered to mills sampled in Minnesota was 56 percent by truck and 44 percent by rail in 1959.

Of the major pulpwood-using states in the North Central region, only Wisconsin moves pulpwood to mills primarily by rail. In 1959 as high as 70 percent of the pulpwood used in Wisconsin mills was transported by railroad (Manthy and James, 1964). This is a decrease from 1954 when the percent of pulpwood transported by rail was reported as 84 percent. Wisconsin mills reach out farther for wood thus making rail haul more economical. Hamilton (1965), however, felt than even for relatively long distances pulpwood transported to Wisconsin mills may be better moved by truck. He indicated that some gains could be made in transportation efficiency if a greater percentage of the total pulpwood receipts were delivered by truck.

The distance pulpwood is shipped varies widely. Manthy and James (1964) reported that in the Lake States rail haul

is generally not used for distances of less than 100 miles. Truck haul was used for shorter distances, although in isolated cases it went beyond 200 miles. Average truck haul distances were reported as 71 miles for Michigan, 30 miles for Minnesota, and 28 miles for Wisconsin.

In a study of pulpwood trucking in Maine, Schroeder and Cocoran (1965) also indicated a wide variation in the distance pulpwood moved by truck. In general, small operations shipped shorter distances than larger ones. Pulpwood harvesting agencies, excluding company producers, shipped most of their wood to markets located within 70 miles.

In a later study Thompson and Corcoran (1966) investigated the physical and financial nature of independent pulpwood trucking firms in Maine. They concluded that the independent firm cannot be realistically typified because of wide variations. Since truckers adapt to varying situations, the size and type of firms differ both within and between groups of firms transporting pulpwood to various mills.

Most lumber in the Northeast moves via rail and truck. Whitmore (1963) indicated that 60 percent of the lumber purchased by wood products manufacturers in the Northeast is delivered by truck. The remainder is delivered in railroad carload lots.

Lumber movement in the Southwestern United States is also predominately by truck. In a study of the efficiency of lumber transportation from New Mexico to out-of-state markets Hong (1966) observed that trucks were used to transport 73 percent of the lumber exported from the state.

Generally trucks were used for distances of up to 600 miles and railroads for greater distances. Of the companies surveyed, one quarter used trucks exclusively to transport their lumber to markets. The remainder utilized both truck and rail.

In still another study of the primary wood industries of West Virginia W. H. Reid (1961) indicated that trucking was the most frequently used method for transporting raw material to primary processing sites. Approximately 40 percent of the operators of wood-using industries use their own trucks exclusively in transporting wood raw material, and nearly 20 percent use contract trucking exclusively. The balance of the operators use combinations of their own trucks, contract trucking and railroads. Small and medium sized sawmills tend to use their own trucks for transporting material to the mill whereas large mills used a contract means, either truck or rail, to transport 85 percent of their logs. But average hauling distances are relatively short. Small mills hauled logs an average of 10 miles, medium size mills 17 miles, and large mills 36 miles. The study made no mention of the distance or mode of transportation for finished products.

The movement of finished printing papers to market is largely by rail and truck. Spindletop (1964) surveyed printing and fine paper merchants and converters in Pennsylvania, Maryland, New York, Massachusetts, Indiana, Illinois, Georgia, Missouri, Ohio, Tennessee, Louisiana and Kentucky. Thirty-eight percent of the respondents stated that the majority of their orders were shipped from the mill by truck

while 33 percent indicated rail as the primary carrier. The remaining 29 percent indicated that truck and rail facilities were used on an approximately even basis.

A particular method of transportation is generally favored for a number of reasons. Habit, economy, speed, lack of knowledge, reputation, and special services are but a few. A New Hampshire Agricultural Experiment Station study (1966) reported that truck transportation was favored by wood-using industries in the study area because it permitted truck-load as well as less-than-truck-load lots. Motor carriers are considered flexible where infrequent small lot shipments are moved and can provide a high degree of service where large volumes are involved.

Spindletop, in its sample of printing and fine paper merchants and converters, indicated that respondents preferred outbound truck shipments because of speed, convenience, and dependability. In addition, truck shipments of small quantities involved less handling, thereby holding damage to a minimum. The prevailing reasons for preferring rail transportation were: (1) cheapness of long distance shipping, (2) ability to handle large tonnages, and (3) merchant's convenience in unloading shipments.

Long rail transportation may sometimes be preferred by pulp mills even though costs may be higher than truck delivery. James and Lewis (1960) and Manthy and James (1964) indicated that one of the reasons is the fact that mills want to avoid overcutting the wood supply within short distances of the mill. Another reason is that negotiations with producers at

greater distances may make them quick to respond when the mill needs large additional volumes in the future. Some companies also think that rail delivery can be more easily controlled.

Studies of the Upper Peninsula

Toward the turn of the century forestry and mining were still the mainstay of the economy of the Upper Peninsula. Shortly thereafter, however, as the pine forests were cut over and the mines exploited, people began to leave the area. Since then the Upper Peninsula has been faced with chronic unemployment and a slowly declining population. But the potential of forestry and mining are still all important in the economy of the Upper Peninsula. The cut-over pine forests which originally dominated the area have been largely replaced by a maturing northern hardwood forest. In addition, new mining methods and discoveries of additional ore bodies have again placed mining in an important position.

Realizing the potential of the Peninsula's natural resource, various governmental organizations have funded studies designed to recommend ways of stimulating economic growth. Although a number of factors are necessary to bring industry and people back into the region, transportation facilities and cost are among the most important. The studies examined here are those which deal, in varying degrees, with the adequacy of transportation.

Ebasco Services (1953) undertook the first major study of

the Upper Peninsula oriented toward economic development. The purpose of the study was (1) to evaluate the economic and cultural climate of the Upper Peninsula, and (2) to recommend comprehensive programs for economic improvement. The report, which was prepared for the Michigan Economic Development Commission, was quite comprehensive. It recommended, among other things, more extensive utilization of the forest resource by developing both primary and secondary forest products industries.

In general the Ebasco report treated transportation very lightly. The study considered transportation facilities within the study areas as "fairly good", although it stressed the need for a better link with lower Michigan--a link which came several years later in the construction of the Mackinac bridge. The study also recognized freight rates as extremely important and recommended that they be given further study.

Ten years later, Ebasco Services (1963) submitted another report to the Commission. This report was designed to examine what had occurred during the intervening 10-year period and to recommend future action programs. It indicated that in general good progress had been made but suggested there was room for more completely integrated wood-using operations. They recommended the development of marketing agencies to sell the related products of a number of small manufacturers and furnish them with required sales, advertising, and sales promotion services.

Although physical transportation facilities and service were considered adequate, the report also recommended that

consideration be given to the possibility of establishing a general cargo port in the study area. They felt that since the port of Escanaba is able to operate on a year-around basis it should be considered favorably for such a facility.

Several years prior to the second Ebasco report James (1961) completed a comprehensive review of the economy and growth potential of the Upper Peninsula for the Committee on Public Works of the United States Senate. James also indicated that the timber resource of the Upper Peninsula could support a large expansion of its wood-using industries. He saw the greatest potential for expansion in the pulp and paper industry and recommended integration of the various stages of production in the other forest products industries.

On the subject of transportation facilities James indicated that the transportation network was "fairly well" developed within the study area and the connections with consuming markets were good. In discussing freight rates, he concluded that the total costs of transporting raw material to mills and manufactured products to consuming markets are less than they are in most timber products exporting regions of the country. Freight costs for chemical deliveries were indicated as probably being lower than in most important pulp-producing regions. James further showed that pulp freight rates from Sault Ste. Marie to Midwestern markets are substantially lower than from Southern pulping centers.

In early 1964, Nathan Associates, Inc. (1964) completed a report for the Transportation Committee of the Upper Peninsula Committee on Area Problems. This was the first

study of its kind to deal strictly with transportation. The report was comprehensive and presented numerous tables concerning freight rates, traffic volumes, and origins and destinations of various products.

Nathan Associates emphasized, as other studies have done, that the Upper Peninsula is tied economically to Wisconsin, Minnesota, and Illinois. Among other things, they recommended that the Upper Peninsula develop highly coordinated transportation planning with those states.

In recognizing the potential of the forest resource Nathan Associates stressed the development of industries to utilize it. They indicated that transportation facilities and service routes which serve all industrial development were adequate to meet the current and foreseeable future needs of the area. Freight rates were seen as favorable for the forest-products industries. Indeed, on the subject of rail shipping costs, the report stated:

> Anticipated growth in manufacturing in the U.P. is likely to be in the wood products sector selling to the major Midwestern markets of Chicago, Milwaukee, Detroit and Minneapolis. The cost of shipping wood products such as lumber, wood pulp, printing paper, paper board, pulp board, wallboard and plywood to these markets is substantially less from the U.P. than from competitive resource areas such as the South, New England and the Northwest. Aside from differences related to minimum weights and other rate factors, the cost of shipping these products from the U.P. to markets enumerated is about half of the cost from other regions. (Tariff data provided by the Soo Line Railroad Rate Department)

The Nathan report concurred with the Ebasco report (1963) in recommending a study of rates and tolls on the Mackinac Bridge. The Nathan report was particularly concerned with

the effects of lower rates on commercial truck traffic over the bridge. Effective January 1, 1969 rates over the Mackinac Bridge were lowered an average of 60 percent.

In view of the potential importance of low-cost water-borne transportation, the Nathan report recommended an all-year port facility. Unlike the Ebasco report (1963), however, Nathan recommended Menominee as a location (rather than Escanaba) because of its greater diversification in products handled.

In 1964 the Soo Line Railroad (1964) produced a report designed to up-date the timber resource data as presented by the Forest Service for the period 1946 to 1954. The report concentrated entirely upon the location, growth, and cut of commercial forests in the Upper Peninsula. It concluded that the resource base would allow increased utilization by all segments of the forest products industries. In particular, the report indicated that pulpwood production could be increased by 25 percent without deteriorating the resource base.

The Soo Line report did not mention transportation specifically. The Soo Line, however, is one of the two major suppliers of rail transportation in the Upper Peninsula and, as such, depends on forest products for freight revenue.

A report to the Institute of Wood Research, Michigan Technological University, by Arther D. Little, Inc. (1965) concentrated on the opportunities for pulp and paper manufacture in the Upper Peninsula. This report indicated that one of the principal advantages for pulp mill location in the study area was low-cost transportation to major markets.

Some sites were indicated as having a freight rate advantage of around $4.50 per ton over Southern mills also supplying North Central markets.

The most comprehensive study of transportation and distribution facilities in the Upper Peninsula was compiled by EBS Management Consultants, Incorporated (1967). Developed as a technical assistance project for the Economic Development Administration, this study concentrated on transportation problems in the Upper Peninsula and the northern 32 counties of the Lower Peninsula.

Although the EBS report discussed almost all current and potential users of the various transport modes, forest products were given particular attention. Lumber and pulpwood were recognized as products having a relatively low value per unit of weight and a high percentage of delivered costs in the form of transportation. The report indicates these products move primarily by rail over any distance greater than 70 to 80 miles. Furthermore, interviews indicated that shippers were concerned about poor rail service and the lack of railroad cars, while the carriers complained that lumber and pulpwood were poor revenue producers. Because the large number of small producers and frequency of small loadings contributed to the poor revenue situation, the EBS report recommended that pulpwood be concentrated in relatively few locations during the production seasons and shipped to mills at a steady volume throughout the year. This arrangement, they felt, would insure the carriers a steady commodity flow and thereby provide an incentive to increase service.

Since relatively high value wood products produced by small independent manufacturers are usually sold on an f.o.b. factory basis, manufacturers are largely ignorant of transportation costs and services. Those who are concerned with service are frequently dissatisfied with the quality of common carriage and in many cases resort to private and/or contract carriage as an alternative. In most cases, however, these shippers are unaware of the actual costs of providing their own service.

The EBS report concluded that both rail and truck facilities in the Upper Peninsula were generally adequate, although common carrier service was below standard in some cases. The report recommended a number of actions which would help break the vicious circle of lack of traffic which in turn stimulates lack of service and discourages further traffic. Cooperation and communication between shippers and carriers was a major element in all recommendations.

CHAPTER III

TRANSPORTATION FACILITIES

The demand for transportation facilities is a product of the demand for goods produced; it is a derived demand. Accordingly, the demand for wood raw material and resulting products from a producing area stimulates the development of railroad facilities and roads to link resources to manufacturers, and manufacturers to consumers. Moreover, facilities ordinarily develop only after a demand has been established, and they may remain after the demand for them has diminished.

Largely because of the growth in extractive industries, notably mining and timber, the Upper Peninsula possesses an adequate rail and highway network. Rail facilities developed rapidly until around the turn of the century when mining and lumbering operations reached their peak. Today, most railroad trackage remains active although the volume moved has declined substantially on some lines.

A continuing highway development program over the years has increased general accessibility to all counties in the Upper Peninsula. In addition, logging roads constructed during the early lumbering days can usually be reopened at modest cost.

However, due to the apparent geographical remoteness from midwestern markets, concern has been expressed over the Peninsula's so-called transportation disability. In recent years several studies have examined transportation facilities

in an effort to point out existing "disabilities." One such study (James, 1961), conducted for the Committee on Public Works of the United States Senate, indicated that the geographical remoteness of the Upper Peninsula was more of a psychological obstacle than a physical one. It concluded that the transportation network as a whole was fairly well developed within the Peninsula, and that the connections with consuming markets were good.

Railroads

The Upper Peninsula is served by eight railroads, three of which are classified by the Interstate Commerce Commission as Class I railroads having annual gross operating revenues of five million dollars or more (Table 1). These three railroads have the longest trackage in the Upper Peninsula, and all have direct connections with Milwaukee and Chicago. Class II railroads in the Upper Peninsula are primarily local roads serving as feeder lines either to ports or to interchange points with Class I railroads. The longest Class II railroad operates over 134 miles in Marquette and Alger Counties and a small portion of Schoolcraft County.

The shortest line extends north of the city of Marquette for 24 miles along the shore of Lake Superior.

Most of the railroad routes are oriented toward the region's mineral resources in the western end of the Peninsula (Figure 2). The longest operating road, the Soo Line with 656 miles in the Upper Peninsula, is generally oriented east and west,

Table 1. Railroads serving the Upper Peninsula of Michigan, 1965

Railroad	Miles of track in the Upper Peninsula
	(Miles)
Class I [a/]	
Soo Line	656
Chicago and North Western	468
Milwaukee Road	148
Class II	
Lake Superior and Ishpeming	135
Copper Range	71
Escanaba and Lake Superior	67
Manistique and Lake Superior	38
Marquette and Huron Mountain	24

[a/] Class I railroads are those having $5,000,000 or more in annual gross operating revenues.

Source: Michigan Public Service Commission, 1965.

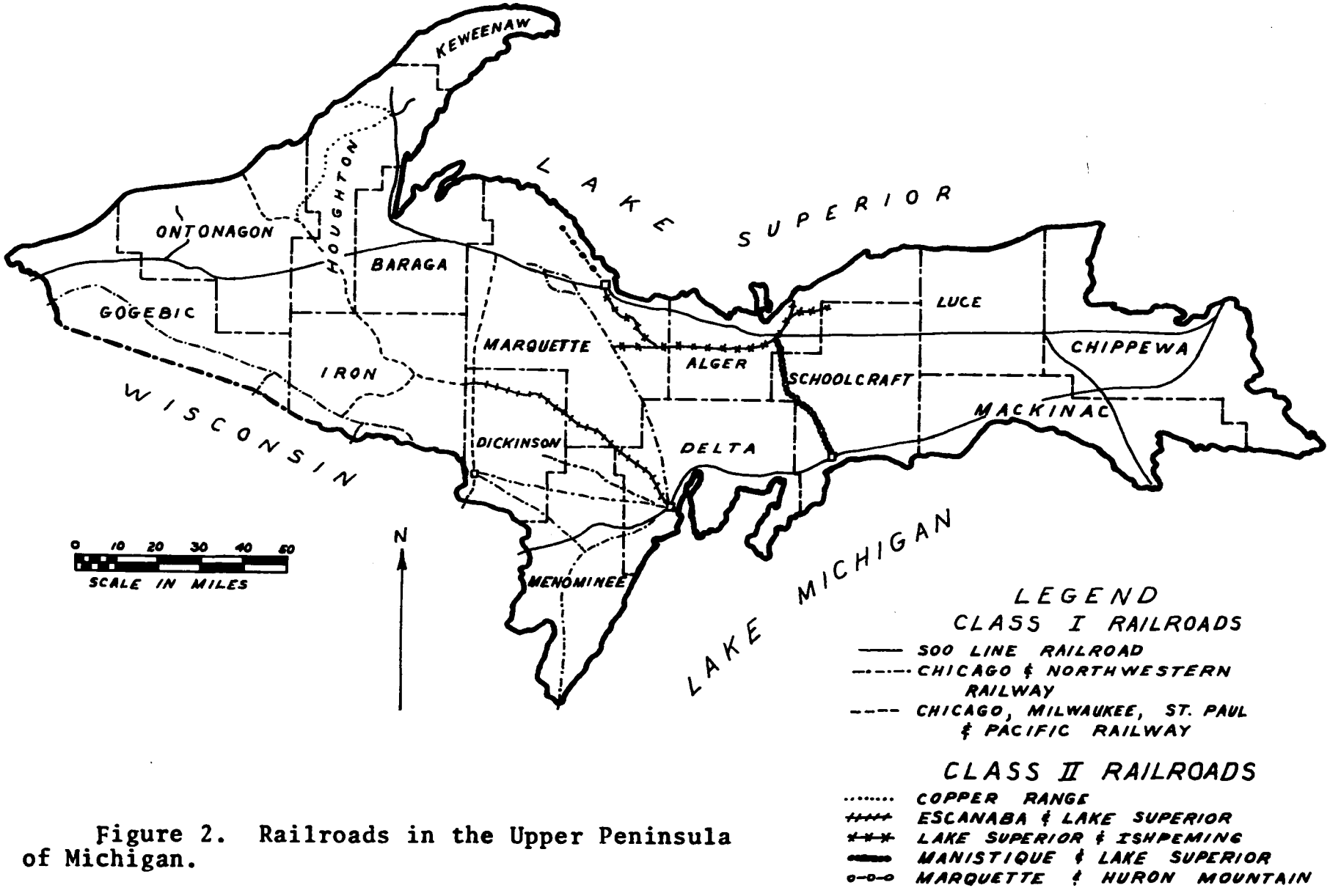

Figure 2. Railroads in the Upper Peninsula of Michigan.

and it provides the only rail link through the Peninsula connecting the west end with Sault Ste. Marie and the Mackinac car ferry in the east. Because of this orientation, however, products originating along the upper portion of the Soo Line tracks in Houghton or Marquette Counties must follow a circuitous route to Chicago, unless traffic is given to a north-south railroad.

The Chicago and North Western's 468 miles of track in the Upper Peninsula extends along the Wisconsin border, dividing the Peninsula in half from Menominee in the south to Marquette in the north. The Milwaukee Road, with 148 miles in the Upper Peninsula, enters the west central Upper Peninsula at Iron Mountain and extends to Ontonagon in the northwest and past Marquette in the northeast.

There is an abundance of rail loading points in the Upper Peninsula. Occurring on tracks at an average of one in every seven miles, they offer easy rail access to almost every point in the Peninsula. In addition, all three Class I railroads offer trailer-on-flat-car (TOFC) services, although loading ramps have been constructed only where justified by local demand.

Two independent studies indicate the adequacy of rail facilities. In a study for the Upper Peninsula Committee on Area Problems, Nathan Associates Inc. (1964), stated, "In general...the Upper Peninsula seems to have a perfectly adequate rail system for the volume of traffic now in existance." Moreover, the company indicated, "In view of the

general decline of the economy over the last five years, there is undoubtedly an excess capacity in the form of either abandoned way or track that is under-utilized." Furthermore, in a more recent study of transportation in the Upper Peninsula, EBS Management Consultants (1967), concluded that with the current density of rail lines "...there is little question as to the adequacy of rail coverage."

Structured interviews with eight major shippers of forest products in the Peninsula during the summer of 1966 revealed concern over railroad rates and service (See questionnaire, Appendix A). Most of the shippers interviewed indicated that rates were fair, but that some discrimination exists where products move long distances and pass through several rate territories.

Lack of service is an unanimous complaint. Every pulpwood shipper interviewed indicated a seasonal shortage of pulpwood cars. Moreover, some railroads offer a reduced rate for multiple loadings, but shippers cannot take advantage of the rate because cars are not available. Likewise, shippers also mentioned that cars are not well-maintained and in some instances are difficult to load because of non-existent or inadequate flooring.

One shipper complained about the condition of a particular section of track. He indicated that the track was so poorly maintained that engine speed was reduced substantially, and that wood was frequently lost because of whipping action or even derailing. This is an isolated instance, however, and

is not representative of the rail network as a whole.

Trucks

Highways provide easy access to all major population centers within the Peninsula, linking them with markets throughout the North Central Region. Major highways in the Upper Peninsula are shown in Figure 3. In addition, a well-developed system of secondary and logging roads insures that most timber is no more than one or two miles from some type of road.

One limited access highway connects the Mackinac bridge with Sault Ste. Marie and most shippers feel that there is little need for additional freeways. Some individuals think that more limited access highways might spoil the Peninsula's unique character for tourists, but most people feel that relatively light traffic and an already well-developed road network do not justify additional limited access highways.

Load restrictions on some primary and secondary roads during the spring break-up period limit timber movement. But most shippers feel this is not a serious obstacle since soil conditions in the woods during this period severely restrict many logging operations.

Almost all wood raw material moving by truck is transported by private or contract carriers exempt from federal regulation because they transport only unprocessed agricultural products. Shippers acknowledge that trucks are more expensive than rail transport on long hauls, but trucks are not as efficient on

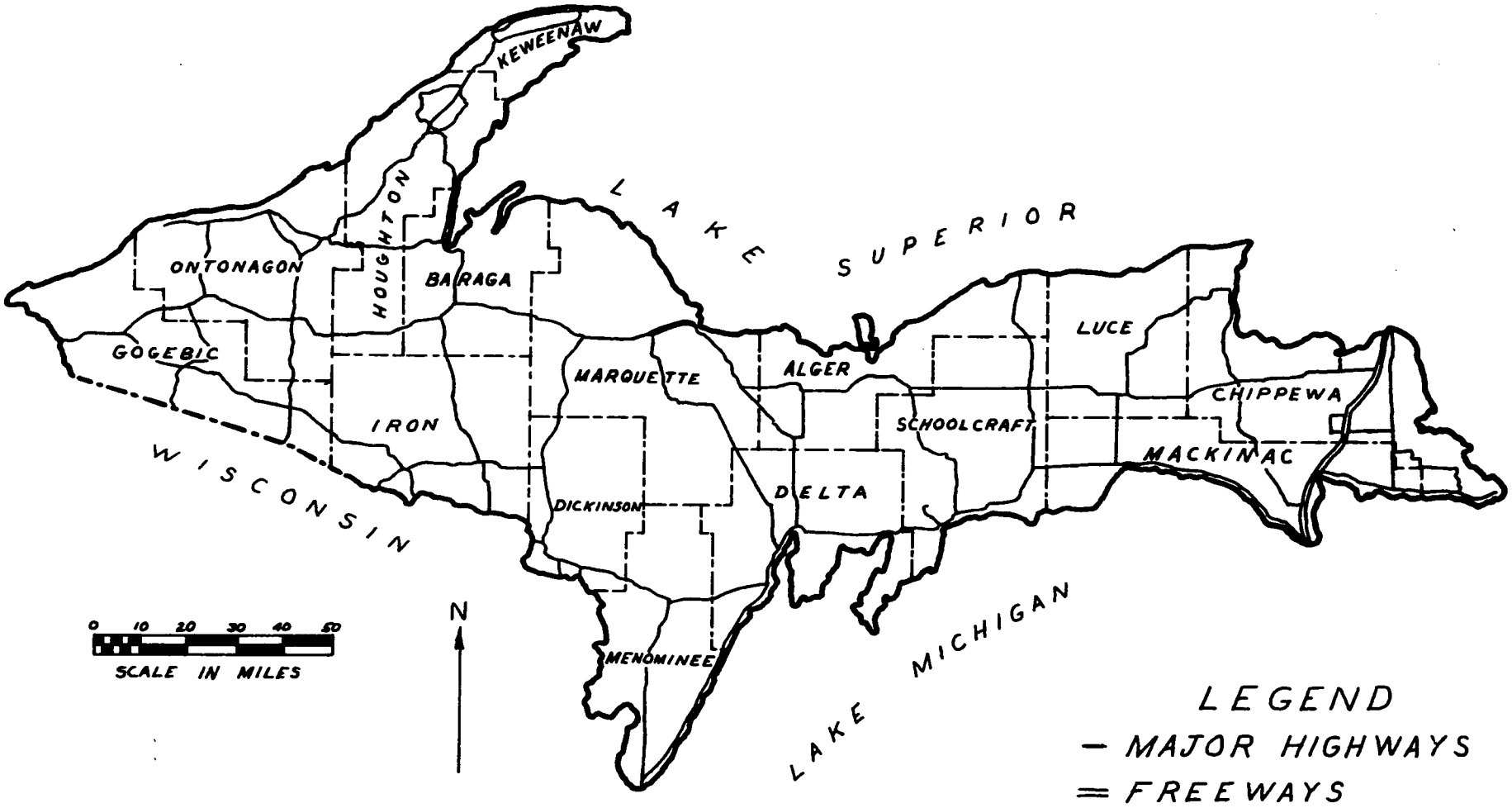

Figure 3. Major highways in the Upper Peninsula of Michigan.

short hauls where volume does not permit full vehicle utilization. Notwithstanding, they feel trucking overcomes these disadvantaged because of its inherent flexibility. For example, trucks hauling pulpwood can be loaded at roadside and can be trucked directly to the mill, thus eliminating intermediate transfer to a rail carrier. In addition, trucks are faster than rail over short and intermediate distances, and therefore may offer a greater opportunity for control in scheduling.

Although at the time of interview all shippers felt the road network was adequate, they indicated emphasis must be given to continued improvement. Larger trucks, having a greater hauling capacity, will require planned road development.

CHAPTER IV

CURRENT PATTERN AND COST OF PULPWOOD MOVEMENT

Regional Movement

Accurate statistics involving the movement of pulpwood are difficult to assemble. Although regulated truck and rail carriers are periodically required to report the origin and destination of groups of forest products, information is ordinarily published on a regional basis. This makes it difficult to isolate small geographical areas such as the Upper Peninsula and Wisconsin. In addition, regional comparisons are difficult because census reporting regions for truck and rail carriers are not identical.

Occasionally the Interstate Commerce Commission publishes a listing of the state-to-state distribution of freight by broad commodity groups, but this information is usually limited to special studies of state or regional transportation problems.

Private and exempt contract carriers are important in transporting forest products, particularly in raw material form. But private and exempt carriers, except under special conditions, are not required to report information concerning the volume and destination of products they handle.

The most comprehensive tabulation concerning the movement of commodities in the United States is contained in the 1963 Census of Transportation. For the purposes of the census,

the universe of manufacturing establishments is divided into groups of reasonably homogeneous industrial activities, approximately the same as those used in the 1961 Annual Survey of Manufacturers. Two shipper groups concern forest products: Shipper Group 6--Paper and Allied Products; and Shipper Group 11--Lumber and Wood Products, Except Furniture. Although these two groups cover a wide range of manufactured forest products moving by all forms of carriage, Standard Industrial Classification 2411, which includes primary forest products such as pulpwood, was not sampled.[1/] The exclusion of this important group of primary forest products severely restricts the Census of Transportation as an indicator of raw wood products movement within the North Central Region.

Pulpwood production and destinations by states are published annually by the U. S. Forest Service. The destinations of pulpwood produced in 1966 in the three major pulpwood producing states of the North Central Region are shown in Table 2. Seventy-seven percent of the pulpwood produced in Upper Michigan and 16 percent of the pulpwood produced in Minnesota was shipped to Wisconsin. Pulpwood from these states, together

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[1/] SIC 2411 Logging camps, pulpwood camps, and logging contractors, are defined as follows: Logging camps, pulpwood camps, and logging contractors primarily engaged in cutting timber and producing rough, hewn, on ravin primary forest or wood raw materials. Independent contractors engaged in estimating or trucking timber, but who perform no cutting operations, are classed in non-manufacturing industries. Logging and woods operations conducted in combination with sawmills, pulpmills, or converting establishments, and not separately reported, are classified in their respective industry groups. Source: Standard Industrial Classification Manual. 1967. Office of Statistical Standards, U. S. Government printing office.

Table 2. Pulpwood production and destinations, selected states in the North Central Region, 1966

Origin	Total cut[a]	Total percent	Destination			
			Minnesota	Wisconsin	Michigan	Other
	(M cords)		(Percentage distribution)			
Upper Peninsula	871	100	--	77	23	--
Lower Peninsula	699	100	--	--	100	--
Wisconsin	1,536	100	1	98	--	1
Minnesota	1,174	100	83	16	--	1

[a] Includes residue and chips

Source: North Central Forest Experiment Station, Pulpwood production and consumption in the North Central Region by county, 1966.

with almost all the pulpwood produced in Wisconsin, was consumed as raw material by 42 mills in that state. The Upper Peninsula retained 23 percent of its pulpwood for consumption by the five pulp mills within the Peninsula, while Minnesota withheld 83 percent for domestic use. In direct contrast, all the wood produced in Lower Michigan was consumed by local mills.

Pulpwood receipts by method of delivery in 1965, the latest year for which figures are available, are shown in Table 3. Rail delivery is common in Wisconsin largely because of tradition and established working relationships with the railroads. Most mills are within economical trucking distance of a large portion of the raw material producing areas within the state. Indeed, Hamilton (1965) indicated that some gains could be made in transportation efficiency if a greater percentage of total pulpwood receipts were delivered by truck.

Minnesota receives a slightly greater percentage of its raw material by truck rather than by rail. Here again long established patterns influence the method of transportation used, although there is a slight trend toward more truck transport.

Although not separated in Table 3, there is a difference in the method of pulpwood transportation used in Upper and Lower Michigan. Lower Michigan depends almost entirely upon trucks largely because the north-south orientation of the rail network limits east-west hauls. In addition, the expense of multiple line rail hauls combined with relatively

Table 3. Pulpwood requirements by method of delivery, selected states in the North Central Region, 1965

Method of delivery	State		
	Wisconsin	Minnesota	Michigan
	(Thousand cords)		
Rail roundwood	1,054	377	80
Rail chips	129	6	--
Truck roundwood	711	435	706
Truck chips	22	3	21
Total	1,916	821	807
Percentage distribution	(Percent)		
Rail roundwood	55	46	10
Rail chips	7	1	--
Truck roundwood	37	53	88
Truck chips	1	--	2
Total	100	100	100

Source: The Timber Producer, (February, 1967), p34.

short distances have established trucks as the most economical transport mode for pulpwood produced and consumed in Lower Michigan. As will be shown later, wood exported to Wisconsin from the Upper Peninsula is transported almost entirely by rail.

Pulpwood Movement from the Study Area

Volume

In 1966, 837,000 cords of roundwood pulpwood were produced in the 13 Upper Peninsula counties. Production ranged from a high of 93,000 cords in Menominee County to a low of 11,000 cords in Alger County.

The five counties selected for a detailed analysis of pulpwood movement pattern and transportation costs produced 408,000 cords of pulpwood in 1966. Production of these five counties represents 48.7 percent of the volume produced in the entire Upper Peninsula. Moreover, 85.5 percent of the pulpwood produced in these counties was exported to Wisconsin. As shown in Table 4, exports ranged from a high of 95.1 percent of production in Marquette County to a low of 73.2 percent in Delta.

Forty-two pulpwood mills in Wisconsin are potential destinations for pulpwood produced in the Upper Peninsula. But only a limited number of these mills actually receive Upper Peninsula wood. Shipping distance from the Peninsula and availability of pulpwood in Wisconsin narrow the number and

Table 4. Pulpwood production and exports to Wisconsin from selected Upper Peninsula counties, 1966

Upper Peninsula county	Pulpwood production [a]	Exports to Wisconsin	
		Cords	Percent
	(Thousand Cords)		(Percent)
Menominee	93	78.6	84.5
Iron	88	73.7	83.8
Marquette	72	68.5	95.1
Dickinson	71	66.4	93.5
Delta	84	61.5	73.2
Total	408	348.7	85.5

[a] Roughwood basis.

Source: North Central Forest Experiment Station, unpublished report.

location of Wisconsin pulp mills receiving pulpwood from the five counties in the study area.

An interview with personnel from the Institute of Wood Research, Michigan Technological University, indicated that 17 Wisconsin pulp mills consume the bulk of pulpwood exported from the five-county study area. These 17 mills were grouped into five pulping centers having an average radius of 10 miles each and designated with the letters A through E. On request of the North Central Forest Experiment Station, which supplied data on the volume of pulpwood received at these mills from each study county, the names and geographical location of the 17 mills cannot be disclosed. As shown in Table 5, these pulping centers accounted for 92.2 percent of the pulpwood exported from the five-county study area in 1966.

In 1966, five species accounted for 89.7 percent of the pulpwood produced in the study counties. As shown in Table 6, over half the total pulpwood produced was aspen, followed by pine, balsam, miscellaneous hardwoods and hemlock. Three other species--birch, spruce, and tamarack--account for only 10.3 percent of total production and are not included in subsequent calculations involving the five study counties.

In 1966, approximately a third of the aspen, one-half of the miscellaneous hardwoods and an insignificant amount of hemlock, balsam, and pine produced in the study area were peeled. In subsequent calculations the volume of peeled and roughwood are combined. No restriction is placed on the proportion of peeled or roughwood produced by origins or re-

Table 5. Pulpwood exports to Wisconsin and to five pulping centers in Wisconsin from selected Upper Peninsula counties, 1966

Upper Peninsula county	Total exports to Wisconsin [a/]	Exports to five pulping centers	
		Cords	Percent
	(Thousand cords)		(Percent)
Menominee	78.6	74.8	95.2
Iron	73.7	66.5	90.2
Marquette	68.5	59.7	87.1
Dickinson	66.4	63.0	94.9
Delta	61.5	57.4	93.3
Total	348.7	321.4	92.2

[a/] Roughwood basis.

Source: North Central Forest Experiment Station, unpublished report.

Table 6. Total pulpwood production by species in selected Upper Peninsula counties, 1966

Species	Production by county [a]					Percent of total production
	Menominee	Iron	Marquette	Dickinson	Delta	
	(Thousand cords)					(Percent)
Aspen	65	54	21	49	39	55.9
Balsam	10	5	9	5	17	11.3
Hemlock	1	5	1	2	5	3.4
Pine	6	3	31	8	9	14.0
Misc. Hwds.	3	11	--	2	5	5.1
Other [b]	8	10	10	5	9	10.3
Total	93	88	72	71	84	100.0

[a] Roughwood basis

[b] Other species include birch, spruce, and tamarack

Source: North Central Forest Experiment Station, Pulpwood production and consumption in the North Central Region by county, 1966.

quired by destinations. The adjustment for differences in weight between peeled and roughwood of the same species is indicated later.

The pattern of pulpwood movement from the five county origins to the five pulping center destinations is shown in Table 7. The largest volume shipped from a single county origin to one pulping center destination occurs in the movement of 31.9 thousand cords from Menominee county to pulping center A. The greatest volume of wood from the study counties was received by pulping center C, which amounted to 106.2 thousand cords or 36 percent of the pulpwood shipped from the five county origins. Together, centers A, B, and C received 265.1 thousand cords or 89 percent of the total pulpwood received by the five possible destinations. Although pulping centers D and E received relatively small amounts of wood from the study counties, their inclusion was considered practical in order to increase the percentage of total exports accounted for by pulping center destinations.

Method of Movement

Pulp mills within each pulping center were asked to indicate the amount of pulpwood they received by truck and rail from each of the five Upper Peninsula county origins (See questionnaire in Appendix B). With one exception, all mills released the necessary information. Since the single mill declining was located in a pulping center where the other mills received pulpwood almost entirely by rail, it is assumed

Table 7. Pulpwood volume received at selected pulping centers from five county origins in the Upper Peninsula by truck and rail, 1966

County of origin and transport mode	Volume received at destinations [a]					Total
	A	B	C	D	E	
	(Thousand cords)					
Menominee						
Truck	27.6	--	--	--	--	27.6
Rail	4.3	15.7	18.6	1.2	.4	40.2
Total	31.9	15.7	18.6	1.2	.4	67.8
Iron						
Truck	--	--	--	--	--	--
Rail	2.4	23.2	20.6	8.7	6.4	61.3
Total	2.4	23.2	20.6	8.7	6.4	61.3
Marquette						
Truck	--	--	--	--	--	--
Rail	17.4	7.3	28.0	3.7	.9	57.3
Total	17.4	7.3	28.0	3.7	.9	57.3
Dickinson						
Truck	.3	--	--	--	--	.3
Rail	4.0	24.5	24.8	1.7	3.2	58.2
Total	4.3	24.5	24.8	1.7	3.2	58.5
Delta						
Truck	1.4	--	1.7	--	--	3.1
Rail	14.0	16.8	12.5	5.5	1.3	50.1
Total	15.4	16.8	14.2	5.5	1.3	53.2
Total						
Truck	29.3	--	1.7	--	--	31.0
Rail	42.1	87.5	104.5	20.8	12.2	267.1
Truck and Rail	71.4	87.5	106.2	20.8	12.2	298.1

[a] Volume figures represent the sum of peeled and rough pulpwood.

that it also received all pulpwood from the study area by rail.

In the study area, trucks generally move pulpwood direct to mill destinations where the round trip distance is 70 miles or less. But few origins in the Upper Peninsula are that close to mill destinations in Wisconsin. Consequently pulpwood is most frequently transported by a combination of truck and rail. Thus railroads are the most important final carrier of pulpwood moved from origins in the Upper Peninsula to pulping centers in Wisconsin.

As shown in Table 7, 267.1 thousand cords, or 89.6 percent of the total received by mills in all pulping centers was received by rail. Only one pulping center received a significant volume of pulpwood by truck. Pulping center A received about one-third of the wood shipped from the study counties by truck and the remaining two-thirds by rail. Almost all of the trucked wood originated in Menominee county and represented 86.4 percent of the volume received from Menominee county by pulping center A.

Although rail loading points are spaced on an average of one every seven miles along existing tracks, only a limited number are used extensively as pulpwood loading points. Major pulpwood shippers and the three major railroads serving the study area were asked to indicate the most frequently used pulpwood loading points (See questionnaire in Appendix C). At least 80 percent of the pulpwood shipped by rail from each county originated from a limited number of shipping points. These "most frequently used" points are listed in Table 8.

Table 8. Most frequently used pulpwood rail loading points in selected Upper Peninsula counties, 1966

County	Loading points [a]		
Menominee	Carney	Hermansville	Section 19
	Daggett	La Branch	Spur 27
	Eustis	Peronville	Whitney
	Helps	Powers	
Marquette	Champion	McFarland	Republic Junction
	Ishpeming	Negaunee	Watson
	Little Lake	New Swanzy	Witch Lake
	Mashek	Northland	
Iron	Alpha	Caspian	Kiernan
	Amasa	Elmwood	Mitchal Spur
	Basswood	Gibbs City	Scott Lake
	Beechwood	Iron River	Triangle Spir
Dickinson	Alfred	Hylas	Sagola
	Felch	Merriman	Waucedan
	Floodwood	Randville	
	Foster City	Ralph	
Delta	Bark River	Ensign	Rapid River
	Beaver	Larch	Rock
	Brampton	Nahma Junction	Woodlawn
	Cornell	Pine Ridge	

[a] These most frequently used points are assumed to account for 80 percent of the pulpwood shipped to Wisconsin from each county.

They represent roughly one-half the total number of loading points available in each study county except Marquette. Here approximately one-third of the loading points available are frequently used to load pulpwood.

In subsequent calculations involving the cost of movement, all pulpwood transported from study counties to Wisconsin by rail is assumed to originate from the loading points indicated in Table 8. Moreover, the volume of pulpwood exported by rail from each county is assumed to be evenly distributed among the loading points listed.

Cost

The steps in calculating the average cost per cord of moving pulpwood from origins in the Upper Peninsula to destinations in Wisconsin are shown in Figure 4. The volume of pulpwood actually moved in 1966 is used in these calculations. Truck and rail rates, however, are based on 1968 cost estimates; these rates are used in an effort to generate the most recent total cost figures. Truck and rail rates in 1966 were about 10 to 15 percent lower than in 1968.

In calculating the cost of moving pulpwood by a combination of truck and rail, the pulpwood volume exported by rail was evenly allocated among the most frequently used loading points in each county. Thus the same volume of wood exported by rail to the various pulping centers must be delivered to the rail loading point by truck.

Using Iron county as an example, the average cost per

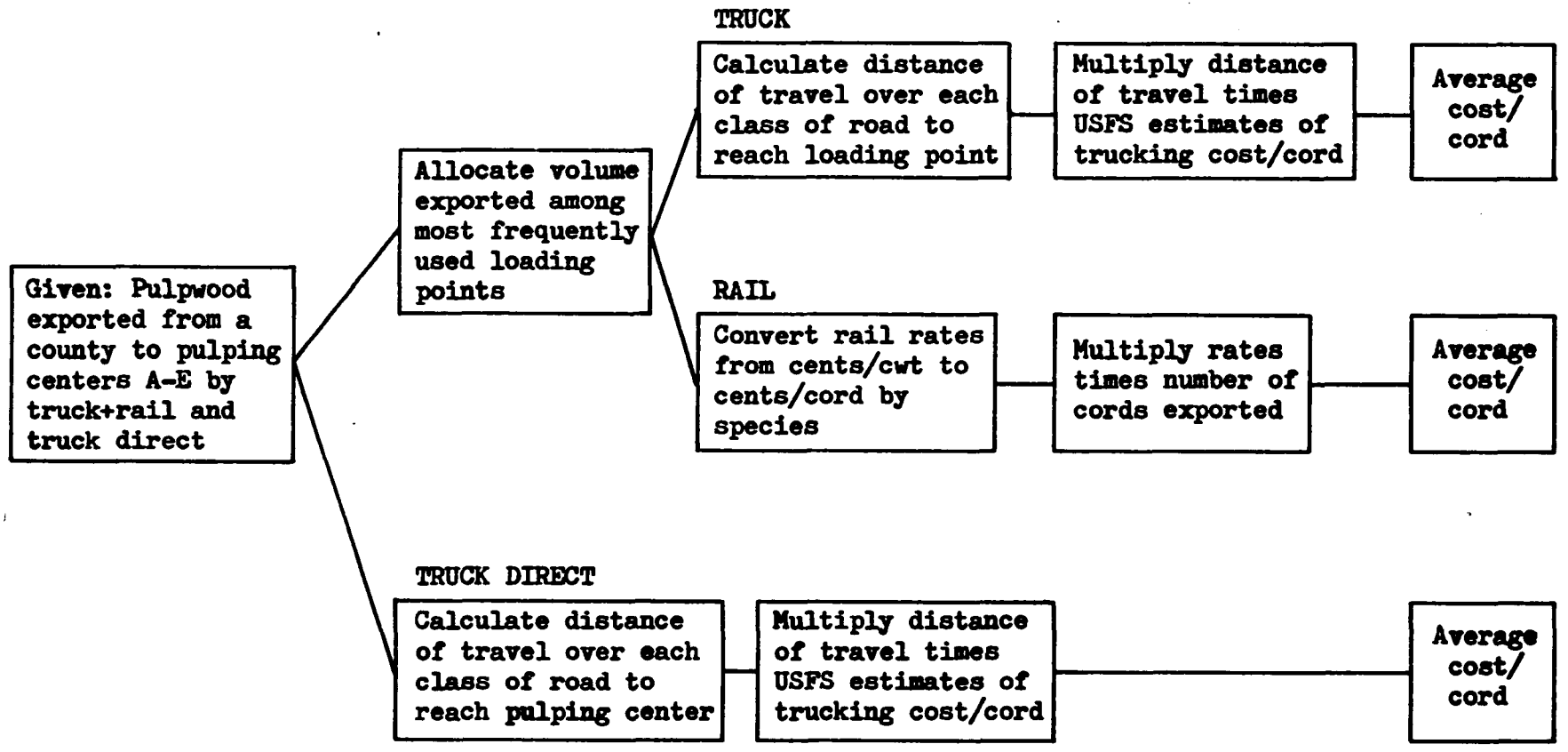

Figure 4. Steps in calculating the average cost per cord for moving pulpwood from an Upper Peninsula county to pulping centers A through E.

cord for moving wood by truck to the most frequently used rail loading points previously indicated in Table 8 was calculated as follows:

Data for truck haul calculation: Iron county

Highway class	Miles of highway	County area (sq. mi.)	Miles per sq. mi.	Accumulated miles per sq. mi.
High Speed (45 mph)	98	1,197	.082	.082
I (35 mph)	80	1,197	.067	.149
II (25 mph)	78	1,197	.065	.214
III (16 mph)	310	1,197	.259	.473
IV (8 mph)	83	1,197	.069	.542
V (4 mph)	Private and Logging			

The number of miles of highway in each class were obtained from the Michigan Department of Highways, Report 162. Miles per square mile was obtained by dividing the number of miles of highway in each class by the square mile county area. Individual miles per square mile figures were then accumulated to obtain the miles per square mile as each class of road was added. The total accumulation is a measure of the miles per square mile of all public roads in the county.

The distance of travel required to reach each class of road was found by the formula:

X_i = miles of travel an class i

$$X_i = \frac{1}{M_i} - \sum_{j=i+1}^{n} X_j, \quad i = 4,..,1.$$

$$X_5 = \frac{1}{M_5}$$

M_i = the accumulated miles per square mile for all roads in higher classes than those under consideration.

In the Iron County example, the necessary miles of travel on each class of road are:

Highway class	Calculation	Miles of travel on each class
High speed	$\frac{\text{miles of high speed highway}}{\text{number of loading points}} \div 4$	= 2.042
I	$X_1 = \frac{1}{.082} - 6.711$	= 5.484
II	$X_2 = \frac{1}{.149} - 4.673$	= 2.038
III	$X_3 = \frac{1}{.214} - 2.114$	= 2.559
IV	$X_4 = \frac{1}{.473} - 1.845$	= .269
V	$X_5 = \frac{1}{.542}$	= 1.845

The miles traveled on each class of highway were then multiplied by the US Forest Service estimates of the cost of hauling for that class as shown in Table 9.

The average cost per cord for moving pulpwood by truck to multiple rail loading points in each county are shown in

Table 9. Average pulpwood trucking cost per round trip mile in Upper Michigan, 1968

Road class	Trucking cost per cord [a]
	(Dollars)
High speed (45 mph)	$0.08
Class I (35 mph)	0.12
Class II (25 mph)	0.17
Class III (16 mph)	0.24
Class IV (8 mph)	0.43
Class V (4 mph)	0.78
Standby, delay, load, unload	1.65

[a] Flat bed 6 x 4 tandem axle truck with mounted hydraulic loader, gross weight 37,000 lbs., six cord capacity.

Source: U. S. Forest Service Handbook on Timber Appraisal, Region 9, 1968.

Table 10. Costs per cord ranged from a high of $5.274 in Marquette County to a low of $3.811 in Menominee County. The range of $1.463 per cord can be accounted for primarily by differences in the mileages for various classes of road. The weighted average cost per cord for the five counties was $4.648.

In calculating the average cost per cord for moving pulpwood from rail loading points in the five county study area to pulping centers in Wisconsin, rail rates in cents per hundred pounds must be converted to rates per cord. Three variables must be considered in this conversion: (1) the species being shipped, (2) whether the wood is peeled or rough, and (3) the rail rate per hundred pounds. Almost all hemlock, balsam, and pine were shipped as roughwood from the study counties in 1966. Significant amounts of aspen and miscellaneous hardwoods, however, were peeled before rail shipment. A composite weight for these two species was calculated in order to reflect differing volumes of peeled and unpeeled wood actually shipped in 1966. Weights in pounds per cord for each species are as follows:

Species	Weight (Pounds)
Aspen	3,646
Hemlock	4,500
Balsam	4,700
Pine	4,400
Misc. Hwds.	4,036

The rail rate per hundred pounds depends primarily on the distance between loading points within each county and

Table 10. Average trucking costs per cord for transporting pulpwood to the most frequently used rail loading points in selected Upper Peninsula counties, 1968 rates

Upper Peninsula county	Trucking cost per cord [a]
	(Dollars)
Menominee	$3.811
Iron	4.987
Marquette	5.274
Dickinson	4.593
Delta	4.253

[a] Trucking cost per cord is not influenced significantly by different species.

each pulping center destination. Consequently, there is a rail rate from each loading point to each pulping center. The total number of rates from all origins to all destinations is 275. These rates are used to calculate the cost per cord for transporting various species from origins to destinations. Table 11 summarizes the average cost per cord for transporting the 1966 volume of pulpwood from each county to each pulping center.

Applying 1968 rail rates, the weighted average cost of transporting a cord of pulpwood by rail from multiple loading points in the study area was $5.403.

On the basis of average truck and rail rates, the total cost of transporting a cord of pulpwood by this combined mode from the study area to Wisconsin Pulping centers was $10.051 per cord.

As shown earlier in Table 7, in 1966 only 31.0 thousand cords of pulpwood moved from the study area by truck directly to pulping centers in Wisconsin. Moreover, Menominee county accounted for almost 90 percent of the volume shipped by this mode. The cost per cord for trucking direct to pulping centers was developed in the same manner used to calculate trucking costs to rail loading points. The average cost per cord for transporting pulpwood by truck direct to pulping centers in Wisconsin was $8.986 per cord. Costs per cord are somewhat higher than trucking to rail points within each county owing to the longer distance of travel over high speed highways necessary to reach pulping centers.

Table 11. Weighted average cost per cord for transporting pulpwood by rail from multiple loading points in selected Upper Peninsula counties to Wisconsin pulping centers, 1968 rates

Upper Peninsula county	Wisconsin pulping center				
	A	B	C	D	E
	(Dollars per cord)				
Menominee	$4.738	$4.340	$5.055	$6.977	$6.321
Iron	5.473	4.670	5.202	6.597	5.812
Marquette	5.824	4.773	6.227	7.890	7.546
Dickinson	5.635	4.407	5.483	7.823	7.051
Delta	5.293	4.722	5.924	7.422	6.826

Applying 1968 transportation costs, the weighted average total cost per cord of exporting 298.1 thousand cords of pulpwood by truck+rail and truck direct from the five study counties to pulping centers in Wisconsin was $9.940.

CHAPTER V

IMPROVING PULPWOOD TRANSPORTATION COSTS

Physical Facilities

Many factors affect the mode and cost of transportation used to move raw material to processing facilities. Distance, volume and frequency of movement, weight per unit, ease of handling, possibility of damage, flexibility of the carrier, and speed of delivery are some of these variables.

Because pulpwood has a low value per unit of volume, it is most often transported by truck and rail. Pulpwood exported from the study area moves either by truck to rail loading points and then by rail to destinations, or by truck direct to destination. Improved transportation costs could take place by increasing the hauling capacity of trucks and by concentrating pulpwood for shipment by rail in 10 car lots. Volume, however, must be sufficient to provide for full equipment utilization. In addition, the inventory and species requirements at particular mills could affect the method of movement. As a result the transport system for a particular mill is usually unique.

This study does not attempt to evaluate either the large number of alternative transport means available to individual mills, or the effect of one mill's transport policy on adjacent mills. Rather, the purpose is to seek a more efficient method of transporting pulpwood from the study area to

Wisconsin pulping centers, given existing transportation facilities. Therefore the total cost of transporting the volume of pulpwood actually moving between origins and destinations by specific mode in 1966, which was calculated in the previous chapter, will be compared with two costs:

1. Optimum distribution pattern.--Linear program solution of least total cost for transporting pulpwood after assuming volumes available at multiple rail loading points per county and volumes received at pulping center destinations are the same as in 1966, but allowing actual allocations to assume least cost proportions.

2. Single loading points.--Total cost of transporting the same volume of pulpwood actually moved between the study area counties and Wisconsin pulping centers in 1966, but assuming single rail loading points within each county.

Optimum Distribution Pattern

The weighted average total cost per cord for transporting pulpwood actually moved in 1966 from multiple rail origins in the study counties to Wisconsin pulping centers was $9.940. But can the allocation of pulpwood between origins and destinations be modified to reduce transportation costs? To answer this question a standard linear programming transportation model was employed.

The linear program takes four items as given: (1) the volume available at origins, (2) the volume required at destinations, (3) the transportation cost from each origin to each destination (in this case truck+rail or truck direct, whichever is lower), and (4) an objective function which is to be minimized (in this case total transportation costs per

cord). The program calculates a progressive series of feasible solutions each one reducing total transportation costs while still satisfying the constraints. The final solution is the lowest transportation cost possible, given specific volumes available at origins and volume requirements at destinations.

As expected, volume allocation in the linear program solution differs from that existing in 1966. Major differences occur in the volume of aspen shipped from Menominee and Delta Counties. As compared with the actual allocation in 1966, the program indicates that Menominee should reduce the amount of aspen shipped to pulping center A by one-half and double the amount shipped to pulping center B. For Delta County the program indicates that no aspen should be shipped to pulping center B, but shipments to pulping center C should be increased fourfold.

In the linear program solution, 6.0 thousand cords of pulpwood were shipped by truck direct to pulping centers as compared with 31.0 thousand in 1966. Furthermore, all truck direct shipments originated from Menominee County.

The program indicates that with the origin availabilities and destination requirements as they existed in 1966, the optimum allocation of volumes could be achieved at a total transportation cost of $9.868 per cord. This represents a savings of only $0.072 per cord of one percent over the total costs of shipping under the actual 1966 volume allocation. Hence, the 1966 method of transporting pulpwood from the study area appears to be

almost operating in the least costly manner.

Single Loading Points

There is a possibility that total transportation costs could be reduced by shipping pulpwood by rail from a single loading point in each study county instead of from multiple points. To answer this question, representatives of the three Class I railroads in the Upper Peninsula and four major pulpwood shippers in the study area were asked the following question: "If you had to choose one location within each of the five counties (in the study area) to concentrate and trans-ship pulpwood by rail, where would they be?" (See questionnaire in Appendix C) Respondents indicated the locations shown in Figure 5.

The same procedure used to calculate total costs in Chapter IV, using multiple loading points, was used to calculate total costs using single loading points.

Average costs per cord for moving pulpwood by truck to single rail loading points within each county are shown in Table 12. The extra distance of travel over high speed highway necessary to reach a single rail loading point in each county makes the cost per cord significantly higher than to reach multiple rail loading points. The weighted average cost per cord for trucking to single rail loading points is $6.501 compared to a weighted average of $4.648 for trucking to multiple loading points.

Costs per cord for moving pulpwood by rail from single

Figure 5. Single rail loading points in each of the five study counties.

Table 12. Average trucking cost per cord for transporting pulpwood to single rail loading points in selected Upper Peninsula counties, 1968 rates

Upper Peninsula county	Trucking cost per cord [a]
	(Dollars)
Menominee	$5.611
Iron	6.784
Marquette	7.835
Dickinson	5.673
Delta	6.305

[a] Trucking cost per cord is not influenced significantly by different species.

rail loading points to pulping centers in Wisconsin are shown in Table 13. In almost every county, costs are lower than where multiple rail loading points are used. The weighted average cost per cord for transporting pulpwood by rail from single rail loading points to pulping centers is $5.030. This is $0.373 lower than costs from multiple rail loading points.

The cost of trucking 31.0 thousand cords direct to mill destinations is the same regardless of whether multiple or single rail loading points are used. As indicated earlier, direct trucking costs average $8.986 per cord.

Applying the 1968 transportation costs to the actual movement of pulpwood from the five study counties to pulping centers in Wisconsin in 1966 by truck+rail and truck direct, using single rail loading points, results in a weighted average total cost of $11.265 per cord. Although the cost of rail transportation to destinations from single loading points per county is less expensive than from multiple loading points, the additional cost of trucking to single loading points makes the cost of using single loading points more expensive by $1.325 per cord. Cost for multiple and single loading points are summarized in Table 14.

Table 13. Weighted average cost per cord for transporting pulpwood by rail from single loading points in selected Upper Peninsula counties to Wisconsin pulping centers, 1968 rates

Upper Peninsula county	Wisconsin pulping center				
	A	B	C	D	E
	(Dollars per cord)				
Menominee	$3.913	$3.836	$4.444	$6.732	$5.926
Iron	6.176	3.126	5.202	6.566	5.486
Marquette	5.410	4.940	5.798	7.929	7.190
Dickinson	4.866	4.462	5.345	8.131	7.138
Delta	3.243	4.391	5.156	7.344	5.869

Table 14. Average cost per cord for transporting pulpwood to Wisconsin pulping centers from multiple rail loading points and from single loading points, selected Upper Peninsula counties, 1968 rates

Method of movement	Multiple loading points	Single loading points
	(Dollars per cord)	
Truck to rail point	$4.648	$6.501
Rail direct	5.403	5.029
Truck direct	8.986	8.986
Weighted average	9.940	11.265

CHAPTER VI

SUMMARY AND CONCLUSIONS

Pattern of Pulpwood Movement

Michigan's Upper Peninsula is an important source of pulpwood to Wisconsin pulp mills. Of the 871.0 thousand cords of pulpwood produced in Upper Michigan in 1966, almost 80 percent was transported to Wisconsin. The remaining 20 percent was used by five pulp mills within the Peninsula.

Almost all pulpwood sent to Wisconsin is shipped by rail. Wood produced and consumed within the Peninsula, however, is transported almost exclusively by truck.

The five counties in the Upper Peninsula producing the greatest volume of pulpwood in 1966 were selected for detailed analysis of pulpwood movement and transportation costs. These counties are Menominee, Iron, Marquette, Dickinson and Delta. Eighty-five percent of the pulpwood produced in these counties was exported to Wisconsin. Aspen, balsam, hemlock, pine and miscellaneous hardwoods were the most important species, accounting for 90 percent of the pulpwood produced in the study counties.

Of the 42 potential pulp mill markets in Wisconsin, 17 received 92 percent of the pulpwood exported from the five Upper Peninsula counties. These 17 mills were grouped into five pulping centers and designated by the letters A through E. Of the 298.1 thousand cords exported to these

pulping centers, 267.1 thousand cords were shipped by a combination of truck and rail, while 31.0 thousand cords were shipped direct by truck.

Rail loading points are numerous in the Upper Peninsula. In the five study counties there is one for every seven miles of railroad. But all potential loading points are not used to transport pulpwood. Representatives of the three Class I railroads and four major pulpwood shippers in the study area indicated those loading points most frequently used. They ranged from 12 in Iron County to 10 in Dickinson County.

Three pulping centers A, B and C, accounted for 89 percent of the volume of pulpwood received. Pulping center A received most of its wood by truck from Menominee County, and by rail from Marquette and Delta Counties. Iron and Dickinson Counties supplied most of the pulpwood shipped by rail to pulping center B. Pulping center C received substantial rail shipments from all five counties.

More Efficient Raw Material Flow

The purpose of this study is to examine possible changes in secondary pulpwood transportation methods which would stimulate more efficient raw material flow between selected producing locations in the Upper Peninsula and major pulping centers in Wisconsin. This is accomplished in three steps:

1. Multiple rail loading points.--Calculating the cost of transporting the volume of pulpwood actually moved from multiple rail loading points in the five study counties in 1966 to pulping centers in Wisconsin.

2. Optimum distribution pattern.--Assuming volumes available at multiple rail loading origins and requirements at destinations as they existed in 1966 and solving a linear program for the volume allocation which would minimize transportation costs.

3. Single loading points.--Calculating the cost of transporting the volume of pulpwood actually moved between county origins and destinations in Wisconsin, but assuming wood moving by rail originated from one rail loading point in each county.

Results of these calculations are summarized in Table 15. The optimum distribution pattern (linear program) allocation of volume between multiple loading points in the Upper Peninsula and Wisconsin pulping centers is the least expensive. But the linear program allocation represents a savings of only $0.072 per cord over the volume allocation existing in 1966.

Consolidating the pulpwood volume shipped from each county into a single rail loading point per county increases total transportation costs over the theoretical minimum by $1.397 per cord. Rail rates from single loading points per county to Wisconsin pulping centers are less expensive than from the average multiple loading point, but the increased trucking distance necessary to reach single loading points increases total costs beyond that of utilizing multiple loading points.

Thus, given conditions in 1966, the least cost volume allocation was almost achieved. Additional savings may be possible by taking advantage of the special rail rates for

Table 15. Average cost per cord for transporting pulpwood from five Upper Peninsula counties to Wisconsin pulping centers by three different methods, 1968 rates

Method of movement	Average cost per cord
	(Dollars)
Optimum distribution pattern	$9.868
Multiple loading points	9.940
Single loading points	11.265

shipment of 10 cars or more and by increasing the size of trucking vehicles to accommodate more cords per load. Both these savings are made in some instances, but based on average conditions the least cost transportation matrix has been implemented. Transportation facilities are deemed adequate to handle current as well as substantial increases in volume. This is the opinion of the major shippers interviewed during the conduct of this study, and it is substantiated by several independent studies of the adequacy of current rail and highway facilities.

One complaint regarding the availability of rail cars was voiced by pulpwood shippers. During peak pulpwood-shipping periods, shippers complain that rail cars are not available in quantity. The railroads indicate, however, that to place more cars in service in order to accommodate the relatively short peak demand for a low revenue commodity would severely restrict their profit position. They are, however, making effort to gain more efficient equipment utilization through computerizing rolling stock inventory.

Another complaint arises from the fact that shippers wanting to take advantage of a 10 car rail rate may not be able to get cars when needed. In most instances, however, these shipping points are not those most frequently used.

A reduction in rail rates is possible if the railroads could close those rail points not frequently used for loading pulpwood, thereby eliminating some maintenance costs. In addition, economies of scale could develop from routing pulpwood cars to 11 loading points instead of 50.

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APPENDIX A.

INTERVIEW SCHEDULE FOR SHIPPERS OF FOREST PRODUCTS

TRANSPORTATION OF FOREST PRODUCTS IN THE UPPER PENINSULA OF MICHIGAN

Personal interview schedule[1/]

Date _____

Part I, GENERAL

1. Name of firm

2. Location

3. Person interviewed

4. Title or position

5. Types of raw materials purchased

6. From whom do you purchase these raw materials

7. Types of products sold

8. Types of buyers sold to (estimate, by products, the volume or percent of volume)

PRODUCT

	volume	percent	volume	percent	volume	percent
Manufacturer						
Wholesaler						
Retailer						
Other (specify)						

9. Major market areas (by product and State)

10. What was the monthly pattern in the volume of raw wood receipts in 1965? (peak and low months--with volumes if possible)

Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec

[1/] The interview schedule presented here has been abbreviated by deleting spaces for recording data for many of the questions.

11. Is this a typical pattern?

12. What is your current raw material procurement area? (indicate on map)

13. Do you anticipate any changes? Why?

14. What was the monthly pattern in the volume of product shipments in 1965? (peak and low months--with volumes if possible)

Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec

15. Is this a typical pattern?

16. Do you anticipate any changes? Why?

Part II, TRANSPORTATION FACILITIES

17. What was the approximate percent of your inbound raw material shipments in 1965 arriving by:

	TYPE OF RAW MATERIAL			
CARRIER		(Percent)		
Railroad				
Truck				
Contract				
Common				
Private				
Water				

18. How do you buy your raw material?

a. delivered at mill
b. delivered to railroad cars at designated loading points
c. stacked in the woods at designated points
d. other

19. Are there any differences in prices paid for delivered wood on the basis of Haul? If yes, what are they?

20. Do you use transit privileges? How?

21. What were the inbound truck hauling distances to your mill in 1965?

TYPE OF RAW MATERIAL

		(Miles)		
Average distance*				
Min. distance				
Max. distance				

*Weighted by volume

22. What were the inbound rail hauling distances to your mill in 1965?

TYPE OF RAW MATERIAL

		(Miles)		
Average distance*				
Min. distance				
Max. distance				

*Weighted by volume (also indicate 1,2, or 3 line haul)

23. What changes occurred in the use of different methods of inbound raw material transportation during the last 10 years? (55-65)

24. How is the decision made to use one particular carrier rather than another? (for inbound shipments)

25. What was the approximate percent of your outbound product shipments in 1965 shipped by:

TYPE OF PRODUCT

CARRIER				
		(Percent)		
Railroad				
Truck				
Common				
Contract				
Private				
Water				

26. What were the outbound truck hauling distances to markets in 1965?

	TYPE OF PRODUCT			
	_____	_____	_____	_____
		(Miles)		
Average distance*	_____	_____	_____	_____
Min. distance	_____	_____	_____	_____
Max. distance	_____	_____	_____	_____

*Weighted by volume

27. What were the outbound rail hauling distances to markets in 1965?

	TYPE OF PRODUCT			
	_____	_____	_____	_____
		(Miles)		
Average distance*	_____	_____	_____	_____
Min. distance	_____	_____	_____	_____
Max. distance	_____	_____	_____	_____

*Weighted by volume (also indicate 1,2, or 3 line haul)

28. Do you use the piggyback service of the railroads? Explain.

29. What changes in the use of different methods of outbound product transportation occurred during the last 10 years? (55-65)

30. How is the decision made to use one particular carrier rather than another for outbound shipments?

Part III, THE TRANSPORTATION FUNCTION

31. Who is responsible for the following traffic functions?

FUNCTION	PERSON OR DEPARTMENT RESPONSIBLE
Ascertainment of rates	
Tracing of shipments	
Selecting types of carriers	
Selecting specific carriers	
Routing of shipments	
Auditing of freight bills	
Determining classification	
Maintaining tariff files	
Diversion, reconsignment and stopping shipments in transit	

Expediting shipments
Preparing rate case evidence
Rate and service negotiation with carriers
Handling cases before regulatory bodies
(ICC and state commissions)
Arranging for adequate car and truck supply
Consolidating and pooling orders
Arranging for payment of carriers
Documentation (preparation of bills of lading, etc)

32. Has your firm ever made a study to determine how the above functions should be handled?

33. Does your firm make use of outside traffic consultants?

Part IV, USE OF PRIVATE TRANSPORTATION

34. Does your firm make use of any private transportation? If no, skip to question 39.

35. What kind of private transportation do you use?

36. Who owns the equipment? (company, leased, both)

37. Why does your firm make use of private transportation?

38. How was the decision made?

39. Why doesn't your firm make use of private transportation?

Part V, OVERALL TRANSPORTATION PROBLEMS AND PLANNING

40. Has your firm set forth any specific principles or rules to follow for transportation planning for either new or existing products? Explain.

41. Have you experienced difficulties in getting rail cars or trucks when you need them?

42. Do you recommend any principles to be followed by firms of your firm's size in planning transportation expenditures?

43. Do you know of any attempt to organize a shippers association? If yes, explain.

44. What do you consider to be the future of wood chipping in the Upper Peninsula?

45. What broad transportation problems do you anticipate in the next 10 years?

46. What broad improvements in transportation do you anticipate in the next 10 years?

47. Do you think the St. Lawrence Seaway will have any effect on your firm's operations? Explain.

APPENDIX B.

PULP MILL QUESTIONNAIRE CONCERNING INBOUND TRANSPORTATION MODE

COVER LETTER

September 18, 1968

Dear:

I am working on a PhD thesis at Michigan State University involving alternative pulpwood transportation costs from origins in the Upper Peninsula of Michigan to destinations in Wisconsin. At this point in the study I need your help in gathering data.

In order to calculate the total current pulpwood transport cost by transport mode, I need to know the volume of pulpwood received at selected Wisconsin pulp mills by truck and rail from each of five counties in the Upper Peninsula. Will you please complete the enclosed table by indicating the percent of each species of pulpwood received at your mill by truck and rail from the counties shown. The appropriate cells are outlined in green. A return envelope is provided for your convenience.

Identifying individual mills in this study will be impossible. Mill figures will be aggregated into "pulping centers" which will be identified only by the letters A, B, C, D, and E.

Your cooperation will be greatly appreciated.

Sincerely,

William R. Wynd

MILL LOCATION _____

PERCENT OF PULPWOOD RECEIVED BY TRUCK AND RAIL FROM SELECTED UPPER PENINSULA ORIGINS, 1966

Upper Peninsula county origin	Species				
	Aspen	Hemlock	Balsam	Pine	Misc. Hwds.
Menominee					
Percent by Truck					
Percent by Rail					
Iron					
Percent by Truck					
Percent by Rail					
Marquette					
Percent by Truck					
Percent by Rail					
Dickinson					
Percent by Truck					
Percent by Rail					
Delta					
Percent by Truck					
Percent by Rail					

APPENDIX C.

PULPWOOD SHIPPER QUESTIONNAIRE CONCERNING RAIL LOADING POINTS

COVER LETTER

September 24, 1968

Dear:

I am working on a PhD thesis at Michigan State University involving pulpwood transportation costs from five counties in the Upper Peninsula of Michigan to five "pulping centers" in Wisconsin. At this time I need your help in securing data.

The enclosed questionnaire contains questions concerning the most frequently used pulpwood rail loading points within each of five Upper Peninsula counties, and your estimate of the most likely pulpwood concentration point within each county. I am asking representatives of the railroads, paper companies and large producers and dealers to help me varify my estimates. Your assistance will help me establish "real world" conditions.

Thank you for your cooperation.

Sincerely,

William R. Wynd

PULPWOOD TRANSPORTATION QUESTIONNAIRE [1]

In answering these questions, please consider the railroads involved as a group.

1. The following rail loading points in each of five Upper Peninsula counties have been designated as those most frequently used to load pulpwood. On the basis of your knowledge, please indicate any appropriate additions or corrections.

Note: These "most frequently used" loading points are assumed to account for 80 percent of the pulpwood shipped to Wisconsin from each county.

County	Loading points		Your additions or corrections
Menominee	Carney	Hermansville	
	Daggett	La Branch	
	Eustis	Peronville	
	Helps	Powers	
	Whitney	Section 19	
	Spur 27		
Iron	Alpha	Gibbs City	
	Amasa	Iron River	
	Basswood	Mitchal Spur	
	Beachwood	Kiernan	
	Caspian	Scott Lake	
	Elmwood		
Marquette	Champion	Little Lake	
	McFarland	Mashek	
	New Swanzy	Negaunee	
	Northland	Republic Junc.	
	Watson	Witch Lake	
Dickinson	Alfred	Felch	
	Floodwood	Foster City	
	Hylas	Merriman	
	Ralph	Randville	
	Sagola	Waucedan	
Delta	Bark River	Beaver	
	Brampton	Cornell	
	Ensign	Nahma Junc.	
	Pine Ridge	Rapid River	
	Rock	Woodlawn	

[1] The questionnaire presented here has been abbreviated by deleting spaces for recording data for many of the questions.

2. If you had to choose <u>one</u> location within each of the five counties to concentrate and trans-ship pulpwood by rail, where would they be?

Upper Peninsula county	Concentration Point	
	My estimate	Your estimate
Menominee	Daggett	
Iron	Iron River	
Marquette	Little Lake and/or Ishpeming	
Dickinson	Felch	
Delta	South of Gladstone --possibly Larch	