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Spatial Analysis of Great Lakes Ferry Transit Systems

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SPATIAL ANALYSIS OF GREAT LAKES FERRY TRANSIT SYSTEMS

by

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Western Michigan University, 2007

This thesis will explore the feasibility of a cross-lake ferry on Lake Michigan between Metropolitan Chicago and Southwestern Michigan. Two potential origins have been chosen in Northeastern Illinois (Evanston and Downtown Chicago) and two potential destinations have been chosen in Southwestern Michigan (St. Joseph / Benton Harbor and South Haven).

The introduction includes historical information on Great Lakes Ferry Systems, information about Great Lakes ports, routes and locations along with the operation requirements for a ferry system. The Methodology includes In-Depth interviews that were done with maritime experts of the Michigan Department of Transportation. This is in order to illustrate a complete list of required attributes for an alternative Cross – Lake Michigan Ferry Transit System. These attributes were scored and weighted to determine which particular ports encompass the optimal feasibility factors needed to accommodate this unique form of multi – modal transportation.

TABLE OF CONTENTS

Table of Contents—Continued

CHAPTER

Table of Contents—Continued

CHAPTER

LIST OF TABLES

LIST OF FIGURES

CHAPTER I

INTRODUCTION

Growing up, near the Lake Michigan Shoreline, I have developed a particular interest in marine transportation. Reviewing the literature, I have focused on a unique form of marine transportation; ferry transit systems, specifically cross-lake ferries on Lake Michigan. This thesis will explore the feasibility of a cross-lake ferry on Lake Michigan between Metropolitan Chicago and Southwestern Michigan.

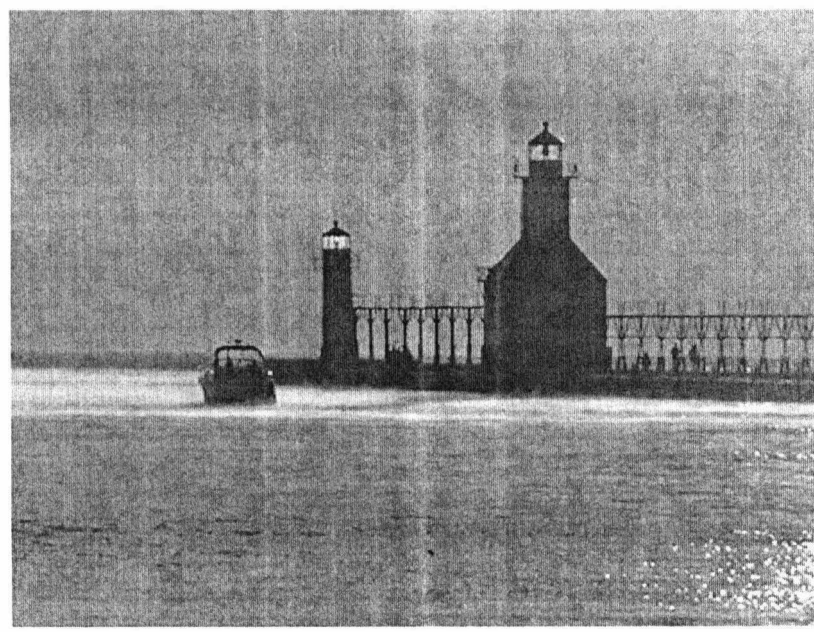

Figure 1. St. Joseph North Pier Lighthouse (Source: Emily B. Starke, 2001; www.michigan.gov)

I will examine four different routes across the lake. Two potential origins will be chosen in Metropolitan Chicago (Evanston, Illinois and Downtown Chicago) and two potential destinations will be chosen from Southwestern Michigan (St. Joseph – Benton Harbor and South Haven). Feasibility will be determined through both quantitative and

qualitative analysis and the route with the optimal feasibility will be selected for this alternative Cross-Lake Michigan Ferry System.

Ferry Systems (General)

"In regions throughout the United States, both urban and rural, ferry transit systems have been increasing dramatically; it is now an opportune time to look at ferries as being a viable means of regional transportation (Weisbrod, 2003)." Successful ferry systems are drawn by certain objectives that make their 'niche' in transportation feasible. The benefits of ferry transit range from alleviating road congestion in major urban areas, to serving as a 'bridge' that connect distant cities or towns in remote locations of our nation. Each system must be designed to adapt to a given region. This is primarily pertinent in vessel design, but each system must also fit the cultural geography of a particular region. Cultural geography also incorporates customer demands. These may include everyday commuting demands or demands for an overnight cruise that connects destinations otherwise inaccessible to each other. Ferry transit systems must correspond to the characteristics of each of these individual markets. Currently, advances in marine design technology allow a properly managed ferry transit system to provide fast, safe, reliable transportation, with little or no adverse environmental effects.

Many areas are giving serious consideration to the development of new ferry systems, frequently involving high-speed vessel design. Recent development, especially within the realm of high-speed vessel design, is taking place in cities such as Seattle, Washington and Vancouver, British Colombia. These cities are implementing new ferry

routes to their current inter-modal transportation networks. The idea is to help elevate congestion on these cities public transportation systems.

High – Speed ferries are also found practical in unusual ventures such as receiving a flu shot. "In an enterprising combination of tourism and health care people are taking a high – speed ferry cruise across scenic Puget Sound to British Colombia, and getting a flu shot too (Associated Press, 2004)." Although not part of this ferry systems normal advertising strategy, the cheaper price for the flu vaccine in Canada is proving to be an ample method of filling the boats capacity during the cooler months of the off season (off tourist season). "The U.S. supply of flu vaccine was slashed nearly in half when British manufacture Chiron Corp. was barred from shipping its product because of contamination of a plant in England (Associated Press, 2004)." The ferry is not the only method of transportation, however it serves as a link for those who cannot drive or do not have an automobile. "It's been incredible! As soon as the news started breaking we were inundated with calls, said Darrell Bryan, executive vice president and general manager of Clipper Navigation. We're filling what we feel is a needed void, but we're not trying to gouge the public (Associated Press, 2004).

High speed vessel design is also becoming prominent in the Eastern United States. A Baltimore company, working with researchers from the University of Maryland plans to build high speed, energy efficient ferries to run between Baltimore and the Eastern Shore. "The company said its intention is to build a fleet of ferries that will carry passengers 18 miles, from Baltimore to Rock Hall in Kent County. The drive to Rock Hall from Baltimore usually takes about two hours, but Mark Rice (president of Maritime Applied Physics Corp.) says his boats will deliver people in about 30 minutes (McCarthy,

2005)." This service would elevate congestion for commuters and promote tourism and recreational travel during peak hours. "P.A.M. Schaller, director of economic development for Kent County, said the ferries could be "a wonderful alternative to another Bay Bridge, delivering tourists to the restaurants of the Eastern Shore and Kent County residents to Baltimore for baseball games and theater productions (McCarthy, 2005)."

Ferry transit systems have played an important role in both the economic and spatial development of North American transit systems. "Public debate on these proposals is proceeding, involving myriad questions of societal, economic, environmental and safety impacts (Sweeny, 2000)." In both urban and rural landscapes, ferry transportation has changed the process by which people and freight commodities are transported. "Freight, hauled by ferry, is primarily characterized by, overweight, oversize trucks that may be particularity suited for utilization within a given vessel (Wade, 1994)." The body of this research covers wide-ranging economic, infrastructure and spatial issues related to ferry systems.

Ferry Systems (Great Lakes)

At one time, Lake Michigan had a complex and comprehensive network of inter-modal transportation. In its peak of existence, 1920 to the late 1950's, 'Great Lakes Railroad Ferries' hauled tremendous amounts of people and commodities throughout the region. Unique to the Great Lakes, railroad ferries served as a link that connected two market or endpoints; cities located on the Michigan and Wisconsin and Illinois shorelines. Today cross-lake ferry transportation is primarily tourism driven. Traffic has

dwindled into two existing ferry lines that move little freight traffic, and mostly vacationers and their automobiles. Explicitly this idea of ferry transit systems is the foundation of my research.

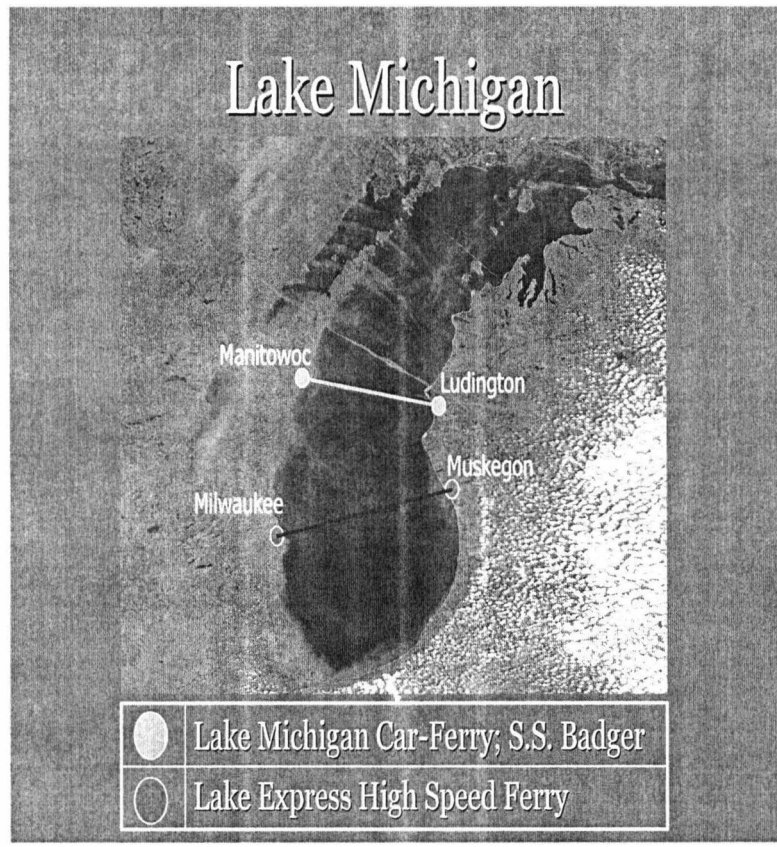

Figure 2. Lake Michigan Ferry Routes (Source: Google Earth, 2006)

Significance of Study

It is with optimism that this study will make a contribution to the economy of the communities that border the Lake Michigan Shoreline. "With the significant downturn in the manufacturing industry within the Great Lakes Region, tourism and entertainment are becoming a driving force of employment in the mid-western economy, especially along the Lake Michigan Shoreline (Healey, 2004)." Increasing the transportation accessibility and convenience within a region will boost tourism and promote job growth. The

following background information and literature review takes note that very little academic information is available in reference to this subject, especially within the bounds of the proposed study area. It is anticipated that this study will spur future research related to this topic.

CHAPTER II

BACKGROUND

Information about Ports, Routes and Locations

Southwestern Michigan

This analysis will consider the region of 'Southwest Michigan' to stretch as far north as Holland and as far south as New Buffalo. When examining a map of this region it is relatively easy to exclude a few ports for this analysis. Furthest to the north, the City of Holland is only an approximate 45 minute drive to an existing ferry service located in the City of Muskegon, Michigan. The close proximity to a ferry port in Holland would decrease passenger demand for this northern end of the research region. In the opposite direction furthest to the south, the Port of New Buffalo is barely above the latitude of the southern end of Lake Michigan. Not only would this lessen the positive effects of a ferry system, but in addition, this city will soon gain four additional daily passenger trains (traveling to Chicago). This combination of factors would drastically reduce the need for a future ferry system in New Buffalo, Michigan. In-between Muskegon and New Buffalo are the two ports of St. Joseph – Benton Harbor and South Haven. The physical and cultural geography of these two locations are the basis of research for the Michigan side of the Lake.

At the origin of this perspective research, the City of Saugatuck was examined as a potential third research candidate. The city has a large tourism draw, especially for residents of Greater Chicago, and it is not likely to be affected by the existing ferry service in Muskegon. Problems occur with the long narrow channel of the Kalamazoo River that connects Lake Michigan to the actual port and central business district. The

ferry would be forced to travel at extremely reduced speeds while within the confines of this river system; thus drastically reducing the benefits of selecting this city as a research candidate. It is with this knowledge that the City of Saugatuck has been excluded from analysis of an alternative Cross – Lake Michigan Ferry System.

Northeastern Illinois

This analysis will consider 'Northeastern Illinois' as the six most northeasterly counties within the State of Illinois. Northeastern Illinois is a historic meeting point of America's East and West.

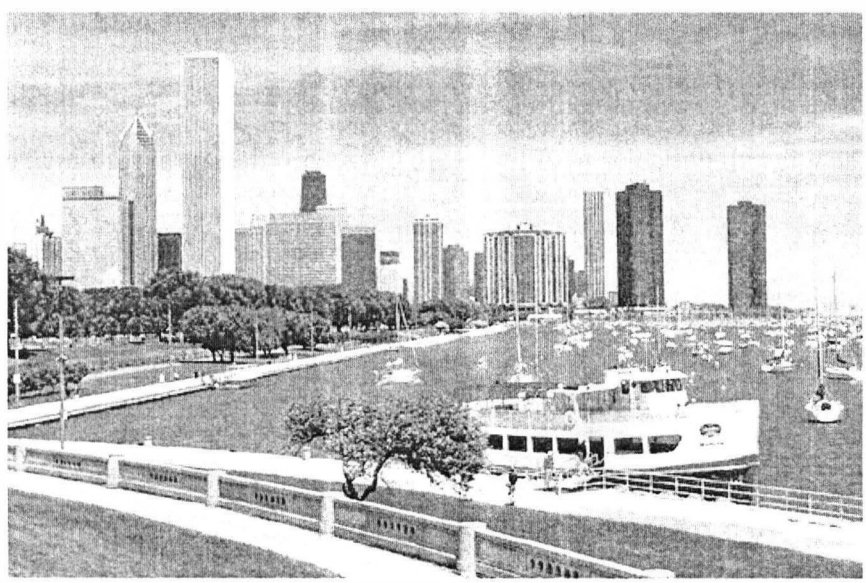

Figure 3. Chicago's Lakefront (Source: www.aureo2006.org)

Established at the easiest natural portage between the Great Lakes and the Mississippi Valley, this region has served as a major transportation link in the nation's water, rail, automobile and aviation networks. With the City of Chicago as a center of economic and cultural diversity, this region accounts for the third largest urban population center in the United States. The six-county metropolitan area is home to over eight million people.

Leading economic sectors include financial services, electrical machinery and equipment, insurance, pharmaceuticals and retailing.

When analyzing the port cities of Northeastern Illinois, similar aspects to that of the port cities of Southwestern Michigan were taken into account. The Western Side of Lake Michigan will be the primary population base therefore, selecting appropriate endpoints will be essential for the operation of a cross – Lake Michigan Ferry System. This ferry will primarily serve citizens from an 'upper income bracket,' therefore communities like Waukegan and South Chicago were excluded in the preliminary analysis. Initially the community of North Chicago was to become an alternate endpoint for the ferry. Due to the lack of available waterfront land, along with inadequate harbor infrastructure this location was excluded from any further analysis. With a large and dense population of high income residential housing along with a close proximity to the Lake Michigan Shoreline, Downtown Chicago and Evanston, Illinois have been chosen as the two port cities to be analyzed in this particular research.

Complexity of Connection

In order to fully understand the complexity of ferry transportation, we must first examine every available outcome of connectivity between these two states. The current infrastructure of the Southwest Michigan Lakeshore Communities include a well-developed interstate highway system, two rail lines, a few small airports (none of which provides commercial air service) and four small navigable Great Lakes Ports. At the present time, most people use the interstate highway system when traveling between Southwest Michigan and Chicago.

From the start, it is easy to understand that a bridge or tunnel is not only ineffective; but impossible. The approximate 45 mile distance is too far and the depths of Lake Michigan pose too great an engineering feat to accomplish. Stepping 'back into reality,' commercial air service comes to mind. Although none of the Southwest Michigan airports currently handle commercial traffic, this option is not out of the question. Both South Haven and Benton Harbor have runways capable of handling small commercial jets; however Benton Harbor was unable to make a profit with the service after a brief trial (www.swmiairport.com). The port system is heavily used for private pleasure boating, but there are few docks capable of handling large vessels. Besides the Interstate Highway System, the only other public mode of transportation is the government regulated passenger rail service, Amtrak. Amtrak runs five trains daily through Southwest Michigan (www.amtrak.com). Three trains originate in Detroit, one in Port Huron and one in Grand Rapids; all ending in Downtown Chicago (in addition each train provides round trip service). At first glance this appears to be a viable mode of transport, however only one train stops in a Western Michigan Resort Community of St. Joseph / Benton Harbor. Therefore, rail service is limited to a single daily train.

In addition to these existing rail lines Southwestern Michigan has the option of rebuilding old rail lines that have been destroyed. The former Lakeshore Railroad, which runs north and south along the Lake Michigan Shoreline, could be rebuilt and therefore serve as another means of multi-modal transportation. The tracks are gone, but due to the fact that the rail bed still exists, startup costs would be drastically reduced. Due to the lack of government support and current financing strategies of the Interstate Highway System, it is unlikely that this option will ever be significant enough to become a reality.

The Problem with Automobiles

Like any large city, certain roadways in Chicago are plagued with congestion. Despite this congestion and the apparent availability of relatively good public transportation, Chicagoans still use their cars. "According to Census data almost 3.1 million commuters, 70.8 percent of the CMSA total, got to work by driving by themselves (Shultz, 2005)." In addition to residents of Metropolitan Chicago, the highway systems surrounding the city are also highly congested. Travelers from all over the Midwest must use this corridor, as it is the only route around the lake. The Michigan State Line, along Interstate 94, handles over 30,000 vehicles annually (Indiana Department of Transportation, 2005). Most of these vehicles travel at peak times so congestion is further enhanced. Today, a great majority of the population uses this freeway to traverse this corridor.

Switching to examine this congestion problem as a whole, we must examine what the major problems are along this corridor. Waiting in traffic accounts for a tremendous percentage of a family's travel and vacation time. Adults and children could, and are probably more than willing, to spend their time on other more advantageous activities. This time spent on congested roadways costs money in fuel, travel food, wear and tear on the automobile, etc. Pollution is another concern when dealing with highly congested freeways. More vehicles mean more toxic chemicals entering the atmosphere. When commuting to work, many people prefer to drive alone. With thousands of people traveling the freeways, these vacant seats only add to the problems of congestion and pollution. This idea is directly related to the problems of urban sprawl and our dependency on foreign oil.

The Problem with Passenger Rail Service

The 'efficiency' problem with Amtrak is currently under examination by a number of organizations. "Research is being conducted to determine the feasibility of adding stops to the other trains that pass through the area (Shultz, 2005)." In addition to the increase in station stops, high speed rail service is also under serious investigation. These ideas, to increase the usage of passenger rail service within the region, are in an effort to allow people to live in Southwest Michigan and commute to work in Chicago; as well as, to live in Chicago and commute to Southwestern Michigan. This complex effect of Southwest Michigan becoming a 'suburb' will be discussed later in the research, however, it is important to examine how this idea (increased frequency of passenger rail service) poses a major problem in itself.

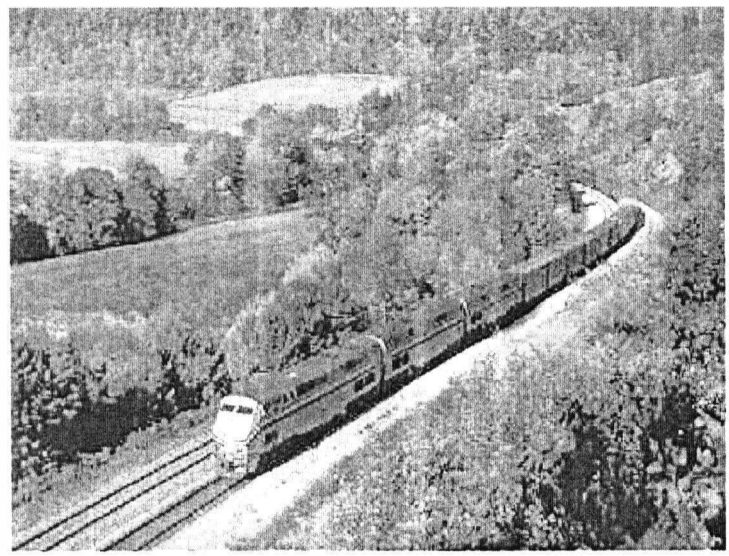

Figure 4. Amtrak Passenger Rail Service (Source: www.amtrak.com, 2007)

Passenger trains that currently run through the area do not originate in Southwestern Michigan. Usually reaching New Buffalo in late morning or afternoon, the trains are

simply not scheduled to transport commuters to and from Chicago. Not only does their origin, Detroit, Grand Rapids or Port Huron affect what time they reach New Buffalo, but each train must face a series of delays along this route. "These delays might not be the direct result of Amtrak, or Amtrak personnel, but this problem highlights the cause that Amtrak has been largely unsuccessful as an efficient mode of transportation (Jacquez, 2004)." To create a successful commuter rail service, Amtrak would have to add trains that originate in Southwest Michigan.

In addition to station stops, speed is a prime factor for commuter transportation. At the present time, between Kalamazoo, Michigan, and the Indiana State Line, Amtrak has the capability to operate at speeds in excess of 90 mph. However, upon reaching Indiana, the train must switch to tracks owned by other freight lines. Since Amtrak does not operate these lines, they are forced to travel at reduced speeds and are often slowed or stopped by freight traffic. This situation is worsened by the steep increase in overall train traffic within the Northwest Indiana Corridor, similar to the congested freeway system that runs parallel to these rail lines. These tracks are some of the most congested in the nation, and unlike an automobile a train cannot simply switch lanes and pass another train. This problem of congestion, both freeway and rail line, has a drastic increase on the number of transportation accidents and deaths in the region. In order to create and operate an efficient commuter service, Amtrak is forced to either purchase an existing rail line, highly unlikely due to the fact that these lines are so heavily used by freight traffic, or construct a new high speed rail line. Obviously the costs in either venture would be enormous.

To add further analysis to the railroad issue there is a possibility to extend the South-Shore Railroad (electric commuter service). This commuter rail service provides frequent round trips to and from the City of Chicago. Most of these trains end service in South Bend, Indiana, however the bulk of the passengers originate along the southern end of Lake Michigan. There is a possibility of extending a separate line to continue around the Lake Michigan Shoreline and up to the resort communities of Southwestern Michigan. These trains would be able to operate on the existing rail lines, but they would require the construction of electric wiring above the track.

Location and Operation Requirements

The Problem of a 'Suburb'

Presently, there is a substantial connection between Chicago and Southwestern Michigan. Currently, this close proximity attracts mostly vacationers and second home residents, however, this connection is becoming so enhanced that some Southwestern Michigan communities, particularly southern Berrien County (New Buffalo, MI), are becoming actual suburbs of Chicago. From a planner's point of view, it is important to examine if this idea of a "suburban community" is truly what the residents want. This idea of new development illustrates another part of the problem. A study, conducted by Shultz Consulting, has examined some of the benefits a commuter rail system (from New Buffalo, MI to Downtown Chicago) might have on this region. "The communities being served need to be prepared for an increase in population. They need first-rate planning and zoning. They need to know where the 'transportation corridors' are; where the cars and trains will run, where the expanded power lines and water and sewer systems will go

(Shultz, 2005)." Residents of Berrien County must understand how to properly develop each community. "They need to know what the rules will be when that "city-slicker" developer comes sliding in with his plans for a 400 home development or a 12-story office building (Shultz, 2005)." Without a well-defined plan this new idea of integrated transportation might become a 'bust' before it gets the chance to 'boom.'

Probable Vessel Design

With a better understanding of the encompassed research complexities, it must now be determined what type of vessel would best suit both the physical and cultural geography of the region. Lake Michigan spans an average of 50 miles from shoreline to shoreline. A ferry system is only feasible if it is able to reduce travel times from origin to destination. Therefore, optimal vessel design will be achieved with the implementation of a 'high-speed ferry.' Currently there is only one high-speed ferry operating within the continental United States. This ferry operates from Milwaukee, Wisconsin to Muskegon, Michigan, just a short distance from this Northeastern Illinois to Southwestern Michigan proposed ferry route. The vessel, Lake Express High-Speed Ferry, is well equipped to handle the physical geography of this large lake. The ferry is capable of reaching speeds up to 34 knots. It is equipped with a self-actuating computerized ride control system, providing a smoother ride and fewer cancellations due to lake conditions. It uses state-of-the-art radar, fire suppressant systems, Global Positioning Systems and engine room monitoring systems. The vessel is powered by four-diesel engines that are capable of producing 300hp each which drive four independent water jets.

The proposed construction for this alternative Cross - Lake Michigan Ferry System will be similar to the Lake Express High Speed Ferry; however this new vessel

must be able to handle its route with unique respects; and, therefore, unique design. All of the proposed routes have the benefit of the Chicago Metropolitan Region as on endpoint within the transportation system. Due to this fact there is great probability that, during 'high season,' this ferry must be capable of handling more passengers and cargo. It is with this idea in mind that the proposed ferry will be a combination of the Lake Express High Speed Ferry and the larger high-speed ferries operating on the Northwestern United States.

Rather than 248 passengers, this new ferry will be designed to carry a maximum of 300 passengers and 50 vehicles. Similar to its northern cousin this new ferry will be designed for pedestrians and vehicles to enter from either end of the main deck. Four lanes will be available for passengers to drive their own vehicle on-board; this is due to insurance and liability reasons also similar to the Lake Express High Speed Ferry.

"Between lanes 1 and 2, will be available restrooms for men and women; an emergency generator room; an enclosed stairway to the engine room; and two exterior stairways that connect to the second deck (See Figure #1). The second deck will enclose a passenger lounge with a small restaurant, benches and tables (Vehicle Ferry Case Study, 2006)." Connected to this area will be open decks on either end of the vessel. In addition, the vessel will have two exterior stairways that connect to the third deck that is for crew only and contains the pilot house.

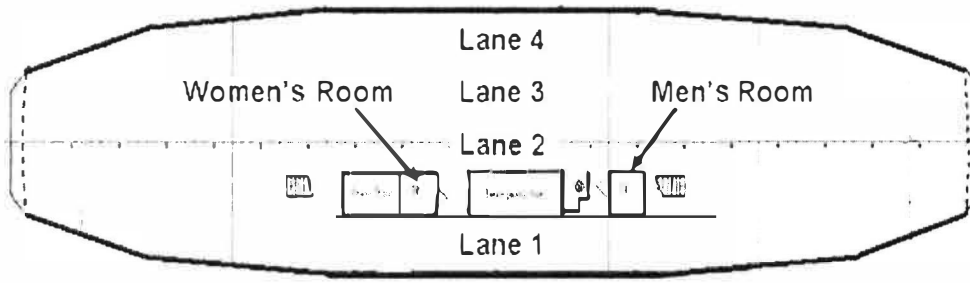

Figure 5. Vessel Design (Source: www.access-board.gov, 2006)

In order to comply with Federal Maritime Standards this proposed vessel must also be similar in electrical power, fuel consumption and vessel stability impacts. The ferry will have "two 92 kilowatt generators that have sufficient excess capacity to supply the vessel with ample power. The ferry will also have a 72 kilowatt generator that has sufficient excess capacity to power the platform lift when used as an accessible means of escape (Vehicle Ferry Case Study, 2006)." The ferry will meet other proposed designs to meet the draft guidelines, which will be discussed later within the research, and have minimal impact on the vessel's electrical power, fuel consumption and stability.

As the need for a new ferry progresses, new design alternatives will be evaluated. Alternative systems could include the implication of a Hydrofoil or a Hovercraft to this Cross – Lake Michigan route. In the case of a hydrofoil "the vessel would be able to operate in similar conditions, but much of the hull would rise out of the water at cruising speed (Frater, 2004)." This effect reduces drag on the vessel, therefore reducing fuel consumption. A "hovercraft design incorporates an inflated cushion rather than a traditional hull (Frater, 2004)." This cushion provides the vessel an actual lift out of the water. Both these designs are currently in use in worldwide ferry transportation systems. Due to the success of the Lake Express High Speed Ferry this particular research will only consider the traditional high-speed ferry.

Future Traffic and Population Growth

Congestion is a transportation issue that affects everyone in both regions of this particular research. "It impacts regional travel and economic growth and development, as well as air quality. Excess congestion represents increased travel time, lost productivity and decreased safety and quality of life for everyone (Southeast Michigan Council of Governments, 2005)." The Southwest Michigan Region is home to many industries, particularly those supporting automobile manufacturing and medical / pharmaceutical industries. Tourism and agriculture are also significant industries in the region. The state is currently addressing capacity and operational issues in order to remove congestion points, as well as provide improved access to support the economic growth occurring across the region.

Due to the fact that the resort communities north of St. Joseph are located on Interstate 196, it is the Grand Rapids – Chicago 'economic corridor' which is also an integral part of the Detroit – Lansing – Grand Rapids – Chicago 'economic loop,' that this ferry system will most likely affect. The major Interstate 94 corridor extending between major Canadian economic centers, Detroit and Chicago is located 16 miles to the south of South Haven. Being that Interstate 94 and Interstate 196 are the two major freeways traversing the region, extensive research is being conducted in order to determine what areas are in most need of repairs and upgrades.

Within the selected region of analysis, only the City of Benton Harbor is expecting major road or highway renovations. US – 31, Napier Road to Interstate 94 / Interstate 196 are top on the State of Michigan's list for lane improvements in the near future. "The design phase for the last segment of the major US – 31 improvement is

complete and partial right – of – way acquisition is ongoing. The construction phase and any remaining right – of – way acquisition are deferred pending reasonable assurance of achieving and sustaining system condition goals and the identification of additional funding (Michigan Department of Transportation, 2007)."

CHAPTER III

REVIEW OF LITERATURE

Great Lakes Historical Studies

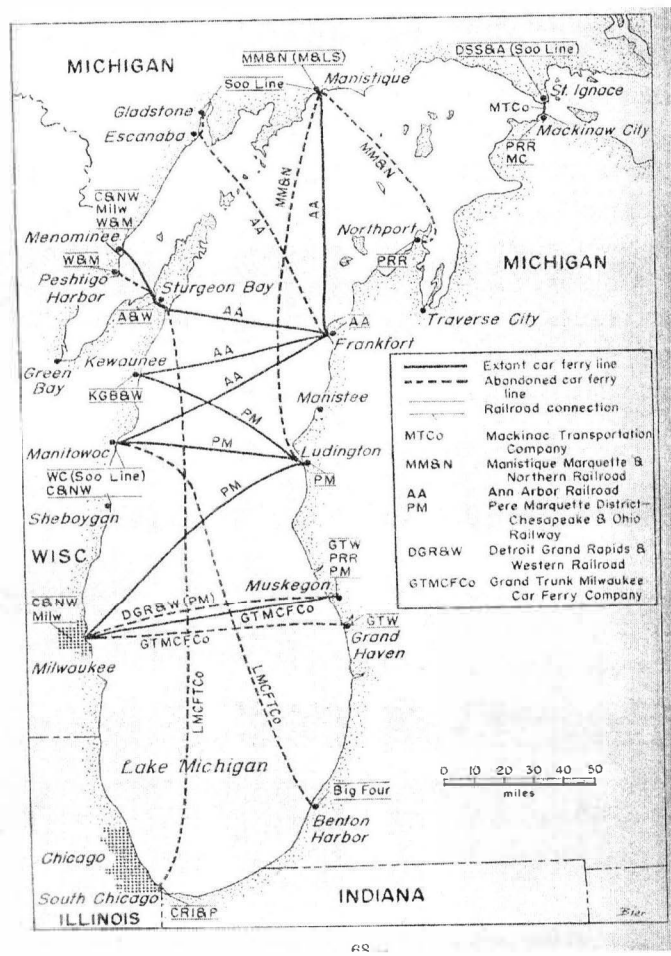

Figure 6. 1950's Ferries (Source: Hilton, 1962)

Great Lakes Railroad Ferries began to service the Lake Michigan region in the mid 1800's. "A century later, the railroad ferry was in its 'heyday' of existence; (Hilton, 1962)." With most of the business dominating the lakes of Michigan, Eric and Ontario, these steel ships built with a combination of railroad and marine technology, hauled thousands of railroad cars each year. "Although most of the earnings were made from

freight commodities, these ferries gained 'pure profit' when adding passenger revenue to their cross-lake voyages (Uckley, 1962)."

At their peak, during the mid 1950's, the three dominate ferry companies, Pere Marquette Line, Ann Arbor Line and Grand Trunk Line collectively operated a total of 14 vessels solely across Lake Michigan (Frederickson, 1994; Hilton, 1962). These boats were an essential part of an integrated transportation network lasting until 1980, when the S.S. Badger, part of the Pere Marquette Line, concluded its last cross-lake voyage; thus ending the era of Great Lakes railroad ferries (Horowitz, 1980).

In addition to railroad ferries, the Great Lakes honor a historic realm of passenger ferry transportation. Prior to the revolution of the affordable personal car and highway

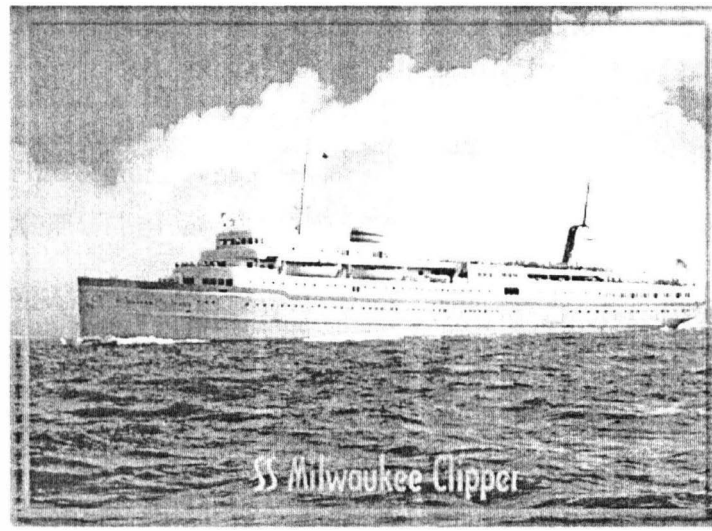

Figure 7. S.S. Milwaukee Clipper (Source: www.hnsa.org/ships/img/clipper.jpg, 2001)

networks, these ferries provided a necessary transportation connection between large cities and recreation centers. Dating back to the early 1800's these vessels, constructed of both wooden and steel technology, transported people throughout the entire Great Lakes Region. Beginning in the mid 1840's steamboats on the Great Lakes grew in both

size and numbers. "The screw propeller was introduced to the Great Lakes by the steamer 'Vandalia' in 1842 and allowed the building of a new class of combination passenger and freight carrier ferries (Milwaukee Clipper History, 1997)." With this new technology (steel screw propellers) numerous passenger ferries were built to transport people throughout the region. "Passengers were accommodated in staterooms, and package freight was stored below on the large main deck and within the holds (Milwaukee Clipper History, 1997)."

The Southern Lake Michigan Region has a distinctively rich history in maritime transportation. "South Haven's Harbor has always been considered one of the most easily accessible harbor entrances on the eastern coast of Lake Michigan (Kraus, 2003)." The bustling harbors of the small Resort Communities of Southwestern Michigan began regular ferry transit to Chicago in the late 1870's. "Several shipping lines were operating toward the end of the century. The Graham – Morton line offered competition to the South Haven and Chicago Transportation Company, as did the Chicago Lines and the Goodrich Transit Company (Kraus, 2003)." The romanticism of Lake Michigan travel attracted an abundance of tourists. These vacationers would travel to their final destinations via the small lakeshore railroads upon departing the ferry boats. Similar to large vessel transportation of the era, cross – lake ferry boats provided first class amenities along with cheaper, less elegant transportation. "One memorable ship, the City of Kalamazoo, built in South Haven in 1892 had fifty – one staterooms to accommodate one hundred ten passengers. As many as three hundred passengers on excursion fares traveled forward or in the rear of the ship, with cargo stored amidships (Kraus, 2003)." The 'heyday' of luxury cross-lake ferries lasted more than 50 years. With the United

States entering World War I, vessels were taken off the lakes to serve as "troop transport vessels in the North Atlantic (Kraus, 2003)." In addition, the Great Depression of the 1930's proved to be the end of luxury steamship travel on the Great Lakes.

Today, cross-lake ferry transportation is primarily tourism driven. Traffic has dwindled into two existing lines that move little freight traffic while revenue is mostly derived from vacationers and their automobiles. Two cross-lake ferries remain operational; the S.S. Badger operated by the Lake Michigan Car-Ferry. This ship is a former railroad ferry now converted to handle semi-trucks and automobiles, and connects the communities of Ludington, Michigan and Manitowoc, Wisconsin. The second ferry is the Lake Express High Speed Ferry, which connects Milwaukee, Wisconsin with Muskegon, Michigan. Of these two, Lake Express is the only vessel considered a 'fast ferry,' operating at an average speed of 40 knots (Sandler, 2002).

Ferries in Contemporary Transit Systems

Ferries do have inherent advantages over other forms of transport. "The primary justification for new ferry systems, within urban areas, is to mitigate vehicular traffic on already overloaded bridges and streets, and to alleviate pressure on inner city parking resources (Sweeney, 2000)." Ferry transit systems have proven highly successful in motivating commuters and other travelers to leave their vehicles behind, thereby substantially relieving highway, street and inner city parking congestion and air-pollution (Sweeney, 2000; Weisbrod, 2003; Wade, 1994; Hutchison, 1998). Research, from the public sector, uses the primary example of New York City's Staten Island Ferry, which "currently carries over 19 million passengers annually on the 5.2 mile run between Staten

Island and lower Manhattan. The service is provided 24 hours a day, 365 days a year and is the most reliable form of New York City Mass Transit, with an on-time performance of over 96 percent (Sweeney, 2000)."

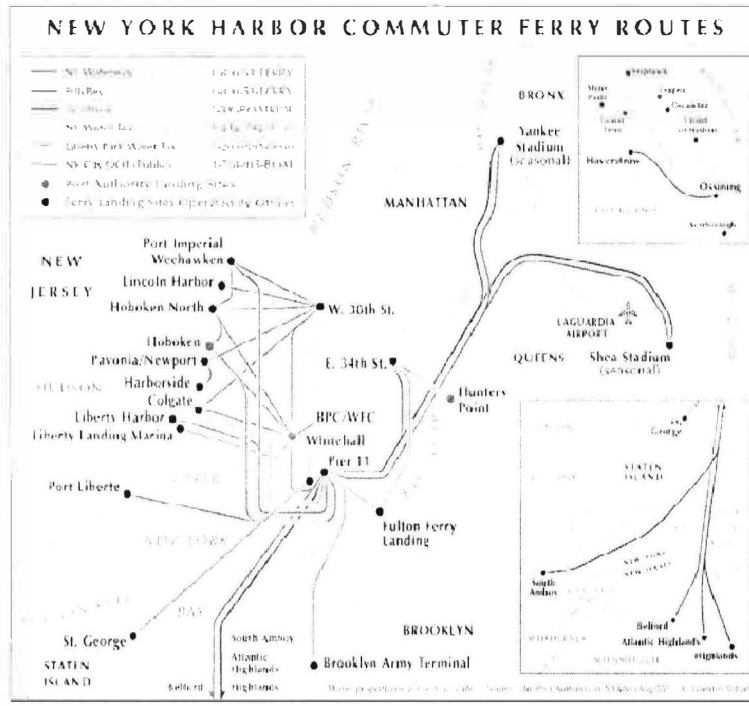

Figure 8. New York Harbor Commuter Ferry Routes (Source: www.nyctourist.com/newyorkcity/ferries, 2006)

"Although urban planning (in this case primarily transportation planning) is traditionally thought to be a public-sector enterprise, the private sector has been responsible for one of the best examples of modal integration of ferry transportation (Weisbrod, 2003)." "The private sector planning for transportation integration in the metropolitan region of New York/New Jersey/Connecticut metropolitan now has the largest ferry rider-ship in the world, operating 53 ferries with approximately 64,500 daily riders (Weisbrod, 2003)."

Research on current ferry systems is not exclusively related to urban areas. In consistency with all ferry transit systems, it is essential that rural systems be integrated with other modes of transportation. "This integration, in rural settings, is accomplished

primarily via the connection of highways. The isolation and limited road systems, within the rural northwestern United States, are ideal regions for ferries to provide year-round, all-weather and affordable transportation (Hutchison, 1998)." Washington State Ferries (WSF) currently operates one of the largest ferry systems in the United States, serving eight counties within Washington and the Province of British Colombia in Canada. The existing system has 10 routes and 20 terminals that are served by 28 vessels. "In fiscal year 1999, this ferry system carried over 11 million vehicles and 26 million people (WSF, 1999)." Interestingly, it is common practice for rural ferry systems to receive financial support from federal governed organizations. In Washington, state tax sources have included a gasoline sales tax along with a portion of motor vehicle registration fees. Additionally, 'WSF' pursues federal and local funds for specific projects. The use of public funds for ferry system purposes is strictly regulated, and taxes imposed for operating and capital expenses are levied and tracked separately. The taxes used to fund operating and capital expenses have been raised over recent years in order to cover rising costs. In the fiscal years 1998 and 1999, ferry system generated revenue covered 65% and 66% of its operating costs, respectively. The Washington State Transportation Commission mandates that the ferry system fare box generate a minimum of 60% of the system's operating expenses. The remaining percentage is provided by tax revenues, which are dispersed by the state. The Alaskan Marine Highway (Figure #3) is another example of a successful federally funded high-speed ferry system which operates in tandem with western Canadian high speed ferry systems (Hutchison, 1998). This system provides integration with Alaskan State Highways and serves as an inter-modal network

that links various remote regions of the state at costs much lower than the potential costs of highway construction.

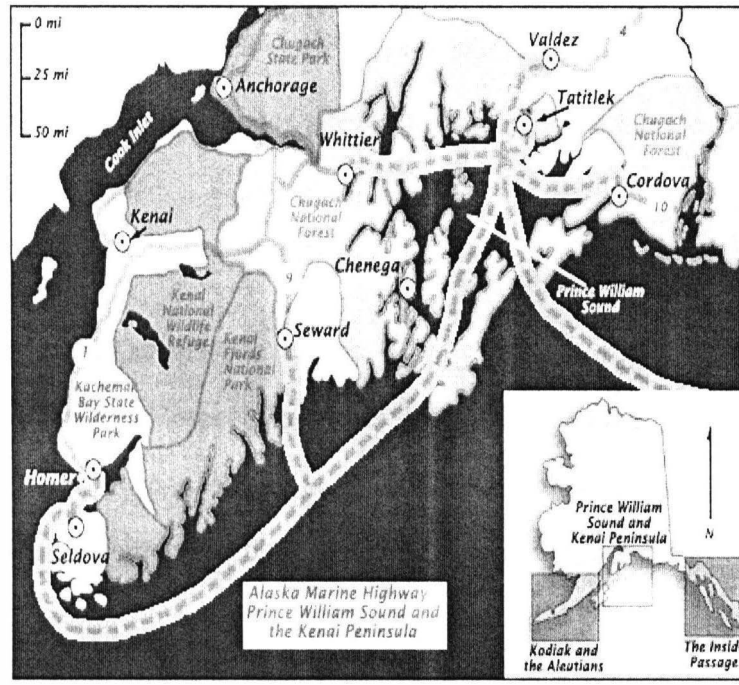

Figure 9. Alaska Marine Highway System (Source: www.alaskatrekker.com, 2006)

A review of regional transportation studies was also conducted on ferry transit systems. Literature illustrated that planners rarely research "the integration of ferry systems to land links, including public transit (Frater, 2004)." The regional study of the Galveston-Port Bolivar Ferry provides a case in point, funding has not yet been recognized as an issue of importance by the Federal Government; therefore, this transit system was planned with little research on similar ferry networks. "The ferry has a high ridership, but since there is little integration with the rest of the transportation system, the region does not receive the full economic and environmental benefits (Weisbrod, 2003)."

Additional regional studies have examined tourism benefits of ferry transportation. With the sharp downturn in manufacturing jobs in recent years (research

concerning the mid-western United States; Sweeney, 2000; Weisbrod, 2003; Wade, 1994), "many governments and investors are turning to service sector initiatives to revitalize the economy, particularly tourism (Frater, 2004)." Historical inauguration of marine routes, such as those found on the lakes of Michigan and Ontario, will shift roles from "heavy industrialized transit into tourism development, or they will probably disappear (Jacquez, 2004)."

Federal Funding for Ferry Transit Systems

Literature reviewed, especially within the examples of the previous section (Ferries in Contemporary Transit Systems), portrays the importance of access to funding in order to maintain a viable ferry transit network. "The American Public Transportation Association conducted a survey of its transit agency members during the first quarter of 2004 to determine (a) the amount of funds they spend on and need for federal ferry transit systems; (b) the extent to which they had increased and improved their security measures since September 11, 2001; and (c) the priorities they place on ferry transit systems that should be supported by federal funding (Healy, 2004)." Literature, that was available for public examination determined that public transportation systems have spent $1.7 billion from their own budgets to meet threats brought about by the terrorist attacks on our nation. "The American Public Transportation Association is communicating the results of this survey to Congress and the Administration and is advocating for significant federal investment in transit funding (Healy, 2004);" these results encompass all types of transportation funding, not only ferry transit systems.

Environmental Issues Related to Ferry Systems

Literature reviewed from an environmental perspective illustrates the fact that "modern regulations have reduced the question of water pollution by vessels to a 'non-issue' (Sweeney, 2000)." When all components of engine exhaust emissions are considered, the harmful emissions of the automobiles summed to roughly two and a half times that of the fast ferry. Virtually all toxic substances entering navigable waters now originate from non-site specific land origins, primarily vehicle lubricant leaks and other automotive products (Fast, 2002; Knight, 2004; Sweeney, 2000). Ferries lack the need for expensive infrastructure, which would involve high impact land use, such as highways and rail, but it must be recognized that "the wakes of some ferries erode the land and interfere with the ecosystem (Weisbrod, 2003)." Wakes, the waves induced by watercraft, can not only undermine shorelines and erode wetlands, but they can also cause damage to docks and docked vessels. The amount of wake a vessel produces is a function of the shape of its hull and its speed. This correlation is not direct; for some of the "newer hulls, the wake diminishes at higher speeds (Weisbrod, 2003)." With proper vessel design and route planning, the effect of "wake pollution" is far less important when compared with other methods of transportation.

CHAPTER IV

METHODOLOGY

An in-depth interview has been conducted with Mr. Larry B. Karnes of the State of Michigan's Department of Transportation. Karnes is a freight policy specialist in the inter-modal policy division; he is the Bureau of Transportation Planning's 'expert' on issues related to Great Lakes Marine Transportation. The interview was conducted over three hours at the Van Wagoner Building located near the Michigan State Capitol building in Lansing. The information from Mr. Karnes comes from his tenured experience, along with information shared from his colleagues at The Michigan Department of Transportation.

As far as 'experts' are concerned, Karnes was not my first choice when selecting a citable interview candidate. My first choice was to work with the management of the two companies that currently operate cross-lake ferry systems on the Great Lakes; Lake Michigan Car-Ferry and Lake Express High Speed Ferry. Unfortunately I discovered that these two companies are private and choose not to share any information with people outside of their employ. This choice is not strictly related to my particular research. These companies have chosen not to share any of their operational or financial information with any outsiders. Due to the nature of the research, it was also decided not to cite depth interviews with ferry operators that do not manage specific cross-Lake Michigan routes. These routes, although discussed in the Literature Review section of the paper, have been determined 'different' than the nature of the research and therefore will not be discussed within the methodology section.

As an employee of the Michigan Department of Transportation, Karnes is responsible for the "planning, designing, building and operating streets, highways, bridges, transit systems, airports and railroads to provide for the safe, rapid, comfortable economical, convenient and environmentally safe movement of people and goods (Michigan Department of Transportation, 2007)." Karnes' primary experience is in the issues of inter-modal freight transportation. His past work includes recent research on the Beaver Island Ferry Company (northern Lake Michigan mainland to island ferry system) and with the private company Lake Express High Speed Ferry to begin infrastructure procedures for proposed their Cross - Lake Michigan route.

After some discussion Karnes organized his thoughts in order to 'list' the most important attributes for a cross-Lake Michigan ferry system. From the lakes current ferry operations along with his conducted research Karnes explained what attributes are of optimal importance.

Optimal Research Attributes
• Terminal Facilities
• On – Site Parking
• Accessibility
• Dock Site Location
• Traffic Congestion
• Dredging
• Population

(Table 1, Optimal Research Attributes)

The research methodology will incorporate a Delphi Weighted Scoring System to determine the feasibility of a Cross - Lake Michigan Ferry System. Essentially this term 'Delphi' refers to the consensus of experts within a particular field of research. "Fundamentals for this Delphi System were first devised in the 1950's. Most recently, the Delphi has been used in a variety of different forms including land-use planning, regional policy making in areas such as transportation, social service programming in education and health care, and in organizational restructuring. These applications stem from one of the Delphi's main objectives; to obtain a reliable consensus of opinion from a group of 'experts' (Butler, 1992)."

The previous in-depth interviews have established the 'experts' within this field of research. From their expertise the following seven research attributes have been chosen:

1. Terminal Facilities
2. On-Site Parking
3. Accessibility
4. Dock Site Location
5. Traffic Congestion
6. Dredging
7. Population

Weights were then assigned to each individual attribute. This weight will measure the importance of each individual attribute. Weights were assigned using a bottom-up method. The least important attribute or attributes were given a weight of one. Each subsequent attribute in importance was given a weight in relation to the least important attributes. As an example, Terminal Facilities and On – Site Parking were found to be the least important and were given weights of one. Accessibility was found

to be twice as important as Terminal Facilities or On – Site Parking and so it was given a weight of two. The other attributes were weighed accordingly.

The listed attributes along with their equivalent weights are as follows:

Attribute	(Weight)
o Terminal Facilities	(1)
o On-Site Parking	(1)
o Accessibility	(2)
o Dock Site Location	(2)
o Traffic Congestion	(2)
o Dredging	(5)
o Population	(4 or 7)
o Destination Accessibility	(4 or 7)

(In addition, to these seven, this particular research includes one more attribute; Destination Accessibility. Although not an issue discussed in the 'in-depth' interview with the panel of experts, this attribute was selected, with the advice of the primary research advisor and from the author's background and local knowledge of Southwestern Michigan. This attributes unique importance, along with an explanation of different scoring methods (four and seven), will be discussed and explained later within the methodology section).

Next these attributes will be examined at four selected port cities.

The four selected port cities are as follows:

1. South Haven, Michigan
2. St. Joseph / Benton Harbor, Michigan
3. Evanston, Illinois
4. Downtown Chicago, Illinois

Each attribute will then be multiplied to a Likert Scale.

The port city Likert Scale for scoring is as follows:

1. Poor
2. Ok
3. Good
4. Very Good
5. Superior

The sum of the products of these attributes, using the Likert Scale, will determine the optimal port city. Each side of the lake must have a superior and an inferior port; therefore, the port with the highest score on the Michigan side will be deemed as most feasible, in addition the port with the highest score on the Illinois side will also be considered as most feasible. These two ports will be selected as endpoints for the optimal route of an alternative Cross – Lake Michigan Ferry System.

Terminal Facilities (1)

"A well-designed and situated ferry terminal can also generate riders through good connections to existing pedestrian and bicycle infrastructure (Butler, 1992)." In comparison with On – Site Parking and Traffic Congestion the ferry terminal, itself, must be functional and convenient to the current modes of inter-modal transportation and walking cities. "Pedestrian access design should include wide sidewalks, trees, lighting, seating and public open spaces with views. Far from an amenity or 'extra,' this pedestrian orientation is an important investment in growing transit rider-ship and is as valuable as funds spent for other transit connections (Butler, 1992)." Essentially the optimal ferry terminal site will be chosen from the best available land each port city has to offer.

This attribute, ferry terminals, will be scored on the likert scale, one being the port city with the least available waterfront land and five being the port city with the most available waterfront land. Ferry Terminals have been given a weight of one. Essentially this is one of the least important attributes, along with On-Site Parking. Although scored the lowest this attribute is needed for the functionality of a Cross-Lake Michigan Ferry System.

On-Site Parking (1)

"Parking demand at the proposed ferry site is dependent upon adjacent land use, the size of the terminal's rider ship catchments area, the ability to operate effective transit feeder service and the local communities' views about parking (San Francisco Bay Area Water Transit Authority)." Inter-modal transportation, when properly organized, could have a drastic effect on the attribute of On – Site Parking. By definition, "a water transit system begins and ends at the shoreline or dock site. Since this shoreline is not an endpoint for most travelers; they must travel from home to the ferry site and from the ferry terminus to their trip destination (Butler, 1992)."

In the case of either side of Lake Michigan, bicycle access should be considered an important sector of inter-modal transportation. Most, if not all, of the existing bicycle networks traverses the shoreline. Bike connections across Southwestern Michigan travel from both the South Haven and St. Joseph Beaches and into the city and surrounding neighborhoods. Chicago and Evanston bike routes are similarly designed, but also incorporate the use of existing bus and rail transit routes. Essentially a ferry network could extend the bicycle network across the lake. Due to the fact that the ferry will be

able to carry an equal ratio of bikes to passengers, people now have the option of traveling without their automobiles.

Partnerships with other transit providers are essential to deliver potential riders to ferry terminals. In comparison with traffic congestion, the Illinois side will be able to incorporate the current modes of inter-modal transportation, thus reducing the demand for a large scale on-site parking lot. Having this inter-modal transportation network on the Illinois side will also benefit the Michigan side. People that opt not to bring their automobile, when traveling to Michigan, will not be concerned with on-site, or off-site parking upon arrival. Even though public transportation is still limited, in both Michigan port cities, passengers will find that walking or biking, is very accessible. Passengers who depend on the bicycle as their primary mode of transportation will most likely stay in the central city of either South Haven or St. Joseph; thus promoting the downtown business districts and the general benefits of walking cities.

While offering numerous options for passengers to exclude their vehicles when using the ferry, the research must still examine the necessity of On – Site Parking for travelers that choose to bring their automobiles. As previously stated, this alternative ferry system will be designed to fit into the current inter-modal transportation network. Having reasonably sized On - Site Parking will promote travels to choose this form of transportation. "When ferry terminals need parking lots, they should be sized appropriately and should provide attractive options that encourage walking, bicycling and the use of bus or rail to reach the ferry terminals. Measures to minimize the demand for parking spaces could include car-parking charges, car-share programs and preferential parking for car and van pool users (San Francisco Bay Area Water Transit Authority)."

On-site Parking has been given a weight of one, therefore, considered of equal importance to the ferry terminal facility.

Accessibility (2)

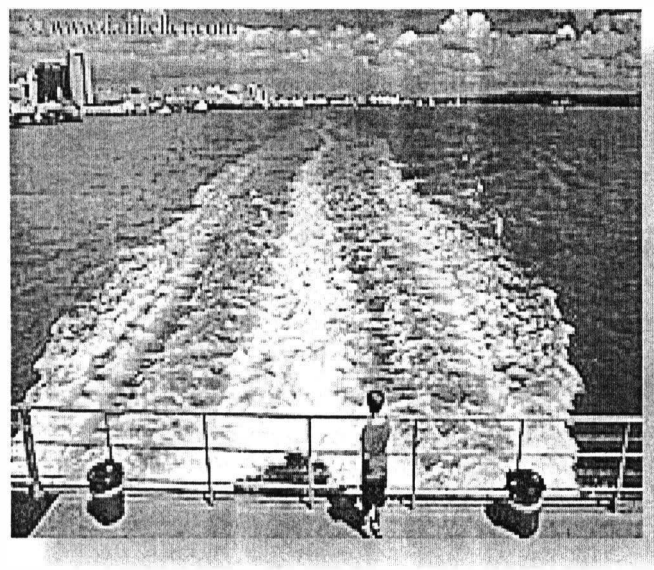

Figure 10. Lake Express High Speed Ferry (Source: www.lake-express.com, 2007)

Seemingly, people will use this service to 'save time.' Public transportation in itself adds the hassle of waiting for others. A passenger's journey does not originate nor conclude at the ferry terminal. People must use other modes of transportation to reach their final destination. This disadvantage of ferry transit results in the extra time needed to find parking, or arrange for their automobile to be brought on board, buy tickets, be on time etc. All of these activities burn time, time that would otherwise be used in actual distance covered.

In the case of this research, time distance will consider the location that provides the most accessibility to the ferry terminal. This attribute is difficult to weight, due to the

extreme complexities of this term 'accessibility.' Looking at this term in a sense of inter-modal transportation, Downtown Chicago would rank first and foremost; however, the experts have considered the problems of congestion that are related to the urban density of this location. If 'accessibility' is best suited for the port city with the least amount of congestion, South Haven or St. Joseph would easily score higher than the urban areas of Evanston and Downtown Chicago.

Accessibility is considered twice as important as the two previously explained attributes; Ferry Terminals and On-Site Parking. Therefore, this attribute will be given a weight of two. When multiplied with the score, the port with the best access, when considering both multi-modal transportation and congestion levels, will be given the highest score and the port with the least amount of multi-modal transportation and worst congestion will be given the lowest score.

Dock Site Location (2)

First and foremost the actual dock site must be sized appropriately for the chosen vessel. The qualifications for a commercial ferry system require large accommodations that are not necessarily constructed at the present time. With an expected length of 192 feet and an approximate beam of 57 feet, this vessel will require at least 200 feet of dock space, while allowing enough navigate-able channel room for other vessels to pass when the ferry is docked. Vessel draft will be discussed later in the research.

The actual dock site would best be suited in an area of high concentration of commercial and retail establishments. To effectively maintain rider-ship the dock site must be located in close proximity to the existing modes of transportation. No one transit

source can operate alone; therefore, we must incorporate the discussed characteristics of traffic congestion, on-site parking and terminal facilities for the optimal dock site location. In this case dock site locating is more effected by the land transportation, where people go when they depart the vessel.

Dock site location is best suited to the available water-frontage that is in close proximity to the lake. On the Michigan side, this strategy would drastically limit the need to travel down a narrow winding river; thus shorting the actual trip time. Both Illinois dock sites are located within a man-made, break wall; (a small harbor that is protected from the lake by cement pylons or extremely large boulders); therefore, close proximity to the lake is not only beneficial but eminent. Essentially this attribute is limited to the available water-frontage and the best outcomes of the previous three attributes.

Dock Site Location, will be multiplied by the score with a weight of two; thus deeming it of equal importance to accessibility and twice as important as Ferry Terminal Facilities and On-Site Parking. The port, on either side of the lake, with the best Dock Site Location will be given the highest score and the highest level of feasibility, while the port with the worst Dock Site Location will be given the lowest score and, therefore, deemed as least feasible.

Traffic Congestion (2)

"Traffic congestion occurs when the volume of traffic on a roadway is high enough to become detrimental to its performance. In congested conditions, vehicle speeds are reduced, increasing drive times. These conditions are also more frustrating for

drivers; therefore, automobile accidents may be more frequent (Federal Highway Administration, 2005)." Furthermore, vehicles burn unnecessary fuel when stuck at idle. "While congestion problems faced by travelers and freight shippers in metropolitan regions of more than one million people consume more travel time and waste more fuel than congestion faced in cities less than 500,000, the burden and frustration has increased across all population groups (Federal Highway Administration, 2005)."

Highway congestion, very simply, is caused when traffic demand approaches or exceeds the available capacity of the highway system. Though this concept is easy to understand, "congestion can vary significantly from day to day because traffic demand and available highway capacity are constantly changing. Traffic demands vary significantly by time of day, day of the week, and season of the year, and are also subject to significant fluctuations due to recreational travel, special events, and emergencies (e.g. evacuations). Available highway capacity, which is often viewed as being fixed, also varies constantly, being frequently reduced by incidents (e.g. crashes and disabled vehicles), work zones, adverse weather, and other causes (Federal Highway Administration, 2005)."

While traffic congestion is a problem for most cities, its affects are usually different on each individual city. To add even more complexity, the definition of congestion also varies significantly from time to time and place to place based on user expectations. Even though there are tremendous population differences between Chicago and Southwestern Michigan, traffic still poses a problem. "An intersection that may seem very congested in a rural community may not even register as an annoyance in a large metropolitan area. A level of congestion that users expect during peak commute

periods may be unacceptable if experienced on Sunday morning. Because of this, congestion is difficult to define precisely in a mathematical sense – it actually represents the difference between the highway system performance that users expect and how the system actually performs (Federal Highway Administration, 2005)."

Congestion can be measured in a number of ways: "level of service, speed, travel time, and delay are commonly used measures (Federal Highway Administration, 2005)." However, travelers have indicated that more important than the severity, magnitude, or quantity of congestion is the reliability of the highway system. People in a large metropolitan area may accept that a 20 mile freeway trip takes 40 minutes during the peak period, so long as this predicted travel time is reliable and is not 25 minutes one day and 2 hours the next. "This focus on reliability is particularly prevalent in the freight community, where the value of time under certain just-in-time delivery circumstances may exceed $5 per minute (Federal Highway Administration, 2005)."

In order to operate a lucrative ferry system, passengers must be able to access the vessel. The current transportation infrastructure differs greatly on each side of the lake. Northeastern Illinois is a complex network of highways, rail transportation and crowded surface roads, while Southwest Michigan is served primarily by un-congested surface roads. While this difference is significant, traffic congestion is an important weight in the research of a ferry system.

Beginning with the Illinois side, the day-to-day traffic congestion plagues commuters and tourists alike. In fact traffic congestion is the primary reason this region would benefit from a cross-lake ferry system. As explained previously, there is a strong connection between Chicago and Southwestern Michigan. With the Chicago – Gary

Corridor being one of the most congested in the nation, it only seems logical to offer an alternative mode of transportation. People on this side of the lake would have the option of using the current modes of available public transportation: bus and light rail. With the implementation of a passenger ferry system, to these current modes of inter-modal transportation, traffic congestion along with on-site parking would have a reducing effect.

Southwest Michigan, as previously described, illustrates a much different picture. This alternative ferry will be designed with the ability to handle up to 50 vehicles along with 12 motorcycles; therefore, it will have a direct impact on local traffic. Each time the ferry docks the atmosphere of these small cities will change, if only for a short period of time. Just like a drawbridge opening during peak commuting times, residents will be forced to deal with the sudden rush of vehicles entering or exiting their community. Traffic Congestion has been given a weight of two, meaning it is of equal importance as Dock Site Location and Accessibility. This attribute has been deemed twice as important as the first two attributes; On-Site Parking and Terminal Facilities.

Dredging (5)

Dredging is an excavation activity or operation usually carried out at least partly underwater, in shallow seas, or in this case fresh water areas, with the purpose of gathering up bottom sediments and disposing of them at a different location. The United States Army Corps of Engineers is the government agency formally in charge of dredging U.S. waterways. Officially they handle commercial, recreational, flood control and hydro-electric dredging projects throughout the nation. The highest percentage of these costs is spent dredging commercial waterways that handle over one million tons of cargo

per year. These commercial waterways are primarily located on coastal saltwater ports. Smaller ports, such as those being researched, must use additional methods in order to support the dredging of their channels.

The cutter suction dredge is the most commonly used dredging equipment for dredging navigable waterways. The capital costs of these dredges are in the millions of US dollars and the dredging projects involve the removal of hundreds of thousand to just over a million cubic yards of dredged sediments. "Production engineers usually accomplish estimating the production of dredges, and controlling the operation of the dredge is usually the responsibility of the dredge operator (leverman). In order to improve the performance and education of the production engineer and the leverman, cutter suction dredge simulators are available for training of these dredging personnel (Great Lakes Dredge and Dock, 2005)."

Specifically this research will only cover information related to the dredging of small commercial and recreation harbors. The first step is the examination of the proper dredging system therefore; "The Water Resources Development Act" must then be explained and understood. The Water Resources Development Act of 1986 was authorized for the construction of numerous Army Corps of Engineers projects. "The Act sets forth detailed cost sharing provisions for navigation projects for harbors and inland harbors and for inland transportation. The Act specifies the percent of construction and operation and maintenance costs. These are costs that non-federal interests are required to pay and they include the federal share of costs for the projects. The Act also sets forth detailed cost-sharing provisions for the project costs associated with flood control and other purposes, including hydroelectric power, municipal and industrial water supply and

agricultural water supply (Water Resources Development Act, 1986)." The Act has been amended numerous times, however, most importantly revised in 1986 in order to describe non-federal cost sharing for small commercial and recreational ports.

For small inland waterway projects, dredging is classified in two separate categories: Capital Dredging and Maintenance Dredging. Capital dredging refers to the digging of new canals or adding tributary canals to additional navigation channels. On the other hand, Maintenance dredging refers to work needed to maintain the required depth of an already existing channel or river. These clarifications were established by the 1986 Water Resources Development Act, explained by the 'Inland Waterways Uses Board.' "The Act established an Inland Waterway Users Board, composed of eleven members selected by the sectary. The members are to represent various regions of the country and a spectrum of the primary users and shippers utilizing the inland and Intracoastal Waterway for commercial purposes. The Board must meet at least semi-annually to develop and make recommendations to the Secretary regarding construction and rehabilitation priorities and spending levels on the commercial navigational features of the U.S. inland waterways and harbors (Water Resources Development Act, 1986)." Essentially, this board must be consulted for the required maintenance dredging projects for this alternative cross-lake ferry system. This ferry system will not require any type of capital dredging, only maintenance dredging of channel and dock depth.

Since the Water Resources Development Act of 1986, federal funding will only account for 65 percent of the total maintenance dredging of these small commercial / recreational harbors. The remaining 35 percent must be subsidized by non-federal sources. In most cases this residual percentage is covered by state or local government.

Most Great Lake States and the Province of Ontario, including Illinois and Michigan, have developed a trust fund to support these residual costs. This trust fund is a tax that is levied against the actual shippers of a particular cargo. The shippers then add additional chargers to the cargo receivers; therefore, in the end, it is the local company that pays the residual dredging costs for their harbor. As of 2005, this trust fund has only been available for the dredging of cargo docks; docks that handle freight commodities. This is an extremely important entity for the establishment of a cross-lake ferry system, due to the fact that a port city with an existing function of freight shipping will already have a much deeper draft and; therefore, be given a higher score.

At the time of this conducted research, Dredging is a major issue in the realm of Great Lakes Maritime Transportation. In an excerpt from the Ironwood Daily Globe dredging has become a state of Federal Importance in the case of 'emergency dredging.' The article is just one example of the current importance of dredging waterways, especially within the Great Lakes. "Low lake levels have put at risk the safe passage of residents and goods to Madeline Island (Madeline Island is located in Lake Superior off the Wisconsin Shoreline). The authorization of this emergency dredging appropriation will allow the community to address this growing safety concern (Ironwood Daily Globe, 2007)." This emergency appropriation is part of a package of $97 million in unanticipated federal transportation funding. "Falling lake levels have now been cause for concern for two summers and are becoming a real threat to tourism expenditures, residential travel, as well as to the shipping industry. This much needed funding will assist the community in making sure channels are safely passable throughout the year. The federal Park Service has indicated while ferries and ships running to Madeline Island

are still able to pass through the channel, they are only able to do so under optimal weather conditions. If Lake Superior were to drop just a few more inches, it would be nearly impossible for larger ships to reach the island under any circumstances without the emergency dredging (Ironwood Daily Globe, 2007)."

In the case of an aluminum ferry an extreme draft is not required. The vessel will only require a depth of just over eight feet. Due to the natural silting of river beds, the Michigan side will have the most dredging tribulations, again wielding the importance of choosing a port city which already has freight shipping covering most of the residual dredging costs. Both sides of the lake will still need to support small dredging cost directly around their dock site for maneuvering and docking procedures. It is, therefore, eminent that the port, on each side of the lake, with the deepest water (either naturally or currently being funded for dredging projects), both in the channel and along the dock, will be given the highest score and; therefore, be deemed as most feasible. This attribute has been given a weight of three and will therefore be deemed three times as important as Terminal Facilities and On – Site Parking.

Population (4 = Michigan, 7 = Illinois)

Consumer demand must be explored in order to determine the feasibility of any new endeavor. Population and distance characteristics will be considered as the principle markets that would benefit from a cross lake ferry service. Due to extreme complexities, this thesis will not consider any type of financial report or cost analysis.

Due to the fact that the port cities on either side of the lake are in such close proximity to each other, this attribute becomes difficult to score, weight and even

understand. The author's original plan was to develop a 100 mile radius from each city and simply score each port in correspondence with census data / population. When attempting this process, it was realized that this strategy was virtually impossible. Not only was the radius overlap, of both Michigan and Illinois, to great but any land, or population, that was located south of Lake Michigan would not be benefited from a cross – Lake Michigan Ferry System and, therefore, would be insignificant within the described research. On the other hand population is one of the most important characteristics for the successful attainment of an alternative ferry system, so it must be analyzed and weighted.

Unlike the previously discussed attributes, population will be weighted in correspondence with importance on the opposite sides of Lake Michigan. The urban region of Northeastern Illinois will provide the bulk of passenger origin, therefore, population is considered almost twice as important on the Illinois side of the lake. Population will be scored 1.75 times more important in the urban areas of Northeastern Illinois than the rural region of Southwestern Michigan. In other words, most of the people choosing this form of transportation are residents of the State of Illinois and will be traveling to Michigan for summertime activities. With this understanding, both Illinois port cities will be given the weight of seven, while both Michigan port cities will be given the weight of four for the attribute of Population. The scores and weighted scores will be determined by each port cities actual population along with the proximity of metropolitan regions.

Destination Accessibility (4 Illinois or 7 Michigan)

This attribute adds a distinctive angle to the conducted research. Destination Accessibility along with the effects of population will be weighted in a different way on each side of Lake Michigan. Destination Accessibility refers to the geographic 'pull factor' for ferry passengers.

Figure 11. Paw Paw Lake, Michigan (Source: www.rhodesschool.com 2007)

Essentially, this attribute is asking, which port city offers a greater number of attractions at a closer proximity? Or, in other words, what port city offers a greater number of final destinations? It is important to note that this attribute is unique in origin. The attribute was not determined by the panel of 'experts,' but rather from the literature reviewed, along with professional consideration between the author and the primary research advisor.

Due to the fact that the majority of ferry passengers will be originating on the Illinois side, population will be given a higher weight in both Downtown Chicago and

Evanston. In the same respect many of the passengers will be vacationing on the Michigan side of the lake. In light of this fact the Michigan side will be given a higher weight in this attribute of Destination Accessibility.

Similar to all other attributes, the port cities on the same side of the lake will be in competition with each other. Beginning with Illinois it is predicted that Evanston will be at an extreme disadvantage, due to the fact that this is primarily a 'bedroom' community and will be not have a large 'pull-factor' for Michigan tourists. On the other hand, Downtown Chicago will be a huge draw for the small amount of Michigan residents using this type of transportation. The Michigan side should show somewhat comparable scores. This is due to the fact that both of these Resort Communities have a similar 'pull-factors' for tourists from the Illinois side of the lake. For instance this attribute will examine which of these two Michigan Port Cities offers more tourist destinations at a closer proximity to the actual ferry endpoint. (It is important to note that this attribute comes from the analysis of the author and primary research advisor)

CHAPTER V

FINDINGS

Table #2	MICHIGAN FINDINGS			
	South Haven		St. Joseph	
Attributes (Weights)	Score	Weighted Score	Score	Weighted Score
(1) Terminal Facilities	3	3	5	5
(1) On-Site Parking	3	3	5	5
(2) Accessibility	4	8	3	6
(2) Dock-Site Location	3	6	5	10
(2) Traffic Congestion	5	10	5	10
(3) Dredging	3	9	5	15
(4) Population	2	8	3	12
(7) Destination Accessibility	4	28	4	28
Sum of the Products		75		91

(Table 2, Michigan Findings)

Table #3	ILLINOIS FINDINGS			
	Chicago		Evanston	
(Weights) Attributes	Score	Weighted Score	Score	Weighted Score
(1) Terminal Facilities	5	5	3	3
(1) On-Site Parking	1	1	2	2
(2) Accessibility	5	10	5	10
(2) Dock-Site Location	5	10	3	6
(2) Traffic Congestion	1	2	1	2
(3) Dredging	5	15	2	6
(4) Destination Accessibility	5	20	3	12
(7) Population	5	35	5	35
Sum of the Products		98		76

(Table 3, Illinois Findings)

Evaluation of Findings

While the weights were determined by the panel of experts, I have determined the scores and therefore the weighted scores. A great deal of effort was given to remain consistent with the individual scoring for all four of the selected port cities. Beginning with Terminal Facilities scoring was based on available infrastructure. A ferry terminal must contain certain aspects needed for the incorporation of a ferry transportation system. With this idea in mind I also kept a consistent method of scoring if a building was a least capable of be re-modeled to desired specifications in order to contain a Ferry Terminal. On – Site Parking is a site location attribute that requires the most amount of adjacent available land. A parking lot does not have to use expensive waterfront property, but it must be close enough for people to walk to and from the ferry terminal within a matter of a few minutes. Higher scores were given to port cities with a great deal of available land located close to the proposed ferry dock. Dock – Site Location needed to be located directly on the waterfront. Higher scores were given to port cities that had available waterfront land that was close to Lake Michigan, the central business district and other modes of transportation; roads, bike routes etc. Lower scores were given to the port cities that would need to completely redesign their waterfront in order to accommodate a proper Dock Site.

Accessibility was scored in accordance to proximity of other modes of transportation. All methods of transportation were considered, along with the ease it takes to reach these other modes of transportation. If a city has good bike routes and easy access to highways it was given a high score, while a dock site that was less accessible was given a low score. Traffic Congestion was considered equally as important as

Accessibility due to the fact that these two attributes are closely correlated. If a port city has good accessibility, but poor traffic congestion, these two attributes would cancel themselves out. This way each individual score would fulfill its intent for each individual port city.

Dredging was scored higher for port cities that would not need additional dredging, lower for port cities in need of some dredging and lowest for the port cities that would need a great deal of additional dredging. Two of these port cities are considered commercial / industrial harbors; therefore they are already dredged to at least the required depth needed for the proposed cross – Lake Michigan Ferry System. In the case of the two scores of five, neither city would require any supplementary dredging.

Population, even though it was given a different weight was scored the same on both sides of the lake. Due to the fact that the port cities on either side of the lake are in such close proximity to each other, this attribute becomes difficult to score, weight and even understand. My original plan was to develop a 100 mile radius from each city and simply score each port in correspondence with census data / population. When attempting this process it was realized that this strategy was virtually impossible. Not only was the radius overlap, of both Michigan and Illinois, to great but any land, or population, that was located south of Lake Michigan would not be benefited from a cross – Lake Michigan Ferry System and, therefore, would be insignificant within the described research. On the other hand population is one of the most important characteristics for the successful attainment of an alternative ferry system, so it must be analyzed and weighted. Due to these complexities the attribute of population was scored by determining each cities overall population.

Destination Accessibility was scored in accordance to each port cities surrounding tourism pull factor. Distance and popularity were measured in accordance to the literature review and my knowledge of the local areas. Each port city has its own draw along with the pull factors from the neighboring communities. A port city with many tourism destinations, along with many tourism destinations located within a short distance, was given a high score. On the other hand a port city with few tourism destinations was given a lower score. (This particular attribute was a big downfall for Evanston, Illinois, due to the fact that it is a bedroom community with little draw for Michigan tourists).

The Delphi Weighted Scoring Technique has determined the two most highly rated ports for this alternative Cross – Lake Michigan Ferry System: Downtown Chicago and St. Joseph, Michigan (Figures #1 and #2). At first glance it appears that all four port cities should have accomplished an almost equivalent score, however, upon further study it becomes obvious why these two particular locations have been summed as dominate. Next I will analyze what exactly the Delphi Weighted Scoring Process has determined, along with a description of which attributes were beneficial and which attributes turned out to be detrimental each individual community.

Southwestern Michigan Pros and Cons

South Haven, Michigan

South Haven received a score of three in the categories of Terminal Facilities, On-Site Parking and Dock-Site Location. Each of these attributes closely correlates to the overall outlook of site location or ferry infrastructure. This correlation is due to the fact

that South Haven lacks availability on its riverfront; The Black River. Although the riverfront provides many good locations for ferry infrastructure, these sites are currently occupied by other tourism businesses. More importantly South Haven has almost no available riverfront locations within a close proximity to Lake Michigan or the cities downtown business district. This lack of available waterfront real-estate results in a 'con' for the City of South Haven. To examine these attributes from a 'fair' standpoint the experts included the fact that if some riverfront land, close to both the downtown business district and Lake Michigan, were to become available it would be a 'good' location for ferry infrastructure. It was in this method that Terminal Facilities, On-Site Parking and Dock-Site Location were all given the score of three and a total weighted score of twelve for these attributes.

In the category of Accessibility South Haven received a score of four, or very good. Although this attribute only has a weight of two this was a definite 'pro' for the city. The central business district, being located almost directly on the Black River and the Lake Michigan Shoreline, is also close, within about a mile and a half from Interstate 196. This close proximity to another mode of transportation, a major North / South highway system, gives the city a definite 'pro' for this attribute. South Haven also scored high or 'excellent' in the attribute of Traffic Congestion. Although the city receives some backups or slowdowns during peak hours of the day, during the high tourist season, there is rarely a delay that results in more than a few minutes. This attribute was scored with a five and, therefore, given the weighted score of ten, resulting in a definite 'pro' for the City of South Haven.

The attribute of Dredging resulted in a score of three and a weighted score of nine for the city. It is my opinion that the experts were 'generous' when giving South Haven this 'good' score. Since the ferry will only require an approximate draft of eight feet there are few spots within the river that would require any extra dredging; this part of the analysis weights in a benefit for the city. On the other hand any additional dredging will be extremely expensive and, therefore, be extremely detrimental to the feasibility of an alternative ferry system. South Haven also lost points in the attribute of population. The city is relatively close to the Grand Rapids and Kalamazoo Metropolitan Areas, but besides these regions South Haven, along with all of Van Buren and Allegan Counties is considered rural and not projected to be a tremendous draw for an alternative ferry system.

South Haven has become one of the dominate vacation destinations for Southwest Michigan and a good portion of these tourists are residents of the Chicago Metropolitan Area. Many vacationers, owning second 'lake homes,' go to South Haven for shopping and entertainment activities. The city is in close proximity to other small inland tourist communities; Glenn, Coloma, Watervliet etc. It is also the closest ferry endpoint to the major tourist destination of Saugatuck / Douglass, therefore, the city would provide a 'very good' endpoint for a cross – Lake Michigan Ferry System. This attribute is a definite 'pro' for the City of South Haven.

Table #4	South Haven			
Attributes (Weights)	Score	Weighted Score	Pro / Con	Weighted Score Compared to St. Joseph
(1) Terminal Facilities	3	3	Con	-2
(1) On-Site Parking	3	3	Con	-2
(2) Accessibility	4	8	Pro	2
(2) Dock-Site Location	3	6	Con	-4
(2) Traffic Congestion	5	10	N.A.	0
(3) Dredging	3	9	Con	-6
(4) Population	2	8	Con	-4
(7) Destination Accessibility	4	28	N.A.	0
Sum of the Products		75		Negative 16

(Table 4, South Haven, Michigan Scores)

In total The City of South Haven scored sixteen points lower than the City of St. Joseph for the competition of an alternative Cross – Lake Michigan Ferry Systems. The cities greatest downfalls or 'cons' were in the categories related to site location (Terminal Facilities, On-Site Parking and Dock-Site Location) dredging and population. Although the city only scored a point of two below St. Joseph in these categories the combination of the scores and the weighted scores resulted in the Delphi Weighted Scoring Technique to determine the city inferior to St. Joseph.

St. Joseph, Michigan

In the attributes of Terminal Facilities, On-Site Parking and Dock-Site Location St. Joseph was given the highest score of five, resulting in the a total weighted score of twenty for these three categories. These three attributes gave St. Joseph an eight point lead over South Haven. This 'pro' for St. Joseph is due to the fact that there is ample available riverfront land; this land is also between the central business district and Lake Michigan. It is somewhat ironic that the cities poor planning practices have shown a benefit for the Delphi Weighted Scoring, since the current available land will provide premium real – estate for all three of these 'site location' attributes.

According to the experts, Accessibility became a complicated attribute to examine. "Although there is the benefit of passenger rail service (in St. Joseph) it is very unlikely that people will travel by ferry to this location and then switch modes to continue their journey northward (Karnes)." The passenger rail service is a benefit for this location, but the lower score was the result of the cities distance from Interstate 94.

The freeway is only about ten minutes from the possible ferry dock, however this route is somewhat confusing and might detour passengers from using this mode of transportation.

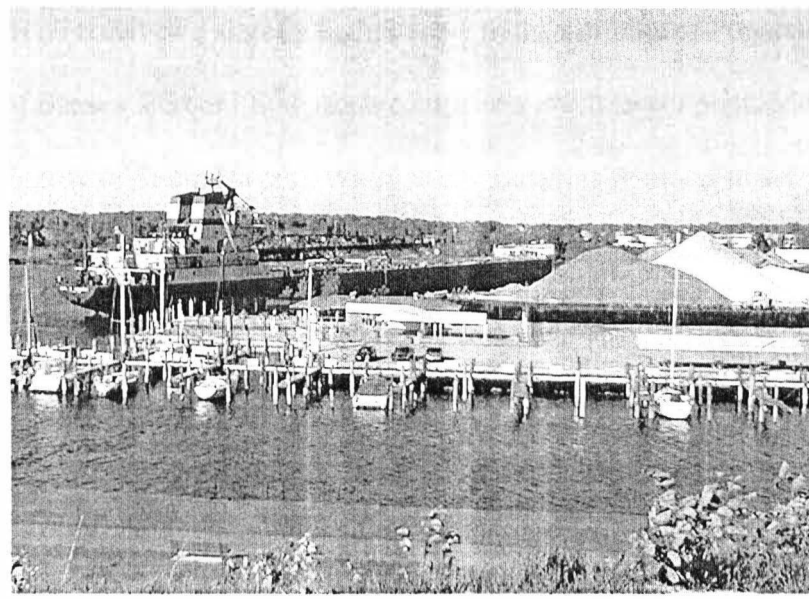

Figure 12. St. Joseph, Michigan Harbor (Source: www.boatnerd.com, 2001)

In similar standing to South Haven, St. Joseph was given the highest score in the attribute of traffic congestion. Although the downtown business district can appear congested at some points during the high tourist season delays rarely result in more than a few minutes. This small delay period is unlikely to discourage residents of the major urban areas of Northeastern Illinois from choosing this mode of transportation.

Dredging has proven to be a major 'pro' for the City of St. Joseph. Given the highest score of five, this city is simply better kept for the purpose of industrial marine transportation. With three docks currently operating in the river, and river turning basin, a depth of 23 feet is maintained each season. This depth is kept from the mouth of the St. Joseph River (between the pier-head) back to the City of Benton Harbor's Main Street

draw bridge and, therefore, within the boundary for any proposed ferry infrastructure site. This is a huge benefit over South Haven due to the fact that ferry operators would have little if any additional costs in dredging.

St. Joseph received a slightly higher score in the attribute of Population. The Twin Cities of Benton Harbor / St. Joseph comprise a much larger population than the smaller community of South Haven. While South Haven is within a closer proximity to the major Grand Rapids – Holland – Grand Haven Metropolitan Area, St. Joseph connects to the major Interstate 94 and, therefore, is in a faster driving time to the Kalamazoo – Battle Creek Metropolitan Region. This is also the main route connecting Chicago with Detroit and Main Street Canada. This combination, of a larger county (Berrien County) population base along with the shorter driving time to other metropolitan areas, gives this port city a slightly higher score for the attribute of Population.

This attribute of Destination Accessibility is similar to that of South Haven. St. Joseph offers an almost exact amount of small inland tourist destinations. These tourist destinations are mostly small inland lake communities; Sister Lakes, Three Oaks, Dowagiac etc. This port city is also within about thirty minutes from the large Chicago Metropolitan Tourist draw of New Buffalo, Michigan. When summing up the small tourist lakes and the major draw of New Buffalo, St. Joseph and South Haven receive the same score for this highest weighted attribute. The Delphi Weighted Scoring Technique has determined St. Joseph to be the most feasible port city for this side of Lake Michigan.

Table #5	St. Joseph			
Attributes (Weights)	**Score**	**Weighted Score**	**Pro / Con**	**Weighted Score Compared to South Haven**
(1) Terminal Facilities	5	5	Pro	2
(1) On-Site Parking	5	5	Pro	2
(2) Accessibility	3	6	Con	-2
(2) Dock-Site Location	5	10	Pro	4
(2) Traffic Congestion	5	10	N.A.	0
(3) Dredging	5	15	Pro	6
(4) Population	3	12	Pro	4
(7) Destination Accessibility	4	28	N.A.	0
Sum of the Products		**91**		**Positive 16**

(Table 5, St. Joseph, Michigan Scores)

Chicago, Illinois

The City of Chicago is the primary reason these four routes have been selected for the analysis of an alternative Cross – Lake Michigan Ferry System. The cities diverse population, along with its complex connection to the resort communities of Southwestern Michigan, provides a superior opportunity to study any type of transportation research. With all of these ideas under consideration it is still important to remember that Evanston, a major bedroom and lakeshore community, is a contender for an endpoint for the ferry system.

Beginning with the attributes of Terminal Facilities, On-Site Parking and Dock-Site Location the City of Chicago scored relatively well. Out of these three attributes a total weighted score of sixteen was achieved. This is due to the fact that Navy Pier, the most likely location for these attributes, already contains most of the infrastructure needed for ferry implementation; the only downfall was lack of available On-Site Parking. The city was also given the highest possible score in the category of Accessibility. With ample methods of multi-modal transportation; automobile, light rail and a well developed bus system, passengers can pretty much tour the entire city, or reach their final destination without using their personal automobile. Looking strictly at the idea of automobile transportation, Chicago scored extremely low. This attribute, along with On-Site Parking, are the only categories that did not allow the city to score 100% in the Delphi Weighted Scoring System. The experts have made it clear that these two attributes pose a problem for the probable end-point of a ferry system simple because

of the congested nature of a densely populated and congested central business and tourist urban hub.

Dredging is another attribute in which the city earned valuable points. Both the lock, leading into the Chicago River and the many 'man-made' harbors, have been dredged to at least the appropriate depth needed for this fast ferry. Like the City of St. Joseph, these dredging operations are currently maintained by other marine businesses throughout the lakefront. Population is another benefit for Downtown Chicago. It was also noted by the experts that this location houses expensive real-estate, real-estate in which wealthy owners are more likely to choose this possibly 'expensive' mode of unique transportation. The largest margin between Downtown Chicago and Evanston was Destination Accessibility. As explained earlier within the research, this attribute was weighted in correspondence to either side of the lake. These attributes make Chicago's Lakefront Harbor an attractive site for an alternative Cross – Lake Michigan Ferry System.

Table #6	Chicago			
(Weights) Attributes	Score	Weighted Score	Pro / Con	Weighted Score Compared to Evanston
(1) Terminal Facilities	5	5	Pro	2
(1) On-Site Parking	1	1	Con	-1
(2) Accessibility	5	10	N.A.	0
(2) Dock-Site Location	5	10	Pro	4
(2) Traffic Congestion	1	2	Con	0
(3) Dredging	5	15	Pro	9
(4) Destination Accessibility	5	20	N.A.	8
(7) Population	5	35	N.A.	0
Sum of the Products		98		Positive 22

(Table 6, Chicago, Illinois Scores)

Evanston, Illinois

In the attributes of Terminal Facilities, On-Site Parking and Dock-Site Location the City of Evanston continually scored lower than Chicago. According to the experts the city has little available waterfront real-estate and has not been extremely successful in their planning of public waterfront land. For these reasons the city lost a total of nine possible points in the Weighted Scoring System. Similar to Chicago, the City of Evanston is exceptionally accessible. Accessibility ranges from all forms of transportation; automobile, light rail and bus system, it is also very close to O'Hare International Airport, therefore making it the most accessible of the four analyzed port cities. Bike and walking paths are also readily available making this a true multi-modal transportation network. Also similar to Downtown Chicago, Evanston has a great deal of Traffic Congestion. Even with its high accessibility of multi-modal transportation, backups can last for long periods of time, especially during rush hours.

Dredging became a definite con for Evanston. Any projected waterfront land would only be available inside of a man-made harbor, or a break-wall. These small harbors are currently only used for recreational boat traffic and, therefore, unequipped to handle large vessels with deep drafts. Although the projected maximum draft is only eight feet, this small harbor would require dredging in a few areas into the harbor and around the dock and, therefore, drastically increasing start up costs.

Although Destination Accessibility has less of a weight on the Illinois side of Lake Michigan this is a definite 'con' for the City of Evanston. For Michigan Residents this is not necessarily an unattractive location, it is just not as attractive as Downtown Chicago and a Destination Location. Evanston lost points because it is a bedroom

community and would not be as effective in drawing Michigan Tourists to choose this type of transportation.

Similar to Downtown Chicago, Evanston received a 'superior' score in the attribute of Population. Population is the most important attribute on the Illinois side and, therefore, was a definite 'pro' for the city. The fact that Evanston is a 'bedroom community,' proved a negative in the previous attribute, however this situation now proves to be beneficial to the community. The city was given the highest possible score, due to the fact that this suburb encompasses a tremendous amount of residents within a very close proximity to Lake Michigan, and therefore, very close to any projected ferry dock.

Table #7	Evanston			
(Weights) Attributes	Score	Weighted Score	Pro / Con	Weighted Score Compared to Evanston
(1) Terminal Facilities	3	3	Con	-2
(1) On-Site Parking	2	2	Pro	1
(2) Accessibility	5	10	N.A.	0
(2) Dock-Site Location	3	6	Con	-4
(2) Traffic Congestion	1	2	N.A.	0
(3) Dredging	2	6	Con	-9
(4) Destination Accessibility	3	12	Con	-8
(7) Population	5	35	N.A.	0
Sum of the Products		76		Negative 22

(Table 7, Evanston, Illinois Scores)

CHAPTER VI

CONCLUSION

Geographers have long recognized the importance of regional interactions. This thesis has analyzed these regional interactions at both the physical and cultural levels. It has also employed a combination of qualitative and quantitative data. In spite of being one of the least used methods of transportation in the United States, this research has shown that ferry systems are capable of elevating congestion issues in both rural and urban settings. In addition, ferry systems, when designed correctly, can fit into almost any type of inter-modal transportation infrastructure. The spatial analysis of Lake Michigan is an ideal location to provide this type of ferry analysis. The Delphi Weighted Scoring Technique has determined the most feasible ferry route across Southern Lake Michigan. This investigation of a Spatial Analysis of Great Lakes Ferry Transit Systems is a first attempt to describe the regional benefits this transportation system could incur. With the understanding that this is the optimal route across this section of the lake, the following material will illustrate additional research opportunities and future recommendations.

To examine future research opportunities, literature has been reviewed to determine the current prospects for expanded ferry transportation systems. One of the biggest misconceptions is that a proposal for a ferry service is somehow out of synch with worldwide trends in transportation; specifically that new bridges and tunnels are supplanting the need for ferries. "Actual data indicates ferry trips worldwide were stable in 2002, compared to the year previous (Barrett, 2006)." "In recent years 14 new services, within the United States and Canada, have been established or are about to start

(Barrett, 2006; Sandler 2006)." The previously mentioned data includes ferry systems that have begun service since 2002. Of the systems mentioned one ferry has already proven a failure. "Due to financial problems, the City of Rochester, NY was forced to permanently discontinue the cross-lake ferry service, Spirit of Ontario (York, 2005; York, 2006; Associated Press, 2005)."

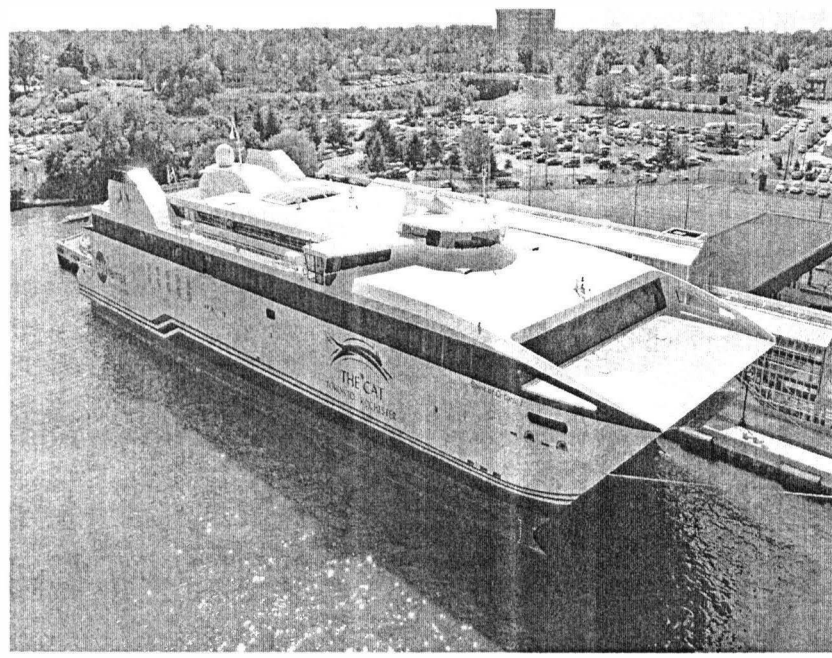

Figure 13. The Breeze (Source: www.democratandchronicle.com, 2004)

Reasons for failure include financial issues that originated when the planners and investors lacked proper research methods when planning for this service.

Future research can be conducted examining reasons for this failure. More importantly future research can be conducted regarding the aspects of ferry transit systems that are vital in order to maintain a successful operation. Existing research conducted on ferry transit systems provides information regarding the long-term success of both historical and existing ferry systems. This literature reviewed, along with the

previously conducted and explained research, has provided five basic criteria for successful operation: 1. the integration of ferry transit must correlate with current transportation systems 2. the maximization of economic development must be achieved 3. the system must minimize any adverse environmental impacts 4. the maximization of safety and security must occur 5. all ferry systems have benefited when adding the commodities of freight to their inventory. This criterion provides a valuable foundation for future research related to this subject.

Realized only at the mid-point of the research, existing infrastructure poses a threat to the most feasible outcome. The research has examined four port cities that do not currently contain a ferry system. On the other hand the thesis will not explain the viability of using an existing ferry dock; such as The Lake Express High Speed Ferry Dock in Milwaukee, Wisconsin. From the previous depth interviews along with the literature review, the connection between Southwestern Michigan and Eastern Wisconsin in not as strong as the Southwestern Michigan and Northeastern Illinois. On the other hand it is also realized that utilizing this existing ferry dock would drastically reduce construction costs along with needed site location infrastructure issues.

Another issue for future examination would be the United States Law "The Maritime Jones Act." Passed by Congress in 1920 the Jones Act is a unique law to the United States Maritime Industry. The act requires that all vessels, sailing between two United States ports, must be built, maintained and crewed solely by American citizens. This Act has had a tremendous effect on long distance freight and passengers service, but it also poses a problem for an alternative cross-Lake Michigan ferry service. The centralized location of Northeastern Illinois and Southwestern Michigan portray a logical

perspective to require American citizens to crew and maintain the vessel, but the construction costs alone pose a huge threat to the entire feasibility of this venture. This law is meant to keep American workers, especially shipyards and businesses directly related to ship construction, viable in today's global economy. Without this law there is great likelihood that the United States Merchant Marines would cease to exist. Simply, foreign competition is able to construct, maintain and crew ships in almost every trade. In the case of this particular research the problem is directly related to the construction cost of a ferry vessel. The Lake Express High Speed Ferry is the only fast ferry currently operating in the continental United States and, therefore, one of the only fast ferries constructed completely on American Soil. The only other American fast ferries, capable of operating in the open waters of the Great Lakes, are located in Northwestern Washington State and Alaska. The ferries in Washington make travel to British Colombia and therefore are not required to meet Jones Act guidelines. The ferries operating in Alaskan waters are designed to travel great distances with large cargoes (both freight and passengers) and are therefore simply to big to be economical in the Great Lakes. With that being said the only option for this alternative cross-Lake Michigan ferry is new construction. New construction would be by far the largest investment for this new venture making the feasibility that much more doubtful.

Looking from another perspective, why has the Jones Act not been amended? Currently there is not other form of transportation, or any company for that matter, that is solely dependent on Americans. American companies that make automobiles, railroad cars, electronics etc... are not required to be strictly managed by American citizens.

Unfortunate as it may be, this service will not be available for continuous commuter use; weather, due to both high winds and winter ice, will prevent too many crossing for a reliable commuter service. On the other hand this service will be highly attractive to recreational use. Similar to the existing two routes, especially Lake Michigan Car-Ferry which operates the 50 year old Steamship Badger, this method of transportation will be more attractive for recreational travelers. This decision, determined from the experts along with certain aspects of the literature review, is primarily based upon the seasonality of this ferry system.

CHAPTER VII

ANTICIPATED VESSEL COST SUMMARY

Although this research does not contain a cost analysis for an entire cross – Lake Michigan ferry system, an already constructed vessel, similar in design will be used as and example. This will be done for future researchers, or investors, to anticipate the probable cost of the actual vessel for the proposed use. It is hoped that any future research, conducted in relation to this subject, will take some type of cost analysis into consideration. "The ferry representative estimated the cost for constructing the vessel based on the original designs to be approximately $8 million in 2006 dollars. The ferry representative estimated that the platform lift and other proposed designs to meet the draft guidelines would add from $206,250 to $256,250 to the vessel's construction costs, or a 2.6 percent to 3.2 percent increase. About 75 percent to 80 percent of the additional costs are attributed to the platform lift. Four car spaces would be lost on the main deck. The cost estimates are summarized below in order of magnitude (Vehicle Ferry Case Study, 2006)."

Appendix

Spatial Analysis of Great Lakes Ferry Systems


The Great Lakes Region
N
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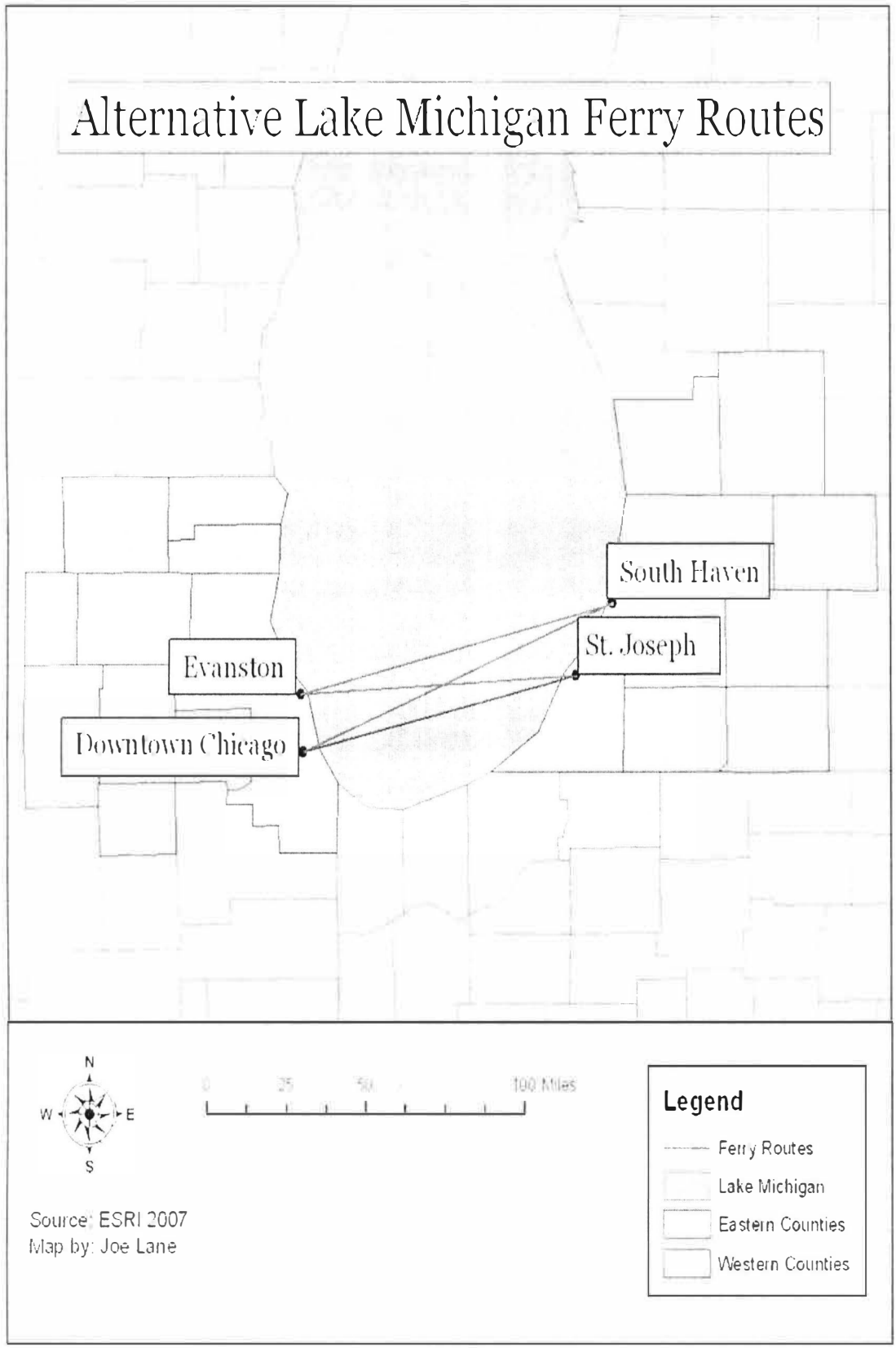
150
300
600 Miles
Source: ESRI 2007
Map by: Joe Lane


Alternative Lake Michigan Ferry Routes
South Haven
St. Joseph
Evanston
Downtown Chicago
N
W
E
S
0
25
50
100 Miles
Legend
Ferry Routes
Lake Michigan
Eastern Counties
Western Counties
Source: ESRI 2007
Map by: Joe Lane

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