

Upper Midwest Freight Corridor Study

Final Report
Phase II
MRUTC Project 06 - 09



University of Wisconsin-Madison
Midwest Regional University Transportation Center

University of Toledo
Intermodal Transportation Institute
Center for Geographic Information Sciences and Applied Geographics

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<p>16. Abstract</p> <p>Growing travel, freight movements, congestion, and international competition threaten the economic well being of the Upper Midwest States. More Congestion, slower freight movement, fragmentation, and economic slow down are the probable outcomes if the threats are not addressed. However, planning for and managing the growth of freight transport are complex issues facing transportation agencies in the region. In an effort to crystallize the issues and generate thought and discussion, eleven white papers were written on important factors that influence freight and public policy. The papers provide the background on specific aspects of freight in the Upper Midwest. As a collection, the papers provide a primer on freight issues and related responses that may form the basis for a regional freight agenda.</p> <p>The Upper Midwest Freight Corridor Coalition used input from transportation administrators in Ohio, Indiana, Michigan, Wisconsin, Illinois, Minnesota, and Iowa, as well as the provinces of Ontario and Manitoba, along with the Federal Highway Administration and researchers from the University of Wisconsin - Madison, the University of Illinois- Chicago, and the University of Toledo to draft an agenda to help meet the challenge of freight movement and economic vitality within the Upper Midwest. The agenda identifies thirteen priority initiatives to respond to growing freight demand. Data and technology are needed to support the initiatives outlined in the agenda, and both topics are discussed in subsequent plans. The final report in Volume II is a white paper explaining the importance of transportation to the economic well being of the region.</p>			
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Upper Midwest Freight Corridor Study-Phase II

March, 2007

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Upper Midwest Freight Corridor Study Phase II

Executive Summary

Introduction and Problem Statement

Safe, reliable, and efficient transportation systems are essential to the economic viability and strength of our nation. If the U.S. economy is to reach new heights, the transportation system must be capable of moving people and goods safely, quickly, and efficiently. Federal transportation activities increasingly consider freight movements as key elements of planning and development. There are strong correlations between freight volume and both general employment and manufacturing employment. Data also shows that growth in Gross Domestic Product (GDP) is linked to growth in freight transportation. In addition, the quality of life including work-related, leisure, and recreational travel depend upon safe and reliable transportation.

Currently, demand on our nation's transportation system is stretching infrastructure to, and in many cases beyond, capacity. While estimates vary, the freight moving across this network is expected to increase by about 50 percent by 2020. Responding to this challenge with a 50 percent increase in infrastructure may not be a viable option because it is costly and it consumes valuable land that could be used for agriculture, recreation, residential, or commercial and industrial development. Ideas and methods are needed that increase the utilization of existing assets through the application of technology and innovative management practices and that identify and solve bottlenecks in the transportation network.

The Upper Midwest states are the economic and geographic cross roads of the nation. All major U.S. and Canadian railroads converge in Chicago. Major East-West (I-80, I-90, and I-94) and North-South (I-35, I-69, I-71, and I-75) roadways link the states to each other and to the nation. Ports on the Great Lakes and the Illinois, Ohio, Mississippi, and Missouri Rivers carry goods around the nation and the world. Substantial freight moves through our busy airports. In addition, the Upper Midwest is also influenced by a strong and growing economy in Ontario. To improve regional competitiveness, it is essential that we seek system-wide efficiency and inter-modal connectivity to link suppliers, manufacturers, distributors, and retailers regionally, nationally, and globally.

It is necessary that regional transportation leaders create a vision for the future of transportation in the Upper Midwest and define a structure and process that leads us to that vision through broad-based participation. This vision needs to involve transportation as the means to an end. The end involves economic

development and the quality of life. Key factors include the development, application, and use of technology -- both transportation and information systems related. Creating a vision involves cooperative efforts in planning, implementation, and operations and is supported by sharing resources, information, and ideas. A process for turning this vision into reality requires a multi-state, multi-jurisdictional partnership of public and private sector stakeholders that can transform the vision to specific goals, action plans, and projects.

Objectives of Study

The seven states of the Upper Midwest Region (Ohio, Illinois, Indiana, Iowa, Minnesota, Michigan, and Wisconsin) and two Canadian provinces (Manitoba and Ontario) collaborated during Phase I of the Upper Midwest Freight Corridor Study to examine freight movements, infrastructure capacity, and administrative issues in the Upper Midwest region. This study builds upon work completed in Phase I and continues regional efforts targeting planning and cooperation.

The initial intent of the Phase II study was to create a regional approach for freight transportation in the Upper Midwest states based on a multi-state, multi-jurisdictional partnership of public and private sector stakeholders. This partnership considers and addresses short- and long-term issues surrounding anticipated increases in freight movement within the region and the likely impacts on the region's infrastructure and economic health. The specific objectives include: Development of a Regional Freight Agenda, facilitating discussions of a regional approach to deploying commercial vehicle-related intelligent transportation systems, and maintenance and improvement of the regional information system on freight.

To develop a Regional Freight Agenda, the research team prepared a series of whitepapers on various policy options that the region could consider for addressing specific and emerging freight challenges. Based upon the work completed in phase one, conversations with state freight, planning and federal relations staff, and other efforts at the national level, these white papers were prepared for regional analysts and decision makers to consider.

This research project also reports progress in facilitating discussions of a regional approach to deploying commercial vehicle-related intelligent transportation systems, and allowed continued maintenance and improvement of the regional information system on freight (Midwest FreightView).

Background

Several regions in the US began to study freight movements in the 1990s. In April of 2002, the Midwest Regional University Transportation Center (MRUTC) hosted a workshop for transportation stakeholders focused on freight and the

need for adopting a regional approach for the Upper Midwest states. In July 2002 at the AASHTO Mississippi Valley meeting, the research team (MRUTC, University of Wisconsin at Madison, University of Illinois-Chicago, and University of Toledo) was assembled and initial discussions began with the state DOTs.

In cooperation with these state DOTs, the research team developed the preliminary scope of work for Phase I of the Upper Midwest Freight Corridor Study. The effort was led by the Ohio Department of Transportation under pooled fund TPF-5(078) "Upper Midwest Freight Corridor Study." The complete results of the Upper Midwest Freight Corridor Study were published in the spring of 2005. That study included compiled and synthesized existing freight-related plans and efforts, created a setting for coalition building through regular communications and data sharing, identified the conditions and needs across all modes of freight transportation for the corridors in the region, and analyzed administrative processes for the motor carrier industry in the region. At the conclusion of Phase I, the participating states agreed that continued focus on a regional basis was necessary and identified the key elements of the Phase II workplan.

Benefits

The first effort in regional cooperation in freight for the Upper Midwest carried many benefits that Phase II builds upon. Following the experience of many other areas in the country, the research results further demonstrate the benefits of regionalism. Working together as a region tends to influence federal policy and foster a systematic view of the transportation network as an integrated set of parts. Previous efforts also reinforce the value of communication between public agencies and between the public and private sectors. Phase II confirmed these findings in the Midwest region. Results of Phase II benefit the region by:

- Enabling both the public and private sectors to leverage the resources and strengths each has toward developing a comprehensive approach toward freight;
- Sharing our understanding of the processes and practices employed by neighboring states relative to freight;
- Considering project planning and delivery using a collaborative approach;
- Bridging the gap between the public and private sectors relative to decision making practices; and,
- Placing the region in a stronger position to solicit federal funds to support enhancement of the corridor through several mechanisms such as applying for earmarked funding, and applying to designate the corridor as a Corridor of National Significance;
- Building on existing studies and efforts to ensure that duplication of efforts is avoided or at least minimized.

Process

Phase I of the study included compilation and synthesize existing plans and efforts, creating a foundation for the Phase II efforts. In addition to research literature and the experience of other states and regions, data collected in Phase I was used by the research team in their preparation of this Phase II report.

To develop the regional freight agenda, the research team conducted monthly teleconferences and two teleconferences with the state technical committee. The teleconferences allowed for the development of key elements for inclusion in the stakeholder meetings.

The research process included two stakeholder meetings. The first meeting was held in November 2005 in Milwaukee, Wisconsin. Over 70 participants attended the November workshop and developed a list of potential action items. At this stakeholder meeting, the states represented in the pooled fund also requested that the research team begin drafting a series of actions to comprise a regional freight agenda. The second stakeholder meeting was held in Columbus Ohio in April 2006.

At the conclusion of the November workshop, the states, in concert with the research team, proposed that the collection of white papers should be delivered as an integral part of the final report. Moreover, the formation of the Mississippi Valley Freight Coalition was a result of these meetings and discussions.

In addition to the formation of the coalition listed above, the Midwest Traffic Operations Coalition was formed to address regional traffic and ITS issues. In the first quarter of 2006, a series of exploratory meetings were held with a collection of Midwest-based organizations with an interest in enhancing interstate traffic and commercial vehicle operations and sharing of traveler information. The Midwest Regional University Transportation Center (MRUTC) and the Traffic Operations and Safety Laboratory (TOPS) at the University of Wisconsin-Madison worked together to explore the establishment of a Midwest Traffic Operations Coalition, using the participants, framework, and existing funding of the Upper Midwest Freight Corridor Coalition as a launching platform. The formation of this coalition resulted in a Conceptual Regional Technology Plan, the second key objective of Phase II.

Results and Recommendations

The principal product of this study is a Regional Freight Agenda document. The agenda is a compilation of the information obtained through the regional dialog. The document includes prioritized statements of potential initiatives that reflect the region's collective interests. Three priority initiatives were identified, these include:

- **Public and Political Understanding**
This priority initiative would strive to improve public and political understanding and better document funding needs. The state participants supported development of a cross-state task group to develop marketing plans, detail necessary audiences, and define messages and actions. This initiative also would include continued work with public officials to clearly document infrastructure funding needs to improve freight movements.
- **Public Sector's Ability to Plan for and Deal with Freight**
This initiative would outline plans on creating an ongoing regional organization and develop an information resource to identify opportunities for freight transportation improvements in the Upper Midwest region. This initiative includes defining a regional multimodal freight network, identifying agency points of contact, developing model planning approaches, and developing the role and structure for public/private partnerships.
- **Intermodal Regulations and Capacity**
This third initiative would focus on the removal or mitigation of regulatory and capacity limits on freight mobility within the Upper Midwest. It identified several specific barriers to enhanced competition in the freight industry and outlined support for alleviating specific bottlenecks.

Another product of Phase II study is a Conceptual Regional Technology Plan. The plan outlines six objectives:

- Organizational and technical support to foster learning and information sharing
- Provide a source of long-distance travel information to shippers and the traveling public
- Development of a mobility-oriented Midwest Regional Concept of Transportation Operations
- Development and maintenance of strategic, performance-oriented business plans
- Creation of frameworks and guidelines that will:
 - Assist members with system management and operations
 - Support investment decisions
 - Select and define standards for information sharing
- Accelerate coordinated system management and operations by facilitating deployments of cross-jurisdictional programs and services

A third objective was the continued development of the regional information system. Included in the Phase II report is the necessary Information Resources for Supporting the Regional Freight Agenda in the Upper Midwest. This data plan highlights the key information necessary to implement the regional agenda. The information system provides a single repository for regional data and provides convenient access to public sector officials to obtain information on freight.

Implementation Potential

There are a number of opportunities for implementation of the results of Phase II. At a minimum, the dissemination of the white papers, briefing documents, and regional agenda will benefit transportation decision makers across the region. There are a variety of audiences for these materials. These audiences include the general public, transportation analysts, agency decision makers and legislators and their staffs.

The materials prepared in Phases I and II can form the basis for the development of a "Corridor of the Future" proposal. These materials also form the basis for a formal Memorandum of Understanding among the states in the region to cooperate in the planning, operation, preservation, and improvement of transportation system infrastructure and in efforts to engage the public and private sectors in the process for improving the efficiency of the freight transportation systems.

Impediments to implementation will be funding required for suggested technology deployment and administrative inconsistencies as also documented in Phase I of this effort. Implementation relies upon continuing cooperation and discourse between the states, the freight industry, and the local governments. The continued dialogue between the states and the development of an emerging Mississippi Valley Freight Coalition will serve as tools for overcoming these challenges.

Introduction

Summary and Report Outline

Freight in the Upper Midwest States is a very complex issue with many factors that influence the development of public policy. In an effort to generate thought for discussion among the stakeholders, a set of fifteen white papers were written to present the issues and important factors that influence freight transportation and public policy. Each of the papers is a standalone document and was written by members of the research team for Phase II of the Upper Midwest Freight Corridor Study. This report includes a compilation of the papers. The selection of the paper topics and order they are presented are simple; two papers are dedicated to defining the problem, then ten papers are devoted to finding solutions, followed by three papers that reflect a regional perspective and identify regional problems and solutions.

Defining the Problem

Growing travel, growing freight movements, congestion, and international competition all threaten our economic wellbeing. *The Challenge Ahead* is a short paper that draws upon the findings of Phase I of the Upper Midwest Regional Freight Study to describe why a problem exists, or is in the making, that requires some actions on the part of governments in the region.

Trade between China and the Upper Midwest States is a short monograph on one key aspect of growing freight movements - trade with China. The paper presents insight for understanding the magnitude of transportation flow this activity generates and its potential impacts on the Upper Midwest States.

Finding Solutions

Solutions may be found for highway, rail and water modes. Since highways are most directly influenced by public agencies, this report dedicates ten papers to finding and analyzing potential highway solutions. In *The Null Alternative in Highway Capacity and Management*, the author describes the future if no actions are taken. More congestion, slower freight movement, continued fragmentation and economic slow-down are the probable conclusion.

The paper *Applying Regular Federal Aids to Highway Freight Capacity Issues*, provides an overview of existing federal programs that might be tapped by the region. The paper, *Creating Capacity*, reviews the federal dollars that come to the region, how they are used and the possible impacts of diverting them to freight-related projects. In *The Role of Tolls in Moving Freight*, the author explores the current federal rules on the use of tolls, the experiences of other states and regions, and the potential for using truck-only lanes as toll facilities.

In *Using Technology*, the authors explore a number of technologies that might be employed to better manage and utilize existing highway capacity. Rail transportation and many of the issues related to it are covered in the paper titled *Railroads and Freight in the Future* including the current state of the rail industry, its probable direction, and the possible public policy options to influence that direction.

Maritime issues on the Great Lakes are described in *Great Lakes Maritime Transportation System*. The paper provides a historical perspective, current usage, constraints and public policy options related to the continued and possible expansion of the Great Lakes Marine Transportation system in the Midwest freight corridor.

Intermodal issues are covered in the paper *Encouraging Development of Intermodal Freight Facilities*. Intermodal here refers primarily to truck/rail. The paper looks at the possible benefits of moving more freight by rail using trailer or container on rail. It also outlines some of the constraints that may hinder intermodal expansion and some of the policy options that might deal with those constraints.

A perennial issue in transportation policy for the public sector relates to investing public funds in non-revenue modes or in facilities that are not owned by the public. The paper, *Investing in Non-Revenue Modes*, outlines some of the arguments for and against such investments.

Finally, *Transportation and the Economy* emphasizes the importance of transportation to economic wellbeing. The paper reviews some of the literature and experiences of other countries to argue that continued and reasonable investment in transportation are essential for maintaining the economic health of the region and country.

Regional Perspective and Recommendations

Individually, these papers provide the essential background on specific aspects of freight in the upper Midwest. Taken together, as they were intended, the papers provide a primer on freight issues and the policy options that must be considered to deal with those issues. The papers listed above form the basis for regional freight agenda, which is a final product of this Phase II study.

In *An Agenda for Meeting Freight Demand in the Upper Midwest* a seven state agenda is outlined to meet the needs of freight movement and economic vitality of the region. Here, a vision is presented to meet the challenges of the region. A set of priority initiatives are identified as tools to achieve the vision.

Introduction

The paper, *Information Resources for Supporting the Regional Freight Agenda in the Upper Midwest* presents arguments for ongoing efforts to assemble, manage and disseminate information dealing with freight movements in the region. The paper discussed the data currently available and the needs for reliable data for to support the development and implementation of the region's priority initiatives.

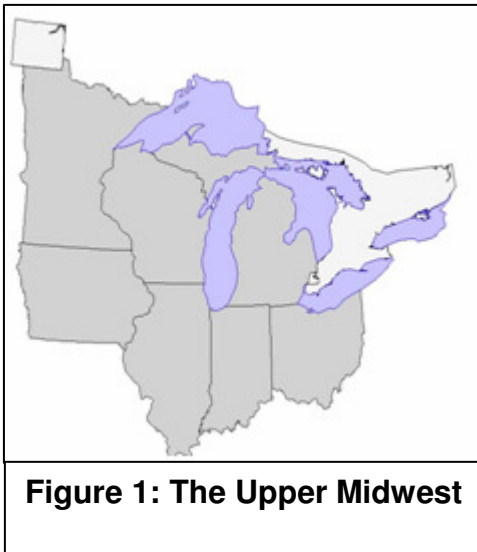
The report concludes with a *Conceptual Region Plan*. This paper contains the results of the Upper Midwest Freight Coalition's successful effort to facilitate a dialog and draft a conceptual deployment plan.

The Challenge Ahead

Ernie Wittwer-Wittwer Consulting

Introduction and Summary

The Upper Midwest faces a significant challenge over the next few years. How the states and the nation respond to this challenge will have a major influence on their economic health in the Twenty-First Century. The freeways, railroads and waterways that have moved the product of our farms and factories for the past forty years are at, or nearing, capacity. This is happening at a time when freight ton-miles (metric ton-kilometers) are projected to increase by as much as 80% over the next fifteen years; and when automobile mileage continues to grow at more than one percent per year. While the resulting grid-lock will be costly, wasteful and inconvenient for the commuter and business traveler, it will be devastating for those businesses that are dependant on reliable, inexpensive transportation to move their raw and finished products.



Freight, which is closely correlated to a healthy economy, moves beyond state and national borders. Our traditional post-interstate era approach to freeway capacity expansion has individual states making some modest improvements to small stretches. It also has each state implementing traffic management and traveler information systems independently. Our traditional approach to rail and water-borne freight is to let the market dictate the services offered. All of these traditional approaches will not meet the challenge that we face over the next decade. They will not produce the

capacity or the efficiency needed to move the freight and people we will have to move to maintain our economic position.

The states of the Upper Midwest (Figure 1), with the cooperation of the Federal Highway Administration and neighboring Canadian Provinces, have undertaken an effort to define a regional agenda for freight. This includes a review of national policies that might benefit the region, a look at state policies that might be better coordinated, and an effort to better develop plans for regional, complimentary traffic information and management systems, particularly as they relate to commercial vehicle operations. Developing this agenda is one first step in meeting the challenge ahead.

Freight and the Economy

Historically, the volume of freight has tracked very closely with Gross Domestic Product (GDP) and employment. Figure 2: Freight and Economic Activity outlines the experience of the last thirty years of freight and economic activity. Ton-miles (metric ton-kilometers) of freight and total employment track very closely (dotted grey and solid black lines). Intercity truck mileage and gross domestic product also track very closely (the dotted black and grey lines).

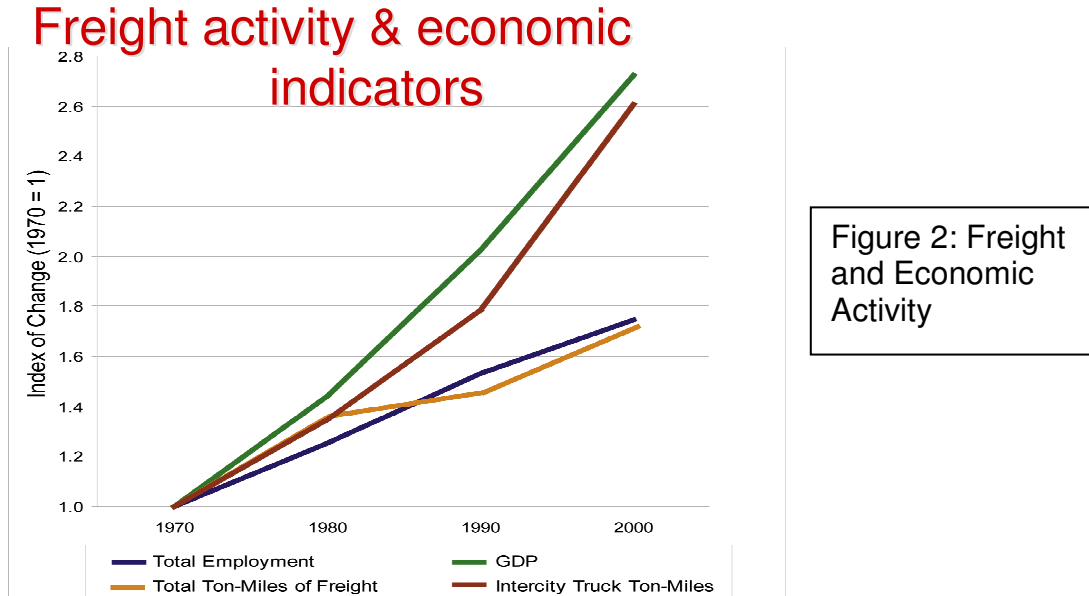


Figure 2: Freight and Economic Activity

Figure 1: Freight and Economic Activity

The tie of freight and manufacturing is even greater than that of freight and the general economy. This is significant for the Upper Midwest because the region is more dependent on manufacturing than is the balance of the nation. In fact, 27% of the nation's manufacturing jobs are located within the seven states. The region's reliance on manufacturing is also illustrated by the top commodities shipped, as measured by value. All ten of the commodities are manufactured products, starting with motorized and other vehicles and ending with printed materials.

Agriculture is also a major force in the regional economy. A look at commodities from the perspective of ton-miles (metric ton-kilometers) illustrates their importance. Five of the ten top ton-mile (metric ton-kilometers) commodities are agricultural, starting with cereal grains and ending with animal feeds.

In total the region has a major role in the national economy. Situated as it is in the center of the country, it connects the coasts and the growing economy of

Ontario to the rest of the nation. Overall in the range of 30% of the nation's freight is either destined to or starting from the region. All modes, whether measured by value, tons (metric ton) or ton-miles (metric ton-kilometers), show the same pattern.

The reliable and efficient movement of freight is vital to the economic health of the region. A challenge to that movement is a challenge to our economic wellbeing.

Modal Shares

Freight moves by one mode or another because of one or more of several factors:

- The value of the freight
- The weight of the freight
- The length of the haul
- The dependability of service required

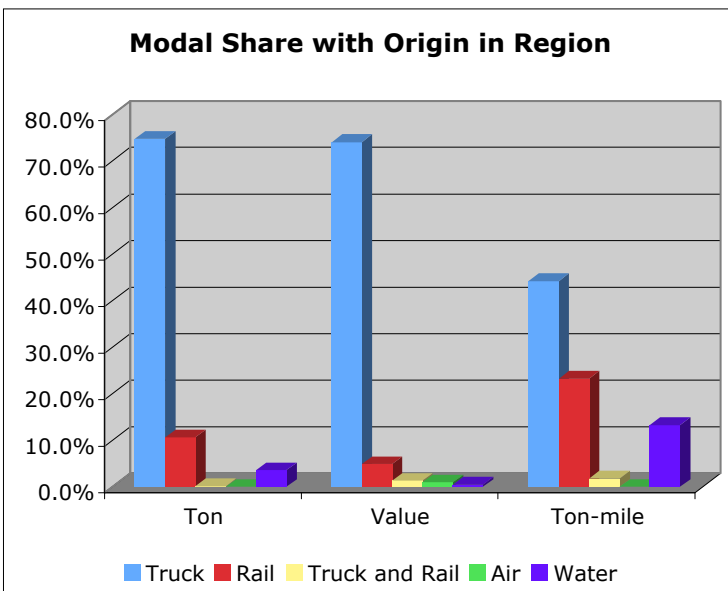


Figure 3: Modal Share with Origin in Region

Typically, high value freight with a high service requirement moves by air or by truck. High weight freight with low service requirements moves by rail or water.

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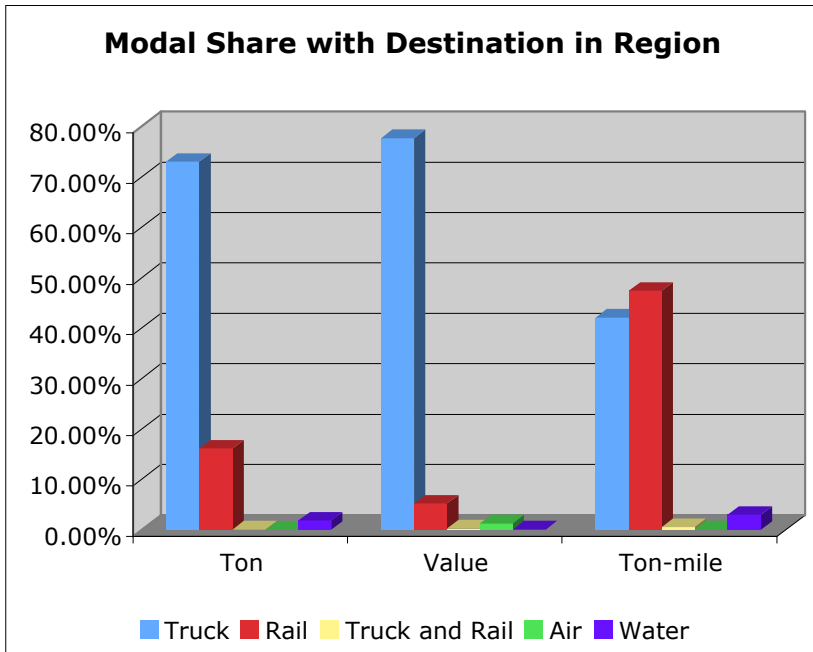


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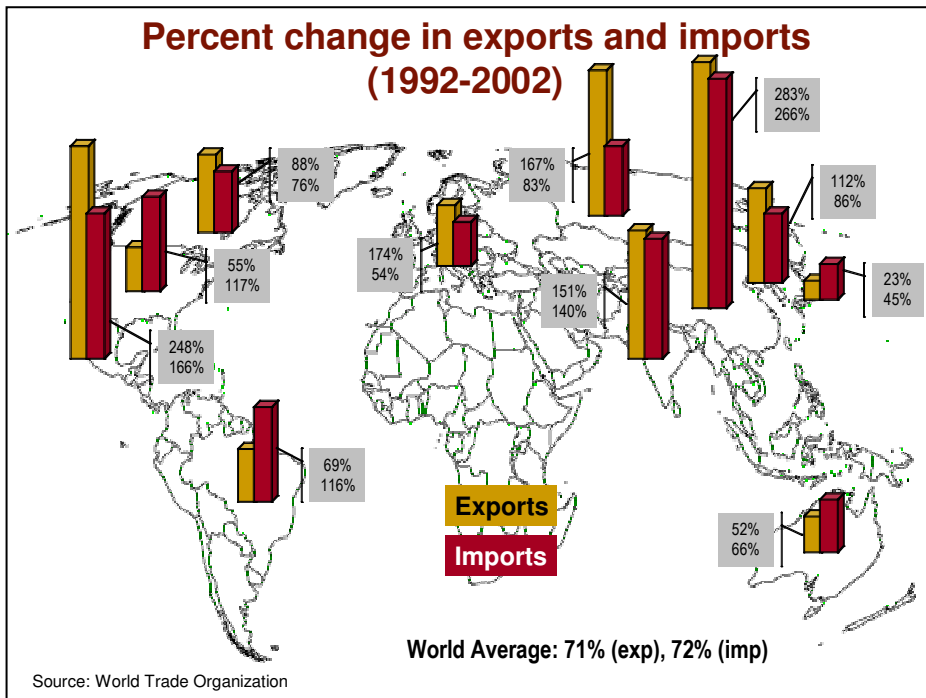
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A number of factors combine to increase the amount of freight moving in our economy. First of all, world trade is growing. Figure 5: Freight and Economic Activity provides an overview of the change in imports and exports for the US and its major trading partners for the ten years ending in 2002. For our region the impact of the growing of Ontario economy is significant. Each week thousands of trucks leave Ontario for the states of the Upper Midwest.



**Figure 5:
Freight
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Another major change that has taken place is in the nature of manufacturing. Historically, manufacturing was geographically consolidated. The Ford plant at River Rouge in the early Twentieth Century was a good example of such consolidation. Raw materials, in the form of iron ore and coal, entered one end and finished automobiles emerged from the other. Now manufacturing is largely distributed across wide regions. Auto engines might be made in one state, transmissions in another, instrument packages in still another, bodies in a fourth, with assembly in a fifth. All of this requires more extensive and complex freight movements.

Finally, the efforts of retailers and manufacturers to minimize warehousing costs by timing shipments, the just-in-time approach, have placed higher service demands on the transportation system. This in turn has forced more freight to the modes that support higher service levels; generally, this means truck.

The Federal Highway Administration and several states in the region have done estimates of future freight. Those estimates suggest growth to 2020 in the range of seventy to eighty percent. As noted earlier, freight movements closely track with economic indicators. Recent projections of those indicators for 2020 show a range of growth from 19% to 78%. If the observed correlation holds, growth in the range of 80% would be on the high range of probability, but growth in excess of 50% would seem likely.

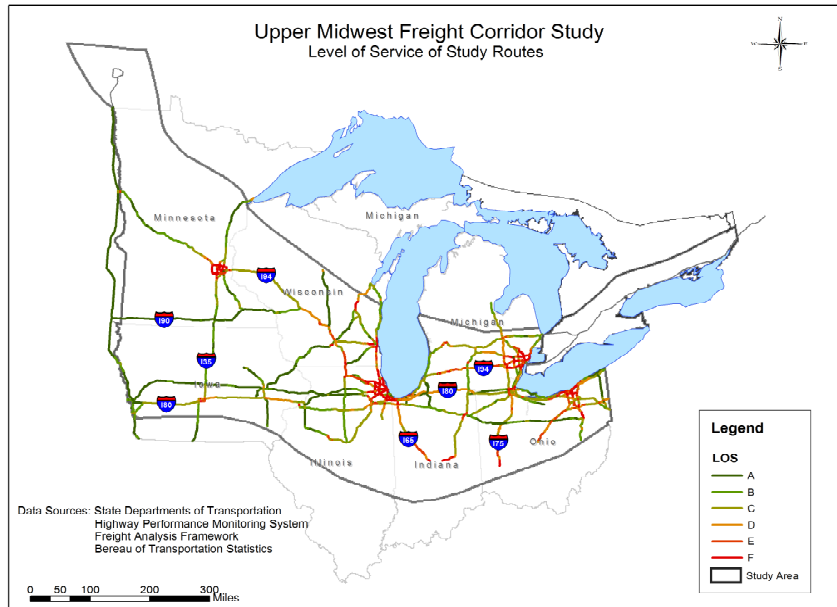


Figure 6: Freeway Capacity

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Figure 7: Rail Track Capacity provides similar information for the class one railroads in the region. Again, much of the system shows capacity constraints. Both this and the highway measures are conservative. They do not consider terminal constraints or operational features, such as interchanges, that can limit capacity.

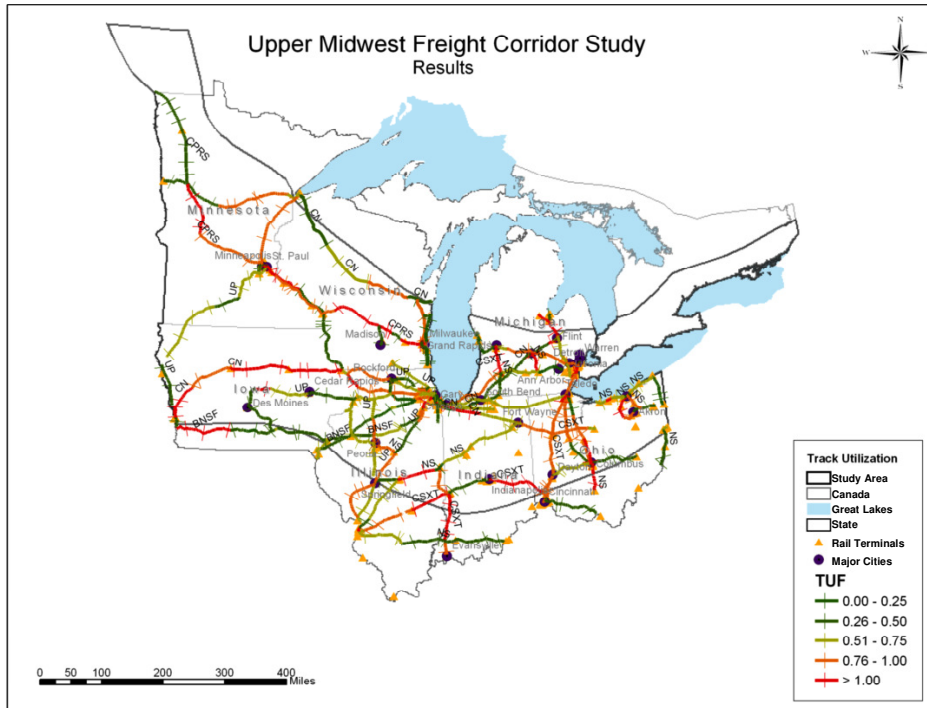


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The inland waterways also show capacity constraints. Since the locks are the primary capacity constraint, it is a good indicator of the operations of the rivers. Delays of up to four hours per transit are common at each lock on the Upper Mississippi and Illinois. Lack of investment and federal statutes and regulations have also effectively limited the capacity of the Great Lakes.

Conclusions

Pulling all the parts together paints a depressing picture. The demand for the movement of freight is growing. Increasingly, service requirements limit the modal choice to truck. Intermodal movements are very small. And capacity is already constrained.

Figure 8 tries to portray data that is largely unknowable. But let us assume that relative modal capacity relates closely to current utilization. The blue, red, and yellow show that approximate distribution for each of the modes. Together, they represent the total freight capacity available in 2000. Then let us assume that capacity changes as well or slightly better in the next 20 years than it did in the previous 20. In the diagram, both rail and truck show slight increases to the year 2020. Previously, we have seen the growth in freight projected to be in the 50 to 80% range. Exactly how much of current capacity is used is unknown, but a conservative guess would place it at about 85% of highway, rail, and water capacity. Plotting all of these lines produces a conceptual deficit in capacity over

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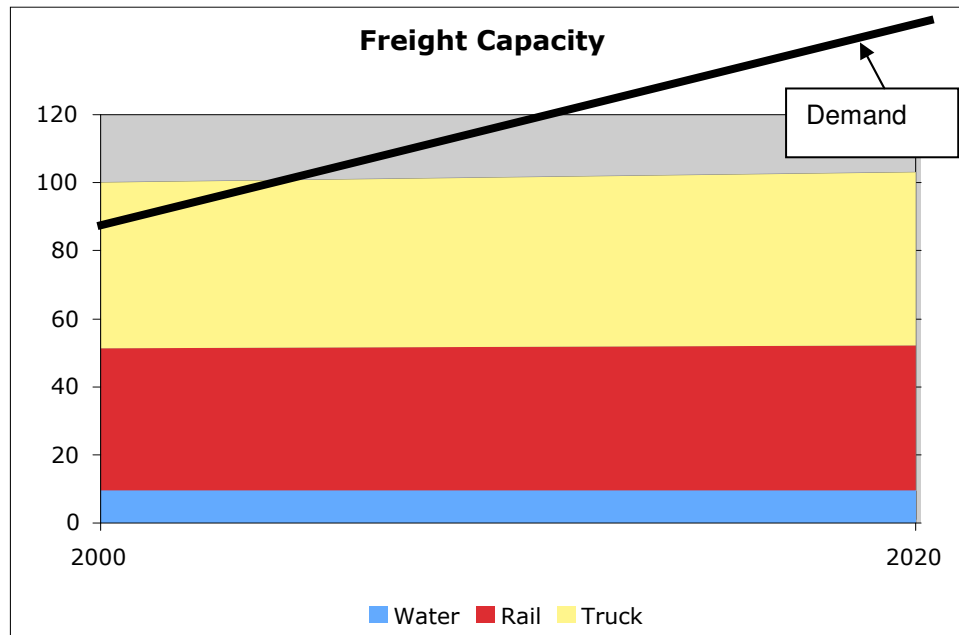


Figure 8: Conceptual Future Capacity

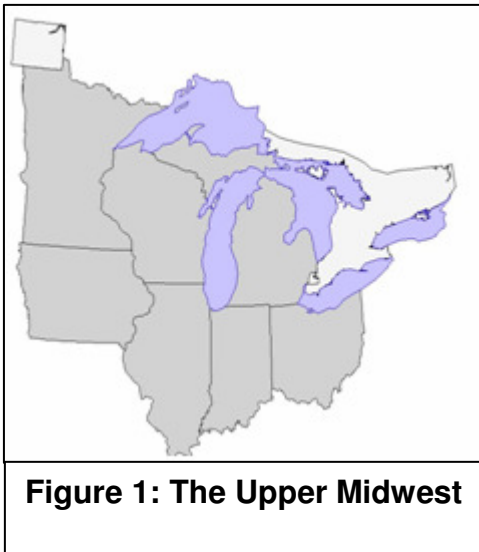
As the region the region considers the future of freight, it will have to evaluate a number of options, many of which will represent major departures from existing policy. Our creativity and courage will determine how well the challenge is met.

The Challenge Ahead

Ernie Wittwer-Wittwer Consulting

Introduction and Summary

The Upper Midwest faces a significant challenge over the next few years. How the states and the nation respond to this challenge will have a major influence on their economic health in the Twenty-First Century. The freeways, railroads and waterways that have moved the product of our farms and factories for the past forty years are at, or nearing, capacity. This is happening at a time when freight ton-miles (metric ton-kilometers) are projected to increase by as much as 80% over the next fifteen years; and when automobile mileage continues to grow at more than one percent per year. While the resulting grid-lock will be costly, wasteful and inconvenient for the commuter and business traveler, it will be devastating for those businesses that are dependant on reliable, inexpensive transportation to move their raw and finished products.



Freight, which is closely correlated to a healthy economy, moves beyond state and national borders. Our traditional post-interstate era approach to freeway capacity expansion has individual states making some modest improvements to small stretches. It also has each state implementing traffic management and traveler information systems independently. Our traditional approach to rail and water-borne freight is to let the market dictate the services offered. All of these traditional approaches will not meet the challenge that we face over the next decade. They will not produce the

capacity or the efficiency needed to move the freight and people we will have to move to maintain our economic position.

The states of the Upper Midwest (Figure 1), with the cooperation of the Federal Highway Administration and neighboring Canadian Provinces, have undertaken an effort to define a regional agenda for freight. This includes a review of national policies that might benefit the region, a look at state policies that might be better coordinated, and an effort to better develop plans for regional, complimentary traffic information and management systems, particularly as they relate to commercial vehicle operations. Developing this agenda is one first step in meeting the challenge ahead.

Freight and the Economy

Historically, the volume of freight has tracked very closely with Gross Domestic Product (GDP) and employment. Figure 2: Freight and Economic Activity outlines the experience of the last thirty years of freight and economic activity. Ton-miles (metric ton-kilometers) of freight and total employment track very closely (dotted grey and solid black lines). Intercity truck mileage and gross domestic product also track very closely (the dotted black and grey lines).

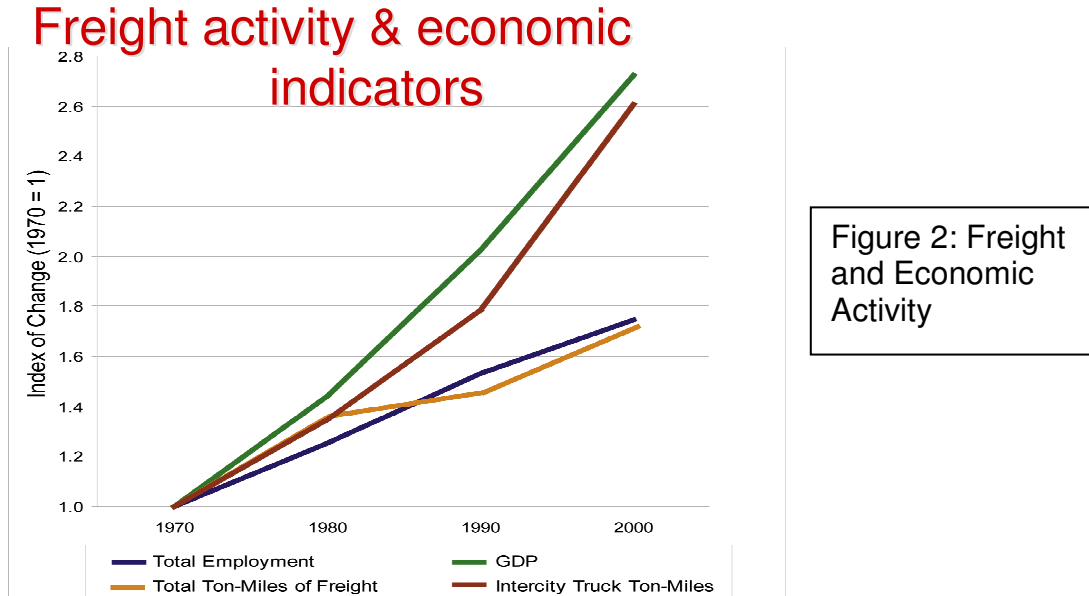


Figure 1: Freight and Economic Activity

The tie of freight and manufacturing is even greater than that of freight and the general economy. This is significant for the Upper Midwest because the region is more dependent on manufacturing than is the balance of the nation. In fact, 27% of the nation's manufacturing jobs are located within the seven states. The region's reliance on manufacturing is also illustrated by the top commodities shipped, as measured by value. All ten of the commodities are manufactured products, starting with motorized and other vehicles and ending with printed materials.

Agriculture is also a major force in the regional economy. A look at commodities from the perspective of ton-miles (metric ton-kilometers) illustrates their importance. Five of the ten top ton-mile (metric ton-kilometers) commodities are agricultural, starting with cereal grains and ending with animal feeds.

In total the region has a major role in the national economy. Situated as it is in the center of the country, it connects the coasts and the growing economy of

Ontario to the rest of the nation. Overall in the range of 30% of the nation's freight is either destined to or starting from the region. All modes, whether measured by value, tons (metric ton) or ton-miles (metric ton-kilometers), show the same pattern.

The reliable and efficient movement of freight is vital to the economic health of the region. A challenge to that movement is a challenge to our economic wellbeing.

Modal Shares

Freight moves by one mode or another because of one or more of several factors:

- The value of the freight
- The weight of the freight
- The length of the haul
- The dependability of service required

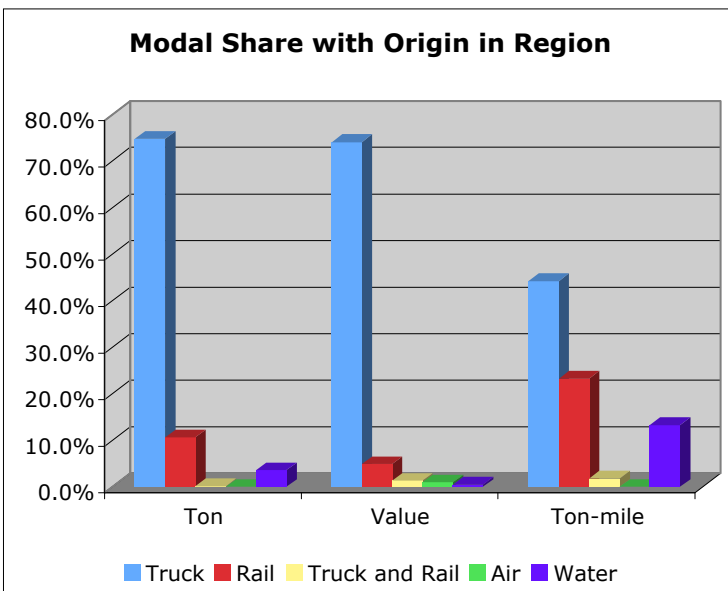


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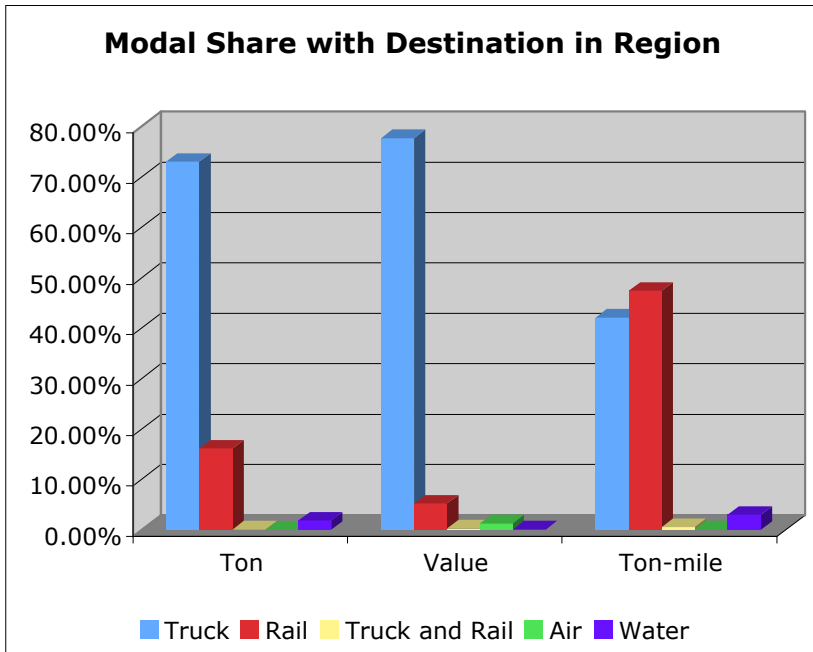


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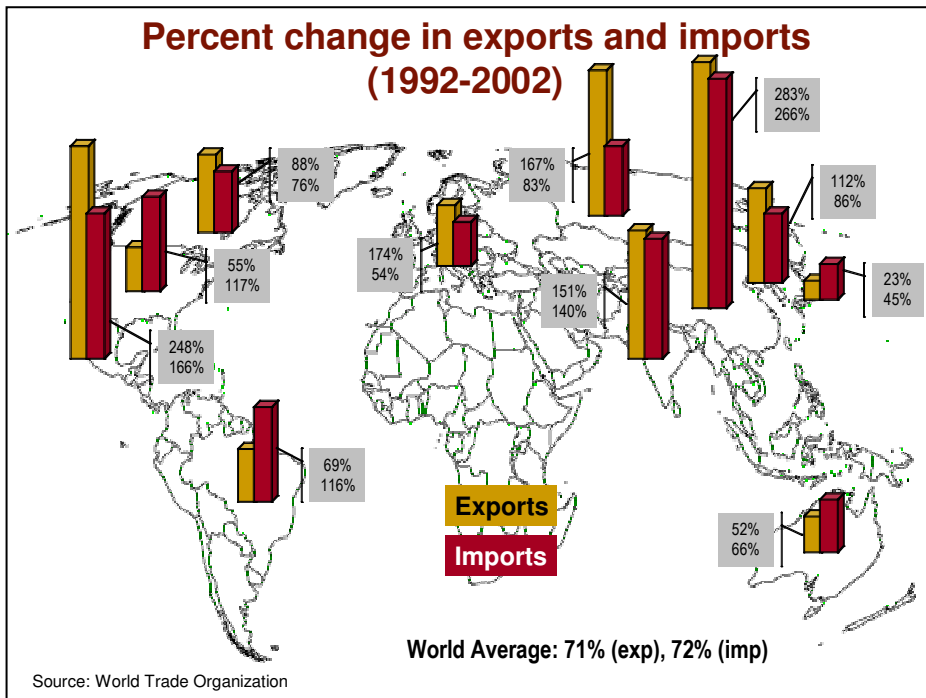
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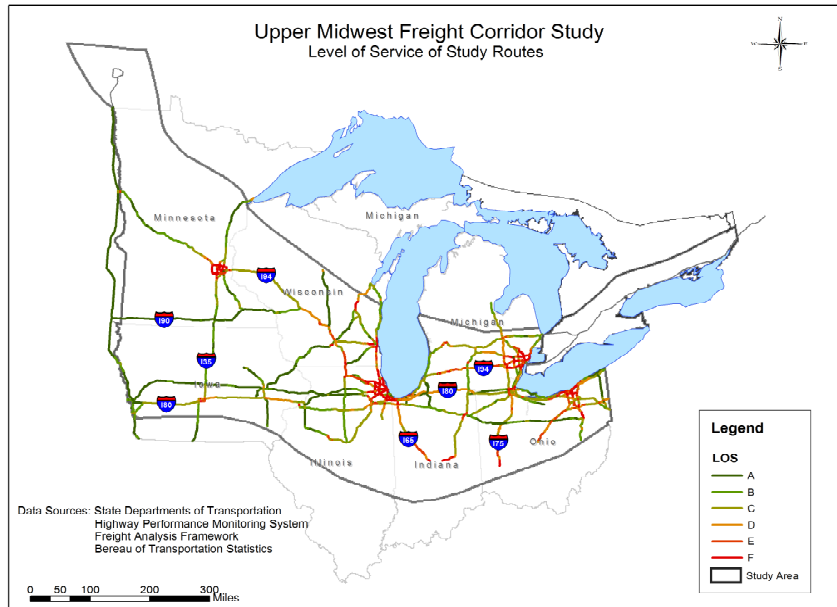


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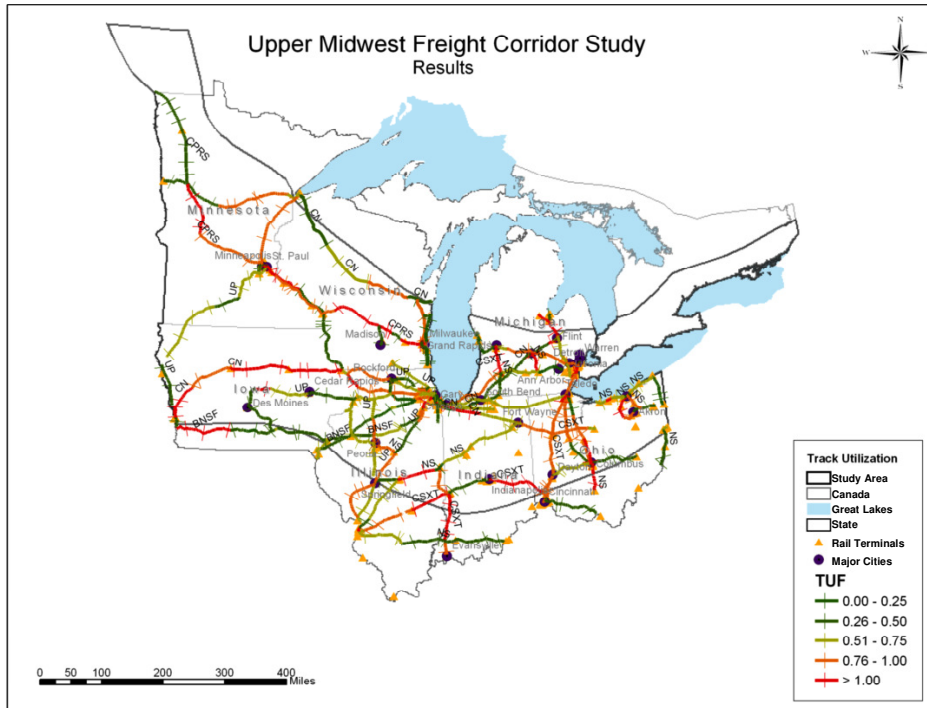


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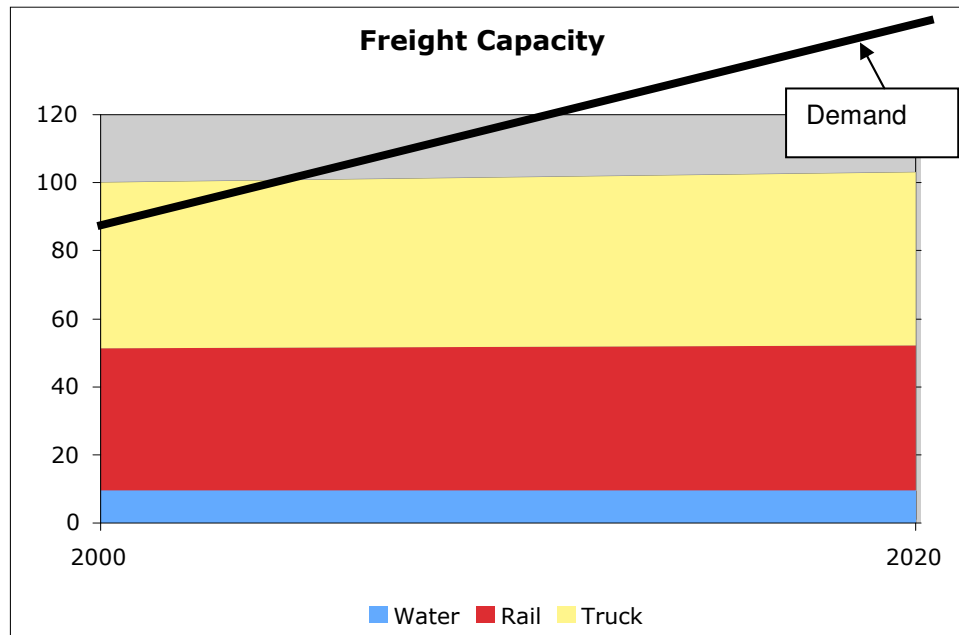


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Trade between China and the Upper Midwest States

Mark Vonderembse, University of Toledo

Trade between China and the U.S. has grown substantially in the past decade. This has placed substantial burden on a transportation systems that already had capacity limitations and flow constrictions at critical nodes. It is important to understand the magnitude of this transportation flow and its potential impacts on the Upper Midwest States.

Currently, we have data that shows freight shipments by air and by water to China from the seven states in the Upper Midwest States (Illinois, Indiana, Iowa, Michigan, Minnesota, Ohio, and Wisconsin). Table 1 and 2 below shows the data are available by volume and by value for 1999 through 2004. All states show a dramatic increase in trade with China from 1999 to 2004. In nearly all cases, the flows of goods from these states to China have increased by a factor of two or more.

We currently do not have data that shows shipments from China to the Upper Midwest States, although one would expect that:

- The absolute values of the shipments from China to the Upper Midwest States are greater than values of the shipment from these states to China
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In short, the goods coming from China are substantial and are likely to continue to grow. Efforts are currently underway to obtain access to data on goods coming from China.

In addition, the data on trade with China are meant to illustrate the capabilities that we have to examine international trade. These same data could be presented for trade from the U.S. to Japan, Korea, or other U.S. trading partner.

Table 1: Data of Air Freight from China

Air Freight to China from (Kilograms)							
State	1999	2000	2001	2002	2003	2004	6 Year Total
Wisconsin	759,390	966,932	1,697,415	2,625,306	3,198,084	3,539,754	12,786,881
Ohio	1,533,918	1,568,272	1,923,067	3,402,230	3,018,003	4,378,581	15,824,071
Minnesota	1,291,444	1,814,828	1,406,639	2,288,680	2,522,442	3,718,975	13,043,008
Michigan	839,368	4,989,921	1,024,106	1,808,921	1,964,107	3,539,753	14,166,176
Indiana	733,965	846,796	911,824	1,310,705	1,282,087	2,528,351	7,613,728
Illinois	4,652,628	4,292,567	4,546,501	4,427,598	6,895,276	8,018,860	32,833,430
Iowa	178,534	172,436	154,452	305,638	498,263	629,326	1,938,649
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Ohio	63,158,325	69,358,097	112,508,514	173,156,930	153,319,936	265,114,350	836,616,152
Minnesota	87,569,581	128,662,428	118,543,982	192,728,418	231,245,176	255,668,624	1,014,418,209
Michigan	22,024,062	38,105,561	57,877,895	68,736,061	70,140,529	131,878,289	388,762,397
Indiana	37,329,541	50,513,385	48,174,077	54,067,487	61,753,834	105,441,355	357,279,679
Illinois	222,130,078	258,199,761	341,993,360	270,179,768	241,402,394	323,119,495	1,657,024,856
Iowa	11,161,444	9,333,385	17,760,992	16,337,098	21,491,144	29,585,098	105,669,161

Table 2: Data of Water Freight from China

Water Freight to China from (Kilograms)							
State	1999	2000	2001	2002	2003	2004	6 Year Total
Wisconsin	25,801,827	30,691,951	55,252,958	60,009,103	228,470,282	85,247,445	485,473,566
Ohio	49,146,028	72,426,000	109,185,912	126,391,178	165,165,668	208,437,791	730,752,577
Minnesota	22,650,107	91,223,914	38,249,609	158,828,939	58,708,964	68,150,161	437,811,694
Michigan	26,214,051	59,562,496	76,305,286	75,423,242	158,802,773	136,026,973	532,334,821
Indiana	45,944,928	35,694,590	53,144,521	53,049,657	145,323,728	97,873,341	431,030,765
Illinois	92,890,048	139,627,201	226,725,554	302,060,679	394,858,556	360,635,387	1,516,797,425
Iowa	7,833,745	15,830,994	33,578,651	24,775,658	29,563,464	43,368,903	154,951,415
Water Freight to China from (Value US\$)							
State	1999	2000	2001	2002	2003	2004	6 Year Total
Wisconsin	94,713,947	104,070,521	179,050,919	192,922,800	314,240,910	327,037,611	1,212,036,708
Ohio	176,000,000	220,225,821	332,181,101	326,620,061	455,558,813	669,823,971	2,180,471,542
Minnesota	80,693,807	77,454,653	95,545,659	111,528,298	137,950,744	139,015,437	642,188,598
Michigan	172,000,000	159,317,000	185,768,354	208,531,987	290,766,686	467,922,946	1,484,362,897
Indiana	97,485,202	115,504,760	151,470,342	132,032,450	171,617,399	186,360,977	854,471,130
Illinois	214,000,000	273,133,962	351,473,065	388,380,347	542,800,548	591,454,247	2,361,614,878
Iowa	24,584,417	35,619,408	65,561,891	61,648,399	70,410,826	98,279,087	356,104,028

Air Freight

As shown in the table 1 above, airfreight moving to China from the U.S. (both by volume and by value) has increased dramatically. It is likely that all or nearly all of this freight was brought to the departing airport via the road network. Illinois has the largest amount of cargo, most likely because Chicago is a major hub for international air travel and a substantial amount of airfreight moves as belly cargo in passenger jets. Minnesota also has significant international connections via Minneapolis, which helps to explain its large air cargo movement to China.

Water Freight

As shown in table 2 above, water freight moving to China from the U.S. (both by volume and by value) has increased dramatically. Only a very small amount of this freight moves through great lakes ports or down the Mississippi to China. The freight tends to move from the Upper Midwest States to West Coast ports via truck and rail, with the majority moving intermodally with trains doing the line-haul work. Once again, Illinois is the largest point of departure, in part, because of its

role as a critical intermodal connection point. Ohio and Michigan are also large trading partners with China due, in part, to their manufacturing emphasis.

Possible Alternative

Currently, inbound and outbound international freight movements between the Upper Midwest States and China and other eastern rim countries, face significant air, rail, truck, and intermodal bottlenecks in Chicago and delays at the West coast ports. These problems are likely to increase unless some relief can be found.

Air Freight

The two largest airports in the Upper Midwest States, Chicago O'Hare and Detroit Metro, have congested air space and/or congested road networks that feed these airports. In the past decade, airports in Indianapolis, Indiana and Columbus, Ohio have been selected by Federal Express as major cargo hubs for its package delivery network. There may be other airports in the Upper Midwest States that are well located, have ample room for development, and limited congestion. These could serve as alternative collection points and destinations for air cargo.

Water Freight

There appear to be four alternatives for water based transportation to the eastern rim.

- Via rail or truck to the U.S. west coast ports. Currently, this is the most heavily used route, but it is congested and adds substantial time and cost to the journey.
- Great Lakes ports through the St. Lawrence Seaway, through the Panama Canal. Even if the lock limitations on the Seaway could be addressed, this alternative is not very attractive for trade with China because of the length of the journey and the delays associated with moving through the Panama and Seaway/Great Lakes locks. This may be an attractive alternative for trade with Europe, Africa, or South America.
- Great Lakes ports through the Illinois River and locks to the Mississippi River and through the Panama Canal. This is not the most direct route, but could be a possible alternative as the delays at the West Coast ports increase.
- Via rail from two or three points in the Upper Midwest States using Canadian National (CN) exiting at the Port of Vancouver or Prince Rupert. This route is shorter in both distance and time from the Upper Midwest States to China, Japan, and Korea, it by-passes the capacity constrained intermodal facilities in Chicago and the Port of Long Beach, and it uses rail lines that can take long, high capacity trains with fewer delays along the route.

Summary

As we collect data on trade moving from China to the Upper Midwest States, we should be thinking about strategies to move goods efficiently into and out of our region. As the spreadsheet shows, our exports to China are substantial. The faster and more efficient we are at moving products the more competitive our manufactures will be in the global market place.

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Trade Between China and the Upper Midwest States

Ohio	63,158,325	69,358,097	112,508,514	173,156,930	153,319,936	265,114,350	836,616,152
Minnesota	87,569,581	128,662,428	118,543,982	192,728,418	231,245,176	255,668,624	1,014,418,209
Michigan	22,024,062	38,105,561	57,877,895	68,736,061	70,140,529	131,878,289	388,762,397
Indiana	37,329,541	50,513,385	48,174,077	54,067,487	61,753,834	105,441,355	357,279,679
Illinois	222,130,078	258,199,761	341,993,360	270,179,768	241,402,394	323,119,495	1,657,024,856
Iowa	11,161,444	9,333,385	17,760,992	16,337,098	21,491,144	29,585,098	105,669,161

Table 2: Data of Water Freight from China

Water Freight to China from (Kilograms)							
State	1999	2000	2001	2002	2003	2004	6 Year Total
Wisconsin	25,801,827	30,691,951	55,252,958	60,009,103	228,470,282	85,247,445	485,473,566
Ohio	49,146,028	72,426,000	109,185,912	126,391,178	165,165,668	208,437,791	730,752,577
Minnesota	22,650,107	91,223,914	38,249,609	158,828,939	58,708,964	68,150,161	437,811,694
Michigan	26,214,051	59,562,496	76,305,286	75,423,242	158,802,773	136,026,973	532,334,821
Indiana	45,944,928	35,694,590	53,144,521	53,049,657	145,323,728	97,873,341	431,030,765
Illinois	92,890,048	139,627,201	226,725,554	302,060,679	394,858,556	360,635,387	1,516,797,425
Iowa	7,833,745	15,830,994	33,578,651	24,775,658	29,563,464	43,368,903	154,951,415
Water Freight to China from (Value US\$)							
State	1999	2000	2001	2002	2003	2004	6 Year Total
Wisconsin	94,713,947	104,070,521	179,050,919	192,922,800	314,240,910	327,037,611	1,212,036,708
Ohio	176,000,000	220,225,821	332,181,101	326,620,061	455,558,813	669,823,971	2,180,471,542
Minnesota	80,693,807	77,454,653	95,545,659	111,528,298	137,950,744	139,015,437	642,188,598
Michigan	172,000,000	159,317,000	185,768,354	208,531,987	290,766,686	467,922,946	1,484,362,897
Indiana	97,485,202	115,504,760	151,470,342	132,032,450	171,617,399	186,360,977	854,471,130
Illinois	214,000,000	273,133,962	351,473,065	388,380,347	542,800,548	591,454,247	2,361,614,878
Iowa	24,584,417	35,619,408	65,561,891	61,648,399	70,410,826	98,279,087	356,104,028

Air Freight

As shown in the table 1 above, airfreight moving to China from the U.S. (both by volume and by value) has increased dramatically. It is likely that all or nearly all of this freight was brought to the departing airport via the road network. Illinois has the largest amount of cargo, most likely because Chicago is a major hub for international air travel and a substantial amount of airfreight moves as belly cargo in passenger jets. Minnesota also has significant international connections via Minneapolis, which helps to explain its large air cargo movement to China.

Water Freight

As shown in table 2 above, water freight moving to China from the U.S. (both by volume and by value) has increased dramatically. Only a very small amount of this freight moves through great lakes ports or down the Mississippi to China. The freight tends to move from the Upper Midwest States to West Coast ports via truck and rail, with the majority moving intermodally with trains doing the line-haul work. Once again, Illinois is the largest point of departure, in part, because of its

role as a critical intermodal connection point. Ohio and Michigan are also large trading partners with China due, in part, to their manufacturing emphasis.

Possible Alternative

Currently, inbound and outbound international freight movements between the Upper Midwest States and China and other eastern rim countries, face significant air, rail, truck, and intermodal bottlenecks in Chicago and delays at the West coast ports. These problems are likely to increase unless some relief can be found.

Air Freight

The two largest airports in the Upper Midwest States, Chicago O'Hare and Detroit Metro, have congested air space and/or congested road networks that feed these airports. In the past decade, airports in Indianapolis, Indiana and Columbus, Ohio have been selected by Federal Express as major cargo hubs for its package delivery network. There may be other airports in the Upper Midwest States that are well located, have ample room for development, and limited congestion. These could serve as alternative collection points and destinations for air cargo.

Water Freight

There appear to be four alternatives for water based transportation to the eastern rim.

- Via rail or truck to the U.S. west coast ports. Currently, this is the most heavily used route, but it is congested and adds substantial time and cost to the journey.
- Great Lakes ports through the St. Lawrence Seaway, through the Panama Canal. Even if the lock limitations on the Seaway could be addressed, this alternative is not very attractive for trade with China because of the length of the journey and the delays associated with moving through the Panama and Seaway/Great Lakes locks. This may be an attractive alternative for trade with Europe, Africa, or South America.
- Great Lakes ports through the Illinois River and locks to the Mississippi River and through the Panama Canal. This is not the most direct route, but could be a possible alternative as the delays at the West Coast ports increase.
- Via rail from two or three points in the Upper Midwest States using Canadian National (CN) exiting at the Port of Vancouver or Prince Rupert. This route is shorter in both distance and time from the Upper Midwest States to China, Japan, and Korea, it by-passes the capacity constrained intermodal facilities in Chicago and the Port of Long Beach, and it uses rail lines that can take long, high capacity trains with fewer delays along the route.

Summary

As we collect data on trade moving from China to the Upper Midwest States, we should be thinking about strategies to move goods efficiently into and out of our region. As the spreadsheet shows, our exports to China are substantial. The faster and more efficient we are at moving products the more competitive our manufactures will be in the global market place.

The Null Alternative in Highway Capacity and Management

Ernie Wittwer, Wittwer Consulting

It has been said that one of the truest forms of insanity is repeating the same actions and expecting a different outcome. In this paper, the writer attempts to envision the most likely outcomes for highway freight transport if current policies and processes are continued in the Upper Midwest. Past experience is the primary guide to the future along with the projections of experts in the field of energy and environment. With this guidance, the outlook is not good. We can expect congestion to get worse, our competitive position to be diminished, fuel consumption to increase, and pollution to be needlessly high.

Capacity

The US has what is often called a system of state-administered, federally assisted highway transportation. Under this system, the federal government provides aids to the states along with broad guidance as to how those aids can be used. Each state makes the decision as to how federal aids and state raised funds will be used to maintain and improve its highway system. In making those decisions, state transportation, and political leaders usually seek to maximize the benefit to their citizens and the impact to their state. They make the best possible decisions for transportation within their borders. Consultation and planning for issues beyond their borders is minimal. Problems that exist within a state are to be dealt with by that state, without regard to the impact that those problems might have for other states. The result for the region and the nation may be less than optimal.

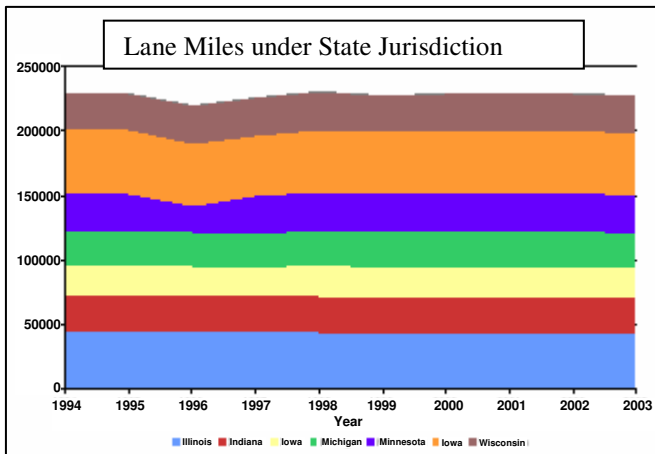


Figure 1: Lane Miles under State Jurisdiction (1)

Since the completion of the Interstate Highway System, no mechanism has existed to either facilitate or compel states to develop projects or routes that are consistent and complimentary across state borders. Indeed, since the completion of the Interstate System, much of the emphasis of state departments of transportation has turned to maintaining their highway investments through rehabilitation, reconstruction, or replacement. The result has been a marginal

change in highway lane miles. Figure 1 provides an overview of the change in overall highway lane miles, regardless of facility type, under state jurisdiction in the Upper Midwest. For the past ten years, overall mileage has not changed.

The picture for limited access lane miles (kilometers) is somewhat better. Over the past ten years, limited access lane miles (kilometers) have increased, but at a rate much smaller than overall traffic mileage has increased. This is illustrated in Figure 2.

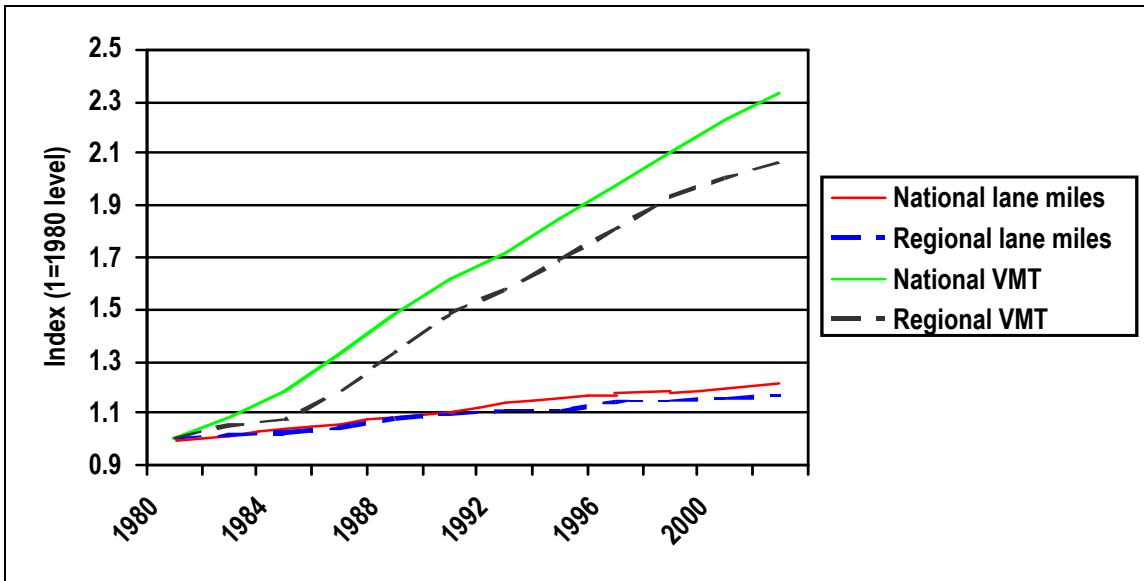
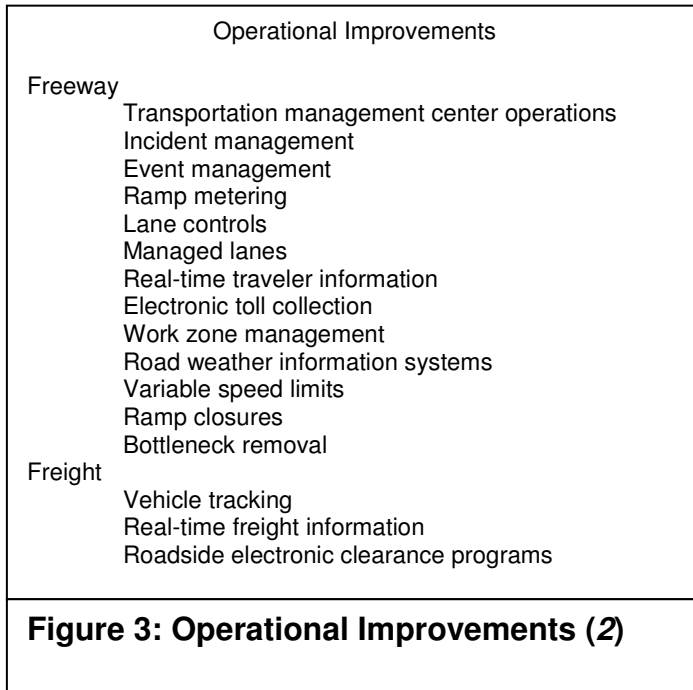


Figure 2: Freeway Lane Miles and changed Vehicle Miles of Travel (1)

We might expect this trend to continue into the future under the assumptions of a null alternative. The only major plan currently being implemented within the region that might provide a slight increase is that of the Illinois Tollway Authority. Under this plan, additional lanes will be added to 117 miles (188 kilometers) of toll ways in Northern Illinois and toll collections will be modernized to eliminate many of the currently required stops. Both of these efforts will add to capacity in Northern Illinois, which will benefit much of the region.



We can, therefore, expect under this alternative a very modest increase in highway lane miles (kilometers) through the year 2020. During those same years, even if annual increases continue at what are historically low rates in the range of 1.5%, automobile travel can be expected to increase by about one-third. If freight ton-miles (metric ton-kilometers) increase in those years by 50% or more, as they are now project to do, we can expect nearly twice the number of truck miles (kilometers) on our highways.

Technology

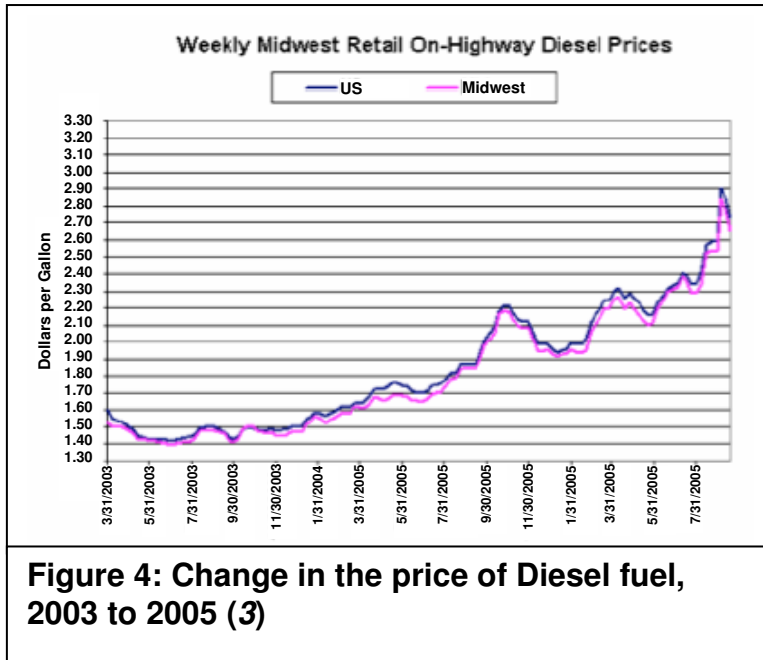
Many have argued that highway capacity alone is not the issue. Our focus should be on how well existing capacity is managed and how the factors which contribute to demand are managed. Figure 3, which is an edited version of an FHWA Office of Operations graphic (portions of the original were deleted to focus on operational tools), illustrates this thinking and what options might be considered. Most of the options shown are Intelligent Transportation System (ITS) tools. Indeed, national studies indicate that these tools could contribute to the reduction in congestion in the region. However, the states of the region have not come to agreement on which tools should be implemented, how they should be implemented or what standards should be employed.

The Government Accounting Office, in its review of the FHWA's progress in implementing a national ITS system, concluded that:

Generally, the promise of ITS as an integrated tool for managing congestion has not yet been met. Although we recognize that [US] DOT cannot always influence ITS investments, limitations of DOT's efforts in goal setting, measuring, and other activities such as evaluating outcomes have reduces DOT's ability to facilitate state and local governments' strategic investment in ITS.

Stated another way, ITS tools may hold promise, but implementation has been slow and inconsistent. Nothing on the horizon would suggest change in the near or mid-term future.

Energy



If a bright spot can be found in the recent surge in fuel prices, it is in its potential impact on congestion. With fuel prices increasing, people may choose to drive fewer miles (kilometers), canceling trips, or using other modes.

A recent informal poll of fuel retailers reported in the New York Times found that sales were off an average of 10%. This

was when gasoline prices were well over \$3.00 per gallon (\$0.79 per liter). If the data is sound, this may translate to a 10% reduction in miles (kilometers) of travel. More probably it means that the Hummer stayed in the garage and the Prius got more miles (kilometers), or the tank on the Hummer got refilled at near empty rather than at half full.

We would normally assume that a price jump of about 100%, as illustrated in Figure 4, would bring about significant changes in behavior. In fact, fuel prices are much higher than they have been in the recent past, but they are comparable to historic levels. Figure 5, contains information on the nominal (the-current or actual dollar value) and real (inflation adjusted

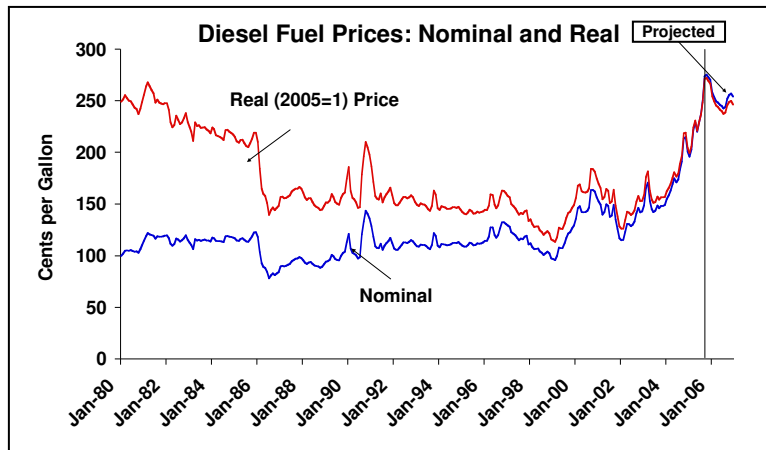


Figure 5: Real versus Nominal: Price of Diesel Fuel (3)

value) price of diesel over the last 25 years. In 1980, the real price of a gallon (litter) of diesel was \$2.50 (\$0.66), not much less than it is in 2005.

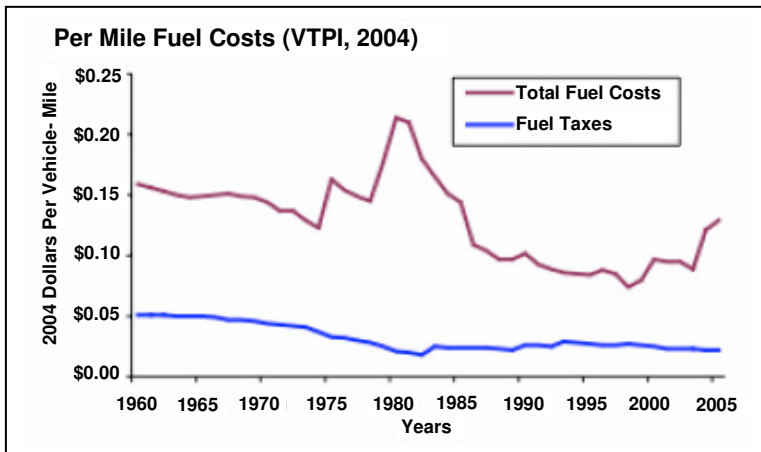


Figure 6: Per Mile Fuel Costs (4)

Another way to look at price is how much we spend to drive a mile (kilometer). Again, as shown in Figure 6, we are at historically low levels. The real price of fuel is comparable to what it was in the past and our vehicles—at least automobiles—are much more efficient.

Finally, to understand the consequence of rising fuel prices on travel, we

have to consider the economic concept of elasticity. How much does a change in price change consumption? The answers in the literature are all over the map, but Goodwin and Hanly (Transport Review, May 2004) did a review of past empirical studies of the issue and found that a real, continuing, price increase of 10% would cause:

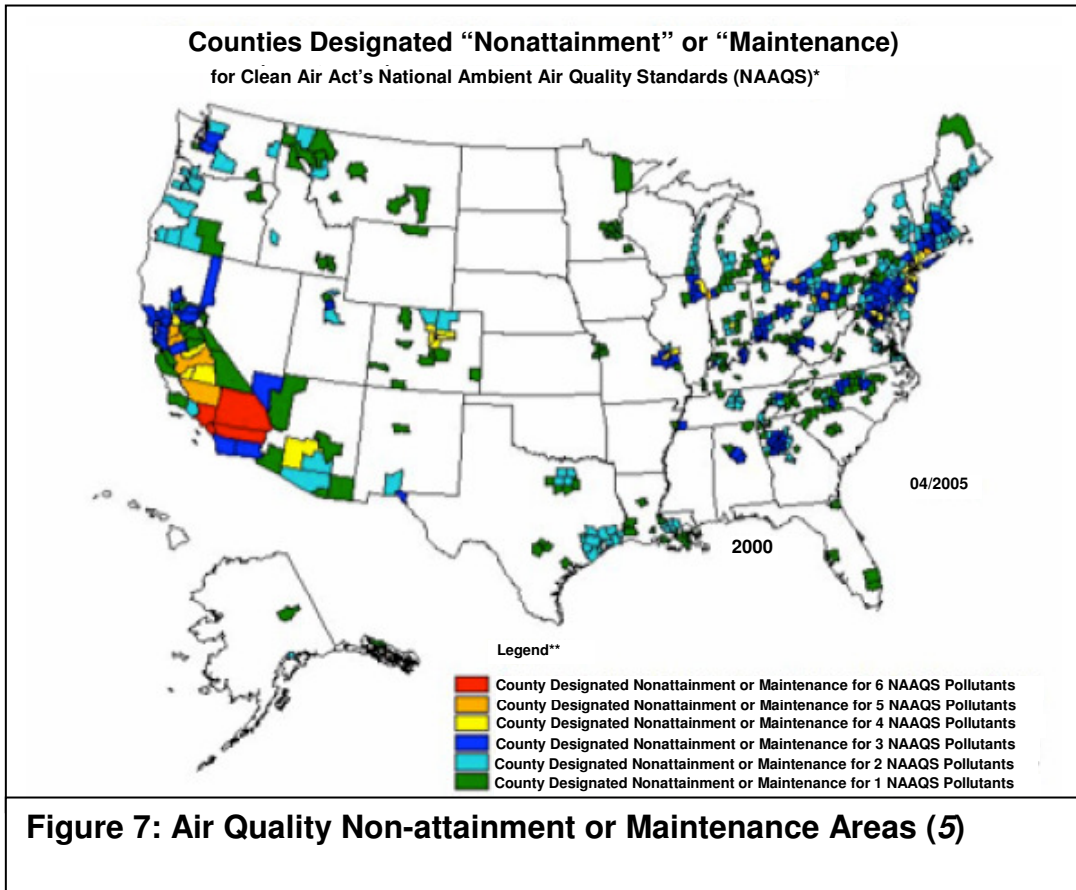
- Traffic to fall by 1% within a year
- Traffic to fall by 3% in about 5 years
- Fuel consumption to fall by 2.5% within a year
- Fuel consumption to fall by 6% in the long run

The reason for the smaller change in traffic than in fuel consumption is the expected increase in the efficiency of fuel use—the Hummer is parked.

All of these changes provide a new base from which growth will occur. At this point it is impossible to tell what the continuing price rise will be. Production has risen and prices are falling. But even a 30% lasting real rise would produce only about a 10% real reduction in traffic in the long run. Therefore, it does not seem reasonable to rely on price change to cure traffic congestion.

Air Quality

The Upper Midwest has a number of areas that are classified by the Environmental Protection Agency as non-attainment that is they have dirtier air than the federal standards deem to be healthy. Figure 7 is a map showing non-attainment and maintenance counties in the US.



From the perspective of freight, the major pollutants are nitrous oxides (NO_x) and particulates, the product of diesel engines. Chicago, Detroit, Indianapolis, St. Louis, and much of the Ohio River Valley are non-compliant with particulate standards. NO_x is one of the gases that produce ozone, so it is problematic in many parts of the region.

The EPA did a study of the impacts of freight on air quality in several urban areas around the country, including Chicago and Detroit. Figure 8, which outlines the proportion of road pollutants attributed to trucks, is from that study.

The Null Alternative in Highway Capacity and Management

Comparison of Heavy-Duty Truck Emissions in the Six Study Regions, 2002

Region	Nox (tons)	as % of total on-road Nox	VOC (tons)	as % of total on-road VOC	PM- 10 (tons)	as% of total on-road PM - 10	CO (tons)	as % of total on-road CO
Baltimore	29,081	49.7%	1,416	5.8%	734	N/A	13,232	3.9%
Chicago	96,291	57.4%	6,500	10.9%	2,641	62.6%	58,330	6.0%
Dallas- Ft. Worth	53,718	50.4%	2,174	4.1%	884	38.3%	20,229	2.3%
Detroit	98,195	62.8%	5,374	8.8%	2,382	N/A	62,805	5.6%
Houston	64,590	54.7%	2,408	5.6%	1,256	47.7%	20,117	2.7%
Los Angeles	130,341	49.4%	14,839	11.0%	2,210	31.3%	121,776	9.1%

Figure 8: Pollutants Attributed To Trucks (6)

Note that in Chicago and Detroit, 57% and 63%, respectively of the road-derive NOx is attributed to trucks. In Chicago, 63% of the road-derive particulates are attributed to trucks. In both cities, about 6% of the on-road carbon monoxide, a greenhouse gas, comes from trucks. So trucks are major contributors to unhealthy air.

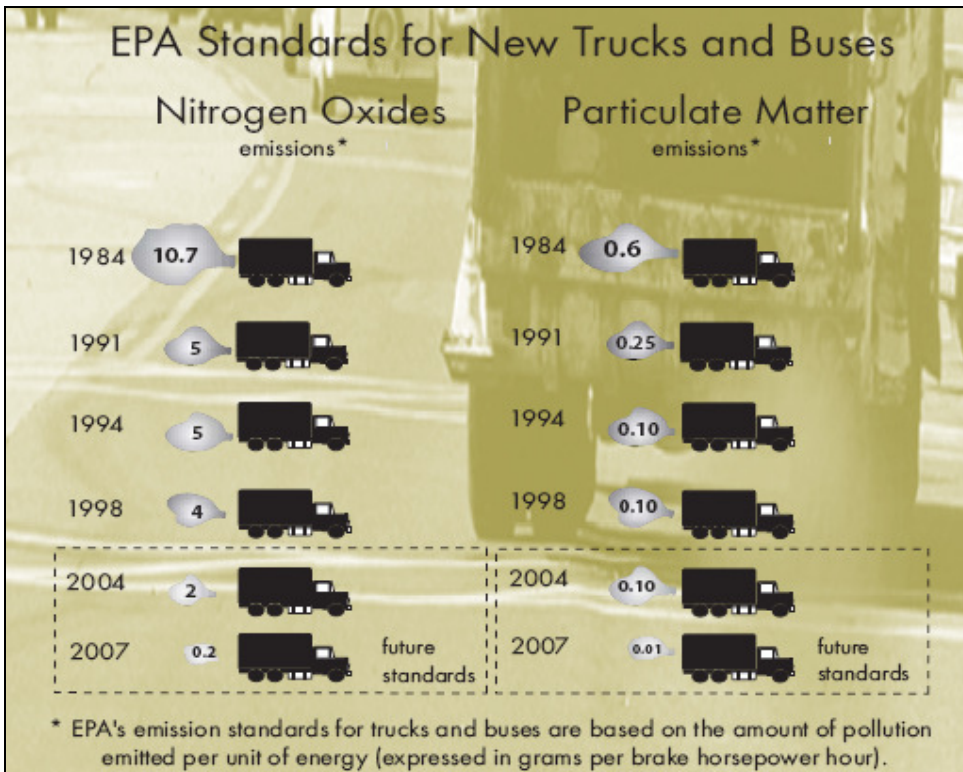


Figure 9: Truck Pollutants

Logically we can expect more trucks operating in more congested conditions to be a greater source of pollution. Fortunately, better engines and cleaner fuels are reducing the pollution caused by trucks. Figure 9 graphically

illustrates the past and projected change in pollution by trucks. By 2007, emissions from individual trucks will be only a small fraction of what they were in the past. But more trucks, operating under less favorable conditions will pollute more than they might under better operating conditions.

We have all experienced the problem of exhaust when we were driving in a cue during rush hour or at a highway crash or work zone. The amount of exhaust in those situations is not only a function of the number of cars and trucks. It is a function of how they are operating. An engine operates most efficiently from both the perspective of fuel consumption and of emissions at slightly below highway speeds. At low speeds and at very high speeds, engines pollute much more than they do at moderate speeds. Congestion will cause more pollution.

Greenhouse gases are another type of pollutants. These gases, primarily CO and CO₂ from transportation, contribute to global warming. According to the Department of Energy and the EPA, the US contributes 23% of the total World emissions of carbon. Thirty-two percent of the US total comes from transportation. (Note this is 1995 data. Current allocation will be somewhat

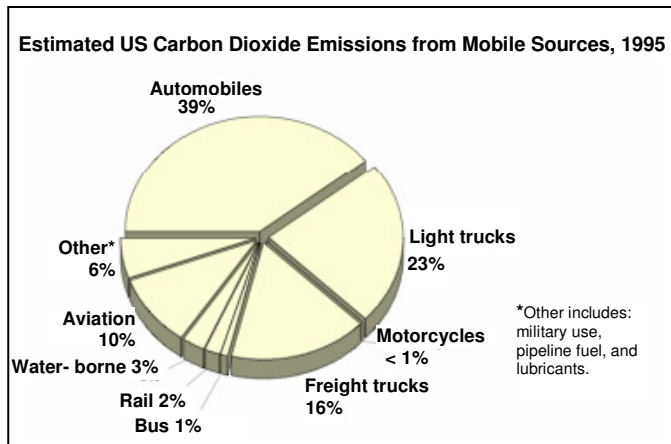


Figure 10: US Carbon Dioxide Emissions from Mobile Sources

different.) As shown in Figure 10, freight trucks account for 16% of the transportation emissions, which is larger than what is the case in the large cities, shown in Figure 8. Water and rail transport account for another 5%.

Engines and fuels are getting cleaner, particularly as it relates to the precursors of ozone. But progress has been slower in reducing greenhouse gases. More vehicles and more congestion will serve to frustrate—not totally cancel--

the progress of technology in meeting this challenge. We may not have as much gunk in the air as we might have had, but we will have more than we want to have.

Conclusions

Using the past to glimpse the future is somewhat risky, but it's the best tool we have. The region has not kept pace in providing highway capacity to meet demand in the past. Under the null alternative, we have little reason to expect a change in the future. The region has not implemented (or even agreed on what

should be implemented) technologies to manage congestion. Following existing policies and processes, there is little reason to expect a change in the future. Therefore, as truck and auto volumes of travel increase, it is reasonable to assume congestion will also increase.

Some have argued that increased fuel prices will act as an unintended congestion pricing mechanism, delaying or reducing congestion. The real price of fuel, which is within historic bounds, and the continuing decline in the energy cost of driving do not support this position, nor does the little that we know about the price elasticity of fuel. Therefore, we should expect congestion.

Motor vehicles emit toxins into the air. Nitrous oxides, and volatile organic compounds cause ozone and carbons cause global warming. Technology has reduced the amounts emitted by autos and trucks and is expected to continue to produce cleaner vehicles into the future. Unfortunately, more vehicles operating under more congested conditions will tend to offset much of the advances to technology.

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Applying Regular Federal Aids to Highway Freight Capacity Issues

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When the prospect of new transportation initiatives is discussed, the billions of dollars that the federal governments provide the states and the flexibility that the states have in using those aids is noted with the implication that they already have dollars that they can use for this new purpose. Indeed the states of the Upper Midwest will receive in the range of five billion dollars per year through 2009 under the recently passed surface transportation act. Figure 1 provides an overview of the amounts that will be apportioned to each of the states under the new act. The overall trend is for an increase in funding in the regular apportionments.

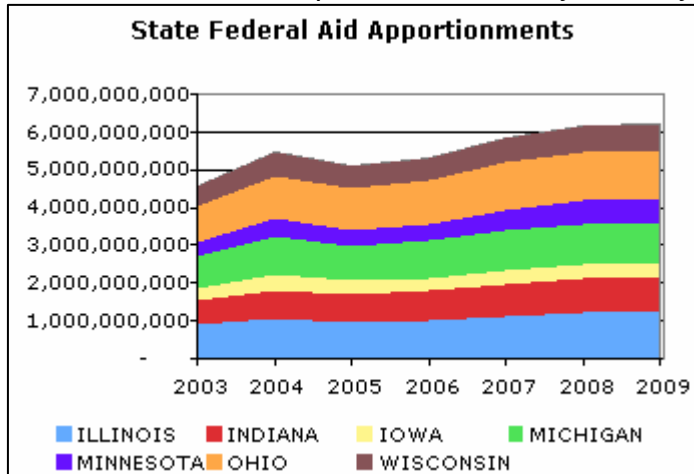


Figure 1: Federal Aid Apportionments to the States of the Region (1)

Two cautions should be applied to this data. First of all, apportionments are always larger than useable dollars. Typically, the appropriations process reduces the funding by as much as 20%, so Figure 1 portrays the highest amounts that might be received. Secondly, as shown in Figure 2, the purchasing power of the dollar is constantly being eroded. Even Figure 2 uses projections of

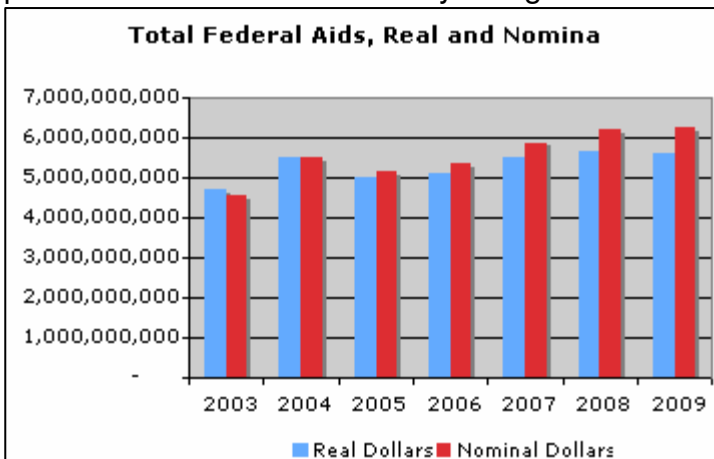


Figure 2: Real and Nominal Federal Apportionments for the Region (2)

the consumer price index that do not capture the impact of the recent surge in oil prices. Since construction prices, particularly for paving and earthmoving, are heavily influenced by the price of fuel and asphalt cements, we can expect the real purchasing power of future federal aids to be constant at best.

While five billion seems like an enormous resource, the demands on the states of the region are also enormous and the federal resource was

anticipated in the investment planning for the region. States normally develop their investment plans, or programs, on a five to eight year cycle. They must anticipate both state and federal resources in each future budget period of the planning cycle. Rarely will they underestimate the resources that will be available, so the federal dollars have already been anticipated and assigned to projects. Those projects are associated with the needs of the region. Any use of regular federal aids for an initiative in freight will require that some existing regional needs be abandoned or postponed. Additional resource will be required if this emerging need is to be met.

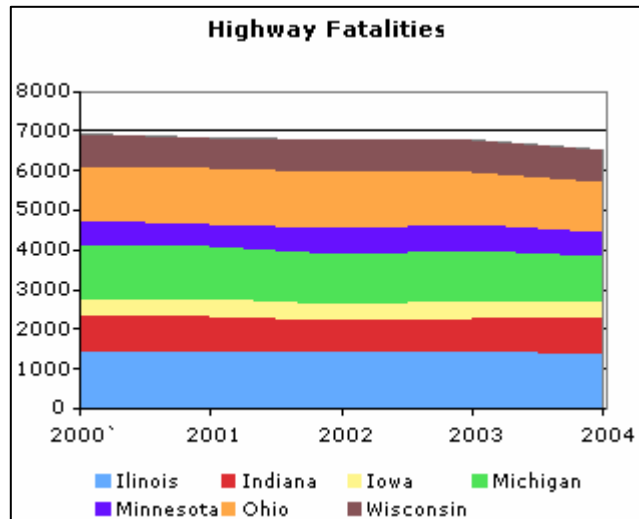


Figure 3: Highway Fatalities in the Region (5)

Safety is a priority of all of the agencies in the region. Yet, as shown in Figure 3, nearly 7,000 people lost their lives on the roadways of the region in each of the past five years. The trend line, such as it is, is downward; but this safety issue confronting transportation agencies in the region remains significant.

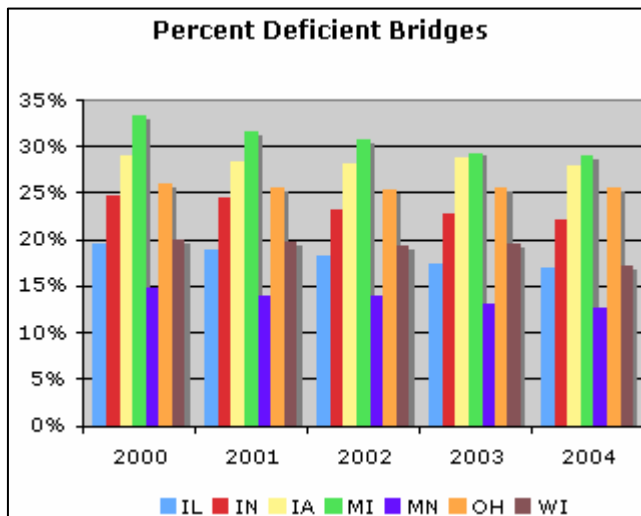


Figure 4: Deficient Bridges in the Region (3)

Safety is not the only demand upon the resources of the region. Despite a recent downward trend in some states, 22% of the bridges in the region remain deficient, as shown in Figure 4.

These bridges could be structurally deficient such that they cannot carry expected loads, or they may be functionally deficient because they are too narrow or poorly aligned with the surrounding roadway. In either case, they pose some safety threat to the traveler.

Figure 5 contains information on the smoothness of the rural National Highway System. The figure shows the distribution of the pavements into categories of pavement roughness, as measured by the international roughness index, (IRI). The smaller the number, the better the pavement. The bulk of the pavements are in the less than 119 categories, indicating reasonable ride quality, but about 8% of the total remain in the greater than 145 categories, the categories that probably would not pass the seat test if you drove them at the speed limit.

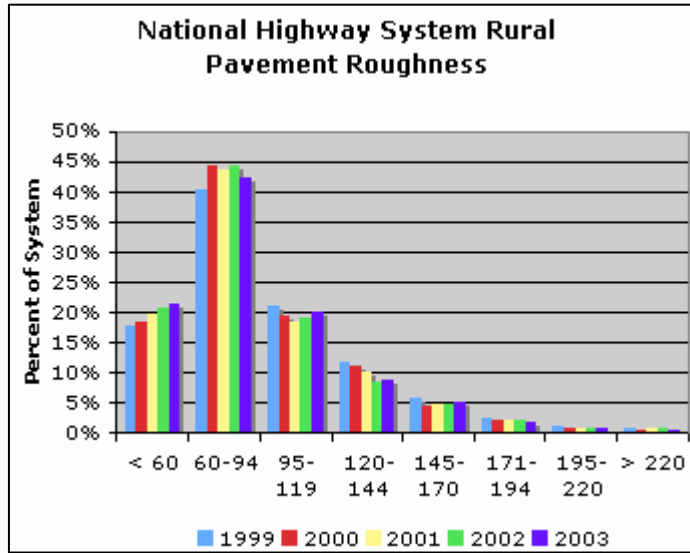


Figure 5: Pavement Roughness on the Rural National Highway System (3)

In addition to safety and the condition of the highway system in the region, the states must respond to ever increasing demands in the use of the system. Figure 6 gives a measure of congestion in some of the major urban areas in the region. The measure is daily freeway traffic by freeway lane mile (kilometer). This is a simple measure of the use to which available capacity is being put. All of the cities show major increases in traffic per lane. For example, Chicago had 12,600 vehicle miles per lane mile (12,600 vehicle kilometers per lane kilometers) in 1982. In 2003, it has 19,500 vehicle miles per lane mile (19,500 vehicle kilometers per lane kilometers), a 55% increase in 21 years.

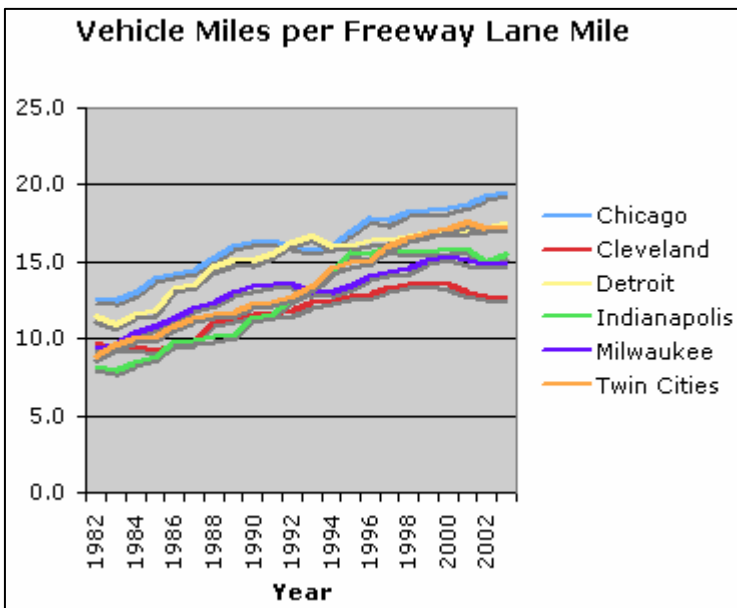


Figure 6: Urban Congestion (4)

In summary, the states in the region do get significant levels of funding from the federal government and they do have flexibility in how those dollars are used. Unfortunately, the states have significant needs and demands that they must

use these resources to meet. The safety of the system, its structural integrity and the growing demands placed upon it all require resources. While federal regulations would allow “regular” federal funds to be used for freight-driven initiatives, such use would come at the expense of existing activities needed to keep the entire system operating. New resources will be needed if the demands of freight are to be met.

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Creating Highway Capacity

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The challenge of creating capacity to move the growing volume of freight in the Upper Midwest will remain one of the primary preoccupations of shippers, haulers, and policy makers for the foreseeable future. Because the current transportation infrastructure, including highway, rail, air, and water, is reaching or exceeding capacity and is difficult to expand, decision makers and planners will likely look towards innovative new programs as another way to increase capacity without adding new infrastructure. This white paper will focus on federal programs, as established in the SAFETEA-LU legislation, that provide opportunities to create and/or expand freight capacity throughout the Upper Midwest region. Information on funding levels, approval processes, and federal formula funding is also considered.

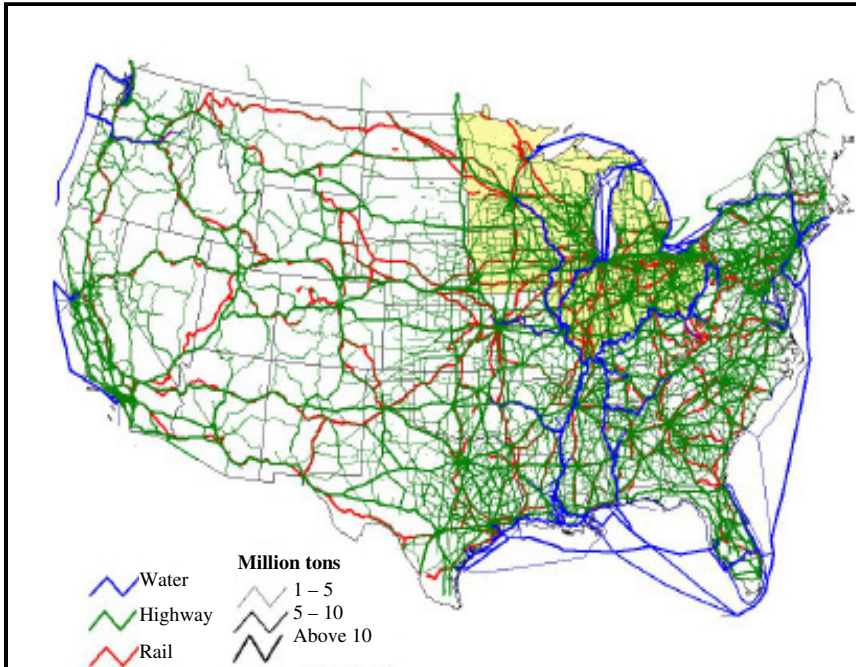


Figure 1: Link Tonnages, 1998

Figure 1 shows tons of freight transported by road, rail, and water and clearly depicts the critical importance of the Upper Midwest in the Nation's freight network. In addition to freight origination in the region, freight moving between the east and west coasts is likely to pass through the Upper Midwest. This image suggests the area is becoming a bottleneck for freight movements.

Existing Federal Programs

SAFETEA-LU includes a variety of programs and tools that could assist in creating additional capacity for freight in the Upper Midwest. A regional coalition must become familiar with funding, project approval processes, and the impact of guarantee dollars on the ability of our transportation system to meet the region's freight shipping demands.

National Corridor Infrastructure Improvement (Corridors) Program (§1302)

Capacity improvement and congestion management for the Interstate Highway System create some of the greatest opportunities for managing highway solutions that facilitate and improve the flow of freight along the nation's highways. The Corridors Program allocates funds to the states to make improvements in nationally significant corridors that are likely to promote economic growth and foster trade. States must apply to the federal government in a competitive bid process to be awarded funds through this program. Funding levels for the Corridors Program are appropriated from the Highway Trust Fund. Authorized funding levels in SAFETEA-LU are as follows:

- \$194,800,000 for fiscal year 2005;
- \$389,600,000 for fiscal year 2006;
- \$487,000,000 for fiscal year 2007;
- \$487,000,000 for fiscal year 2008, and;
- \$389,600,000 for fiscal year 2009.

Project approval process

Under the Corridors Program, projects on the National Highway (Interstate) System that promote national and international trade and economic growth, and can be completed within a five-year period are given priority for funding. Selection factors considered in the legislation during the approval process include:

- The extent to which the project corridor provides a link between two existing segments of the Interstate System;
- The extent to which a project will facilitate major multi-state or regional mobility and economic growth;
- The extent to which commercial vehicle traffic in the project area is projected to increase;
- The volume of international freight traffic in the corridor;
- The extent to which the improvement will decrease congestion;
- The anticipated reduction in travel time through the freight corridor as a result of the project;
- The value of cargo moving through the area
- The extent to which federal funds are leveraged by the project.

But projects funded through this program are earmarked in SAFETEA-LU. Six projects of particular interest to Upper Midwest Freight stakeholders are:

- IL Construction of the U.S. I-80 to I-88 North-South Connector in Illinois - \$152,000,000
- IL Chicago Region Environmental and Transportation Efficiency Program (CREATE). The CREATE program is a \$1.5 billion public/private partnership between the State of Illinois, Metra, the City of Chicago and the nation's freight railroads to provide much needed capital improvements that will increase the efficiency of the region's rail infrastructure.
- IL Construction of Route 34 Interchange and improvements in Illinois – \$55,000,000
- IN I-80 Improvements - \$10,000,000
- MN Falls-to-Falls Corridor - \$50,000,000
- WI Construction and reconstruction of the U.S. Highway 41 corridor between Milwaukee and Green Bay, Wisconsin - \$30,000,000

Many of the criteria noted in the project approval process portion of this discussion are met by the challenges and opportunities currently manifest in the Upper Midwest, making the region a good candidate for funding through the Corridors program. Particularly, provisions to encourage capacity building in areas with significant international trade should draw the attention of states along the Canadian border. A regional freight coalition's proposed projects would be attractive under the criteria for the promotion of multi-state regional economic growth.

Projects of National and Regional Significance (§1301)

In a manner similar to the Corridors Program, this program provides funds for projects that include efforts to improve freight mobility and thus provide regional and national economic benefits. To achieve this goal, SAFETEA-LU establishes a program to award grant money to states, on a competitive basis, to address the need to complete transportation projects that result in economic benefits and improve the safe and secure flow of goods, people, and services along the National Highway System.

Project approval process

Eligible projects under this section of SAFETEA-LU include those that will incur costs expected to equal or exceed either \$500,000,000, or seventy-five percent of federal highway funds apportioned to the state in the most recent fiscal year for the state in which the project is located. This program provides funding for any surface transportation project that is eligible for federal assistance and includes freight rail as well as highway freight transportation projects.

Projects are awarded in a competitive bid process; however, special consideration is given to proposals that effectively do the following:

- Leverage federal investment by incorporating non-federal funding into the budget, including monies from public/private partnerships.
- Use new technologies, including ITS.
- Help protect the environment.

In addition, funding is available over the life of a project, beginning with preliminary engineering through construction.

Projects funded through this program are already earmarked. Five projects designated through SAFETEA-LU are of particular interest to Upper Midwest Freight stakeholders:

- IL Construction of O'Hare, Bypass/Elgin O'Hare Extension - \$140,000,000
- IL Mississippi River Bridge - \$150,000,000
- MI Planning, design, and construction of a new American border plaza at the Blue Water Bridge in or near Port Huron, MI - \$20,000,000
- VA, WV, OH Heartland Corridor Project including multiple intermodal facility improvements - \$90,000,000
- WI Reconstruction of the Marquette Interchange, Milwaukee, WI - \$30,000,000

As the above list displays, states in the Upper Midwest have already begun to take advantage of this program. Regional stakeholders should continue to take advantage of this program, particularly since it focuses on capacity building and congestion reduction with an eye towards economic development and freight movement.

Truck Parking Facilities (§1305)

This program addresses the shortage of long-term parking for commercial motor vehicles (trucks) on the nation's National Highway System. This program seeks to construct new parking facilities and to increase available parking at existing sites, including highway rest stops, park and rides, or other similar facilities. Funding for the Parking Facilities program comes from the Highway Trust Fund. SAFETEA-LU earmarks \$6,250,000 per year from 2006 through 2009 for this program.

Increasing available truck parking on the National Highway System will benefit capacity by providing truck parking spaces for the increasing numbers of trucks that will be entering the highways in the Upper Midwest. These funds are not yet earmarked, which provides an opportunity for Upper Midwest freight stakeholders to take advantage of this program.

Freight Intermodal Distribution Pilot Grant Program (§1306)

The purpose of the Freight Intermodal Distribution Pilot Grant Program (FIDPG) is to facilitate and support intermodal freight transportation initiatives at the state and local levels to relieve congestion and improve safety and to provide capital funding to address infrastructure and freight distribution needs, primarily at inland ports and intermodal freight facilities. SAFETEA-LU sets funding levels for the FIDPG program at \$6,000,000 for each fiscal year from 2006 through 2009.

Project approval process

To receive monies through this program, states must submit a grant application to the Secretary of Transportation. Priority is given to funding projects which:

- Reduce congestion into and out of international ports in the U.S.
- Demonstrate ways to increase the likelihood that freight container movements involve freight containers carrying goods, and;
- Establish or expand intermodal facilities which encourage development of inland freight distribution centers.

By reducing congestion, increasing the number of containers actually carrying freight, and improving or constructing new distribution centers, the FIDPG program may facilitate the improvement of freight-carrying capacity for highway-system freight as well as intermodal freight. These funds are not yet earmarked, which provides an opportunity for regional freight stakeholders to take advantage of this program.

Coordinated Border Infrastructure Program (§3203)

The coordinated border infrastructure program seeks to distribute funds to border states to improve the mobility of freight and motor vehicles across the border between the United states and Mexico and the United states and Canada. Funding from this program can be applied to a number of eligible uses, including:

- Improvements to existing transportation and support infrastructure;
- Construction of highways and related safety facilities;
- Operational improvements (electronic data interchange, telecommunications, etc.) that expedite freight movements;
- Modification to regulatory procedures that expedite cross-border freight movement, and;
- International coordination of freight movements pertaining to cross-border movement of freight and motor vehicles.

Funding Levels and Eligibility Criteria

Funding for this program is distributed by formula. The funding breakdown by year is as follows:

- \$123,000,000 for fiscal year 2005;

Creating Highway Capacity

- \$145,000,000 for fiscal year 2006;
- \$165,000,000 for fiscal year 2007;
- \$190,000,000 for fiscal year 2008, and;
- \$210,000,000 for fiscal year 2009.

Projects funded through this program are already earmarked. Two projects, one in Michigan and one in Minnesota are of particular interest to Upper Midwest Freight stakeholders. The funding levels are as follows:

- Michigan \$20,871,373
- Minnesota \$3,749,666

Funding is available for projects in Canada or Mexico, if a U.S. border state proposes a project to facilitate cross-border trade. Facilities may be constructed in these countries if the appropriate local government in Canada or Mexico can guarantee that the facility will be constructed using equivalent U.S. construction standards and that the new infrastructure will be properly maintained to facilitate trade. States in the Upper Midwest sharing borders with Canada can capitalize on this program to improve efficiency and infrastructure at their border crossings.

Freight Planning and Capacity Building Program (§5204)

This new program funds research, training, and education to support freight transportation planning. Funding for this program comes through the Training and Education funds and is set at \$875,000 a year from 2006 to 2009.

Research targeted towards strategic planning for infrastructure improvements, congestion mitigation needs, and technologies to enhance freight movements across the country would be of particular interest and benefit to a regional freight coalition in the Upper Midwest. This program could potentially interact with the National Cooperative Freight Transportation Research Program (§5209). The development of a national research agenda for freight offers numerous opportunities to develop recommendations for capacity-building programs.

National Cooperative Freight Transportation Research Program (§5209)

Could potentially interact with the Freight Planning and Capacity Building Program. An advisory committee chosen to represent the different stakeholders in freight transport will be selected to develop a national research agenda for this program. The advisory committee should work cooperatively with researchers involved in the Freight Planning and Capacity Program to promote programs that aid in creating capacity for the freight industry. This program is funded at \$3.75 million per year for 2006-2009. The funding comes from Surface Transportation Research funds.

Impact of Formula Funding

The question of the impact of formula funding on the states of the Upper Midwest is a complicated one that is not easy to answer. In short, formula funding refers to the formula the federal government uses to determine the amount of money from the federal gas tax it returns to the states. This tax, collected in the individual states at the pump, funds the Highway Trust Fund. According to FHWA staff, a full analysis of the impact of this money on freight programs has not yet been completed but eligibility relative to freight has not changed from TEA-21. However, FHWA has issued a summary of how these monies will be distributed. Selections from this summary are included here to help in considering funding levels and options for building freight capacity. For a more detailed discussion of funding through SAFETEA-LU, please visit <http://www.fhwa.dot.gov/safetealu/summary.htm>.

Equity Bonus – Federal-aid highway funds for individual programs are apportioned by formula using factors relevant to the particular program. After those computations are made, additional funds are distributed to ensure that each state receives an amount based on equity considerations. In SAFETEA-LU, this provision is called the Equity Bonus (replaces TEA-21's Minimum Guarantee) and ensures that each state will be guaranteed a minimum rate of return on its share of contributions to the Highway Account of the Highway Trust Fund, and a minimum increase relative to the average dollar amount of apportionments under TEA-21, and that certain states will maintain the share of total apportionments they each received during TEA-21. An open-ended authorization is provided, ensuring that there will be sufficient funds to meet the objectives of the Equity Bonus.

Relative Rate of Return – Each state's share of apportionments from the Interstate Maintenance, National Highway System, Bridge, Surface Transportation, Highway Safety Improvement, Congestion Mitigation and Air Quality Improvement, Metropolitan Planning, Appalachian Development Highway System, Recreational Trails, Safe Routes to School, Rail-Highway Grade Crossing, Coordinated Border Infrastructure programs, the Equity Bonus itself, along with High Priority Projects will be at least a specified percentage of that state's share of contributions to the Highway Account of the Highway Trust Fund. The specified percentage, referred to as a *relative rate of return*, is 90.5% for 2005 and 2006, 91.5% for 2007, and 92% for 2008 and 2009.

Concluding Thoughts

Table 1, below, shows the range of federal programs available through SAFETEA-LU. From the perspective of creating new capacity for freight, there are a wealth of possibilities. For example, Projects of National and Regional Significance and the Corridors Program, although fully earmarked in the

legislation, include projects that promise to improve capacity for freight movement in the Upper Midwest. There is clearly a fair amount of funding available that could be used to enhance the region’s freight capacity. However, the manner in which this funding is currently being used focuses on the efforts of individual states. While projects constructed by individual states may improve infrastructure, they are unlikely to address system-wide deficiencies or capitalize on opportunities across the region. Projects proposed by a multi-state coalition, such as a regional coalition of the Upper Midwest Freight stakeholders, hold greater potential for funding projects that not only get constructed, but contribute to enhancing freight movement at a regional level.

Table 1: Freight Capacity-Building Programs in SAFETEA-LU

Program	Section	Infrastructure	Congestion Mitigation	ITS/Data Management	Highway	Multi-modal	International	Research
Projects of National and Regional Significance	§1301	X			X			
Corridors Program	§1302	X	X		X			
Coordinated Border Infrastructure Program	§3203	X	X	X		X	X	
Freight Intermodal Distribution Pilot Grant Program	§1306	X	X	X		X		
Interstate Discretionary	§1113	X	X	X	X	X		
Bridge Discretionary	§1114	X	X	X	X	X		
Truck Parking Facilities	§1305	X	X		X			
Freight Planning and Capacity Building	§5204							X
National Cooperative Freight Transportation Research	§5209							X

Reference

1. Adapted from FHWA SAFETEA-LU summary: <http://www.fhwa.dot.gov/safetealu/summary.htm>

The Role of Tolls in Moving Freight

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Introduction

If one accepts the conclusions of recent studies predicting an increase in congestion on the national highway system then it becomes apparent that new strategies must be developed to manage freight's impact on the country's transportation system.

Tolling strategies are a possible mechanism to relieve congestion caused by freight traffic. They can also facilitate freight movement, thereby providing economic benefits. If the region chooses to employ these tools it must be done on a region-wide basis to help improve the flow of freight through the region. In other words, to get a regional benefit, toll strategies should be deployed at a regional level.

Federal Rules and Tolls

Federal rules and programs for toll roads are delineated in the new transportation bill, SAFETEA-LU. This discussion gives a brief overview of existing federal rules concerning tolling as codified in SAFETEA-LU and investigates different tolling strategies that the Upper Midwest states should consider to benefit regional freight movement.

SAFETEA-LU (§1604) provides states with increased flexibility to use tolling not only to manage congestion, but also to finance infrastructure improvements and maintenance. Tolling programs in SAFETEA-LU, while not freight specific, can be used to manage freight as well as motor-vehicle traffic.

SAFETEA-LU provides the following programs for states to launch tolling projects on a pilot or demonstration basis.

- *Interstate System Construction Toll Pilot Program.* Under this program, the Secretary may permit a state or compact of states to collect tolls on an Interstate highway, bridge, or tunnel for the purpose of constructing Interstate highways. This program is limited to three projects in total (nationwide).
- *Interstate System Reconstruction and Rehabilitation Toll Pilot Program.* Established in TEA-21 and continued in SAFETEA-LU, this program allows up to three interstate tolling projects for the purpose of reconstructing or rehabilitating interstate highway corridors that could not be adequately maintained or improved without the collection of tolls.

- The *Value Pricing Pilot Program* is continued in SAFETEA-LU. The program supports costs of implementing up to fifteen variable pricing pilot programs nationwide to manage congestion and benefit air quality, energy use, and efficiency.
- The new *Express Lanes Demonstration Program* will allow a total of fifteen demonstration projects through 2009 to permit tolling to manage high levels of congestion, reduce emissions in a nonattainment or maintenance area, or finance added interstate lanes for the purpose of reducing congestion. Automatic toll collection is required. This program encourages the use of electronic tolling that is compatible across regions and states. Developing this type of system will be a great improvement in efficiency for all road users, including freight shippers. The Upper Midwest Freight coalition can benefit from this type of interoperability in tolling to reduce freight congestion on highways.

These programs can be used by the Upper Midwest Regional Freight Coalition to both manage congestion on the highway system through road pricing and raise funds for highway maintenance and improvements. Funding for express lanes with electronic toll collection promises to establish infrastructure that will offer significant efficiencies for shippers and could benefit freight movement through the Upper Midwest.

The Upper Midwest states can use these programs to their advantage if they choose to implement tolling programs (1). It is imperative that the Upper Midwest Freight coalition plan any future toll projects jointly. Only by planning projects with an eye to current and future regional congestion issues will a complete and fully functional freight tolling program be established in the region.

Creative Uses of Available Tolling Opportunities

Now that these programs are in place and road pricing is gaining more attention in highway planning circles, what should be done in the Upper Midwest to capitalize on the new opportunities for road pricing made available through SAFETEA-LU? How can the states in the Upper Midwest region use what is being learned through these new programs to improve freight movement through the region? Should the Upper Midwest states convert existing lanes to toll lanes or construct new, dedicate toll lanes? The following are some suggestions of ways the Upper Midwest Freight partners could use tolling to manage congestion and increase freight flows through road pricing.



Figure 1: New York's E-ZPASS System (2)

Electronic Toll Collection

This tool is an automated way to pay tolls without stopping at a toll booth through the use of an electronic transponder. It is most often implemented on existing highway lanes, rather than through construction of new lanes.

Electronic toll collection technology has been available for more than ten years. In the past few years this time-saving tool has gained increasing acceptance and the benefits of this technology are being realized. The **New York State Thruway**, which is funded through users' tolls, has been a leader in implementing electronic tolling technologies. The E-ZPASS program provides truckers with incentives to use the E-ZPASS system through offering discounts on the necessary transponders that allow trucks to use the electronic tolling system.

The Thruway further encourages use of electronic toll collection by offering reduced toll rates for vehicles using the E-ZPASS system. Commercial vehicles get a five percent discount over the standard toll rate for using E-ZPASS. Volume discounts further decrease Thruway tolls for truckers.

Open Lanes

With open lane, or open road, tolling, drivers do not need to pass through a toll booth and do not need to slow down to pay their toll. Like electronic toll collection, open lanes can be used with existing infrastructure or with newly constructed toll lanes.

The **Illinois State Toll Highway Authority** is currently in the process of constructing an open-road tolling system that holds great potential for reducing congestion and therefore providing time savings to shippers. Open-road tolling






Figure 2: Ariel View of Open Lanes on Illinois Toll Highway (3)

allows truck drivers with an electronic transponder (e.g. I-PASS or E-ZPASS) to use the new open lanes *and* benefit from an agreement with the Illinois Trucking Association to give these truckers preferential toll rates. Truck drivers using Illinois' I-PASS receive discounted congestion pricing during the night time and off-peak daytime hours. The goal of this system is to simultaneously facilitate movement of freight while managing traffic congestion during peak periods.

It is important to note that tolls for trucks on the Illinois Tollway vary not just with distance traveled and time of day, but also by axle. Table 1 displays the breakdown of tolls for shippers based on both number of axles and time of travel.

Table 1: Toll Table for the Illinois Tollway (5)

TRUCKS & TRAILERS			
PEAK	2 AXLE 6 TIRES	3-4 AXLES	5+ AXLES
 & CASH 6 AM - 9 AM 3:30 PM - 6:30 PM	\$1.50	\$2.25	\$4.00
DAYTIME NON-PEAK			
 WEEKDAY NON-PEAK & DAYTIME WEEKENDS	\$1.00	\$1.75	\$3.00
CASH	\$1.50	\$2.25	\$4.00
OVERNIGHT			
 & CASH 10 PM - 6 AM	\$1.00	\$1.75	\$3.00
*Rates reflect typical mainline toll plaza rates that can vary by location.			

Some of the additional savings to shippers using I-PASS include (6).

With I-PASS alone:

- Commercial vehicle operators who currently use I-PASS are reducing their travel time by up to 20 minutes for a round trip, using a trip on I-294 between Indiana and Wisconsin as an example.
- Truckers spend less time on the road in traffic, and can spend less on fueling and operating their rigs.
- Truckers save \$25 for every 15-minute reduction in trip time, (The Midwest Truckers Association). For example, truckers can save as much as \$333 per month if they take 10 round trips using I-PASS on the full length of the Tri-State Tollway (I-94/294) compared to operating on roads with manually operated toll booths.
- Vehicle operators experience savings due to less wear and tear on vehicles (engines, tires etc.) due to harsh braking and acceleration.

With I-PASS funded road improvements (1):

The Toll Highway Authority anticipates that trucks will save even more with improvements included in the state's Congestion-Relief Plan. These improvements are funded through tolls collected with I-PASS. The following planned improvements will reduce travel times:

- Rebuilding/restoring 90 percent of the Tollway system
- Widening 117 miles of existing roads
- Tearing down 20 mainline toll plazas and replacing them with Open Road Tolling
- Building the long-anticipated I-355 South Extension

These time savings promise to increase efficiency and promote economic development. Illinois is a partner state in the Upper Midwest Freight Corridor Study and this effort can be expanded and built upon to create a regional approach to address congested areas that have become problematic for moving freight through the region.

Truck-Only Open Lanes

In addition to these two options, some state departments of transportation have begun planning for the construction of separated truck-only lanes on their sections of interstate in order to meet the predicted growth in truck-traffic volume. These types of projects include efforts in Texas to build the Trans Texas Corridor that incorporates existing highways and new construction to create a statewide highway network with truck-only toll lanes. In addition, the "STAR Solutions" project proposed by the Virginia Department of Transportation (VDOT) calls for construction of truck-only toll lanes on I-81 through the Shenandoah Valley. Both projects are facing significant opposition from impacted communities and environmental groups. The project proposed for I-81 in Virginia will be discussed in more detail here.

Under Virginia's 1995 Public-Private Transportation Act (PPTA), which encourages Virginia agencies to enter into partnerships with private-sector interests, the

VDOT has contracted with STAR Solutions to increase the capacity



Figure 3: Ariel View of proposed I-81 Truck-Only Open Lanes in Virginia. (4)

of I-81. STAR has proposed creating truck-only lanes, as well as some minor upgrades to the local freight-rail system. The project will be funded initially through a package of public and private-sector funds, and is ultimately envisioned to be self-sustaining through tolls.

Virginia's I-81 project remains in the planning stages and is controversial for a variety of reasons. The proposed project is on a section of I-81 that runs through environmentally and culturally sensitive lands. The tourism industry, which is an economic force throughout the Shenandoah Valley, remains wary about the future impacts of adding four additional lanes of highway through an area marked by high-quality watersheds and civil war battlefields. Additionally, public watchdog groups question the viability of the toll revenue projects generated by STAR.

The problems VDOT has experienced should provide a caution to other agencies considering construction of this type of large infrastructure project. It is important to accurately gauge public sentiment and take federal regulations such as environmental requirements fully into account before proceeding too far with an infrastructure project of the scale of the one being planned for I-81.

Congestion Pricing

Congestion Pricing refers to variable road pricing, which charges higher prices under congested conditions and lower prices at less congested times and locations. This strategy is intended to reduce peak-period vehicle trips. Congestion pricing can be utilized with any toll-road option. It provides another powerful tool to manage congestion and free valuable space on the highway. By decreasing congestion and improving travel times freight movement becomes more efficient. Shippers can also choose to move freight at non-peak times, thereby lowering their costs.

Industry Issues with Toll Lanes

Not surprisingly, the trucking industry views the possibility of increasing numbers of toll roads with skepticism, asserting that placing tolls on highways will simply divert traffic to arterial and local roads and place an undo burden on the industry. This outcome is unlikely to occur to the extent many in the industry claim. If road prices are set appropriately, truckers will benefit through congestion management more than they would by rerouting to slower-speed roadways. Recent studies have shown that proper use of tolling can provide an appropriate incentive to the freight industry and increase productivity through enhancing the level of service on the interstate highway system (7).

Perhaps the lesson the Upper Midwest Freight stakeholders should take from the industry cautions is to coordinate with the trucking associations well in advance of proposing a tolling project. By including this important group in

discussions from the beginning, the industry will be able to voice concerns and perhaps come to agreements that benefit the states and improve freight movement while minimizing harm to the industry.

The Role of Privatization

Recently the private sector has become more involved in the discussion of tolls on the interstate. Private firms are showing interest in constructing and managing toll roads for states seeking to establish a toll structure for their highways. Most of the information coming from this sector has supported the use of road pricing to reflect the true cost of trip making. Different groups have also suggested this strategy would manage congestion and improve the flow of freight.

The precarious nature of our current highway funding system is yet another argument put forward in favor of implementing tolls on the interstate. States and municipalities are having difficulty maintaining existing infrastructure and funding new road projects under the current system. To address this impending funding crisis, some transportation consultants have suggested tolling highways to not only more closely reflect the true cost of using the roads, but, importantly, to help fund roadways. Many of the same consultants suggest that the improved roads should be constructed by private corporations that would then charge a toll to recoup their costs and maintain the infrastructure (8). A caution should be noted in regard to this strategy. Any agreement with a private firm to construct and manage a toll road should include language allowing the contracting states to construct additional travel lanes on parallel, publicly managed roads if traffic volumes warrant. In addition, the Illinois Tollway and the New York Thruway examples discussed here suggest that states are capable of managing their own toll roads. There is no one-size-fits-all solution to who should manage a toll road, and this decision should be made based on the information specific to the state or region contemplating instituting a tolling strategy.

The opinion of the private sector is not unanimous, however. A variety of citizens and non-profit groups are questioning the benefit of the construction of additional toll lanes on the highways. Others are skeptical of the validity of any tolling scheme, citing the gasoline tax as their fare share payment into the highway system. It is clear that regardless of the need and utility of tolling congested highways, the debate concerning this practice will continue into the foreseeable future.

Environmental and Social Issues and toll lanes

Environmental surveys must be conducted for public road projects that use federal or state monies and/or involve federal or state permits. Contracting with

private firms does not eliminate this requirement. Planned projects requiring additional travel lanes, such as the I-81 project, will clearly result in environmental impacts along the highway corridor. By constructing new travel lanes there is a high probability that new traffic will be generated, increasing carbon monoxide and greenhouse gas emissions that need to be addressed. The additional lane width from adding new toll lanes, either optional or truck-only, will create barriers for wildlife, potentially further degrade waterways, and in urban areas can further marginalize neighborhoods through which an interstate highway travels. The environmental and social costs of any project proposing construction of new travel lanes must seriously consider these issues early in the planning process in order properly assess these impacts. Doing this early allows alternatives to be considered before significant time and money is invested in a particular project, and allows for the development of the best possible alternatives.

However, there are certain environmental benefits from the installation of open-road and electronic tolling systems. This technology significantly reduces wait times and bottlenecks caused by delays at staffed toll booths. This benefit cuts down on emissions from idling at toll booths.

The Debate about Tolling Truck Lanes

Despite some of the benefits, current thinking on the use of toll lanes for trucks is mixed. In general, the experience with road pricing has been inconsistent at both the state and national levels. Freight shippers as well as private citizens historically have balked at the suggestion that they pay a fee to use public roads. However, as our highway system becomes increasingly congested and funding for maintenance and construction becomes diminished, policy makers and transportation planners have turned to tolling and variable congestion pricing as a way to manage travel choices and behavior. The different perspectives on the tolling question come from several different camps: the trucking industry; the private sector; state DOTs; and the federal government. It is helpful to compare the pros and cons of tolled lanes for freight side by side.

The benefits of tolled truck lanes include:

- Safety enhancements gained with truck-only lanes safety by limiting interactions between large trucks and automobiles;
- Reduction in congestion increases productivity;
- Capacity expansion with additional highway lanes;
- Modification of highways designed for truck lanes to accommodate heavy vehicles;
- Construction, maintenance, infrastructure improvement funded through tolls;
- Management of traffic through variable pricing, and;
- Restrictions on double and triple trailer might be lifted for truck-only lanes, allowing more freight to be transported more efficiently.

Some of the negatives associated with tolled truck lanes include:

- Potential for diversion of traffic onto local roads (particularly if the toll lanes are mandatory for trucks);
- Optional tolled truck lanes could be underutilized if cost-conscious industry does not see significant economic benefit to toll lanes and therefore avoids using them;
- Potential for political opposition since much of the public resists tolls on public roads;
- Potential for Industry opposition since view as double taxation;
- Potential for significant harm to environmental and cultural resources;
- Potential to contribute to overall traffic growth through additional lanes (induced demand);
- Possible difficulty implementing projects requiring additional lanes due to significant and understandable public opposition;
- Probably high price tag of projects requiring additional lanes, and;
- Potential that most toll-lane projects will not separate automobile and freight traffic, thereby negating the safety benefit.

Recommendations

The pros and cons of tolled highway lanes tell a tale of the opportunities and barriers associated with implementing this type of road pricing on public highways. Documentation of increasing congestion, particularly in moving freight along the highways in the Upper Midwest, points to a clear need for a regional coalition to address this issue proactively, not after it becomes a crisis. Tolling highways is a viable option to help manage and improve freight flows through the region. Using electronic tolling and open lane tolling technology is probably the most viable of the options discussed here. Construction of additional highway lanes takes time and imposes significant financial, environmental, and social costs. Electronic tolling technology can be installed more quickly and at far less expense than constructing traditional staffed toll booths while providing efficiencies through reductions in trip times. Tolling in general provides additional funding to maintain and improve roadways as well as manage congestion.

Looking forward, the Upper Midwest Regional Freight stakeholders need to consider the range of tolling options available to them. By weighing the different choices, a strategy to improve freight movement in the region that includes some form of tolling may emerge as a good choice for the states. Any effort along these lines must be embarked on as a cooperative effort, between the states in the region, the freight industry, the private sector, and the public. This effort must include an objective, technical analysis of trucking industry metrics, additional research on tolling and traffic flows, and the collection of additional data to complement the list of pros and cons to tolling. By working cooperatively, the Upper Midwest has the best chance of addressing system-

wide issues with freight movements. A well functioning network throughout the region will provide benefits to all the states since movement of goods and services through the Upper Midwest will enhance the economic potential of each member of the coalition.

Reference

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Using Highway Technology

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Introduction

The Upper Midwest faces a variety of problems within its transportation network. There is a growing pressure for roadway systems to operate more efficiently in the face of increased congestion, more vehicle-miles (vehicle-kilometers) traveled, and a deteriorating infrastructure. The historical response to such problems has been expansion of the roadway's capacity. This solution is no longer as feasible, and now pressure has fallen on technology to maximize the efficiency of the current infrastructure.

Various highway technologies are available to facilitate safety and security, operational efficiency, administrative efficiency, and regulatory compliance of freight transportation. Many of these technologies are already implemented in several of the Midwest states.

CVISN

The Commercial Vehicle Information Systems and Networks (CVISN) integrates existing information systems with communication technology and standards. The objective is to improve safety, efficiency, administration, and regulatory compliance of commercial vehicle operations. CVISN has three major components: safety information exchange, electronic credentialing, and electronic screening.

Safety Information Exchange

Safety Information Exchange (SIE) is a centralized database that gathers information about commercial vehicles, such as driver and vehicle data and safety history. This information is then used by state agencies and law enforcement to determine which vehicles should be inspected and which ones should receive their credentials. SIE data gets entered, updated, and made available nationwide in less than one hour. SIE helps enforcement and regulatory compliance programs become more resourceful in maintaining commercial vehicles. For example, the technology can aid law enforcement in identifying high-risk vehicles for more in-depth inspection.

Electronic Credentialing

The process of electronic credentialing includes registering operators, registering and titling vehicles, checking insurance, collecting and distributing fuel taxes, issuing oversize/overweight permits, issuing licenses and permits to haul

hazardous materials, and collecting federal heavy vehicle use taxes. The states process the applications using a combination of manual and automated systems. Motor carriers generally use some type of credentialing system software on their computer to prepare and submit applications electronically. The state agency's system then processes the data. The processing includes error checking, cross-checks with other databases, fee calculations, invoicing, payment, and issuance of the appropriate decal, sticker, plate, or paper document.

Electronic credentialing makes organizing and retrieving of credentials very efficient. In conjunction, the system promotes safer roadways for all travelers by ensuring shippers are complying with regulations. This reduces cost and time to freight carriers, taxpayers, and end users.

Electronic Screening

Electronic screening is a system that monitors the weight of commercial vehicles. It works in conjunction with Radio Frequency Identification (RFID) transponders which are mounted onto commercial vehicles. These transponders communicate driver and vehicle information to receivers at weigh stations and border crossings. Compliant carriers are signaled to bypass the weigh stations, gain entrance to a port, or to expedite border crossing.



Figure 1: Electronic Screening of a Commercial Vehicle (6)

Electronic screening technology saves processing time at weigh stations and border crossings, which means it promotes fuel efficiency. Actual weigh station traffic is reduced, giving law enforcement agents more freedom to focus on extreme offenders. It improves traffic flow along the highways while requiring no expansion of the existing highway infrastructure. Electronic screening technology has low costs to the user with each transponder costing an average of about \$40. The cost of the electronic screening equipment, however, is about 1.5 million dollars per weigh station, which is a huge burden on state DOTs.

Weigh-in-Motion (WIM)

WIM systems record truck axles and gross vehicle weights as vehicles drive over a plate sensor. These sensors measure a truck's gross weight, axle weights, axle spacing, speed, and vehicle classification. This sensor is located within the road and allows vehicles to pass through without stopping. The system can handle a commercial vehicle driving at speeds of up to 55 miles per hour

(89 kilometers per hour) over the sensor. WIM is used for collection of statistical data, support of commercial vehicle enforcement, roadway and bridge cost allocation, and traffic management. These systems can be portable, semi-permanent, or permanent depending on their use. Electronic screening facilities include WIM. Figure 2 shows weigh stations within the corridor, some of which have WIM capabilities.

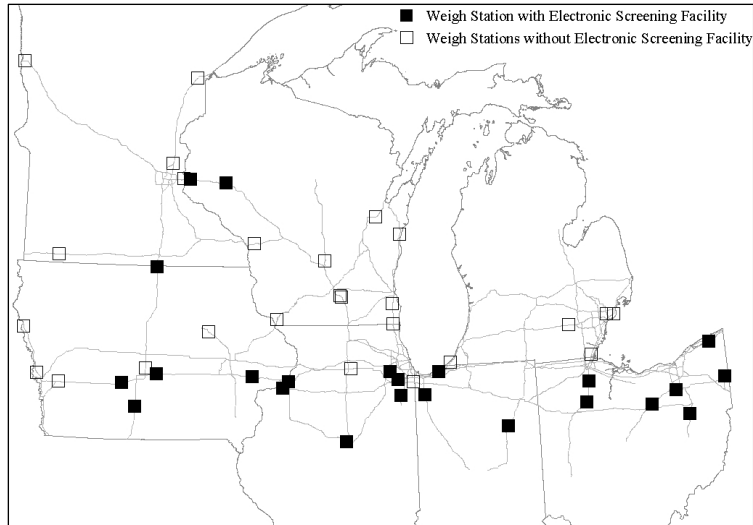


Figure 2: Weight Enforcement Facilities in Upper Midwest Region Study Corridor (1)

Virtual Weigh Stations



Figure 3: Virtual Weigh Station Camera (7)

Virtual weigh stations have WIM scales installed along the highway mainline that are monitored remotely. An overview camera collects the vehicles license plate number. After the data and plate number are collected, the information can be sent to either a portable laptop or office computer to be monitored and/or regulated. Trucks are identified by automated images that record the USDOT number on the sides of their cabs. These images and sensor data are electronically communicated to a control center. Trucks that violate the scale requirements are stopped and inspected at portable scale inspection sites. Virtual weigh stations are being widely embraced and deployed for their cost

benefits. The cost of a virtual weigh station is between \$100,000-150,000, substantially less than a fixed weigh station. A major benefit of a virtual weigh station is that habitual offenders can be identified remotely, which can make the roadways safer and limit violators. Indiana is the only state in the Upper Midwest

that is currently deploying these stations, though virtual weigh station deployment is a high priority of the Gary-Chicago-Milwaukee Corridor.

Freeway Management Systems

Freeway Management Systems (FMS) are used to inform transportation agencies of traffic volumes, traffic speeds, road conditions, and other related data. The systems utilize a variety of ITS tools such as closed circuit television cameras (CCTVs) and in-pavement traffic sensors. Administrators can use the data to inform the public of road and traffic conditions through dynamic signage, web sites with real-time data, and highway advisory radio stations. A functional FMS can aid in the deployment of maintenance and police vehicles, identify areas of obstruction, direct future capacity expansion or technology deployment strategies and location, and mitigate congestion without expanding capacity. The system can also assist in informing the public of important events like Ozone Action Days.

Funding for FMS can come from a variety of sources. Urban areas designated as non-attainment regions for National Ambient Air Quality Standards (NAAQS) under the Clean Air Act often have access to Congestion Mitigation and Air Quality (CMAQ) funds. Other funding can be drawn from the Surface Transportation Program and Interstate Maintenance Federal funding sources.

FMS is one of the few areas in which states have successfully shared technology benefits and responsibilities across the border. For example, the Ohio-Kentucky collaboration on Cincinnati's FMS funding, deployment, and management demonstrates that cooperation between states in using highway technology is attainable.

Asset Tracking Applications

An asset tracking system involves an assortment of technological devices. These devices can track trucks, trailers, containers, cases, or pallets. See Figure 4 for asset tracking technology implementations for freight shipments. Asset tracking coordinates telecommunications technologies, sensors, and simple bar codes and labels. These applications ensure shipments are moved from start to end safely and securely. Asset tracking is particularly helpful for

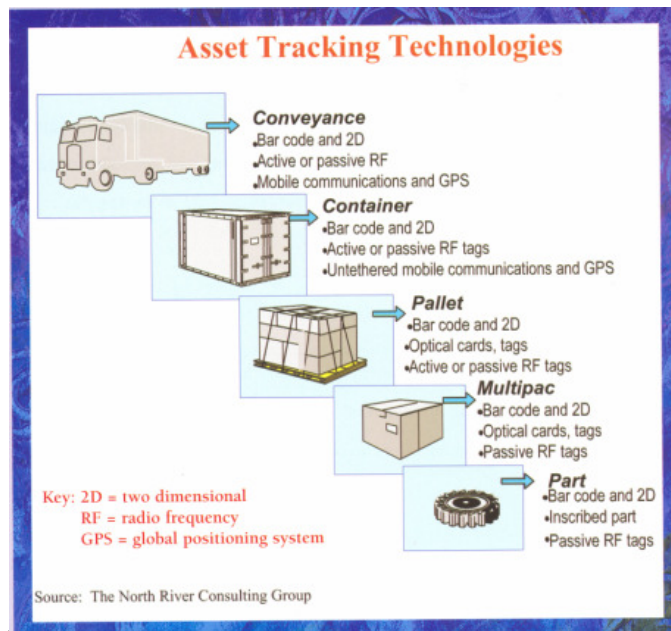


Figure 4: Asset Tracking Technologies for Hazardous Loads (2)

shipments that are carried by multiple modes of transport. For example, a container may be shipped from a plant on a flatbed truck and then loaded onto a rail car, and then back onto a truck for the final leg of its journey. The tracking device on the container would ensure there was no tampering of the shipment. These devices are very important for material handling and anti-theft, which protects the public from threats such as shipments of contraband or potential terrorist weaponry.

HAZMAT Tracking

HAZMAT tracking is a serious concern within homeland security. Hazardous materials have the potential to be targeted by terrorists due to the rare and potentially volatile nature of the cargo. HAZMAT tracking uses GPS and communication applications. The GPS can track the cargo or vehicle to see if they stray from the pre-specified route. If this happens, an alert is dispatched. There are other technologies such as a panic button and intelligent on-board computers. Panic buttons send emergency alerts via satellite or terrestrial communications. Lastly, an intelligent on-board computer can disable the vehicle's motor in the case of a security breach. HAZMAT tracking is often coupled with biometrics to verify operator identification. A biometric login can verify the identity of the driver.

Biometrics

Biometrics technologies are used to improve security. Unique physical characteristics such as the iris, fingerprints, retina, voice, and face are used to authenticate identity. At the Charlotte-Dougllass Airport, iris scanners are used to verify the identity of airport employees, TSA, vendors, etc. through an eye-pass system. To establish this system, a photo of the eye is taken and converted into a unique digital signature. Other benefits to biometrics besides safety include time and cost savings. Biometrics applications streamline checkpoints before the cargo is shipped, saving time and money. The system processes background and clearance checks for the operator faster through computers versus the manual paper work that was filled out and processed.

Radio Frequency Identification (RFID)

RFID uses radio waves to identify different cargo. This technology is already used at existing weigh stations for e-screening. There is an RFID tag which utilizes a microchip and an antenna. The microchip stores a unique serial number that is transmitted to a reader by the antenna. This application is used at weigh stations for e-screening and at toll booths for toll collection. The RFID tags are very inexpensive, generally costing less than \$15. On the other hand, there are some disadvantages to RFID systems. The standards of RFID are still under development. The range of the RFID tag is limited to about 10 feet (3 meters) and high range tags, which broadcast farther, cost more.

E-Seals

E-Seals are disposable RFID transponders for container doors. Law enforcement and customs officials use expensive readers to track E-Seals' movements along highways, borders, and ports. The E-Seal transmits the container's ID number to a reader within an inspection station. The seals are readable at mainline speeds. If the container has been tampered with, a message will appear on the reader. The inspection station can then use the information to determine which containers should be inspected. When a container has left the country this information is posted on the internet for tracking purposes. This application can increase efficiency and security at border crossings. One application of E-Seals, used by the Department of Agriculture, is the tracking of in-transit containers of restricted foods. E-Seals, however, are not widely used within the country. A major problem with E-Seals is the lack of standardization in transponder frequencies. This not only causes problems within the US but makes it hard to coordinate with other countries.



Figure 5: E-Seal Attached to Freight Trailer (5)

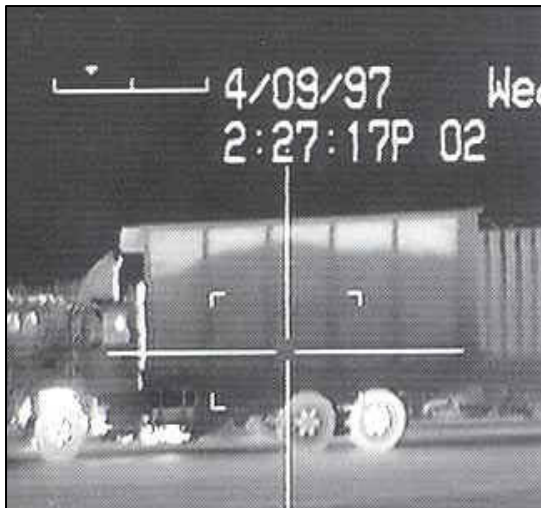


Figure 6: IRISystem Detecting Inoperable Brakes on the Vehicle (3)

Infra-Red Inspection System (IRISystem)

IRISystem detects disconnected brakes on commercial vehicles. This system uses heat sensors to check if the brakes of the vehicle are operational. Figure 6 shows a commercial vehicle with one axle of non-operational brakes. The white wheels are warm, which means the brakes are functional. The dark wheels' brakes are not in operation. Disconnected brakes make a commercial vehicle easier to drive and handle, which is why some drivers unhook them. The cost for one unit is about \$300,000. IRISystem exhibits a significant increase in identifying problematic vehicles and out-of-service orders. This system is implemented at weigh stations and the vehicles can be screened at around 10 miles

per hour (16 kilometers per hour).

Table 1 shows a quick recap of the technologies status in development and the area of focus.

Table 1: Maturity and Focus Areas of Technology (1)

Status	Technology	Driver	Vehicle	Cargo
Widely Tested and Deployed	GPS & Wireless Communication		X	X
	Hazmat Tracking	X	X	X
	WIM		X	
	RFID		X	
	Electronic Screening		X	
Tested by Limited Deployment	Virtual Weigh Station		X	
	Biometrics	X		
	VACIS			X
	IRISystem		X	
Under Development or in Testing	Fatigue Management Technology	X		
	E-Seal			X
	IMRicS			X

Each technology focuses within an area of safety, security, and/or enforcement. Table 2 displays the different technologies within these categories and lists an approximate cost with each.

Table 2: Highway Freight Technology Applications and Cost (1)

Technology	Safety	Security	Enforcement	Fixed Cost
Fatigue Management Tech.	X			\$
E-Seal		X	X	\$
RFID		X		\$
WIM			X	\$
Virtual Weigh Station			X	\$
Biometrics		X		\$
GPS/Wireless Communication		X		\$
Hazmat Tracking	X	X		\$-\$\$
IRISystem	X		X	\$\$
Electronic Screening			X	\$\$\$
VACIS		X	X	\$\$\$
IMRicS	X	X	X	\$\$\$
\$=<\$300K	\$=\$300-1M	\$\$\$=>\$1M		

Barriers to Regional Coordination

There are many significant barriers to regional coordination in technology deployment and management. Interviews with Commercial Vehicle Operations (CVO) experts highlighted several obstacles that need to be effectively confronted in order to create an atmosphere in which regional cooperation can work.

- *There are limited clear benefits to regional cooperation.* Most transportation agencies are concerned primarily with the freight traffic within their jurisdiction. Both congestion and infrastructure damage are viewed as localized problems with localized solutions. There is logic to this mindset. As transportation administrators are called upon to maintain high levels of service despite an aging infrastructure, increasing traffic volumes, and shrinking funding, they must look to their own area of responsibility before considering the larger good of the region. Allocation of funds to regional projects with regional benefits is constantly taking the back seat to projects with easily quantifiable local benefits.
- *Agencies differ in policy directions.* Even within states, there are significant disputes that arise due to different perspectives and directions. For example, weight enforcement in Minnesota is a coordinated effort between the Department of Public Safety's Pro-Rate Division, the State Patrol, and the Department of Transportation's Freight and CVO Office. All approach the table with different agendas, different performance measures, and most importantly different priorities. Without incorporating a uniform policy direction, any plans for regional cooperation are unlikely to succeed. In addition, developing a uniform policy direction for a wide variety of stakeholders with significantly different structures is a serious challenge. There is a lack of quality plans that produce trustworthy, realistic assessments of the benefits that regional cooperation can foster.
- *Regulations are not standardized across borders.* In order to utilize regional technologies, states must agree on what they desire from their transportation system. Regulations reflect differing ideologies that would be sources of conflict in regional cooperation. On an operational level, differing regulations create problems with enforcement, credentialing, and licensing. While it may be a huge efficiency boost to issue one permit to a freight hauler for the entire Upper Midwest, this is impossible if every state in the region has different regulations on when, where, and at what weight the driver can operate.
- *The current culture of transportation management does not foster cooperation.* Several CVO experts mentioned that one of the biggest challenges to regional cooperation was simply finding people willing to try it. Locating agency champions for regional deployment of technology with support from their upper management will be essential for overcoming barriers. Unfortunately, there is a significant opposition to the notion of change within transportation agencies. Cooperation beyond one's borders has never been part of the job for most transportation administrators. It has been viewed as unrealistic, ineffective, and extracurricular. In order to foster the long term vision and dedication that a regionally deployed technology infrastructure would demand, the culture of transportation

management must adapt to incorporate a broader view of the transportation system.

- *Agencies lack the trust necessary to share information and technology management responsibility.* For a public agency, sharing of responsibility has traditionally meant losing direct control. This is one reason why transportation agencies are hesitant to trust other agencies. One state DOT has no guarantee that another state DOT is applying the appropriate standards and scrutiny to data. States frequently disregard data that comes from sources they have little experience with. Unfortunately, other state DOTs typically fall into this category. This lack of trust is not limited to public relationships. Private firms are also resistant to cooperative efforts due to trust concerns. The desire of private firms to protect proprietary information mandates caution. Additionally, a tradition of overestimating the benefits of transportation improvements has created skepticisms amongst private firms that must be addressed to gain their trust.

Interestingly, there are few technological hurdles that arose during conversations with CVO experts. The challenges that must be overcome in order to effectively share information which can increase efficiency in regulatory enforcement, credentialing, and freight movement are minimal. Most barriers to regional cooperation are products of the culture, traditions, and structure of transportation administrations rather than technological limitations.

Funding is obviously of great importance when considering regional cooperation. All of the aforementioned barriers limit the amount of funding state DOTs are willing to dedicate to regional projects. Once the barriers of perspective, policy and regulation differences, culture, and trust have been effectively addressed (not that anyone is holding their breath), it is reasonable to expect to see an increase in the funds state DOTs are willing to contribute to regional scale technology deployment.

Opportunities for Regional Cooperation: The Low-Hanging Fruit

Cooperative technology management would aid the push to standardize regulations, leading to increased efficiency and lowered administrative costs. States could greatly benefit from the increased ability to share information across state lines. A regional database with real-time data would improve efficiency in weight enforcement, safety, security, and congestion mitigation. All of these advances are possible through coordinated efforts. Regional cooperation, a perceived option now, will become a necessity. The issue is whether the Upper Midwest begins to take action now, or waits until regional coordination is no longer an option, but a necessity.

There are several possibilities of how to proceed in developing a regional technology deployment and management strategy. Listed below are several ideas intended to foster discussion and thought.

- *Discussion between CVO experts throughout the Upper Midwest should be a regular component of technology planning.* CVO experts within the Upper Midwest region frequently interact at conferences and other professional gatherings. Yet there is rarely a defined component of technology planning that promotes communication between states as an essential element for effective deployment and maximum results. By fostering interstate communication, the benefits to regional cooperation will become clearer and the barriers to coordination will lower. For example, weight enforcement facility sites are frequently located at state borders, rather than dispersed evenly along corridors. This pattern leads to concentrated weight enforcement and delays at borders and long stretches of highway without any enforcement. The placement of weigh stations at borders is often unneeded, particularly when the neighboring states have similar weight regulations. Communication between CVO experts prior to deployment could help prevent inefficient allocation of resources before they are fixed in place.
- *Involving freight companies can promote the benefits of a regional perspective.* It is important for state DOTs to understand that political boundaries are of far less importance to freight carriers than they are to the government. By bringing freight companies into policy development forums, the interests of the users of the transportation system can begin to take precedence over the interests of the administrators. Freight companies are motivated, efficient, and often have access to the latest technologies. For example, Fatigue Management Technologies (FMT) will likely move from the Federal government into the hands of private freight carriers. If individual states in the Upper Midwest wish to encourage the use of such technologies because of their impacts on highway safety, the states will benefit from a regional approach. It is harder for a single state to enact and enforce a regulation on FMT usage than it would be for a region. By involving freight companies, state transportation administrations can learn about the latest technologies and methods and, through dialogue with the private sector, identify reasonable and effective regulation strategies. Engaging freight companies is not an easy task, given the reservations and skepticisms they frequently have with the public sector. But counting freight carriers' interests and input will ultimately help the Upper Midwest to remain a competitive region for freight movement.
- *The Upper Midwest should solicit the Federal government to play a stronger role within the regional plan.* The Federal government has the potential to provide the states of the Upper Midwest with a regional vision.

This vision can be backed by funding that ensures the effective implementation of a regional technology program. The Federal government provided states with a strong vision of the potential for CVISN. They are frequently praised for their role in getting the program off the ground. Yet their failure to provide the necessary funding throughout the development of CVISN is one of the reasons behind the lackluster adoption of the second phase of the program. States in the Upper Midwest need to recognize that the Federal government's involvement can be crucial to large-scale programs. The states should actively pursue Federal involvement in areas of concern such as security and safety. If the Federal government can perform with endurance in both the visioning *and* funding of a regional technology program, the program will have a far better chance of seeing the light of day.

- *Freeway Management Systems should operate on a corridor scale.* By extending metropolitan ideas about traffic management along interstates, the benefits that are realized on a local level for local trips can apply to the longer trips typical of freight carriers. The compatibility of technology should not be an obstacle to gathering information. Standardized databases can easily adapt data into a usable format. Most importantly, this regional coordination opportunity can use currently deployed technologies as a platform, limiting the need for capital start-up funding. Information that is collected from an FMS informs state DOT monitoring centers of traffic accidents, traffic flows, and congestion along the roadways. This information could be shared between state DOTs to notify them of other states' problems. Issues of congestion and traffic flow interruption impact a corridor. They do not stop at a state border. When state DOTs receive such data from other states, they can then warn their drivers of upcoming delays and possible detours through dynamic signage and other advisory tools.
- *The consistency of CVISN components within the Upper Midwest states should be enhanced.* By improving communication between states through CVISN technology, states will be able to strengthen law enforcement, safety, and security. In addition, by incorporating electronic credentialing and screening within all the states, the Upper Midwest's roadway system could gain a significant advantage. Other transportation networks unable or unwilling to integrate their technological communications would operate less efficiently, giving a competitive edge to the Upper Midwest. CVISN technologies could be extremely helpful in maintaining security, obtaining better safety and operational efficiency of the roadways, and achieving better regulatory compliance across state lines. One benefit is that freight carriers would face fewer delays for unneeded inspections. A compliant vehicle that was inspected in Indiana could be waived through Illinois without inspection delays. This would create more time for enforcement officers to target genuine offenders.

- Additionally, consistent CVISN components would provide a platform to integrate regional electronic credentialing. Commercial vehicles would benefit from time and cost savings under such a program. Reduced paperwork, lower administration fees, and fewer processing delays would be the greater result of regional electronic credentialing. All in all, both private and public stakeholders would profit from an increase in CVISN consistency.
- *Improving regional shipping integrity could provide better homeland security while at the same time protecting shippers.* Intelligent freight technologies can help protect freight carriers against theft, shipment of contraband, and terrorism. Increased security can generate significant economic advantages for freight carriers in the form of lowered insurance costs, higher consumer confidence, and increased reliability. In order for surveillance to be effective, it must operate on a regional scale. Non-compliant and potentially dangerous shipments do not remain within state lines. Interstate coordination can ensure that if a shipment attracts suspicion for any reason within a state, the shipment will not escape scrutiny the moment it crosses a state border. If the Upper Midwest has communication protocols and procedures to coordinate the tracking of suspicious or potentially dangerous shipments (similar to those tracked under HAZMAT), the entire region can monitor its roadway networks collectively. Intelligent freight technologies have received increased attention following the events of 9/11, particularly those which prevent shipments from being tampered with. For example, E-seals ensure that the container has not been tampered with. RFID can track packages to ensure shippers have not deviated from assigned routes.
 - *A regional vehicle-based surveillance system could benefit the Upper Midwest by providing detailed road network traffic flows.* Through coordination with state and local law enforcement, freight carriers, and cellular phone companies, state DOTs may be able to cooperatively establish a regional information-sharing, real-time database of the movements of commercial vehicles. Existing technology can connect law enforcement officials through use of their 911 database, freight carriers through GPS-linked cellular phones, and state DOTs who monitor commercial vehicle movement. This vehicle-based surveillance system could provide accurate, real-time travel data. This data could supplement existing strategies to identify and manage congestion problems. The GPS data would easily integrate with Geographic Information Systems (GIS) for a variety of administrative and analytical functions. This standardized surveillance system could use technologies already deployed under the CVISN program as a platform, making regional cooperation possible. By operating the system on a regional scale, states would lower the barriers to information-sharing across borders and gain access to accurate, real-time data for the entire network.

Conclusion

The possibility of regional cooperation in technology deployment and management is one that the region could benefit greatly from exploring. The progress of ITS and other transportation technologies has significantly lowered the barriers and costs to regional cooperation. By working to create a system-wide technology deployment strategy, every transportation agency in the region could see improved efficiency. As usage and congestion of the current national highway system increases, any efficiency progress can be a competitive boost to the Upper Midwest's transportation system and economic well-being.

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Railroads and Freight in the Future

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Railroads have been a primary mover of freight in the US for more than one hundred and fifty years. For the first one hundred of those years, they were the primary mover of freight. In the post-World War Two era, the nature of railroads and rail service began to change. In the late 1950's and 1960's, the construction of the Interstate Highway System tipped the competitive balance from rail to truck. The result was bankruptcy and merger for many rail companies. Deregulation of the rail industry occurred in the 1980s. It accelerated the already existing trend toward rationalization of rail assets—abandoning low volume lines—and permitted differential pricing, allowing rail companies to match prices to service costs. Finally, changes in manufacturing location and strategy in the 1980's and 1990's brought about a reduction in shipment lane densities and placed a premium on fast, dependable freight services. Both of these changes put rail companies at a further competitive disadvantage to truck.

As a result of these events and trends, rail has evolved from a general carrier of goods of every kind to and from nearly every location to primarily a carrier of specialized goods over long distances to and from a limited number of locations. The trends that brought about this new reality have arguably slowed, but they continue. The rail network and the services provided by it will likely be very different in 2030 than they are today. The public policy discussion that must take place is whether the rail industry and the services provided by it today, and in the probable future, are in the best interest of the economy and broader society of the US. And, if they are not, what public policy options exist for the public sector to influence that industry while maintaining its current financial integrity.

Background

Much has been made of the fact that rail now carries more freight than they ever did before. Railroads are also more profitable than they have been in many years. Despite this seemingly good news, they continue to lose market share to truck. Table 1 outlines the change in the rail share of the combined rail-truck freight market in the several sections of the US. In the five years ending in 1997, rail lost seven percent market share to truck in the Midwest. Across the entire nation, it lost fourteen percent. The loss is much smaller in the Midwest probably because of the region's more heavy use of intermodal service in the auto industry, because of its larger share of the nation's manufacturing industries and because of the large quantities of bulk commodities derived from the mining and agricultural industries.

Table 1: Rail Share of Combined Rail Truck Freight Market (1)

Region	1993	1997	Change in Market Share
Northeast	8.9%	5.7%	-35.9%
Midwest	16.8%	15.7%	-7.0%
South	20.5%	17.7%	-13.4%
West	27.4%	24.0%	-12.0%
United States	19.5%	16.8%	-14.0%

The trends that bring about this loss of market share are not new. In part they are the result of the industries efforts to become more efficient. Larger cars, more powerful and efficient locomotives, longer trains and smaller crews have all joined to make trains more efficient in long haul operations, but less able to operate effectively in the smaller, shorter freight movements. Reebie and Associates, in their Interim Report for NCHRP Project 8-42 came to the following conclusions:

As a result [of recent technological changes], railroads have become capable of handling large loads more efficiently while becoming less efficient at handling smaller loads. This has allowed them to conquer certain dense traffic markets while continuing to cede loose-car traffic to trucks.

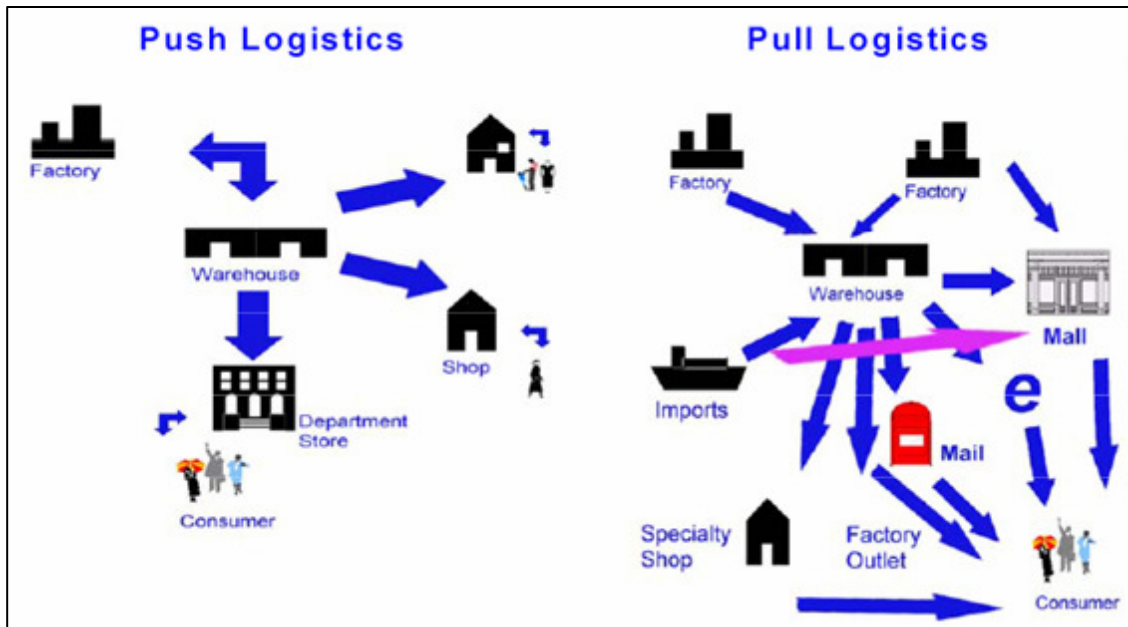


Figure 1: Push and Pull Logistics (1)

The change is due to alterations in industry and the resulting changes in service requirements. We have all heard, probably more than we would like, about just-in-time delivery of product, which has reduced warehousing costs and caused a demand of greater reliability in shipping. A similar and complimentary change has happened in how inventories are maintained and replenished through the distribution system. The old system, the “push system” had the manufacturer producing a product, sending it to the wholesaler and the wholesaler sending it to retail outlets. Each hoped that it would sell. The “pull” system uses information technology to coordinate the entire distribution chain to pull products from the factory or the importer as they are needed. Figure 1 provides a graphic representation of the two systems. The arrows clearly depict the more, smaller and more varied movements required to make the pull system work. Smaller, more varied and more frequent movements place rails at a real disadvantage when compared to truck.

Finally, a basic institutional issue tends to place rail at a competitive disadvantage in many situation. Rail companies are most efficient when they are not forced to interchange traffic with other companies. Interchanges between short lines and class ones or interchanges between class ones take time, increase cost, and degrade reliability. The geography of the Upper Midwest dictates that a large share of rail movements in the region require an interchange between railroads. In many cases, shippers find it faster, more dependable, and less costly to truck their product to the final rail company rather than using rail for intermediate distances. The result is that products that might be shipped by rail if they originated in the far West or East move through much of the Midwest on truck.

The sum of all of this is that growth in the rail industry will not keep pace with the growing freight market. AASHTO, in its Rail Freight Bottomline Report concluded that:

With minimal Class I investments accomplished by the railroads from revenue alone and from investments in short-line improvements and safety enhancements, the freight-rail system could carry the same volume of freight in 2020 as it carries today, but little more. Freight that could not be handled by the railroads, much of it heavy commodities, would move to trucks and the highway system. This would shift almost 900 million tons (816 million metric tons) of freight and 31 billion truck VMT (50 billion vehicle kilometers traveled) to the highways, costing shippers \$326 billion, costing highway users \$492 billion (in travel time, operating, and accident costs), and adding \$21 billion to highway costs over the 20-year period. This \$21 billion is a conservative figure that does not include the costs of improvements to bridges, interchanges, local roads, new roads, or system enhancements. If these were included, the estimate could double. This scenario

illustrates how insufficient investment in our nation's freight-rail system could negatively impact highways and the overall transportation system.

Why Should We Care?

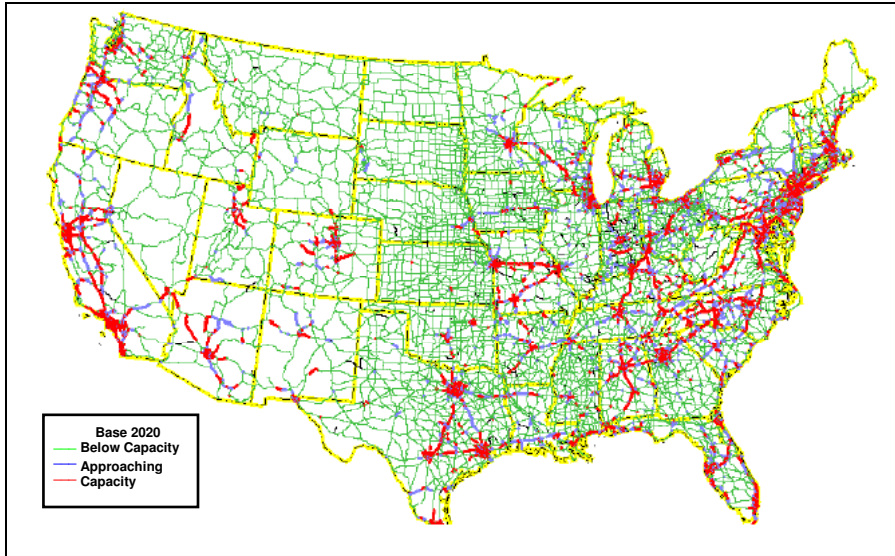


Figure 2: Total Traffic and Congested Segments (Shown in Red and Blue)-Forecast 2020 (1)

Some would argue that the market will determine what gets shipped and how, so why should public agencies care if rails continue to lose market share. Figure 2 provides a graphic outline of why we should care: We do not have the highway

capacity to absorb significantly more trucks. Figure 2 supports one of the key findings of the Phase One portion of the Upper Midwest Regional Freight Study. By 2020 major freight moving corridors throughout the region will be congested, operating near or beyond designed capacity. Each of the major urban areas will be even more congested than it is now. And many of the more rural links will also be operating beyond design capacity.

The causes of congestion may be debated. How much do trucks actually contribute to congestion? Figures 3 and 4 contain the answer to this question. Figure 3 illustrates congestion that will exist in 2020 without any trucks. Figure 4 adds trucks to the mix. The comparison of the two clearly illustrates that trucks will make a major contribution to congestion in 2020.

More congestion will cost the economy of the region; our products will be more expensive as they hit the market. This is acutely important to the Upper Midwest since our economy continues to be dependant on manufacturing. Figure 5 outlines the change nationally and by region in manufacturing between

Figure 3: 2020 Congestion without Trucks (1)

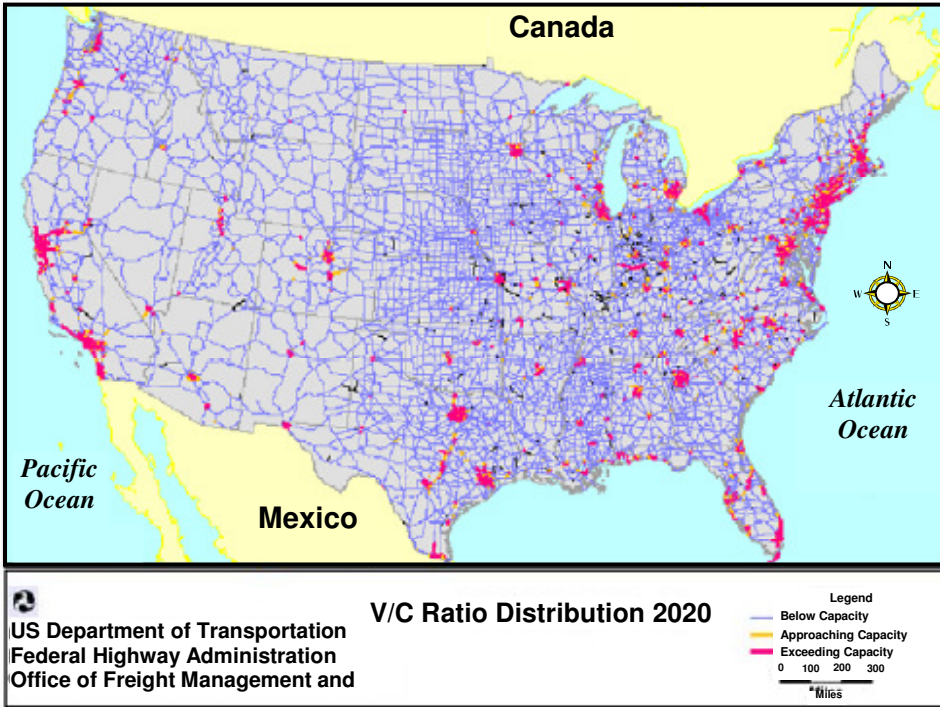


Figure 4: 2020 Congestion with Trucks Added (1)

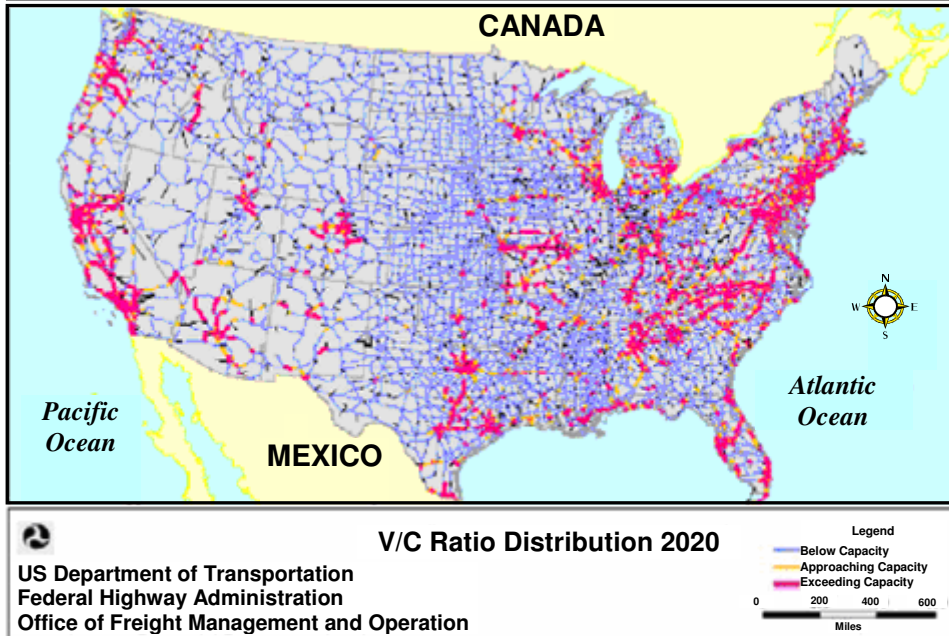
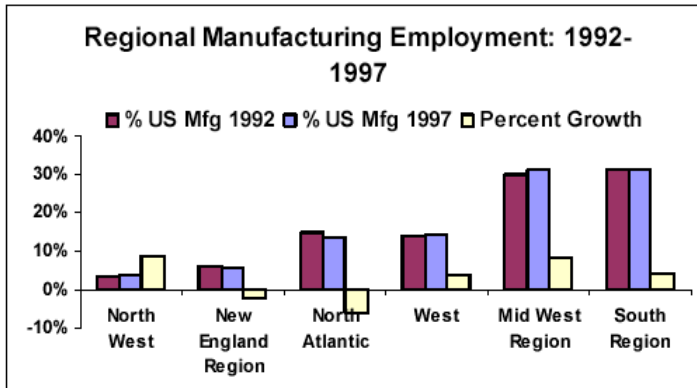


Figure 5: Manufacturing Employment (1)



the years 1992 and 1997. The Midwest grew more than any other region, and it continues to be the major manufacturing region of the nation.

Increased congestion will also cost all of us who use the highway system and pay the fees that support it, as AASHTO illustrated. To the extent that rail could at

least maintain market share, the density and number of red lines on the maps could be reduced and our region's economic health maintained.

Issues in Rail Competitiveness

The potential rail market can be divided into three basic parts:

- Unit trains: Think of the coal trains from the Powder River Basin as the primary example of this. Rail does very well in this market. Except for barge in a few situations, it really has no competition.
- Carload: Think of the sidings at a smaller industrial facility where cars are dropped and later picked up by the rail company. Increasingly this has become a short line business dependent upon interchange with a class one. Since increasingly few businesses have rail sidings, this market is diminishing.
- Intermodal: Think of the truck trailer on flatcar or containers stacked on rail cars, either could be intermodal.



Figure 6: Trailer on Rail (1)



Figure 7: Container on Rail (1)

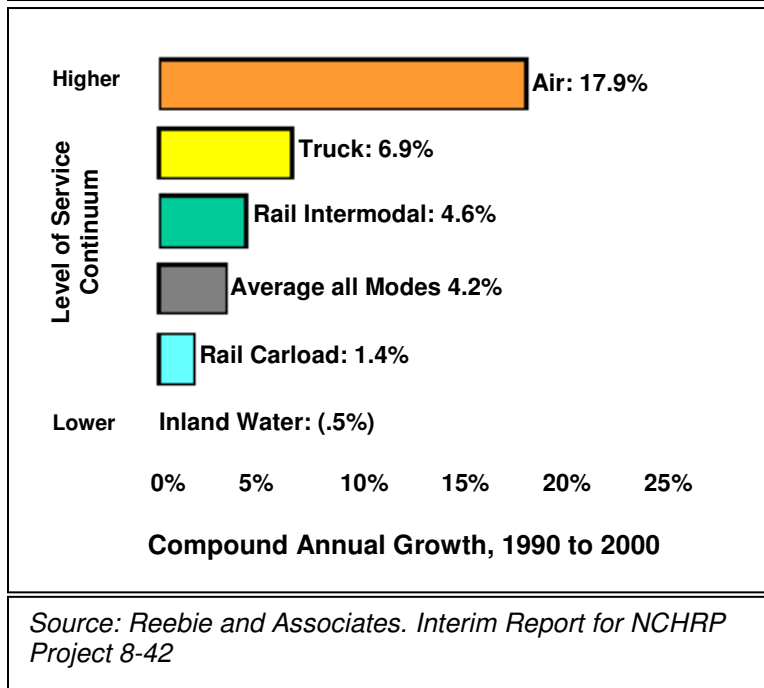
Table 2 outlines 2002 rail activity by length of haul, size of train and the three categories listed above. Longer distances clearly carry the largest volume.

Table 2: Volume by Miles and Class by Operation (1)

RAIL VOLUME BY RAIL MILES & CLASS OF OPERATION									
Source: 2002 CWS; no rebill adjustment									
TONNAGE (000's)	TOTAL	UNIT TRAIN > 50 CARS	CARLOAD < 50 CARS	INTER-MODAL	TOTAL	UNIT TRAIN > 30 CARS	CARLOAD < 30 CARS	INTER-MODAL	
All Tons	2,090,835	982,644	935,778	172,413	2,090,835	1,061,617	856,805	172,413	
% of Tons	100%	47%	45%	8%	100%	51%	41%	8%	
< 100 Miles	260,929	149,343	109,187	2,399	260,929	174,449	84,082	2,399	
% of Tons	12%	15%	12%	1%	12%	16%	10%	1%	
< 200 Miles	456,647	240,722	212,331	3,594	456,647	282,738	170,315	3,594	
% of Tons	22%	24%	23%	2%	22%	27%	20%	2%	
< 500 Miles	927,566	443,100	460,476	23,990	927,566	508,278	395,298	23,990	
% of Tons	44%	45%	49%	14%	44%	48%	46%	14%	
> 500 Miles	1,163,269	539,544	475,302	148,422	1,163,269	553,339	461,507	148,422	
% of Tons	56%	55%	51%	86%	56%	52%	54%	86%	
UNITS (000's):									
All Units	33,366	9,187	12,641	11,537	33,366	10,014	11,814	11,537	
% of Units	100%	28%	38%	35%	100%	30%	35%	35%	

Intermodal, since it tends to provide the highest service level, also is the fastest growing element of the rail business. Figure 8 provides a comparison of different modes and different types of rail service including the rate of growth and the service levels provided.

Figure 8: Rate of Growth and Service Levels



Service expectations have a major impact on the viability of rail service. Shippers list service as the number one consideration before cost. Service can be defined as dependability and speed. Because of pull logistics and just-in-time delivery, reliability is very important. This is the aspects of service that public sector most often thinks about. Speed is also important because of the costs that are involved with greater time. Manufacturers,

distributors and retailers have all made an effort to reduce the “cash-to-cash” time period, that is the time between paying for a good or service and the time

they collect for their product or service. More time in transit or in warehouse increases that time, costing the company money.

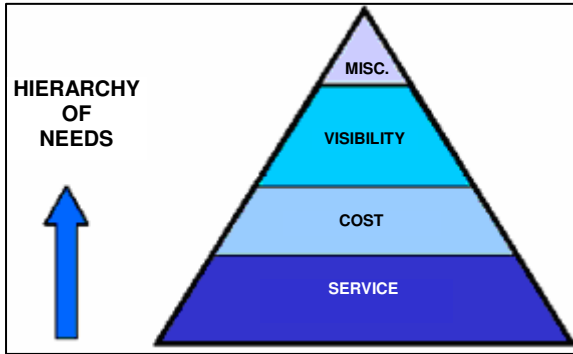


Figure 9: Hierarchy of Needs (1)

Service brings another challenge to rail providers. Figure 9 illustrates the place of service in the minds of shippers. Using the structure of Maslow’s hierarchy of needs, the graphic illustrates that service requirements must be met before other factors can be considered, just as human safety and security issues must be met in Maslow’s hierarchy before higher level needs can be met.

This hierarchy presents a challenge to rail service since shippers must develop a comfort level with a carrier over time. If one trucker fails to meet service expectations, another trucker will be found. If a rail provider fails in service, another rail company is rarely found. Therefore, trucking as an industry tends to hold a competitive edge. For this reason, trucking companies may be the best source of expanding intermodal service. As congestion and fuel costs increase and drivers become harder to find, trucking companies are turning to rail to move long haul product. But for them, cost and service remain issues.

The cost of intermodal is found in the transfer between modes. Figure 10 outlines this issue. Most intermodal moves require drayage at both ends. These transfer costs tend to be fixed regardless of the haul length. Therefore, short haul intermodal is not competitive.

Another issue to be evaluated in intermodal, and other, rail service is line density: How much tonnage (metric tonnage) moves in a corridor? As Table 3 illustrates, rail is most competitive in corridors with high density. This follows logically, since each train movement carries much more freight than each truck movement. Therefore, higher density allows more trains, more frequent service and better service.

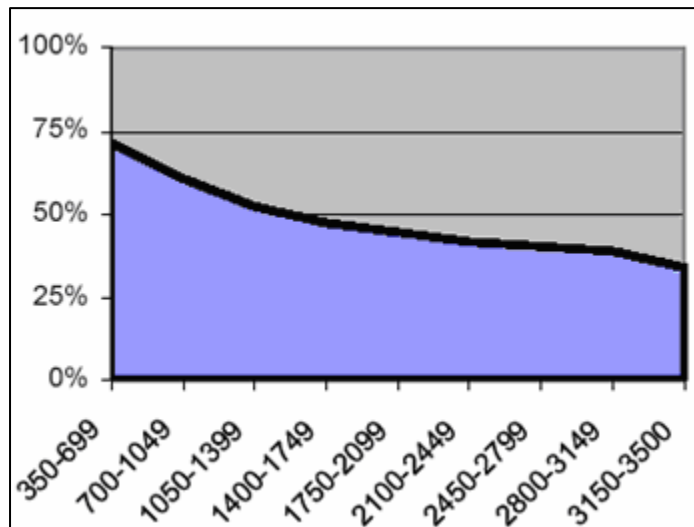


Figure 10: Percent of Transfer Cost in Intermodal by Length (1)

Table 3: Corridor Density and Mode Choice (1)

MODAL MARKET SHARE BY LANE DENSITY & DISTANCE RAIL INTERMODAL (IMX) Vs OVER-THE-ROAD (OTR) DRY VAN TRUCK								
Source Transearch 2000								
HIGHWAY MILES	LANE DENSITY (Annual Tons (000) by IMX+ OTR)							
	< 100		100-400		> 400		Total	
	IMX	OTR	IMX	OTR	IMX	OTR	IMX	OTR
1-100	0.1%	99.9%	0.1%	99.9%	0.4%	99.6%	0.4%	99.6%
100 - 299	0.3%	99.7%	1.1%	98.9%	1.4%	98.6%	1.3%	98.7%
300 - 499	0.8%	99.2%	2.3%	97.7%	3.6%	96.4%	3.0%	97.0%
500 - 699	1.3%	98.7%	5.4%	94.6%	11.1%	88.9%	6.6%	93.4%
700 - 899	1.3%	98.7%	8.3%	91.7%	27.2%	72.8%	12.6%	87.4%
1000 - 1499	2.6%	97.4%	8.7%	91.3%	28.1%	71.9%	11.4%	88.6%
> 1500	7.3%	92.7%	24.8%	75.2%	62.0%	38.0%	37.1%	62.9%
Total	2.4%	97.6%	6.6%	93.4%	8.2%	91.8%	7.0%	93.0%
Total > 500	3.0%	97.0%	10.8%	89.2%	33.8%	66.2%	16.8%	83.2%
Total < 500	0.6%	99.4%	1.5%	98.5%	1.5%	98.5%	1.4%	98.6%

Market Share Key
 OTR TRUCK ? 80% (Yellow)
 Both < 80% (Blue)
 IMX RAIL ? 80% (Dark Blue)

Public Policy Options

Rail companies are private enterprises that must make a profit to stay in business. Profit can be made either by increasing revenues, which is very difficult to do in head-to-head competition with trucking, or by reducing costs. Railroads have generally opted for the second

alternative. Facilities that do not return the desired rate of return, even if they are profitable, are phased out. After decades of this sound basic business logic, rail companies are profitable, but their capacity is limited. Low volume tracks are gone and medium volume tracks are now on the block. Low volume terminals are also gone or going.

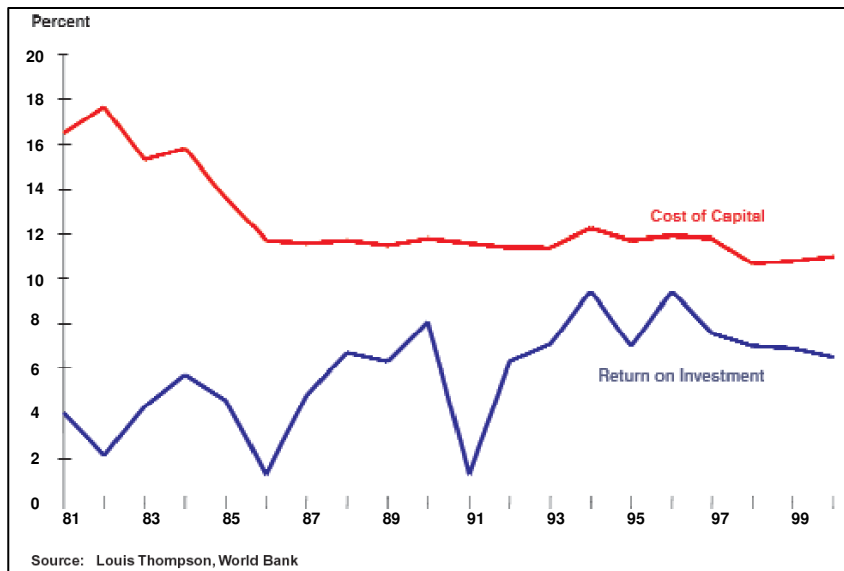


Figure 11: Cost of Capital and Return on Investment (2)

Figure 11 illustrates the basic reason for this change. Rail companies have a very low rate of return. When the return is lower than the cost of capital, outside capital will be used very sparingly. Therefore, investments will be made only with

internally generated funds and only for

projects that bring the require rate of return. Rail companies have become cautious in their investment strategies. While they continue to invest a much larger proportion of their revenues in capital and maintenance projects that other industries, they cannot address many projects that might seem attractive to public sector decision-makers. To illustrate this point, one state reports having public funding in the amount of one million dollars turned down by a railroad, even though it would have reduced the cost of the desired project by one-third.

Figure 12 illustrates why the situation is not likely to change soon. Real revenue for each ton-mile (metric ton-kilometer) of freight moved continues to decline in both constant and current dollars.

The only way that rail as an industry can be more competitive and continue to carry near its historic share of freight is if the economics of the industry are changed, either by broad market forces or by public intervention.

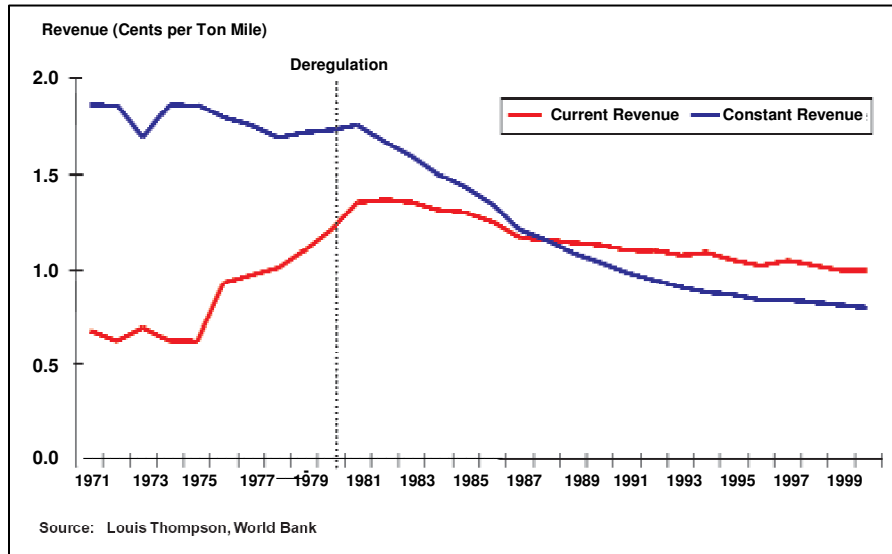


Figure 12: Rail Revenue per Ton Mile (2)

Figure 13 may help to illustrate some of the options that might be considered.

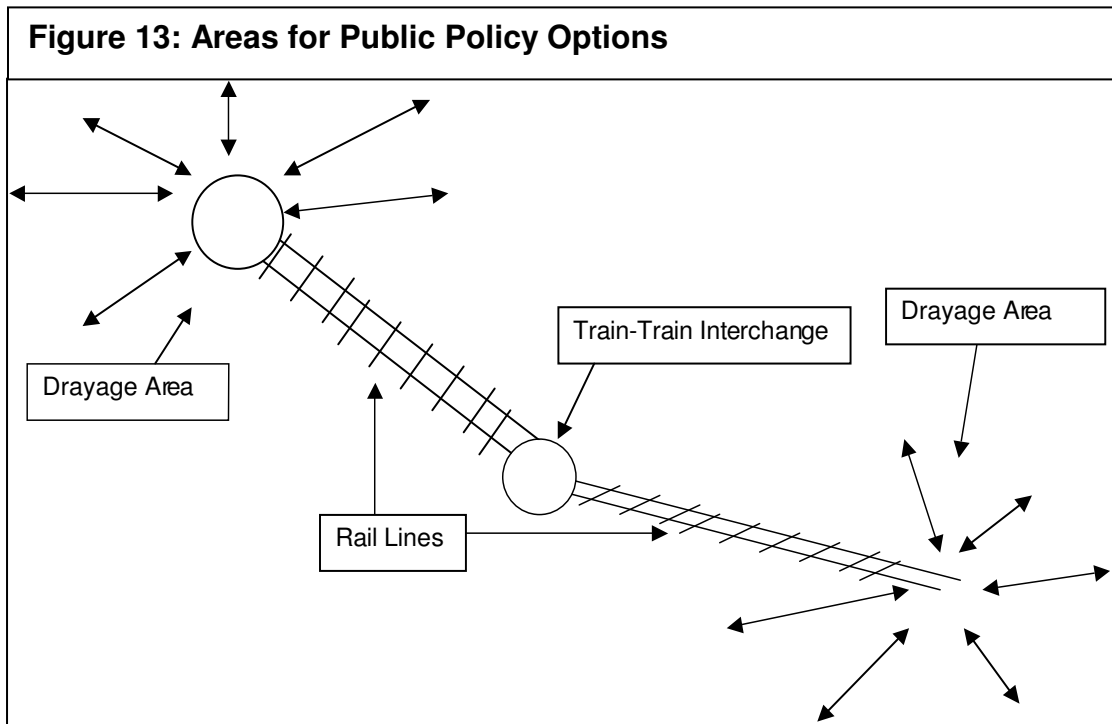


Figure 13 illustrates a simple rail configuration: Two rail lines, with drayage areas at both ends, and a rail-to-rail interchange. Some of the options that might be considered include:

- Reducing the costs of the transfer at the end of each rail line. Remember that Figure Ten pointed out the cost structure of intermodal relative to haul length. If we want intermodal to work in shorter distances, those costs have to come down. Approaches could include:
 - Technology improvement at the transfer—better ramps or lifts.
 - Public investments in terminals or terminal equipment.
 - Public ownership of terminals.
 - Public facilitation of intermodal equipment standards. The range of equipment now in use makes some intermodal movements nearly proprietary. Standard equipment could facilitate competition and reduce the costs.
- Increasing the density of the rail corridor. As noted in Figure 11, rail lines are most competitive when density is high and service frequency can be enhanced. Facilitating shippers associations, locating hubs regionally, and not building highways that parallel potentially viable rail routes and raising the visibility of intermodal hubs might help to increase density.
- Increasing the efficiency of rail line operations. Speed is important, and the public sector could help to improve speeds. Some options:
 - Limiting the number of permitted rail-highway crossings.
 - Increasing the protection level at existing crossings.
 - Investing in rail rehabilitation or expansion.
 - Investing in train control systems.
- Increasing the efficiency of rail-to-rail interchange. Some options to consider include:
 - Facilitating equipment standardization.
 - Investing in interchange facilities.

As noted earlier in this section, market or public action will have to change the economics of the industry if they are to change the actions of the participants in the industry. Ultimately, this will require public investment in any of a number of ways, or it will require actions that have the impact of relieving rail companies of cost. Relying on market forces is simply waiting for highway congestion, driver shortages, or fuel prices to hamper the trucking industry. While in the very long run this might bring about changes in rail service, the method of change could be very traumatic for our regional and national economies.

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Great Lakes Marine Transportation System

Richard D. Stewart, Great Lakes Maritime Research Institute

Historical Perspective of the Great Lakes Maritime Transportation System

The Great Lakes Marine Transportation System (GLMTS) has been a commercial trade route for thousands of years. Routes established by the Native Americans were used in the early fur trading days to link together a vast inland network that predates today's hub and spoke distribution centers. The importance of the trade route resulted in three wars being fought for control of the Great Lakes.

Prior to the advent of the railroad the GLMTS was one of the primary routes in the westward expansion of the United States. The opening of the Erie Canal in 1824 provided an all water route to the rapidly growing port of New York and maritime trade on the Great Lakes flourished. Other canals were built that allowed maritime commerce to enter the Ohio River system through: Toledo, and Ohio, the Mississippi river system at Green Bay, Wisconsin. As the population in the regions around the lakes expanded maritime trade was the primary method of transportation. When railroads were introduced they were linked through ports to the GLMTS. The Chicago ship canal built in 1900 linked the GLMTS to the Mississippi river system creating the largest all water route to the inland river system.

To this day, the movement of vast storehouses of natural resources in the heartland of the US and Canada relies on an efficient GLMTS. Thousands of ships have been built and operated on the Great Lakes. Transportation efficiency is a hallmark of the vessel operators on the GLMTS with two examples being self-unloaders and the use of mariner for line handling. Fleets of ships have been built to carry all varieties of commerce and the GLMTS has a long history of world cruise and day passenger ships. During World Wars I & II Great Lakes shipbuilders made major contributions of merchant and warships to the services of US and Canada.

The two nations had created lasting maritime agreements on the use of the GLMTS addressing cross border trading, environmental issues, and vessel safety. The vessel operators were responsible for actively promoting safe efficient operations including the introduction of the traffic separation lanes, off season maritime educational programs, and other world renown ideas. Future improvements and expansion of the GLMTS will rest on a legacy of innovation, efficiency, environmental stewardship and safety.

Current Operations

The Great Lakes Marine Transportation System (GLMTS) includes Lakes Ontario, Erie, Huron, Michigan, and Superior, their connecting waters, and the St. Lawrence River. It is one of the largest concentrations of fresh water on the earth. The system, including the St. Lawrence River above Iroquois Dam, has a total shore of about 11,000 statute miles (9,559 nautical miles, nm), a total watersurface area of about 95,000 square statute miles (24,600,000 hectares). With the opening of the St. Lawrence Seaway, the system provides access by oceangoing deep-draft vessels to the great industrial and agricultural heartland of the North American continent. From the Strait of Belle Isle at the mouth of the Gulf of St. Lawrence, the distance via the St. Lawrence River to Duluth, MN at the head of Lake Superior is about 2,340 statute miles (2.03nm) and to Chicago, IL near the southern end of Lake Michigan is about 2,250 statute miles (1,955nm). About 1,000 statute miles (870 nm) of each of these distances is below Montreal, the head of a deep-draft ocean navigation on the St. Lawrence River.

The GLMTS serves 15 major international ports and some 50 regional ports on both sides of the border. Maritime commerce on the system supports domestic and international trade, and provides a competitive advantage to a wide range of industries. A recent economic impact study of the St. Lawrence Seaway System estimated the revenue benefit to the US economy to be \$3.4 billion, personal income and consumption benefit of \$4.3 billion and federal state and local tax revenue of \$1.3 billion per year (1). The study examined growth patterns for the system from 1991 to 2000 and found constant expansion in jobs, revenue, tonnage, and economic indicators for the decade.

Marine transportation on the system involves three general trade patterns:

Seaway Trade: traffic moved on the Seaway, much of which is overseas import/export trade.

Great Lakes Trade consists of interlake (between lakes) or intralake (within one lake) domestic or bi-national trades contained within the Great Lakes.

Lake -River Trade is traffic that moves to and from the Great Lakes via the connecting Inland River System.

Seaway Trade

The current Seaway lock system was completed in 1959 and provides an all water route direct to the head of lakes ports of Duluth/Superior in the US and Thunder Bay, Ontario in Canada. The route offers significant savings in distance and cargo handling for products that originate in the heartland bound for European or North African ports. The distance advantage is, to a degree, offset by the slow speed of passing through the lock system and also the diseconomies of scale due to the relatively small ships that the locks can accommodate. As world trade and ship size grew, the number of vessels that could use the seaway

declined never reaching its potential. The Seaway trades have lately been in the range of 50 million tonnes a year. Seaway cargoes are borne both by Canadian-flag and foreign-flag ocean vessels. The U.S.-flag laker fleet is almost exclusively employed in the interlake trades however the grain trade from the head of the lakes ports uses part of the seaway system to reach Buffalo, NY. Current Seaway trade patterns include:

- Upbound (westward) movements of general cargo, including semi-finished steel in the form of slabs, coils, structural forms, and other products from overseas producers.
- Upbound movements of iron ore from mines in eastern Canada.
- Downbound (eastern) shipments of export grain by Canadian bulkers to transshipment points on the St. Lawrence River and by ocean vessels for direct export overseas.

The Seaway also handles project cargoes, forest products, petroleum products, containers, chemicals, edible oils, coal, salt, cement, fertilizers, ores, nonferrous metals, and other bulk commodities. Tolls for use of the Seaway locks are charged for Canadian but not US locks.

Great Lakes Trade

The interlake and intralake trades, approaching some 200 million tonnes a year, are dominated by the dry bulk commodities of iron ore, coal, stone and grain. Also moved within the Lakes are salt, cement, potash and liquid bulk cargoes such as petroleum products, asphalt and industrial chemicals. This commerce is handled by U.S. and Canadian-flag fleets in the Great Lakes. Some of the larger movements within the Lakes are:

- Iron ore, in the form of taconite pellets, moving from the Minnesota Iron Range and Michigan's Upper Peninsula to steel mills around Lakes Michigan and Erie.
- Low-sulphur coal mined in the western U.S., railed to Great Lakes loading ports and moved on water to electrical generating stations on the Great Lakes,
- Coal mined in the eastern U.S. moved to steel mills, generating stations, and other industries.
- Stone moved from quarries to steel mills and taconite plants for flux, and to all major markets for construction.

Lake-River Trade

The GLMTS currently has direct, all water connection to two major river systems. Vessels can travel from Lake Michigan to the Illinois and Mississippi river system via the Chicago ship canal. Vessels can also move from the Great Lakes to the Hudson River system via the New York State Barge Canal (Erie Canal).

New York State Barge Canal

The Erie canal route has significant size restrictions and is primarily used for the delivery of vessels, recreation, and some minor movement of aggregate products. Barges and small vessels can travel from New York Harbor via the Hudson River and New York State Barge Canal System to Lake Ontario at Oswego, NY a distance of 340 statute miles (295.5 nm), or to the Niagara River at Tonawanda, NY; a distance of 496 statute miles (431 nm). All Erie Canal System lock dimensions are 328 feet long, 45 feet wide. The area available for vessels within a lock is 300 feet (91.4 meters); long, 43.5 feet (13.2 meters); wide and controlling draft of 12 feet (3.7 meters); but the most significant restrictions are bridge clearance (air draft) limit of 15.5 feet (5.8 meter) and speed restriction of 5 mph (2)

Chicago Ship Canal and Illinois Waterway System

The Chicago ship canal was originally created in 1900 to divert sewage away from the growing metropolis's supply of fresh water from Lake Michigan as well as provide a marine connection. The canal also currently provides fresh water to communities outside the Great Lakes basin. The basin is the land in which all precipitation, rivers, and streams flow back to the lake. A 1967 U.S. Supreme Court decree allows Chicago and its suburban communities to divert up to 2.1 billion gallons a day from Lake Michigan. The Water Resources Development Act of 1986 requires unanimous approval from the eight Great Lakes governors for any city that lies outside the Great Lakes basin to receive water and it is unlikely that other communities around the lakes will in the future be allowed to build canals that divert water from the Great Lakes.

The diversion of water lowers Lake Michigan's lake level by about 2 inches and is also a pathway for exotic species. The Chicago diversion enabled the zebra mussel to move from the Great Lakes into the Mississippi River. There are real concerns that the Asian carp, a voracious eater, will find its way into Lake Michigan from the Mississippi via the canal.

Barges and small vessels can travel from the Gulf of Mexico via the Mississippi River and the Illinois Waterway to Lake Michigan at Chicago, IL, a distance of about 1,530 statute miles (1,329.5 nm) The canal, has limits of depth, 9 feet (2.7); width, 80 feet (24.38 meters); length, 600 feet (182.88 meters); and vertical clearance 17 feet (5.18 meters). There are no tolls on this route.

GLMTS Capacity

The primary measures that are used to determine the capacity of the GLMTS are the number of vessels that transit locks, call at ports and tonnage carried. The waiting time, number of vessels locked through and the historical comparison with past shipping clearly indicate that the system has significant upward

capacity potential. GLMTS is part of a very competitive transportation system. Rail, truck, the inland river system and the St. Lawrence Seaway system are often competing for freight. Finding methods to improve the GLMTS's efficiencies, streamline the system, and reduce costs will make the GLMTS more competitive and expand its use.

Governance and Regulation of the GLMTS

The GLMTS cuts across local, state, and national borders. More than any other mode it is a joint private and public sector enterprise. The private sector owns virtually all of the vessels and most of the terminals on the GLMTS. Governmental agencies are responsible for keeping the waterways open and functioning at optimum efficiency. By its nature and operation the GLMTS is intermodal which means it interacts and depends on access to and interaction with the other modes.

Operating, maintaining, and constructing transportation systems within state boundaries are very difficult tasks. The complex regulatory and governance structure of the GLMTS greatly increased the difficulty of these tasks. A GLMTS marine carrier in cross border trade will have to comply with approximately thirty sets of US and Canadian regulations that are administered by ten different departments on the federal and provincial level alone. In most cases the interaction will result in a fee, tax, toll, or tariff being paid to one or more of the agencies. When construction, maintenance and regulation are considered the US has at least 18 different federal agencies with responsibilities relating to marine transportation systems (3). Jurisdictions between agencies often overlap with differing objectives further complicating the process.

As the oldest transportation system for the two nations, there is significant legacy legislation and regulation that has not been well coordinated. Unlike air or highway transportation the GLMTS does not have, even at the US federal level, a single agency to direct and coordinate activities. The institutional goals and divisions of responsibility of the dispersed federal government agencies do not always correspond to how the GLMTS is organized and functions today as an intermodal system. The primary US and Canadian agencies with responsibilities in the operation of the GLMTS are listed as follows.

- Transport Canada
- U.S. Army Corps of Engineers
- U.S. Department of Transportation
- The St. Lawrence Seaway Management Corporation (Canada)
- Saint Lawrence Seaway Development Corporation (United States)
- Environment Canada
- U.S. Fish and Wildlife Service
- US Department of Homeland Security

- State agencies of Illinois, Indiana, Michigan, Minnesota, New York, Ohio, Pennsylvania and Wisconsin
- The Provincial regulatory agencies of Ontario and Quebec
- County, state, village governments and planning commissions
- Numerous non-regulatory government agencies such as the US Maritime Administration and non-governmental agencies like The Great Lakes Commission are active in support of the GLMTS

The list is not comprehensive. Other agencies with interests and concerns about the GLMTS can be found on the Great Lakes Commissions website, http://www.great-lakes.net/links/econ/orgs_transp.html. The fifty year old Great Lakes Commission is a nonpartisan, binominal compact agency created by state and U.S. federal law and dedicated to promoting a strong economy, healthy environment and high quality of life for the Great Lakes - St. Lawrence region and its residents. The Commission consists of state legislators, agency officials, and governors' appointees from its eight member states. Associate membership for Ontario and Québec was established through the signing of a "Declaration of Partnership." Some multi-state collaborative efforts such as the Great Lakes Regional Collaboration effort have been stymied by a lack of funding (4).

The cross border location of the GLMTS requires that long lasting programs be coordinated through both US and Canadian agencies. There is a long history of the two nations working together including the planning and construction of the current St. Lawrence Seaway. Bi-national initiatives such as the following example will be essential for the optimum use of the GLMTS.

Bi-National initiatives

On May 01, 2003 the US and Canadian Governments signed a memorandum of cooperation on the Great Lakes St. Lawrence Seaway System.

The Memorandum of Cooperation enhances collaboration between both governments, and helps them to:

- Assess the economic, environmental and engineering factors associated with the current and future needs of the Great Lakes St. Lawrence Seaway commercial navigation system;
- Identify factors and trends affecting the domestic and international marine transportation industries serving the Great Lakes St. Lawrence Seaway, including evolving intermodal linkages and transportation technologies; and
- Evaluate the reliability and condition of the Great Lakes St. Lawrence Seaway, including the ongoing maintenance and capital requirements of sustaining and optimizing the existing marine transportation infrastructure on which it depends.

In order to carry out the goals outlined in the memorandum of cooperation the agencies involved started a Great Lakes Short Sea Shipping Study (GLSSS)

that is due out in the fall of 2006. Canadian and American officials agreed that obtaining a baseline snapshot of existing engineering infrastructure, and current economic and environmental conditions would prove invaluable in determining what actions would be required to ensure no operational degradation in the System for the next 50 years. The study calls for an assessment of the System's current and future requirements to maintain safety, reliability, viability and efficiency at levels consistent with those present today. The scope of the study is limited to the evaluation of the existing marine transportation infrastructure. It is important to note that the focus of the study is on the optimization of the existing infrastructure based on the system's current configuration and that the evaluation of major infrastructure modifications, such as an expansion of the Seaway locks or an increase in channel dimensions is not part of the GLSSS study (5).

Physical Challenges to Optimizing the Use of the GLMTS

Physical Constraints

A waterway that extends over 2,300 miles east to west and over 400 miles north to south into the middle of a continent is impacted by physical limitations. In most instances the barriers to water transportation have been overcome by technology. There are some constraints on the system that current or even future technology may not be able to change.

Winter Operations

Winter operation on the Great Lakes is restricted during the height of winter due to ice conditions and closure of the locks. Vessels that would elect to operate during this period would need an ice strengthened hull, rudder, and propeller and would be limited to operational areas not requiring locking. Air temperatures on the Great Lakes can go as low as -50 degrees F (-46 degrees C) with ice covering a large portion of the northern Great Lakes and most of the harbors.

Despite the severe weather, there have been trial year round operations in intralake service and interlake service on the Great Lakes. The Great Lakes Commission members have proposed extensions of the season (6). Year round service in the Baltic and North Sea regions can provide excellent examples of effective ice operations. Foreign shipbuilders are building ice capable vessels with ballast water systems that exceed the IMO standards and are suitable for GLMTS trade. Lock repair and maintenance downtime issues need to be addressed. The building of a second Poe size lock could be a significant factor in extending the season. If global warming is a reality, the Great Lakes navigation season may steadily increase to the point of year round service. Should that occur then new supply chain options would open in the region.

Lake Levels

Lake level fluctuations occur on a cyclical basis and they can reduce or raise water level in some lakes by as much as 19.5 inches (.5 meters). These fluctuations can impact a vessel's carrying capacity and in turn the total capacity of the GLMTS. Concerns have been raised about global warming and the potential impact on Great Lakes shipping (7). The NOAA study postulates that if global warming continues lake levels will drop anywhere between 2-3 feet. Such a drop could have significant impact on future GLMTS in terms of vessel cargo carrying capacity but this may be offset by an extended or year-round shipping season.

Global warming may have the impact of reducing or even elimination ice cover on many of the Great Lakes. While the phenomena may be a decade away, that is not a long time frame when considering transportation infrastructure changes. If global warming is a reality, the Great Lakes navigation season may steadily increase to the point of year round service. Should that occur then new supply chain options would open in the region. There should be studies by planning agencies and transportation academics on how an ice free GLMTS could be utilized to maximum benefit

Locks

It should be recognized that ships that want to trade in the Great Lakes system have to fit within the physical dimensions of the St. Lawrence Seaway and Welland Canal locks. Vessels that trade into Lake Superior must be able to fit through the locks at the Sault.

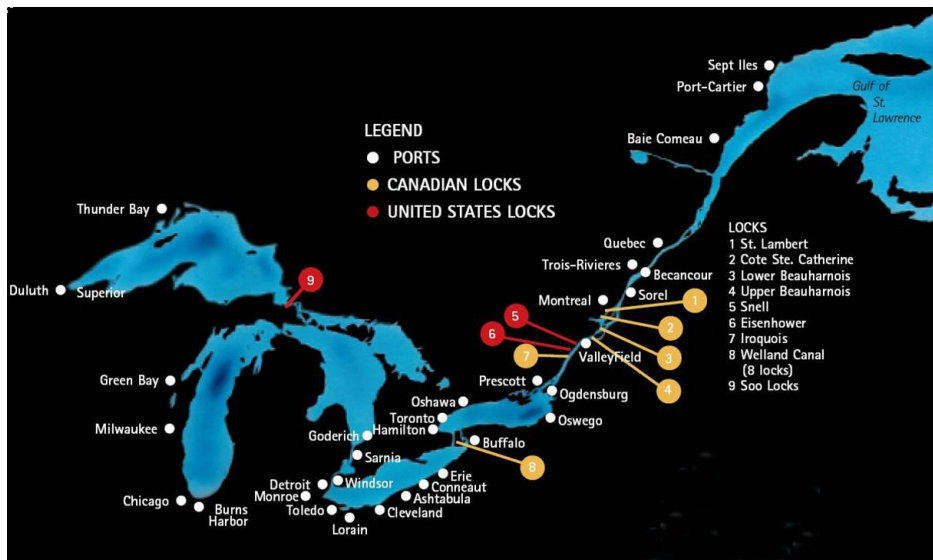


Figure 1: Seaway and Great Lakes Lock System

Seaway Locks

The St. Lawrence Seaway proper extends from Montreal to Lake Erie. The Seaway locks (fifteen in total) overcome the differences in elevation in the system. The Montreal/Lake Ontario section encompasses a series of seven locks over roughly 300 kilometers (187 miles), with five Canadian and two American locks, from Montreal, Quebec to Iroquois, Ontario enabling ships to navigate between the St. Lawrence River and Lake Ontario. The Welland Canal links Lake Ontario and Lake Erie with a series of eight locks over approximately 42 kilometers (27 miles) – all Canadian. The Welland Canal provides more than half the lift needed between tidewater and the lakehead. Figure 1 shows the seaway and great lakes lock system,

All of the seven locks of the Montreal/Lake Ontario section of the Seaway (St. Lambert, Côte Ste. Catherine, Lower and Upper Beauharnois, Bertrand H. Snell, Dwight D. Eisenhower, and Iroquois) as well as those of the Welland Canal, are 233.5 meters long (766 feet), 24.4 meters wide (80 feet) and 9.1 meters deep (30 feet) over the sill.

Responsibility for the operations and maintenance of the navigational aspects of the Canadian portion of the Seaway (thirteen locks) resides with the St. Lawrence Seaway Management Corporation, a not-for-profit corporation, under a long-term management agreement with the Government of Canada pursuant to the Canada Marine Act. The Government of Canada continues to own all fixed assets of the Canadian Seaway.

The two United States locks in the Seaway are operated and maintained by the Saint Lawrence Seaway Development Corporation, a wholly owned government corporation within the U.S. Department of Transportation.

The Soo locks at Sault Ste. Marie, Michigan, provides a vital connection between the upper Great Lakes and Lake Superior. Access to Lake Superior and the Canadian lakehead at Thunder Bay, Ontario and the U.S. lakehead at Duluth, Minnesota is gained via the locks on the St. Mary's canal. The locks are operated and administered by the U.S. Army Corps of Engineers.

The two locks currently operational for commercial navigation purposes are the Poe and the MacArthur. The Poe lock is 1200 feet long (366 meters), 110 feet wide (33.5 meters) and 32 feet deep (9.8 meters). The MacArthur lock is 800 feet long (244 meters), 80 feet wide (24.4 meters) and 31 feet deep (9.4 meters).

Challenges to the Inland Waterways System

The majority of the locks and lock chambers in place on the Mississippi and Ohio river waterways are less than 1,000 feet in length. The U.S. Army Corps of Engineers reports that 15% of the locks are 1,000 to 1,200 feet long, 60% are

600-900 feet long, while 25% are less than 600 feet long. Furthermore, about 50% of the locks and dams are over 50 years of age and reaching the end of their economic life.

Not only is age and the need to replace these aging locks and dams a constraint on the ability of the inland waterways to handle cargo in the future, but the size of the locks limit the size of the tow that can pass through the lock system. A 1,200-foot lock can accommodate a tow consisting of 17 barges, while the older locks of 600 feet or less can only accommodate tows consisting of 8 barges. Since the majority of the tows on the upper Mississippi River System, consist of 12 or more barges, the tows must be split in half in order to transit a 600-foot lock. The splitting of the barge tow results in an increase in transit time for cargo with delays as barges wait to enter the locks. Additional constraints are that the Illinois and Mississippi river system are subject to floods, ice conditions and drought.

Locks Improvements

The current Seaway Locks were built small due to political pressure from East Coast ports and the railroads that had a concern that a larger seaway would take trade from their routes. The end result of building locks that were obsolete when completed is that the majority of today's seagoing vessels cannot fit into the locks. There have been a number of studies and recommendations to expand the locks. One of the principal physical constraints to expansion is the depth of water available in channels, rivers, and other waterways that is an average of 30 feet (9.1 meters). The extensive dredging required to bring the entire GLMTS to a significantly greater depth would be time consuming, expensive, and may have adverse environmental consequences. However the locks could be widened to 110 feet and lengthened without changing the depth and the improved locks would accommodate the majority of handy size seagoing vessels.

Efforts to build a second large lock at the Sault have been under way since the 1980s. Those efforts received significant assistance under the provisions of the Water Resources Development Acts of 1996 and 1999, in which Congress reduced the states' share of the project and allowed it to be paid over 50 years, interest-free. Approximately one-quarter of the originally estimated \$225 million project is to be covered by nonfederal, cost-sharing funds from the eight Great Lakes states. The Michigan, Illinois, and Pennsylvania legislatures all appropriated in the summer of 2001 to cover their contributions toward the new lock, to be built on the St. Marys River between Lakes Huron and Superior. The remaining five Great Lakes states have also committed to supporting the project and are in the process of securing appropriations to cover their shares. After a lengthy review at the U.S. Army Corps of Engineers headquarters, a Limited Reevaluation Report (LRR) revisiting initial benefit-cost ratio calculations for the project has been forwarded to the Assistant Secretary of the Army (Civil Works) with a recommendation to proceed with construction. At last report, the LRR was

still awaiting action. In Congress, the Water Resources Development Act of 2005 has been introduced with language inserted by Cong. James Oberstar (D-MN) calling for full federal funding of the Soo Lock expansion project.

The new large lock will improve shipping reliability and efficiency on the Great Lakes by replacing two small World War I-era locks. Only the Poe lock at Sault Ste. Marie, can handle the 1,000-foot lake vessel. A malfunction of this lock would require that tens of millions of tons of product would have to be shipped on smaller vessels or moved by other modes through the most congested rail and highway routes in the Midwest.

Non-Physical Challenges to Optimizing the GLMTS

A vessel that is suitable for the trade and capable of providing competitive economic returns on the investment is one of the most critical components of any viable transportation mode, the marine service is no different. The ability to acquire suitable cost effective vessels in a competitive market is essential to establishing new maritime trade routes or revitalizing existing traffic lanes (8). Vessel selection is typically driven by legal factors, physical constraints and availability of reasonably priced vessels. Regulatory barriers exist that currently limit the optimal use of the GLMTS.

Taxation and Border Clearance

In 1986, the Harbor Maintenance Tax (HMT) was enacted by Congress to recover a portion of the cost of maintaining, not improving, the nation's deep-draft navigation channels. The amount of tax paid by the shipper, who owns the cargo, was based on the value of the goods being shipped. In addition, a cost-share formula was implemented for improving (widening and deepening) harbors and channels, with local port sponsors paying a part of the cost and the Federal government paying a portion from the General Treasury.

Congress decided to fund 40 percent of maintenance costs from the HMT after much debate and discussion about the broad, national benefits of waterside infrastructure and concerns about the impact of a tax on trade and competitiveness of U.S. ports. An ad valorem tax, rather than a tonnage tax, was chosen to minimize the impact on U.S. exports, particularly price-sensitive bulk commodities.

In 1990, Congress more than tripled the HMT to recover 100 percent of maintenance dredging expenses. The current HMT tax rate is .125% of the value of the cargo. The HMT collected from commercial navigation also funds the roughly \$80 million expended each year to dredge shallow-drafts ports used primarily for recreational purposes.

The U.S. Supreme Court issued a short, unanimous decision in March 1998 finding the HMT unconstitutional as applied to exports. The decision states that the HMT is a tax, not a user fee, because the ad valorem tax is not a fair approximation of services, facilities or benefits furnished to the exporter.

Customs fees and hours of service have proven to be a barrier to optimizing the use of the GLMTS. The Canadian Customs has limited the hours that they would clear vessels on cross border trade. US Customs charge overtime and travel expenses to clear vessels. Truck and rail operators are able to have 24 hours service with no recovery charges. The agencies in charge of protecting borders need to be able to fulfill their missions and still ensure that the GLMTS operates at maximum efficiency.

There are exemptions to the HMT including maritime trade between the US mainland and Hawaii, Alaska, Guam, and Puerto Rico. The impact of the HMT on US-Canada trade on the Great Lakes is severe. The tax impacts NAFTA short sea shipping service to a much higher degree than ocean traffic for several reasons. A vessel that carries multiple cargoes such as the Detroit Windsor Truck ferry is unable to attract additional business such as UPS trucks because each shipper in the truck will have to pay the tax creating a paperwork issue on less than truckload cargoes (9). A cargo shipped on a trailer shipped on a RORO vessel with a \$500,000 value shipped from a Canadian port to a US port will have to pay \$625 US in tax. The same trailer can be transported by a truck with no tax paid. Because there is not limit on the number of voyages that are taxed, the frequency of service of a short sea shipping vessel means taxes collected from the vessel will far exceed the cost harbor maintenance incurred by that vessel.

Cabotage Laws

Cabotage laws restrict entry into domestic transportation markets by other nations. While maritime cabotage laws are the oldest, they are not unique to the transportation industry. The US does not allow foreign flag airlines to operate on domestic routes such as Chicago to Buffalo and there are cabotage restrictions on trucking for drivers, ownership, and routes. However the restrictions imposed by maritime cabotage laws are the most arduous of all the modes of transportation.

A vessel that carries freight from one Great Lakes U.S. port to another U.S. port without stopping in Canada must fulfill the requirements of the 1920 Jones Act authored by Senator Wesley R. Jones. A vessel that carries passengers must meet the requirements of the U.S. 1896 Passenger Vessel Services Act. Both acts require that the vessel be built in the U.S., that U.S. citizens own a majority of its stock, and that it is crewed by U.S. citizens. In the global market place these constraints have placed American Flag vessels at a competitive disadvantage. The costs of capital, crews, and taxation has resulted

in a U.S. shipbuilding base that produces very few large vessels and a merchant marine that carries less than 3% (10) of its imports and exports.

The relatively isolated location of the Great Lakes and the nature of the cargoes carried in interlake trade have allowed the existence of a relatively robust U.S. flag bulk cargo fleet. However, the Great Lakes shipbuilding industry has not built a new vessel for the Great Lakes in two decades. The building boom of the 1970s was driven not only by innovations in shipbuilding techniques that resulted in the 1000-foot (305 meter) length over all lake vessels, but was also aided by government subsidies in the form of Title XI ship financing and tax credits (11). Considering the current high cost of shipbuilding in U.S. shipyards, the prospect of a new U.S. vessel built is problematic at best and then only with government subsidies. The Jones Act as currently applied stifles the ability of ship owners to start new operations, stifles entrepreneurial endeavors, and severely limits the importation of technological advances in shipbuilding.

Canadian flag operators face similar economic constraints. The Coasting Trade Act of 1992 regulates vessels that operate between two contiguous Canadian ports. The Coasting Trade Act allows only Canadian flag vessels crewed with Canadian citizens to carry freight or passengers between two contiguous Canadian ports. One critical difference from U.S. acts is that the Canadian Coasting Trade Act allows the purchase of vessels built foreign to be flagged as Canadian vessels provided permission is obtained, they meet Canadian safety regulations, and all applicable duties have been paid (12)..

The primary difference between the marine cabotage laws and those applying to other modes is the marine operators restrictions on vessel building and purchasing. The necessity to maintain a shipbuilding/repair industry is not in question any more than a trucking or aircraft industry. However the building requirement in the marine laws have inhibited technological advancement in merchant shipbuilding and have raised the cost of ships to the point that the purchase price is a barrier to entry in any new markets that could be developed on the GLMTS. The US Government has recognized this fact and has subsidized shipbuilding however this fix has not resulted in a healthy merchant shipbuilding base especially in the GLMTS. The expansion of the GLMTS requires a shipbuilding/repair base as well as cost effective ships and this issue must be addressed or there can be no meaningful use of vessels for domestic trade on the GLMTS. Business models used by other modes of transportation where a significant portion of the vehicle or plane are made in other countries, the modular parts shipped to the US then assembled at US locations should be explored.

Pilotage Issues

There is the possibility to use a foreign flag vessel on some intralake route, as the vessel would be engaged in international trade. However one of the

requirements that would be imposed on a foreign flag vessel on those routes is that the maritime laws of both nations would require that pilots be employed. By International agreement between the United States and Canada, the waters of the Great Lakes and the St. Lawrence River have been divided into designated and undesignated waters for pilotage purposes. In designated waters, registered vessels of the United States and foreign vessels are required to have in their service a United States or Canadian registered pilot. In undesignated waters, registered vessels of the United States and foreign vessels are required to have in their service a United States or Canadian registered pilot or other officer qualified for Great Lakes undesignated waters. The US pilots operate under the direction of the US Coast Guard (13) The Great Lakes Pilotage Authority Canada manages the Pilotage system for all waters in the Province of Quebec south of the northern entrance to St. Lambert Lock and all Canadian waters in and around the provinces of Ontario and Manitoba (14). Pilotage in the international waters within the boundaries is shared under a memorandum of arrangements between Canada and the United States (15).. The cost of the pilots is several hundred dollars per day.

There is a compelling need to protect lives and the environment by using well trained certified navigation officers who have the required knowledge of the waterways. Pilotage service will continue to be needed for vessels entering from the sea. Several studies have been undertaken on the Great Lakes Pilotage system and the all conclude that there is room for improvement. An optimized pilotage system on the GLMTS would provide high quality pilots to vessels at a reasonable rate, have minimal, if any, impact on vessel schedules or routes, and minimize overhead costs not directly related to pilotage. At present, each of the districts operates as an independent business owned and operated by the pilots who work within the boundaries of these districts. The GL MTS might be better-served by a single pilot organization that seamlessly coordinates vessel movements through the entire seaway (16).

Ballast Water and Air Pollution Issues

Environmental and economic threats posed by non-indigenous species to the Great Lakes, such as zebra mussels, the round goby, and European Ruffe, are well documented. Ballast water has been the major route for the introduction of many aquatic nuisance species into the Great Lakes, including the zebra mussel. The problem of ballast water transport of non-indigenous species is not unique to the Great Lakes. On the East Coast, ships have introduced the Japanese Shore Crab; in the Gulf, the Brown Mussel; on the West Coast, the Chinese Mitten Crab along with numerous other species. Since not much can be done to control the invaders already established in the Great Lakes, policymakers are focusing attention on how to prevent further infestation.

Current U.S. regulations concerning ballast waters were brought about by the passage of the Nonindigenous Aquatic Nuisance Species Prevention and

Control Act of 1990. The US Ballast Water Management Regulations are enforced by the U.S. Coast Guard Marine Safety Office in Buffalo, New York. Enforcement efforts are primarily focused through USCG Marine Safety Detachment in Massena, New York, due to its location at the beginning of the U.S. waters of the St. Lawrence River (17).

The State of Michigan in 2005 passed a ballast law that further restricts how oceangoing vessels can operate on the Great Lakes (18). This state may spur other state laws. A fragmented and unilateral approach to transportation regulation has never been successful. Studies to address the ballast water issue are underway and should be strongly supported at all levels. This is a world wide problem and solutions should be sought wherever they can be found.

A number of studies have been done on the environmental benefits of marine transportation (19). Specific studies on the GLMTS provide clear evidence that the environmental benefits of marine transportation on the GLMTS are significant (20). The introduction of exotic species by ballast water is an issue just as the movement of wood pests by pallets on trucks or trains are and ballast water must be addressed.

In 2006 the EPA is starting the process of examining the levels of air pollutions from vessels. This follows from studies that have been done on air pollution from vessels calling at the US West Coast. The impact of the operations of Great Lakes vessels is unknown at this time. The University of Minnesota-Duluth, sponsored through the Great Lakes Maritime Research Institute, is studying the use of bio-diesel fuels on Great Lakes merchant ships to reduce air pollution and provide a domestic fuel source for the vessels auxiliary engines.

Gentrification of the Waterfront

Increased use of the GLMTS will require increased investment in plant and equipment at the marine cargo terminal. The marine cargo terminals are in an escalating struggle with commercial developers who want to acquire waterfront property for non-maritime uses. There are numerous zoning codes and ordinances at the state and local level that may present barriers to expansion. In some instances state and local laws favor maritime trade. One interesting note is that Wisconsin's state constitution prohibits the use of filled land sites (land created from prior waterways) for any purposes except public recreation or maritime commerce. This effectively put off limit large tracts of harbor front created from dredge or other fill material from having non-maritime commercial development.

Planning at state regional and local levels need to consider the long term impact of removing the possibility of waterfront being used for maritime commercial purposes. Once the waterfront including rail and truck corridors is

developed for housing or other non-freight uses, the possibility of returning at a future date it to maritime commerce are remote.

New Opportunities to Optimize the GLMTS

Hub and Spoke System

Except for a limited number of ferries, scheduled marine service has not existed on the GLMTS since the 1960s. Vessels have sought out freight and carried it from origin to destination. With the advent of intermodal systems and supply-chain management there is an opportunity to add a new dimension in maritime service on the GLMTS. The establishment of liner service that carries RORO or LOLO traffic similar to the models used in northern Europe and the Mediterranean has potential in the GLMTS. The majority of Great Lakes vessels currently seek long term chartered cargoes (21). A new liner service would have the vessels carry trucks with trailers, trailers and or containers. The trucking industry seeks out the shippers and the marine carrier is a link in the supply chain for the trucker moving the shipper's cargo. A timely cost effective scheduled service tied to hubs would, to a degree, provide the trucker with relief from hours of service issues, fuel costs, maintenance costs and congestion. In order for such a service to be successful several parameters have to be met: reliability, minimal cargo damage, low cost of capital for the vessel, low vessel operating cost, routes that bypass congestion nodes and easy access to interstate or other high speed road systems from the ports. Studies on schedule services that could carry freight often recommend that passengers be included as an additional revenue stream (22).

Dedicated Freight Corridors

One of the tremendous advantages of the GLMTS is its ability to transport heavy cargos. The different state and federal road weight limits create constraints to the efficient and economical movement of paper, wood, steel and other dense products. The creation of freight corridors that connect cluster centers to ports on highways engineered for the load would allow heavyweight trucks to connect to RORO type vessels. The freight can then be moved to another port with another freight corridor connecting that destination port with distribution centers or another production cluster. These corridors would take heavy freight off the highway system lowering pavement impact as well as freight costs

New Asian Gateway

Construction has started on the Prince Rupert, British Columbia container terminal. The \$127 million investment should have an operational terminal by 2007. The sailing time from Hong Kong, China to Prince Rupert terminal is 36 hours closer than sailing to Long Beach and 20 hours closer than sailing to Vancouver, BC. The rail transit from Prince Rupert to Chicago is 22 hours closer

than a train from Vancouver, BC (23). The new terminal has the potential to rapidly grow because of its, lack of congestion, shorter route and elimination of the US Harbor Maintenance Tax on the imported cargoes. The CN rail route passes through Duluth/Superior creating the potential for GLMTS link.

The population base of Duluth Superior alone is not sufficient to warrant the establishment of an intermodal terminal (24). However, draying cargo from the Duluth/Superior to the Minneapolis St. Paul Metropolitan region is approximately 700 miles closer and 21 hours faster than the Prince Rupert intermodal train going down south to CN's Chicago intermodal terminal then drayed back north on I-90/94 to the Twin Cities. The Metropolitan Statistical Area of the Twin Cities and surrounding region represent a market of 4.3 million people. An intermodal terminal in Duluth/Superior with a direct route to Asia would present an opportunity for containers and containerizable cargo to be moved by water from the lower lakes to the head of the lakes. There may be the critical mass of cargo to establish a cost effective GLMTS hub for RORO and container trade. Similar intermodal marine links may exist in Toledo or Chicago.

New Vessel Designs

A joint venture between privately held companies Van Enkevort Tug and Barge (VET&B) and K&K Warehousing is investing in a new shipbuilding and repair facility will be located at the Erie-Western Pennsylvania Port Authority-owned shipyard. The project was a united effort between PennPORTS, a division within the Department of Community and Economic Development, and the Erie Port Authority. VET&B has committed to build a new 780-foot self-unloading laker (barge) and four 135-foot icebreaker certified tugs, which are scheduled to go into operation in 2008. The company has also committed to converting at least four additional 780 foot-long straight deckers and self-unloading barges in the next five years. The use of Integrated Tug Barge (ITB) systems will increase in the years to come in order to take advantage of crew size reductions and available Jones Act hulls. A 2005 survey of Great Lakes ship owners by the US Maritime Administration found that those ship owners would prefer ITB for future ships (25).

The school of Naval Architecture at the University of Michigan is researching a ballast free design that uses a ballast flow through design. European shipyards are building "green ships" that are RO/ROs designed for ice service with ballast systems that have electrical shore connections, "Optimar" systems that sanitize ballast water and a ballast system that has no sediment. (26) These vessels can carry 100 trailers while operating with a crew of 12 in the highly congested Baltic & North Sea waters and these vessels are able to fit through the St. Lawrence Seaway locks. Additional vessels with out engine rooms and designed to go from lake to river to ocean are on the drawing boards.

Information Systems Applications

The growth in information systems applications continues to improve efficiencies in GLMTS. Success of this approach requires inexpensive, reliable, paperless freight handling, so that all aspects of goods transport can be arranged, tracked, and managed electronically. There are still many breaks in the chain of electronic data, including restrictions on the use of automated data systems in many port facilities and continuing governmental requirements for some paper documents including redundant overlapping forms such as multiple crew lists. Elimination of these breaks and extraneous paperwork will allow freight to be handled more efficiently, reliably, and quickly, creating a more efficient supply chain.

A reoccurring issue in GLMTS monitoring is the dispersed and sometimes difficult to access data on the system. A single location for storage, access and retrieval that would provide accurate, un-biased data is needed.

A Seamless GLMTS

It is now possible to have seamless, paperless tracking of all freight movements and transactions between parties. It is also possible to automate equipment assignments in the terminal and to optimize terminal operations in the face of complex, competing demands. Increased use of the GLMTS will result in increased rail and road traffic in the ports. In an effort to manage and reduce road truck congestion, many ports worldwide have invested in port traffic coordination systems. Coordination of transportation planning through state and regional planning commissions so that freight traffic flows in and out of the ports with a minimum of implementation could further reduce the environmental impacts of port operations.

The Future of the GLMTS

In order to handle the projected increased foreign and domestic trade the GLMTS partners must provide for and maintain harbors, adopt new terminal technologies, remove non-physical operational barriers, and implement state of the art information systems. A GLMTS that is not utilized to its full potential or in decline will result in present cargo being shifted from the waterways and future freight moving to land based modes, creating additional strain on the nation's rail and highway system and further adding to the deterioration of infrastructure. A GLMTS should be developed that is based on the principals of sustainable development and continues to benefit the environment as well as the economy of the Midwest. The needed infrastructure and technological investments will be achievable with a strong and committed partnership of the private sector, federal, state, provincial and local governments.

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Encouraging Development of Intermodal Freight Facilities

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Introduction

According to AASHTO, trucks and the highway system carry 78 percent of domestic freight traffic, the rail system carries 16 percent, and the water-borne freight system carries 6 percent of shipments. The U.S. economy is projected to continue growing, increasing freight tonnage by 57 percent by 2020. (1) Given the current highway congestion problem and the role of trucks in causing this congestion, developing more efficient ways of shipping freight is essential. Improving intermodal freight facilities can help achieve this goal.

“Intermodal facilities are sites where freight is conveyed from one mode of freight transportation to another. Examples include water to rail or highway movements, and truck/rail interfaces.” Intermodal freight operations involve highway, rail, water, and air and create opportunities to take advantage of the efficiencies and technological advances that can allow the different modes to work in tandem. (2) The attention given to intermodalism since the passage of the Intermodal Surface Transportation Efficiency Act (ISTEA) in 1991 has grown. Federal, state, and private sector initiatives have expanded the availability of intermodal freight terminals. Under the most recent federal transportation bill, SAFETEA-LU, research and development of intermodal facilities continues to be encouraged.

In recent years, increasing volumes of freight, growing passenger travel, and an increasing emphasis on security have strained the efficiency of freight transportation in many locations, particularly at gateways and along major transportation corridors. For example, between 1990 and 2003, U.S. international trade with Canada and Mexico, our top two trading partners, rose by approximately 91 percent, due in part to the creation of North American Free Trade Agreement (NAFTA) in 1994 (3).

In the face of increasing demands on the existing transportation system intermodal freight transport can accomplish several important things in states struggling to manage highway capacity issues. In particular, the strategic use of rail transport along corridors where freight shipment on highways has become congested can take pressure off the highway system. (1) In addition, environmental benefits can accrue by diminishing the perceived need to expand the highway system through better-utilizing existing transportation infrastructure. This paper will explore intermodal shipping options, including the capacity-building potential of intermodal freight, as well as environmental, policy, and technology considerations.

Current Role of Intermodal Freight Shipping

Intermodal shipping is gaining favor as a way to more effectively use existing infrastructure. Utilizing available modes of transportation not only eases highway congestion, but better takes advantage of available transportation assets, such as rail, air, and water shipping. Table 1 highlights the types of freight generally shipped on the different modes and helps identify their strengths. In order to use these modes optimally, existing infrastructure needs to be maintained, and in some cases, expanded. (1)

Table 1: Commodity Types per Transportation Mode

Mode	Commodity Types
Air	Perishables, High Value
Highway	Perishables, High Value, Trailer/Container, Dry Bulk, Liquid Bulk, HazMat, Other
Rail	Trailer/Container, Dry Bulk, Liquid Bulk, HazMat, Other
Maritime	IM Container, Dry Bulk, Liquid Bulk, Other
Inland Waterway	Dry Bulk, Liquid Bulk

Source: FHWA Office of Freight Management and Operations. January 2001. Review of Environmental Factors Affecting Intermodal Freight Transportation Facility Development and Expansion.

Terminals are the hub of activity in an intermodal freight system. They are the locations where freight is transferred from one mode of transport, say highway, to another mode, such as rail or water. Activity at the terminal is intensive and key to achieving the desired level of service and time efficiencies. It is important to remain aware of maintenance and infrastructure issues at these terminals. Basic considerations such as pavement condition ratings and wear and tear on equipment used to transfer loads cannot be overlooked without sacrificing quality of service.



Figure 1: Containers in Shipping Yard

Currently, since transfer costs are typically fixed costs, the price makes using intermodal freight prohibitive for all but longer hauls. The opportunities to expand the viability of intermodal freight shipping, particularly truck/rail, center on improving the efficiency of and the reduction of transfer costs between modes. As noted in the Railroads and Freight in the Future (4), the expense of intermodal freight is largely borne in the transfer costs. Efficiencies in

transferring could come from technology improvements, public investment in terminals and public facilitation of equipment standards. Standardizing equipment could bring notable improvements in time costs associates with

transfers. (4) Reducing these costs might make intermodal shipping attractive for medium length as well as long distance hauls.

The impact of containerization on easing the transfer between modes has provided efficiency benefits at the terminal. Transferring freight loaded in containers is far less labor intensive than the traditional method of packing in pallets. Additionally containers hold more and provide better protection for the product being shipped.

Table 2: Breakdown of Freight Shipments with One or Both Trip-Ends in the Study Area

	Freight Tons %			Freight Value %			Freight Ton-Mile %		
	IS	Reg	Ext	IS	Reg	Ext	IS	Reg	Ext
<i>Total</i>	<i>70.3</i>	<i>13.5</i>	<i>16.2</i>	<i>39.6</i>	<i>23.4</i>	<i>36.9</i>	<i>15.0</i>	<i>17.0</i>	<i>68.0</i>
Truck	64.3	10.4	9.2	38.4	21.9	30.3	12.2	11.9	29.5
Rail	5.1	2.4	4.4	1.0	1.1	4.0	2.2	3.9	22.1
Truck and Rail	0.0	0.0	0.2	0.0	0.0	1.4	0.0	0.0	2.1
Air	0.0	0.0	0.0	0.1	0.4	0.7	0.0	0.0	0.1
Water	0.9	0.7	2.4	0.1	0.0	0.5	0.6	1.2	14.2

IS=Intrastate; Reg=Regional; Ext=External; Total does not include all modes, only the five major modes specified in the table.

Within the study area, intermodal transport, mainly truck and rail combination, is used primarily for long-distance shipping. Table 2 shows the distribution of freight shipments within the study area by mode. These different modes generally serve specific markets. For instance, much of the freight moved by water is low-value bulk commodities such as coal or gravel between the Upper Midwest and Louisiana ports. Intermodal does compete with truck and air transport for certain high-value goods, such as electronics, automobile parts, and machinery (5).

The Upper Midwest is well positioned as a major player in the shipping of intermodal freight. Five out of the ten largest freight-rail traffic generators in the US are located in the study area, which aids in the shipment of high value goods using intermodal (truck/rail) facilities. California is the most important destination for intermodal freight shipments originating in the Upper Midwest (5).

Benefits of Intermodal Freight Shipping



Figure 2: Water Borne Freight Shipping

Intermodal shipping helps relieve the burden large volumes of heavy trucks place on our highway system. By shifting this burden environmental benefits are realized, as has been noted. The public further benefits from reduction in highway congestion and decreased highway maintenance costs (1). By using more than one mode of transportation, many

opportunities become available for shippers and private stakeholders. With the help of new and increased technology, containers can be tracked throughout their

routes and can indicate shipment problems (6). This significant increase in security promotes the intermodal shipping industry and ensures businesses that their goods will be shipped without problems or delays.

Network efficiency is another benefit of intermodal shipping. To increase efficiency, there are many strategies that can be applied or are already in place. Enhancing schedules and routing of freight can create a significant decrease in freight vehicle mileage and increase load factors that will save time and money (6.) With the continuing desire and need to find ways to ship goods faster, time efficiency is extremely important to companies shipping goods and to the shippers. Network efficiency makes a difference to not only the company selling the goods, but to the consumer, who is looking for products to be at their fingertips at all times.

Identifying successful ways to reduce congestion is encouraged because congestion is a concern to freight shippers. With the help of intermodalism, larger shipments that need to travel longer distances can be moved from trucks to rail or water thereby reducing congestion on roadways. Intermodal shipping might help improve community quality of life if fewer trucks are on the roadways. Trucks create large amounts of noise and air pollution, which makes neighborhoods unpleasant to live in (7). There could be a cost savings as well. For shipments with more flexible delivery dates or are not as time sensitive, rail or water shipment is a viable option. Cost savings accrue because it is cheaper to ship by rail or water than by truck.

Intermodalism can encourage shippers to use the mode with the lowest cost. Usually these modes are rail and water. They are more energy efficient, which promotes a healthier environment. Intermodalism is geared to obtain the optimum yield from the country's transportation resources (3). Businesses are able to ship goods at lower costs because of the efficiency of the system. If a product can be shipped economically and within the desired time frame, then

businesses are able to compete in the global market, which expands the country's opportunities for economic growth.

Intermodal Technology

Intermodal freight is constantly being moved within the country and internationally. Tracking of a shipment becomes difficult, because a container can transfer through shipping points several times before it reaches its destination. Asset tracking can enhance the surveillance and security of the container. This tool coordinates telecommunications technologies, sensors, and simple bar codes and labels. These applications ensure shipments are moved from start to end safely and securely. For example, a container may be shipped from a plant on a flatbed truck and then loaded onto a rail car, and then back onto a truck for the final leg of its journey. The tracking device on the container would allow shippers to follow the progress of a shipment and ensure there was no tampering of the shipment. These devices are very important for material handling and anti-theft, which protects the public from threats such as shipments of contraband or potential terrorist weaponry (6).

Security of a shipment is another problem. To reduce the possibility of the cargo inside the containers being tampered with during shipment, electronic transponders are used as tags on the container doors. These track the container's route and ensure the security of the cargo. For example, E-Seals are disposable Radio Frequency Identification (RFID) transponders. It transmits the container's ID number to a reader within an inspection station. If the container has been opened or tampered with, a message will appear on the reader. When a container has left the country, this information is posted on the internet for tracking purposes. This application can increase efficiency and security at border crossings. (6) These technologies improve security of freight and help promote intermodal shipping.

As US freight activity and use of intermodal shipping grows, there is a need to maintain shipping integrity and forecast traffic for planning purposes. US DOT is developing planning models to aid in stimulating activity in the intermodal-shipping industry. These models are important to the government and to shippers and can be useful to the Upper Midwest region when planning

intermodal facilities. These models can simulate border crossings. A program called Border Wizard is a model that identifies and tests possible cross-border movements of vehicles and pedestrians. It was originally developed by the General Services Administration, US Customs, and other federal inspection agencies to identify infrastructure and operational needs at the borders. Today, it is deployed at 57 US ports of entry. The US DOT is considering using Border Wizard as a transportation-planning tool. Internationally, Canada is installing the

system at the Detroit-Windsor crossing, and Mexico is interested in using the model (3).

Challenges with Intermodalism

Intermodalism provides attractive options to shippers, but it is not without concerns that must be addressed. These challenges include congestion and information sharing.

- *Congestion* is at the top of the list. Although shifting to intermodal shipping strategies can help ease highway congestion, this problem remains a concern for intermodal freight. In particular, challenges to the capacity of freight-rail carriers must be dealt with (1). Freight rail and highway freight currently operate at or near capacity. Current estimates show that by 2020 our highways will carry a 62 percent increase in freight traffic and rail will carry a 44 percent increase in traffic (1). If freight rail continues to grow as predicted, and if rail capacity does not increase, congestion on this mode will become a significant problem. This in turn will overburden the highway system. Given these estimates, if nothing is done to manage highway congestion and increase freight-rail capacity there will be major challenges to the functionality of our shipping infrastructure.

The results of this scenario are unappealing. Congestion lessens the reliability and performance of shippers. It also has a domino affect, because it then affects businesses, which in turn affects the consumer getting the goods that they need and want. The US economy runs on a tight schedule to design, make, ship, and sell goods and having on-time shipments helps keep the economy going (3).

- *Information sharing* among shippers is difficult to accomplish effectively. There is a gap in the system of sharing information. This gap occurs between different freight modes as well as within each mode. The problem is particularly acute because the private industries that provide freight hauling services are adverse to sharing information with competitors.

This lack of coordination creates inefficiencies and concerns about security and safety. Even with today's new technology, such as asset tracking, the overall system is hard to implement everywhere because there is resistance to change. Additionally, there is not one standard information system that has been implemented. Different states and even regions use different applications. Additionally, private firms often use systems that are incompatible with each other. This ongoing problem works against establishing a national system and in the end benefits very few shippers. Upper Midwest freight stakeholders should work to create a

unified information-sharing system to facilitate improvements to the regional intermodal shipping system.

These barriers appear large, but two factors are already in motion to overcome them:

- The growing role of third party logistics providers tends to create a level playing field for shippers. Third party providers look for the least cost method of meeting their customer's shipping needs. If intermodal meets the cost and service requirements, it will be used.
- Driver shortages and highway congestion are leading many large trucking companies to form alliances with rail companies to use trucks or containers on rail for longer haul trips. In fact, many have argued that national trucking companies have been the biggest boosters of truck-rail intermodal.

While these factors are positive, it is in the interest of the region to adopt policies that will move intermodalism to the forefront of the shipping industry. This should be done to achieve benefits in efficiency, reduction of environmental impacts, and congestion management that can result from this type of shipping.

Available Programs

A variety of programs exist that facilitate the development of an intermodal freight shipping network. The FHWA has a department dedicated to studying and encouraging the development of intermodal freight infrastructure country-wide. The FHWA has also done significant research into the possibilities of expanding the country's capabilities in this type of shipping, particularly in the international arena (see Figure 1). Brief descriptions of the primary programs currently in place to help develop intermodal freight infrastructure are presented below. Most of the programs are included in the SAFETEA-LU legislation.

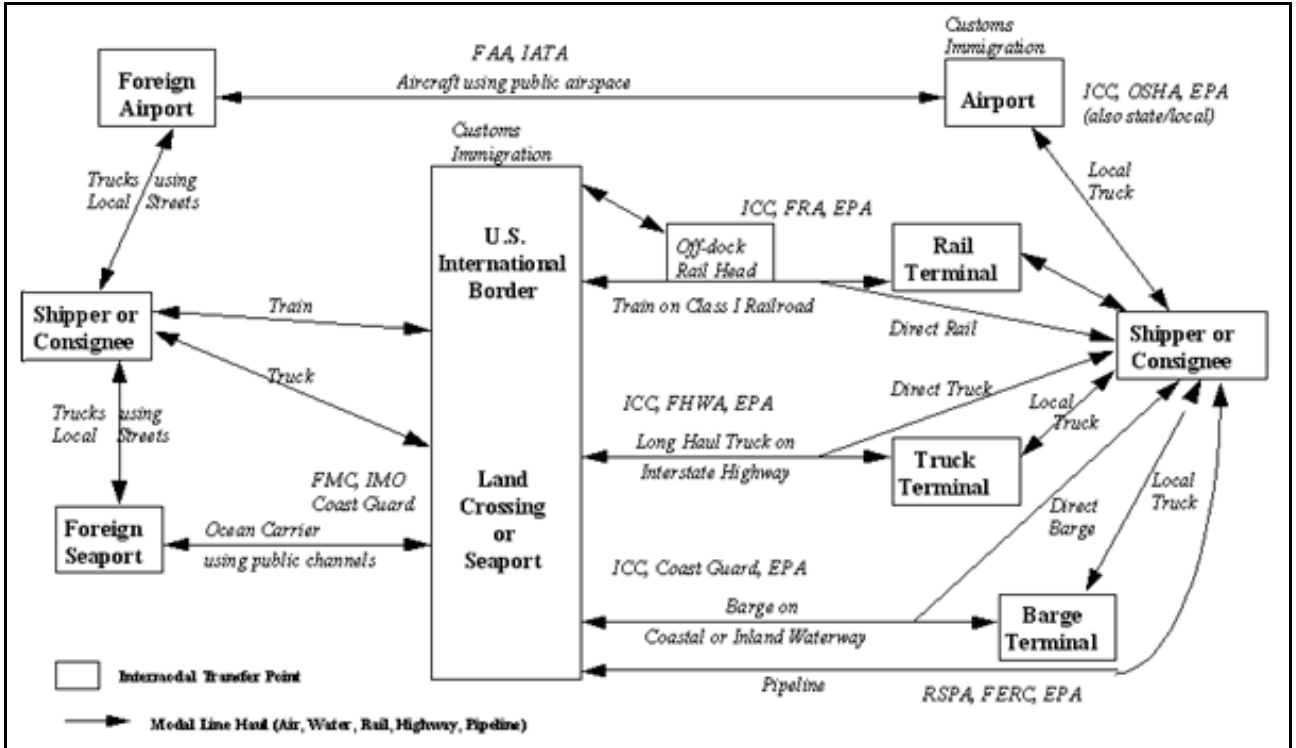


Figure 3: An Overview of the International Freight Transportation System

Intermodal Freight Technology Program

This program is independent of the SAFETEA-LU legislation and represents an ongoing federal effort to promote the development of an efficient and economical intermodal freight network. The Upper Midwest Freight stakeholders can take advantage of this research when working to improve its regional intermodal freight system.

According to the FHWA (8), The Office of Freight Management and Operations promotes the deployment of technology and the adoption of best practices to facilitate the smooth flow of goods on the Nation's transportation system and across our borders. The Intermodal Freight Technology program co-operational tests of Intelligent Transportation Systems (ITS) technologies, supports the development of tools to evaluate infrastructure and operational needs at border crossings, and works with our partners to develop standards for exchanging electronic freight data.

These initiatives provide opportunities for the Upper Midwest states to further develop their intermodal freight shipping capabilities, thereby capitalizing on the existing network of highway, rail, waterway, and air transportation in place in the region. SAFETEA-LU programs designed to improve intermodal connectivity include (9):

- *The Freight Intermodal Distribution Pilot Program (§1306)* provides grants to facilitate intermodal freight transportation initiatives at the state and local level to relieve congestion and improve safety, and to provide capital funding to address infrastructure and freight distribution needs at inland ports and intermodal freight facilities. The Act names six projects, funded at \$5 million each. For each year through 2009, each of the six designated projects is to receive 20% of its funding (\$1 million each) from this program. Projects for this funding cycle are located in the south or on the west coast. The fact that there are no projects scheduled for the Upper Midwest is a missed opportunity. Freight stakeholders in the Upper Midwest need to seriously consider taking advantage of this opportunity in the next round of funding decisions in order to increase the capacity and efficiency of intermodal freight opportunities in the region.
- *Transportation Infrastructure Finance and Innovation Act (TIFIA) (§1601)*- The TIFIA program provides Federal credit assistance to nationally or regionally significant surface transportation projects, including highway, transit and rail.
- *National Highway System [§6006]*: The National Highway System (NHS) also provides support for the development and maintenance of intermodal freight facilities, particularly for highways that provide motor vehicle access between the NHS and the intermodal facilities. The system includes the interstate system and significant rural and urban roads serving major population centers, international border crossings, highways that provide motor vehicle access between the NHS and major intermodal transportation facilities, and major travel destinations.

The Future for Intermodalism

Intermodalism will grow and change as FHWA continues to support improving global connectivity and freight security. FHWA plans to oversee some steps to bring intermodalism into the future. Intelligent Technology Systems will continue to be evaluated by cost and benefit. Research, testing, and evaluation of new technology will be explored in the movement of goods. Further work with federal agencies will advance freight mobility and security. Additionally, working cooperatively with international partners will help develop a standard for moving freight. (3)

Overall, intermodalism needs to become faster, better, smarter, and more profitable. It is and will be a crucial factor in the future of the supply chain. With the broadening of intermodalism, there will be a need for education and training for those who are new and old to the idea of integrating shipping modes. Information and communication systems will be needed to execute intermodalism

and its technology. Consumers will begin to demand a better shipping system as the industry becomes more efficient, meaning all modes of shipment will need to come to an understanding that intermodalism is the most efficient and profitable form of transportation to meet the US and world's needs (10).

The Upper Midwest region is uniquely positioned to take advantage of the benefits of intermodality and freight shipping. The region's location at the country's crossroads, location of significant sections of the interstate highway system, possession of a functioning freight rail system, ability to ship via inland waterways or the Great Lakes, and a solid airport network positions the states of the Upper Midwest to take full advantage of intermodal freight possibilities. These possibilities must be worked on using a regional perspective to garner the greatest benefit from any intermodal system that is put in place.

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Investing in Non-Revenue Modes

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Historically, the states of the US and the Federal government have been reluctant to invest in transportation modes that do not produce a revenue stream or in facilities held in the private sector. The result of this tradition in freight has been that the highway mode--trucking--has become the fallback mode. When rail companies or maritime fleets cannot or chose not to move a product, it will be moved by truck, with the public sector holding responsibility for providing and maintaining the facilities. Although it is difficult to prove, this tradition has probably also resulted in more costly and environmentally damaging solutions to some transportation problems than might have been necessary, had funding constraints been less severe.

Exceptions

Some exceptions to this tradition do exist. For example, public transit facilities never generate a revenue stream adequate to meet their operating and capital costs, but public policy makers have agreed that continuing public transportation is critical for many areas of the nation. Public agencies subsidize those transit service providers so that key services are maintained.

Similarly, in the wake of the terrorist attacks of 9-11, the Congress determined that continuing services from the troubled air carriers was in the national interest. Rather than allowing massive bankruptcies, the airlines were provided public funding, primarily in the form of low cost loans, to ease them over the terrorist-caused disruptions. In this case, the justification was only partially related to service needs. The larger rationale was the impact of the national emergency that was disproportionately felt by the airlines.

AMTRAK is a continuing, if reluctant, exception. In the late 1960's and 1970's, as rail companies all moved out of the passenger business, the federal government established the national passenger rail service, subsidizing both operations and capital. Each renewal cycle, the system is on the funding bubble as Congress and the President argue about the continuation of the service. To date the service continues, albeit at funding levels that continue to degrade services. But the national interest in having passenger rail service is continually reaffirmed.

Another category of exceptions deals with the interface of public and private modes. Rail-highway crossings are the primary example of this category. Within federal programs and in most states, the public benefit in assuring safe crossings has been recognized. The public often installs crossing protection devices and shares the maintenance costs with the rail companies.

Economic Rationale for Investment

Rail crossings illustrate the usual economic justification for public participation in private or non-revenue modes: The public sector should share in costs in proportion to the public and non-public benefit. This concept was recently affirmed by the Government Accountability Office (GAO) in their review of the proposed expansion of the federal role in short sea shipping:

When public subsidization is being considered for freight infrastructure projects—which to a large degree would likely benefit the private sector—the appropriate scope of government involvement must be considered carefully. Apportioning the cost burden of freight projects among participants equitably is important not only to guard against the waste of limited public resources but also to enhance the efficiency of the transportation system by supporting only the most worthy projects. (GAO September, 2005)

In the case of rail crossings, standard benefit-cost analysis procedures can be used to define the relative benefits that will accrue to each sector, providing a basis for the allocation of costs. Items like crash avoidance and timesaving lend themselves to monetization. The process becomes more complex when the benefits considered are less direct, as is often the case with short sea shipping and other freight projects.

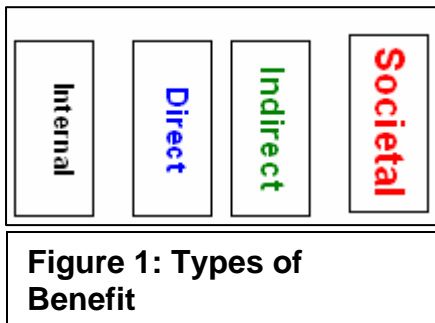


Figure 1 outlines the range of benefits that could be considered. At the core are those benefits that will be enjoyed internally by the agency or company funding the activity. In this case, we might think of rail capacity or operational improvements funded by the rail company from its own revenues. Or we could think of highway infrastructure funded by user fees or tolls. In both cases, a fairly direct

relationship exists between those who benefit from an investment and those who provide the funding for it.

Rail-highway crossings would fall into the next level, direct. In this case, an investment causes benefits for one or more groups. Since the benefits are direct, for example accident avoidance and timesaving, they can be easily monetized and allocated to the benefiting groups.

Indirect benefits take the issues to the next levels. Perhaps a rail-highway separation project connects two parts of a city that were previously separated for long periods by train movements. In this case, a very real benefit might be an enhancement in the dependability and speed of the emergency response system. While the benefit is real, it accrues to the entire community and cannot be readily attributed to one particular group or sector.

Societal benefits share many attributes of indirect, they cannot be attributed to specific sectors of society; their benefit is widely felt; and they cannot be as easily quantified as direct benefits. They are, however, different from indirect benefits as a matter of degree. For example, a transportation investment might tend to direct urban growth in a desired direction, having a positive impact on land use and the natural environment. Like the rail-highway separation discussed earlier, the benefits will be widely felt, but in this case they may also be felt over a long period of time, future generations may enjoy the natural spaces that are preserved. Allocating the benefits and the costs will be much more difficult. Another example that could fall into this category might be the introduction of a technology that significantly reduces the greenhouse gases emitted by the transportation sector. To increase the speed with which the impact of the technology is felt, the public sector might initiate a buy-back program to speed the turnover of the fleet, or it might subsidize the creation of a new fuel distribution system. In this case, the cost would be borne by the US government, while the benefits would literally be felt around the world and into future generations.

The preservation or enhancement of a transportation mode or service that is critical to a regional or national economy might also produce societal benefit. Consider the market-driven scenario in which freight rail and maritime services continue to be marginalized, serving increasingly narrow market niches. For the highway sector, one of two outcomes would be probable. The first is increased congestion, which will increase the cost of operations for industries, reducing their global competitiveness, ultimately degrading our quality of life. The second is the major construction of new or expanded highways, which may keep industries competitive, but which may also have a negative impact on land use and air quality, also degrading quality of life. Obviously, issues of quality of life can be very personal and value-laden, but not addressing them is, in effect, deciding on them. Something will happen. The only question will be if it is the result of deliberate policy choices made by our society or if it will be the result of thousands of decisions made by individuals and companies, each trying to maximize individual benefit without consideration of collective benefit.

To a large degree the issue for consideration is how broadly we define benefit, do we consider the societal issues or only the benefits that are more closely felt and more easily measured. A case can easily be made that the continued viability of freight rail and maritime freight for more than narrow niche markets can produce major benefits to society. They each move freight using less fuel than truck or air. They produce fewer green house gases. And they can have a beneficial impact on land use patterns, when compared to highway-based transport.

Private Ownership

The issue of private ownership, particularly of rail companies, does raise a number of issues that must be addressed specifically. Public dollars should not be used to enrich private firms. Moreover safeguards must be employed to ensure that the benefit expected is actually derived, or at least is not frustrated by operating decisions made by those same private companies. Finally, care must be taken to protect rail companies from a return to the fiscal peril they endured before regulation. All of these things can be accomplished.

Assistance agreements have to clearly spell out the expectations and responsibilities of both parties and the consequence of non-performance. Of equal importance, they must be built on a base of mutual objectives and mutual benefit. For example, the discussions of the past few years on the possible expansion of passenger rail, using existing freight corridors, have begun with the assumption that public investment in rail infrastructure would leave the freight rail companies in a better condition in so far as capacity is concerned than they are now. This mutual benefit approach has kept the private companies at the table. If public funding is ever made available, agreements will be reached that provide for public investment and use of private facilities.

In the highway realm, the cry of the past several years has been "public-private" partnerships. These partnerships all originate with the desire to bring private dollars into what are normally public facility projects. They take many forms. The variation that is most relevant for this discussion is public funding in the development of a privately operated and maintained and tolled facility. The need for this arrangement exists when a desired facility will probably not produce sufficient toll collections to be viable as a purely private venture. Public involvement may take several forms, but typically it involves the use of taxpayer subsidy of the construction cost or the extension of tax-exempt bonding authority to the concessionary. Both approaches are subsidies designed to make an otherwise unattractive project work. As suggested for the "non-revenue" modes, assistance agreements in this case must spell out the expectations, responsibilities and benefits to both parties. They must also be based on a premise of mutual benefit.

Funding Source

Whenever public investment in a new area of transportation is considered, the source of the funding must be evaluated. Typically the sources considered are General Fund Revenues (GPR) and Highway Trust Fund (HTF) monies. This can be a very divisive issue. It is also an increasingly important issue.

Transportation in the US is funded from a crazy-quilt variety of taxes and fees that are not sustainable in the long run. They are not sustainable, because, despite the number of permutations that exist among the states and at the

federal level, the workhorse of transportation funding is the motor fuel tax (MFT). Over the next decade we can expect increasing numbers of vehicles fueled by electricity, hybrids, compressed natural gas, fuel cells, hydrogen and other non-traditional fuels. As this happens, the historic link between use and payment, which the MFT has generally maintained, will be broken. This will reduce the acceptance of the MFT by the public. Moreover, as the available fuels grow in the marketplace, the revenue derived from the MFT will be increasingly inadequate to meet our transportation needs.

We will have to embrace new methods of funding transportation in the relatively near future. As new methods are developed, attention should be given to a wider range of modal applications than currently exist.

Conclusions

The decision to invest public money in a transportation project depends largely on the range of benefits expected from the project and the groups or individuals who will enjoy those benefits. In the case of non-highway freight modes a strong case can be made that significant benefits exist for our economy and our society.

If we chose to recognize those benefits and investment in what are often privately held modes, care must be taken to protect the public interest and ensure that expected benefits are found. This can be done with clear contractual agreements and mutually beneficial arrangements.

The issue of the appropriate source of public money—HTF or GPR—is controversial. It should be addressed over the next decade as new transportation funding methods are developed and implemented.

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Transportation and the Economy

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"It is not the wealth of a nation that builds roads, but the roads that build the wealth of a nation." -- President John Kennedy

President Kennedy's words could have referred to transportation more generally. Each great power in the history of civilization has had the benefit of efficient transport to support its economic growth. Rome had its roads to move its armies and its commerce. For three hundred years the wealth and strength of the British Empire depended upon the sea. In America, the early settlers had the rivers, and later canals, to move their produce to market. In the second half of the 19th century and the first half of the 20th century, railroads moved the product of the nation's growing industrial economy. In the second half of the 20th century, interstate highways continued the post-war boom.

The importance of transportation to economic wellbeing is the topic of this paper. It reviews some of the literature and the experiences of other countries to argue that continued and reasonable investment in transportation is essential to the continued economic health of the country.

Summary and Conclusions

The economy of the Upper Midwest is unique in that it is heavily reliant on manufacturing and agriculture. Both generate significant amounts of freight and are dependent upon efficient transportation systems to remain competitive in the global market. Particularly for manufacturing and agriculture, global competitiveness is critical. Competitors in agricultural production are not in other parts of the U.S.; they are in South America. Competitors in manufacturing are also not in other parts of the U.S.; they are in Asia.

Economists tell us that investing in transportation increases productivity, which enhances competitiveness and brings prosperity. A large number of close correlations between measures of economic health and transportation activity and productivity support this view. The return on an investment in transportation in the U.S is high. It was highest when the productivity gains were greatest because the stock of transportation assets was low. Even at its low point, transportation investment return outpaced private return to capital and interest rates.

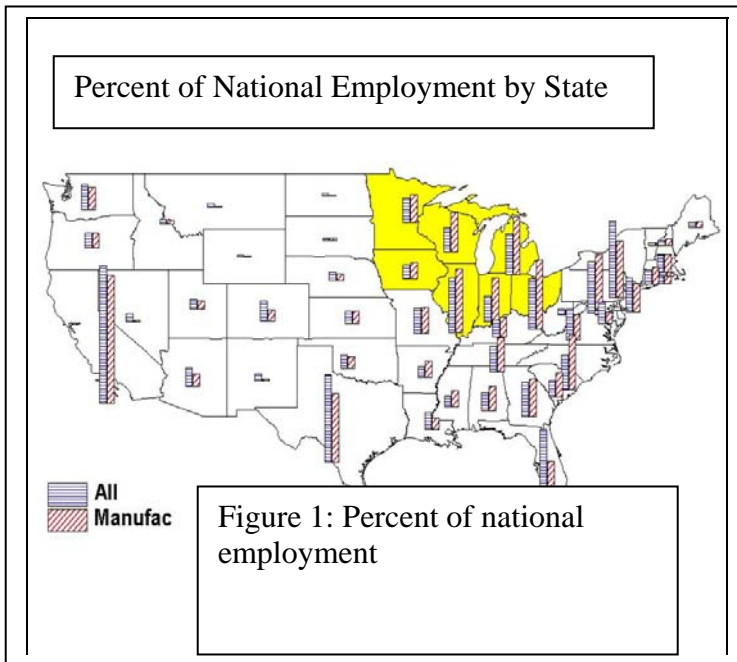
The actions of specific firms either individually or collectively also tell the story of the importance of transport. The reduction in inventory costs, which has saved the economy more than 4% of GDP over the past couple of decades, was made possible by two changes in logistics. The first is the movement in the manufacturing industry to just-in-time delivery systems. The second is the widespread adoption of "pull" logistic systems in retail distribution. Both require

reliable transportation systems.

Finally, our global competitors are making investments that will enhance their competitive position in the world market place. Brazil and Argentina have substantially closed the transportation cost gap in agricultural products. The European Union, India and China are each making huge investments in transportation. If the U.S. is to maintain its place as an economic super power, it will have to take steps to maintain its efficient transportation systems as the demands upon it grow.

Regional Issues

The Upper Midwest is unique in its economy in several respects. First of all, it is much more dependent on manufacturing than is the nation as a whole. Next it is very dependent on agriculture. Finally, it has a robust trade within the region and with Ontario.



Manufacturing is much more dependent on freight services than other economic activities. Goods must be brought to the place of manufacturing and finished product must be moved to wholesalers and retailers. Figure 1 illustrates the relative importance of manufacturing in the region in terms of percent of national employment. Each state in this region has a larger percent of the national manufacturing employment than it has of the total national employment.

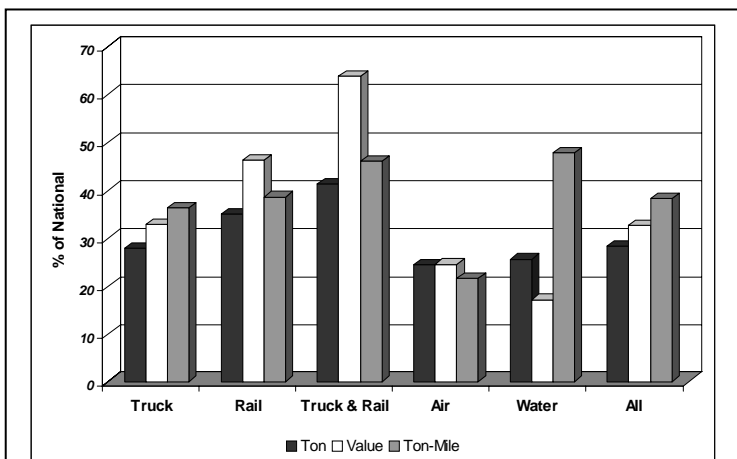
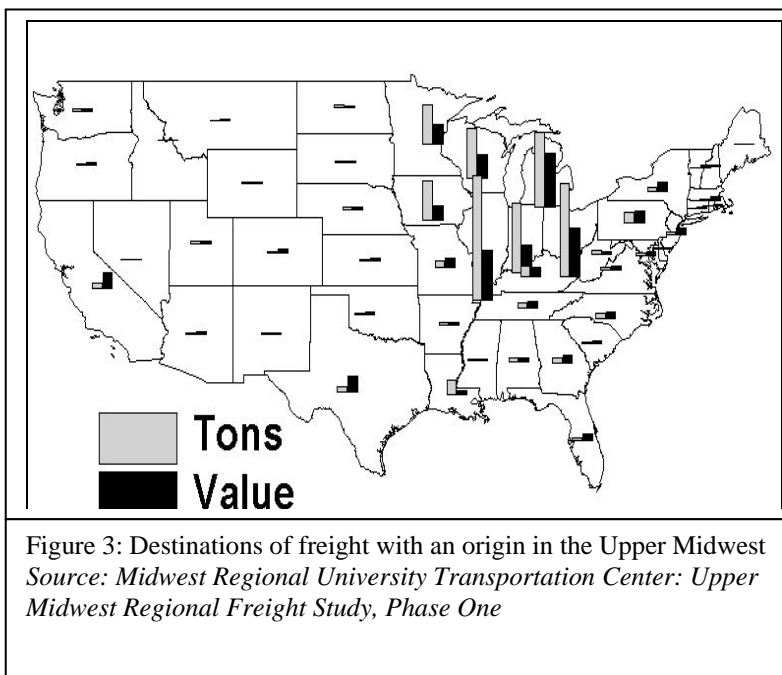


Figure 2: Percent of national freight with either origin or destination in the region

This dependence on manufacturing also helps to explain a greater than national average presence of freight in the region. Figure 2 illustrates the portion of the total national freight that has either an origin or a destination in the region. More than 40% of

the ton-miles of freight of the nation either start or stop in the seven states of the region.

Agriculture is another key part of the region's economy. All seven of the states are ranked in the top ten corn producing states. Five of the seven are ranked in the top ten soybean producers. Some of the states are among the top wheat, produce, cattle and hog producing states of the nation. Like manufacturing, agriculture requires sound transportation. In fact, agriculture-related products rank high on the list of leading goods moved in the region when measured both by tonnage and by value. The seasonal nature of most agricultural products adds to the complexity of freight movements in the region. Finding sufficient rolling stock, either trucks or rail cars, has been a challenge in some years as the grain crops are harvested.



Trade within the region is also very important. Figure 3 illustrates the destinations of freight with an origin in our region. The bulk of the freight that starts within the region stays within the region. The states of the region are their own best trading partners.

International trade is a significant and growing part of the trade in the region. Domestic trade ranges from more than 90% for some states to about 60% for Michigan.

Figure 4 and 5 illustrate domestic trade by tonnage and by value.

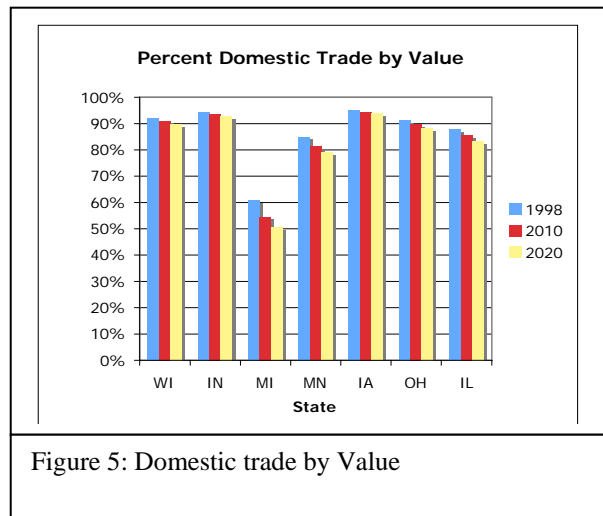
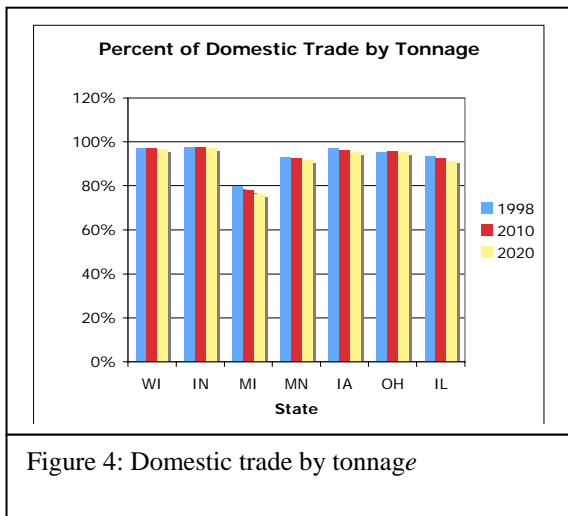


Figure 5 also illustrates a projected trend. According to the Freight Analysis Framework (FAF), domestic trade will comprise a shrinking proportion of the total value of trade for all states of the region by 2020.

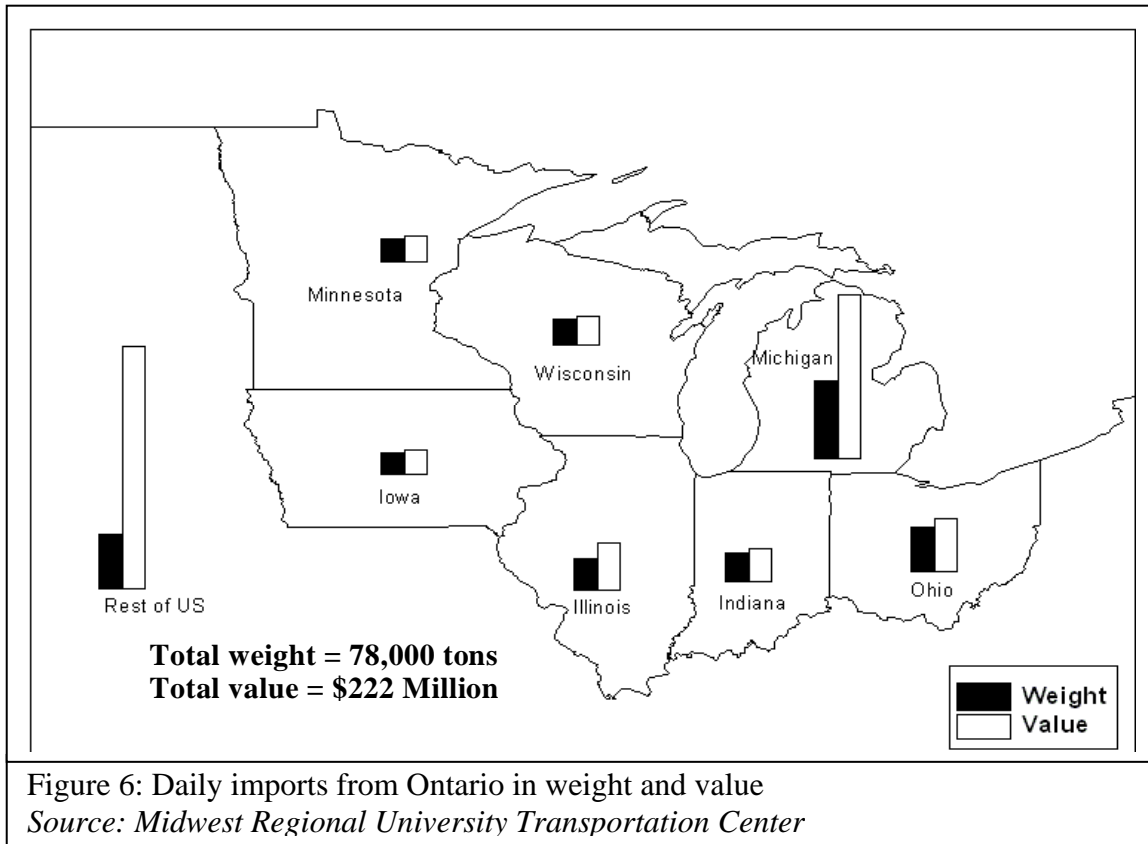


Figure 6: Daily imports from Ontario in weight and value
Source: Midwest Regional University Transportation Center

Finally, Ontario represents a significant international trading partner for the region. All states of the region benefit from it. Figures 6 and 7 illustrate the destination of trucks moving from Ontario into the U.S. and the origin of trucks from the U.S. going to Ontario.

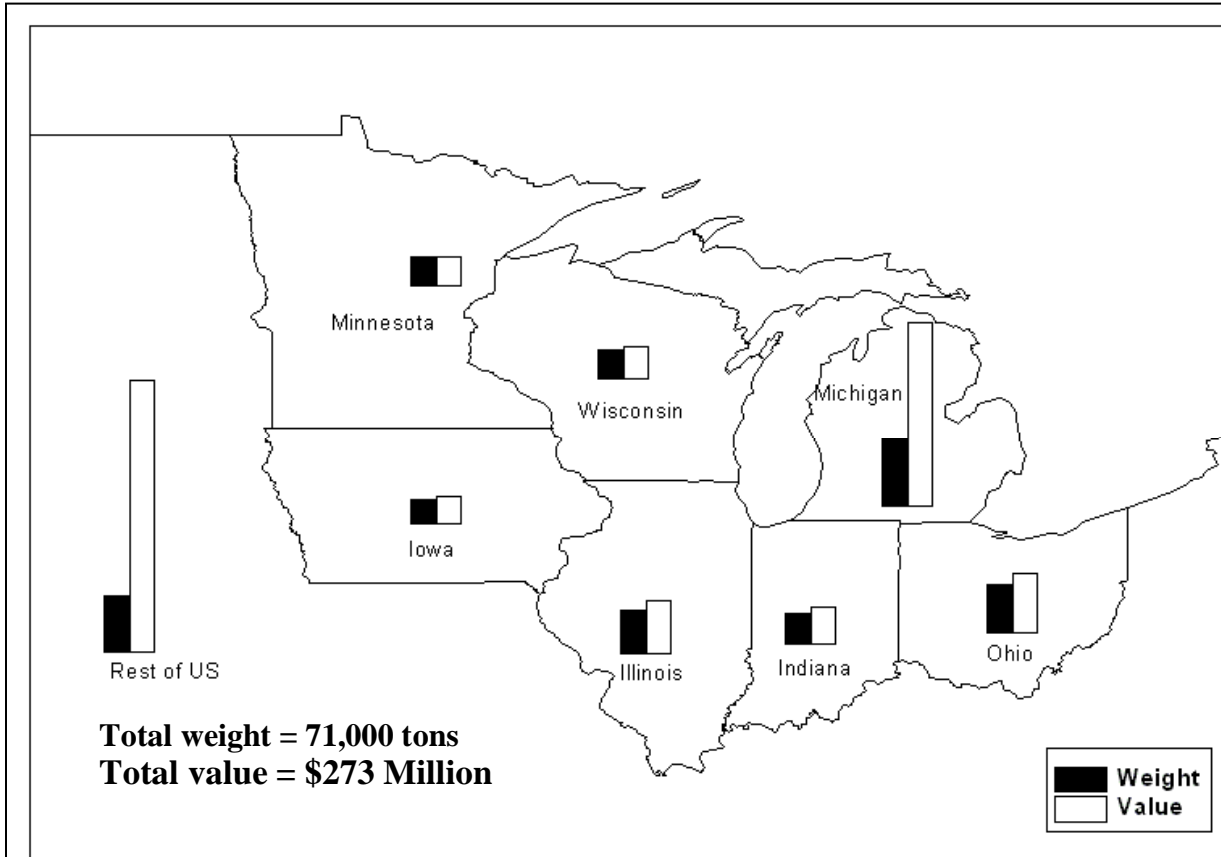


Figure 7. Daily exports to Ontario from the US
 Source: Midwest Regional University Transportation Center

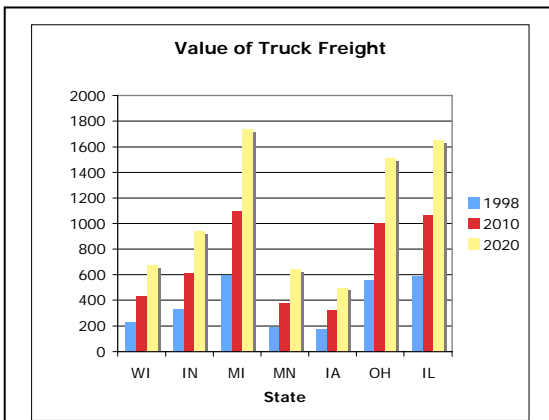


Figure 8. Value of truck tonnage
 Source: Federal Highway Administration: Freight News

Clearly, Michigan is the primary trading partner with Ontario in both directions. Cumulative trade for other states in the region surpasses the rest of the U.S., as well as Michigan.

These unique features of the economy in the region translate into a growth in freight. Figures 8 and 9 show the current FAF projections truck traffic in each state both in terms of tonnage and value. While the projections show an increase in all of the modes, the growth rate, combined with the base numbers make truck the most striking.

Figure 8 shows a projected growth in the value of truck borne freight of more than 100% between 1998 and 2020 for each of the states. Figure 9 shows a near doubling of tonnage across the region.

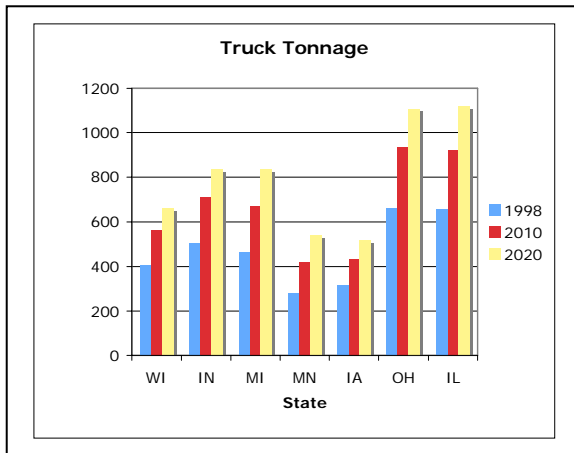


Figure 9. Truck Tonnage
 Source: Federal Highway Administration: Freight News

From the Literature

Economists use three different arguments to link transportation to economic growth. The first is a macroeconomic view that looks at economic indicators and finds correlations to transportation investment and efficiency. The second is a microeconomic perspective that considers that actions of specific companies in response to improvements in transportation services or reliability. The third is an equilibrium model that argues that improved transportation allows for economic specialization,

with trade leading to prosperity. While these arguments each have distinctive bases, they share the view that better transportation leads to economic

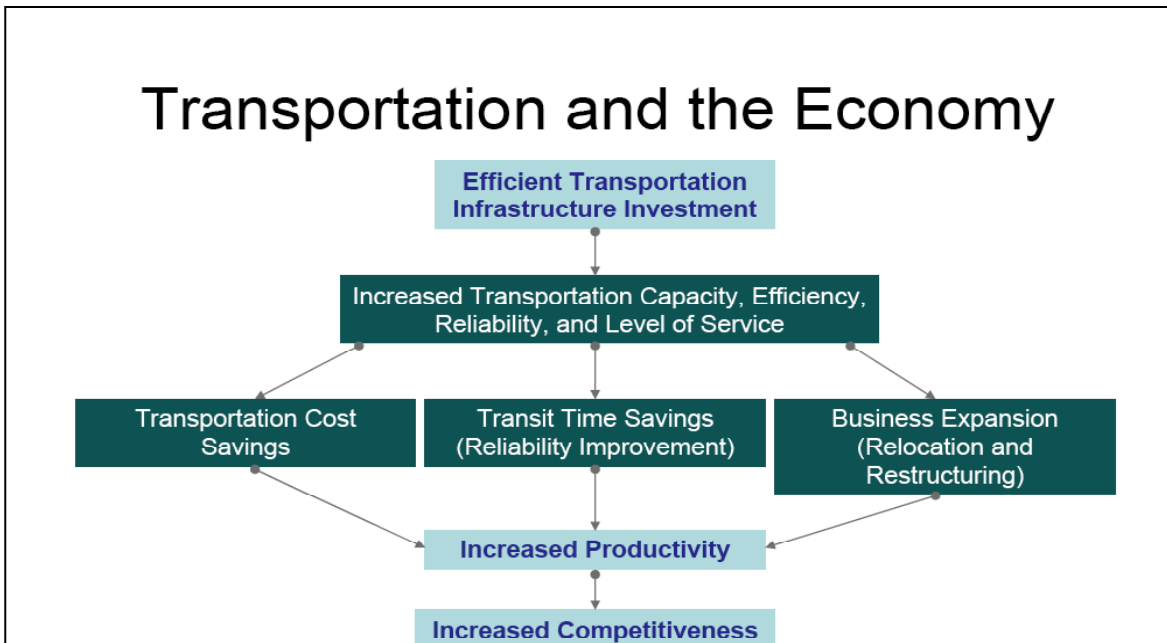


Figure10: Transportation and the Economy
 Source: Penne

prosperity.

Macroeconomic View

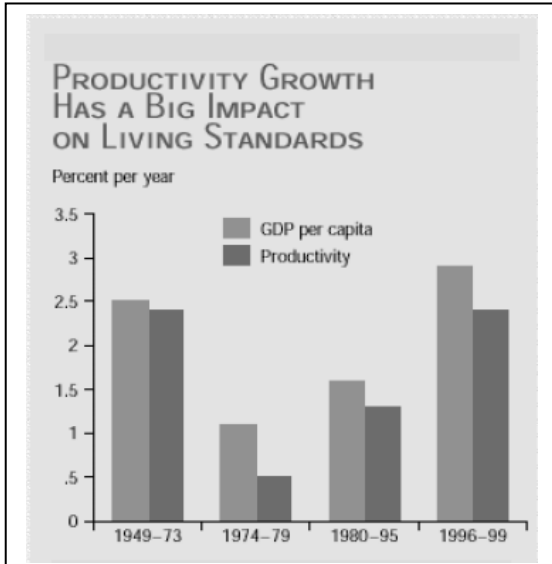


Figure 11: Productivity and GDP
 Source: FHWA, Freight Transportation

The macroeconomic view considers transportation to be a component of economic productivity. As outlined in the Figure 10, investments in transportation lead to increased capacity, efficiency, and reliability. This produces cost savings, time-savings and business expansion. Increased productivity and competitiveness are the result, which in turn causes economic growth. This approach seems defensible, since a close correlation exists between productivity and economic growth, as shown in Figure 11. For each of four very different periods in the economic history of the country, productivity and GDP parallel each other very closely.

Figure 12 provides another view of the correlation. Throughout the years between 1990 and 2003, real GDP per capita, the black line, and trucking productivity, the red line, have changed in almost exactly the same way. In the later years of the period, manufacturing and rail productivity, the green and yellow lines, have grown more quickly, but in the same pattern as GDP.

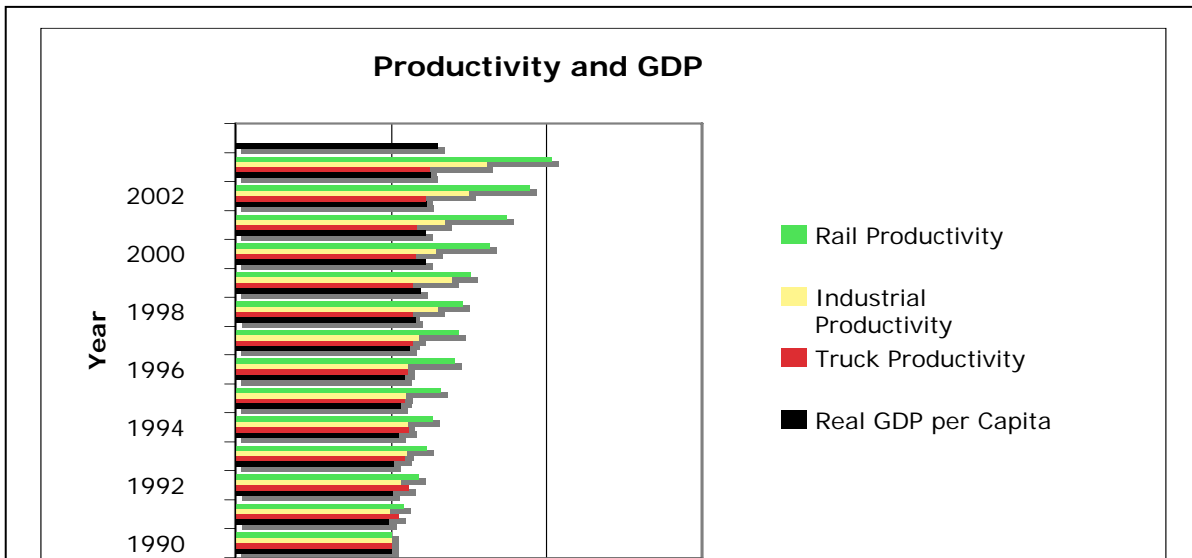


Figure 12. Productivity and GDP in the '90s
 Source: BLS: Major Sector Productivity

Finally, another set of correlations is found in Figure 13. In this case, the Transportation Services Index (TSI), which is a measure of transportation efficiency reported monthly by the U.S. DOT, is related to total payroll, personal consumption and employment. The lines move in very similar ways. Moreover, they respond similarly during a recession, which are indicated by the gray bars on each graph.

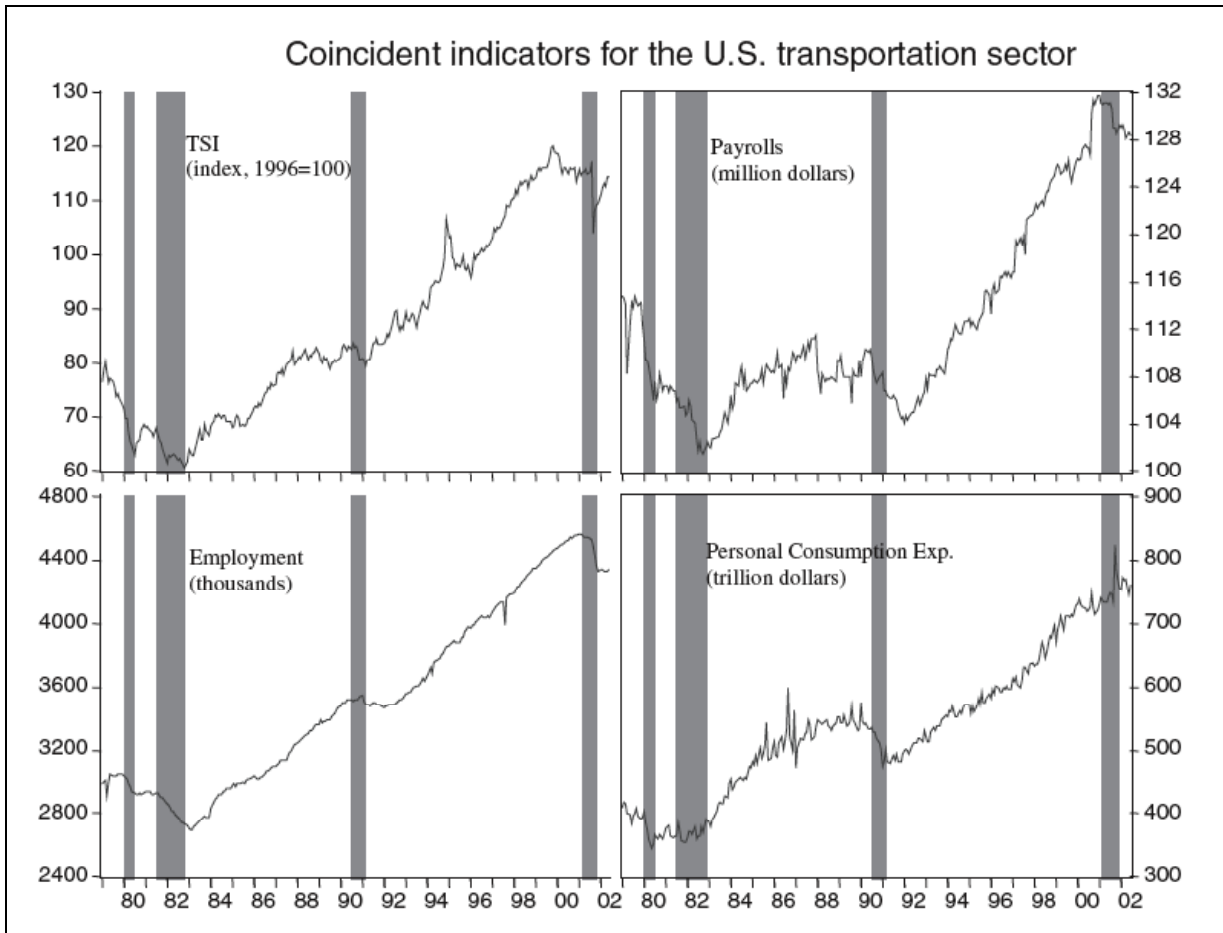


Figure 13. Coincident Indicators for the U.S. Transportation Index

Source: Lahiri: Predictive Power

**Average Net Rates of Return per dollar
Invested in Highways**

	1960-69	1970-79	1980-91	1960-91 Average
Highway Capital	0.54	0.27	0.22	0.32
Private	0.16	0.18	0.17	0.17

Figure 14. Rates of Return per Dollar Invested in Highways

Benefit cost analysis (BCA) is another way of measuring this macroeconomic impact. Not surprisingly, the benefit of investing in highways was greatest when the total stock of highways was lowest, as the interstate was being built in the 1960s, as shown in Figure 14.

In the 1970s and '80s, with the stock of highway capital expanded, the return on new investments was reduced, because those investments failed to provide the same productivity gains received earlier.

To summarize, transportation investments produce productivity improvements and productivity improvements foster increases in GDP. Measures of productivity correlate very closely with GDP and other measures of economic growth. The return on investments in highway capital is greater than on other average investments. Historically, it has been highest when the existing highway capital was smallest, which supports the theory of the importance of productivity gains.

Microeconomic View

The microeconomic view is more difficult to quantify since it deals with the actions of specific businesses as they respond to changes in the efficiency or

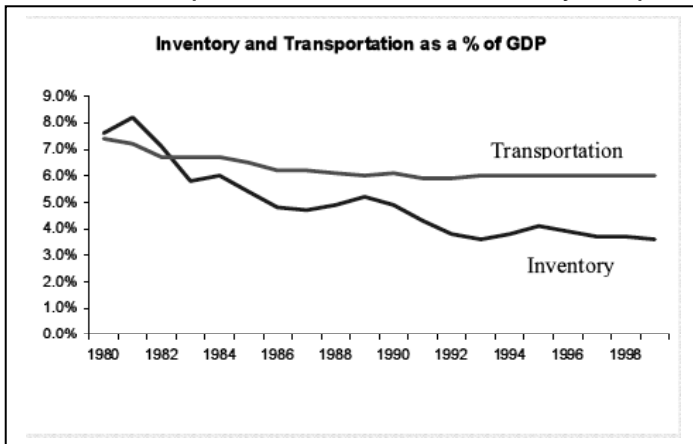


Figure 15. Inventory and Transportation Costs as a Percent of GDP

Source FHWA: *Freight Transportation*

reliability of transportation services. Two major events in logistics of the last two decades are major examples of individual businesses responding to changes in transportation. The first was the movement to just-in-time delivery, which significantly reduced inventory costs for many businesses. Between 1981 and 1999, inventory costs in the U.S. fell from over 8% of GDP to less than 4%, as shown in Figure 15. This change was only possible because firms felt comfortable

enough with the reliability of the transportation system to risk shutdowns of their production lines if materials failed to arrive as planned. The method clearly worked, saving the economy over 4% of GDP, which had previously been consumed in inventory carrying costs.

The second major change, which was adopted by most manufacturing and retail companies, was the “pull” distribution system. As shown in Figure 16, the “pull” system depends upon reliable transportation services and advanced communication services to pull products from the manufacturer or the warehouse as they are needed. The old system had products “pushed” from the manufacturer or the warehouse to retailers who then had to deal with selling them. The result of this change is a further reduction in inventory costs and a more responsive retail system. Goods can be changed in the stores as consumers demand change, rather than as inventories are refreshed. As the two

pie charts in Figure 16 illustrate, the importance of transport and information systems is much greater under the “pull” approach to logistics management. Indeed, without those key tools, the approach would not be possible. Again, the cost of inventory is reduced.

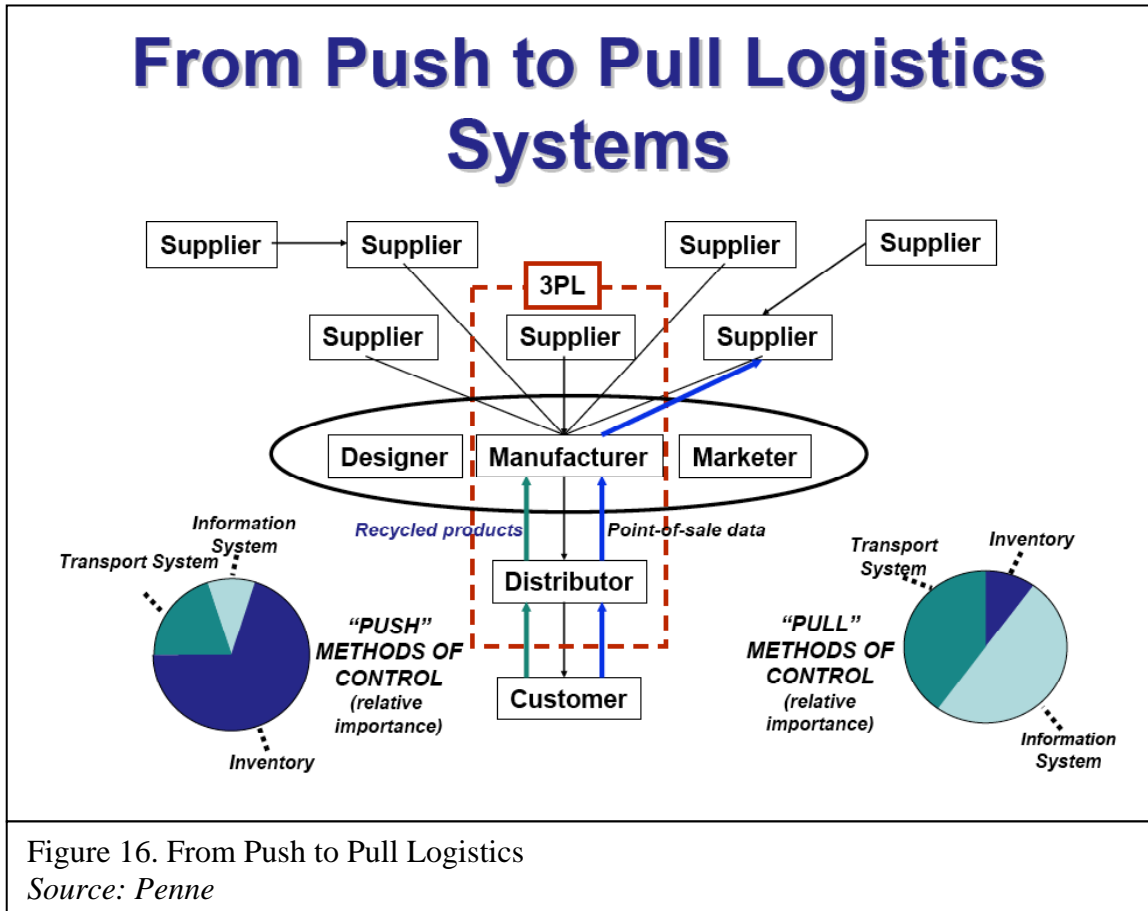


Figure 16. From Push to Pull Logistics

Source: Penne

Specific company responses to changed transportation systems can also be cited. Many represent efforts to make the logistics system more responsive. For example, the Ford Motor Company reduced its delivery time to dealers by implementing regional “mixing” centers for automobile distribution (FHWA). Rather than waiting at the factory until truckloads are ready for shipment to dealers, the mixing centers move completed autos into regions closer to the dealers. As orders are received they are filled efficiently and quickly. The concept made the company more responsive to its customers, but the change was made possible because of dependable transportation services.

Equilibrium

The notion of equilibrium has been a staple of the economic world for two centuries. Regions, countries or firms should do those things they are most efficient in doing and rely on trade to gain the benefit of each country’s, region’s, or firm’s greatest efficiencies. Economic growth through trade is the basis for much of the economic policy of the past sixty years. The World Trade

Organization, the North American Free Trade Agreement and dozens of other trade agreements are based on this premise. In the U.S., economists have pointed to the benefit that Americans have received from inexpensive imports of everything from clothing to electronics. No one can deny that Americans enjoy more things now than they would if global trade did not exist. But global trade and production equilibrium are only possible if transportation systems are inexpensive and dependable.

International Competition

Figure 10 tells us that increased productivity brought about by transportation investment leads to increased competitiveness. To understand the significance of this competitive position, it is important to understand the source of our competition. In the 1960s and 1970s American competition was largely regional. The New England states were in competition with the Southeastern states in the textile industries. The Midwest was in competition with the South in the auto industry. While we may have some residual effects of that regional competition, our competitors in the 21st Century are foreign countries. Therefore, if those countries are making investments in transportation to increase their productivity and to enhance their competitive position, the U.S. should take note.

A simple example of importance to the agricultural community in our region is soybean production. As Figure 17 illustrates, until the recent decades Argentina and Brazil were not players in the world soybean markets. They are now major players. As Figure 18 illustrates, the U.S. has historically had a major advantage over these countries in the cost of transportation, but that advantage

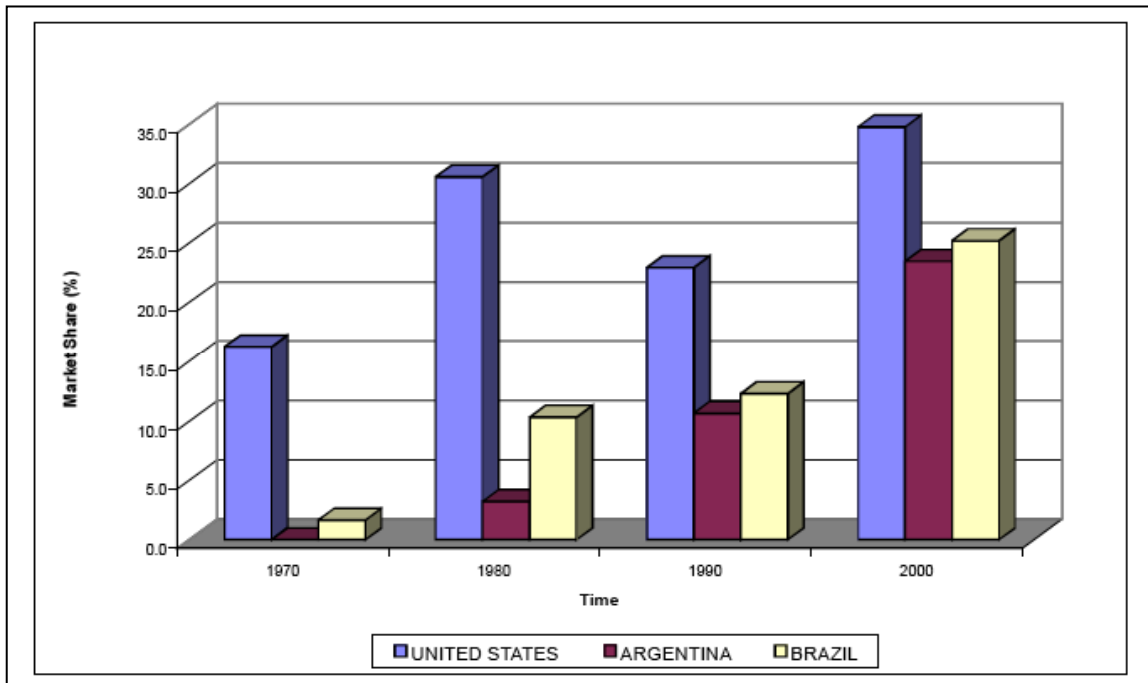
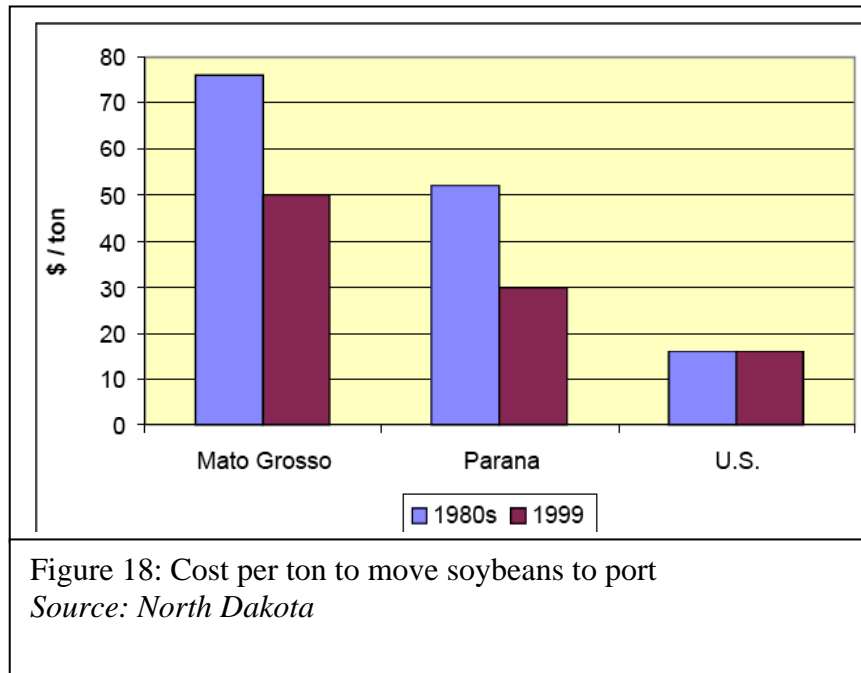


Figure 17: Soybean market share
Source: North Dakota

is disappearing (note: Mato Grosso is a Brazilian port; Parana, Argentine). In fact, when the total cost of production and transportation to overseas ports are considered, the advantage is gone, as illustrated in Figure 19.

Brazil and Argentina are not alone in understanding the importance of transportation for economic success. Both countries have reduced their internal transportation costs through investments in waterways, rail and roads. Those investments are continuing.



<i>Cost Item (\$/bu.)</i>	<i>US</i>	<i>Brazil</i>	<i>Argentina</i>	
	<i>Hinterland</i>	<i>Mato Grasso</i>	<i>Parana</i>	<i>Santa Fe</i>
<i>Production cost</i>	5.11	4.16	3.89	3.92
<i>Internal transport & marketing cost</i>	0.43	0.85	1.34	0.81
<i>Cost at border</i>	5.54	5.01	5.23	4.73
<i>Freight to Rotterdam</i>	0.38	0.57	0.57	0.49
<i>Price at Rotterdam</i>	5.92	5.58	5.80	5.22

Figure 19: Comparative total cost of soybeans delivered to Rotterdam
 Source: North Dakota

The European Union (EU) has articulated its approach in a policy statement dealing with its proposed and partially implemented transportation system:

Modern economies cannot generate wealth and employment without highly efficient transport networks. This is particularly true in Europe where, for goods and people to circulate quickly and easily between Member States, we must build the missing links and remove the bottlenecks in our transport infrastructure. The trans-European transport network is a key element in the re-launched Lisbon strategy for competitiveness and employment in Europe for that reason alone: to unblock major transport routes and ensure sustainable transport, including through major technological projects. (Directorate General)

The EU is dealing with increased demand for transportation, in keeping with the above vision, in several ways. The first is an effort to diversify its system to move more goods from highways to rail and water. As Figure 20 indicates, it has been

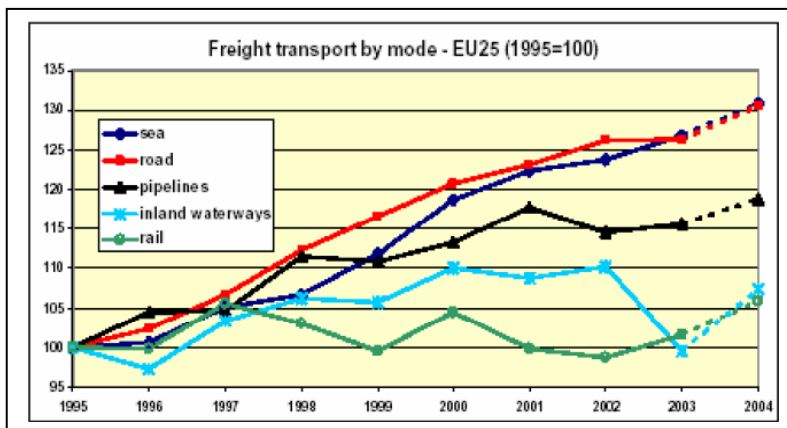


Figure 20: Freight transport modal split in the EU25
Source: Directorate General: Consultation document on logistics for promoting freight

partially successful in that effort. While road (red line) remains near the top in terms of growth, short-sea-shipping (dark blue line) has responded to the effort the EU has placed on the promotion of the mode. Inland waterways and rail also seem to be responding in the later years.

The EU has also devoted much energy to promoting intermodal

freight (short-sea, rail, inland waterway and truck) through a program called Marco Polo. Through this program the EU is funding projects that will better connect the modes. (EU Commission, Europe at a Crossroads)

Closely tied to the Marco Polo program is Galileo, the EU's version of the Global Positioning System (GPS). Unlike America's GPS, Galileo was designed primarily with transport in mind. When completed, it will allow transit times to be monitored, allowing advanced warning of road system breakdowns. It will also assist in tracking goods, making intermodal more attractive. (EU Galileo)

It also has ambitious plans for improved roadway, rail, inland waterway and short sea shipping connections between its member countries. This has become a higher priority with the recent and continued expansion of the EU. Efficient transport is needed to bring the benefits of membership to all parts of the continent. Budget constraints have slowed the implementation of these plans, but

progress is being made. For example, the map of Ireland in Figure 21 shows sections of completed and under construction railways.

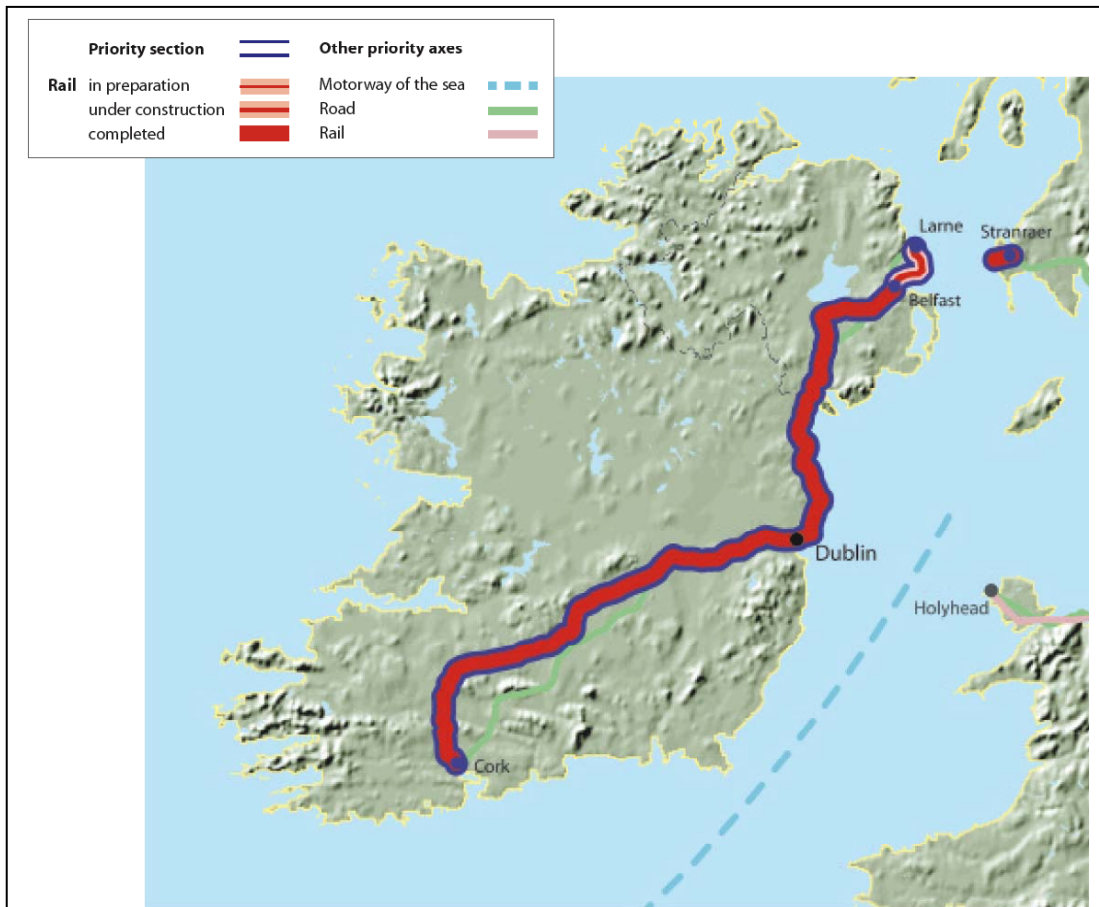


Figure 21: Priority projects in Ireland

Source: Directorate General: Trans-European Transport Network: TEN-T Priority Axes and Projects, 2005

Similar efforts are underway throughout the EU. Roads, waterways and railways are being improved to bring the continent closer together and to improve its productivity and competitive position.

India is another growing economic power that is investing in transportation to stimulate economic activity. Figure 22 outlines the achievements of the country's road building program in recent years. Its accomplishments are significant. Just in the 2004-2005 annual plan, nearly 2,400 kilometers of roadway were widened from two lane to four and nearly 3,000 kilometers of roadway were strengthened.

Physical Targets and Achievements for National Highways During Ninth Plan & Tenth Plan Periods						
S. No.	Activity	Targets/ Achievements	Ninth Plan (1997-2002)	Annual Plan (2002-03)	Annual Plan (2003-04)	Annual Plan (2004-05)
1	Widening to 2-Lanes (km)	Targets	1791	829	701	832
		Achievements	1955	710	671	719
2	Widening to 4-Lanes (km)	Targets	944	582	2245	2944
		Achievements	797	418	799	2386
3	Strengthening weak 2 lane (km)	Targets	3042	1260	3016	3535
		Achievements	3511	1109	1489	2981
4	By-passes (Nos.)	Targets	59	21	20	12
		Achievements	30	12	6	5
5	Construction of Bridges/ROBs/RUBs including rehabilitation of Bridges (Nos)	Targets	633	175	182	232
		Achievements	442	143	123	105

Figure 22: Indian road construction achievements
Source: Indian road statistics

China is another new economic power that is making huge investments in transportation infrastructure. Ports are of great concern to an economy as dependent on trade as the Chinese. According to Robert Kledal, senior vice president and Regional Line manager for Maersk Sealand:

China has done an incredible job of planning for port infrastructure. The central government prioritized port infrastructure construction, and thus avoided the problem of wasteful, overlapping investments. China has also done a great job building ports ahead of time—growth has been 20-25 percent per year for the past 10 years.

Ports are not the only place China is investing in transportation. The U.S.-China Business Council reports that the City of Beijing plans to spend \$11 billion by 2008 to complete a fifth and sixth ring road, refurbish its bus and light rail systems, and build six new subway lines.

The country is also making an effort to move manufacturing inland to provide economic benefit to a larger share of the country. The International Food Policy Research Institute in its Report 138 described the growth in road investment in China:

When the policy reforms began in 1978, the transportation infrastructure in China was poor. With rapid economic growth, the demand for road transport soared, and transportation shortages and congestion problems surfaced as a consequence. Since 1985, the government has given high priority to road development, particularly construction of high-quality roads such as highways connecting major industrial centers in coastal areas. In the 1990s, investment in infrastructure became a national

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priority and various policies were implemented to promote the rapid construction of highways. The development of expressways has been particularly remarkable, with the total length increasing from 147 kilometers in 1988 to 25,130 kilometers in 2002, equivalent to an average annual growth rate of 44 percent.

This commitment to transportation is also reflected in the change in the country's total roadway system, as shown in Figure 23.

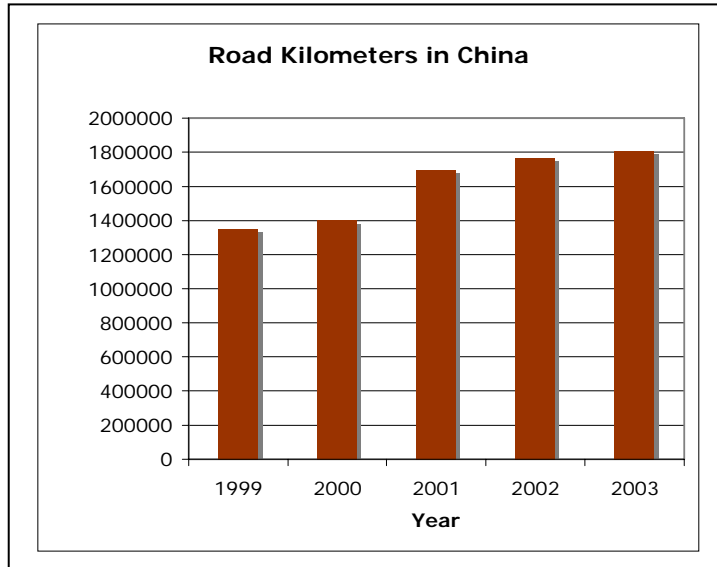


Figure 23: Road kilometers in China
Source: International Road Federation

Roads are not the only place China is investing. Railroads inland waterways and airports are also receiving attention. To summarize, America's global competitors are making investments in transportation. Figure 10 tells us that investments in transportation increase productivity, thereby improving competitive position. This being the case, the nation must take note of the actions of our competitors and consider steps that will preserve some of the historic

advantage that American commerce has had.

Recommendations

Several steps are suggested by the discussion in this paper. While those recommendations are directed at the states of the Upper Midwest, most are also appropriate for the nation as a whole:

1. Recognize transportation as an investment rather than as a cost. American workers and companies can compete in the global market, but they cannot compete if American governments—federal, state and local—fail to provide the tools needed for effective competition. Transportation is one of those key tools.
2. Think strategically in making transportation investments. All local roads, bypasses, freeways, railroads and ports are not equal. Investments in some will yield much greater benefits to the economy than investments in others.

3. Think beyond jurisdictional boundaries. Freight does not stop at borders. It does little good for one state to have a wonderful transportation system, if the next has bottlenecks.
4. Think multi-modally. To meet the demands for capacity as well as demands for efficiency and environmental protection, the best attributes and the capacity of all modes will have to be employed. Our challenge will be to link them and manage them as an integrated system.
5. Make some tough decisions. American governments spend a lot of money, but increasingly they are buying less of the traditional public goods of which transportation is a prime example. If more investments are made in transportation, they will have to either still spend more money, or they will have to buy less of something else. Both call for tough decisions.

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An Agenda For Meeting Freight Demand in the Upper Midwest

Upper Midwest Freight Corridor Coalition Research Team

Summary

The Upper Midwest is nearing a critical point in its transportation and economic history. Just as global competition is challenging the economic preeminence of the US, particularly in the manufacturing and agricultural sectors critical to the Upper Midwest, congestion and inadequate investments are threatening to strangle our historically efficient and dependable transportation systems.

In response to growing freight demand in the Upper Midwest, seven states have developed an agenda to help meet the challenge of freight movement and economic vitality in the region. In phase one of these efforts, the Upper Midwest Freight Corridor Study, identified the conditions and needs across all modes of

freight transportation for the corridors in the Upper Midwest. The Upper Midwest Freight Corridor Coalition, created for phase two of this regional effort, used the findings of phase one as background information for drafting of a regional freight agenda. This report is the product of their efforts.

Priority Initiatives


1. Public and Political Understanding
 - 1.1. Improve public and political understanding
 - 1.2. Document funding needs
2. Public Sector's Ability to Plan for and Deal with Freight
 - 2.1. Create an ongoing regional organization
 - 2.2. Collect data
 - 2.3. Define agency focal point
 - 2.4. Develop model planning approaches
 - 2.5. Define regional freight network
 - 2.6. Develop role and structure for public/private partnerships
3. Intermodal Regulations and Capacity
 - 3.1. Modify Jones Act
 - 3.2. Establish regional traffic management technologies
 - 3.3. Support river and lock improvements
 - 3.4. Support multi-modal bottleneck solutions
 - 3.5. Address regulatory bottlenecks at borders

The Upper Midwest Freight Corridor Coalition's vision is to have the states of the region, along with the affected provinces of Canada, cooperate through efficient use of all transportation modes to ensure the adequate capacity of systems. The priority initiatives in this Regional Freight Agenda will help the Upper Midwest realize that vision and meet the challenge of freight movement and economic vitality in the Twenty-First Century.

Background

Background

- **Seven states participated**
- **Phase One**
 - Congestion
 - Lack of coordinated technology
 - Minor regulatory differences
 - Major internal regional trade



Ohio, Indiana, Michigan, Wisconsin, Illinois, Minnesota, and Iowa, as well as the provinces of Ontario and Manitoba, participated in the Upper Midwest Freight Corridor Study along with the Federal Highway Administration and researchers from the University of Wisconsin-Madison, the University of Illinois-Chicago, and the University of

Toledo. The effort was coordinated by the Midwest Regional University Transportation Center.

Phase one of the study concluded that congestion is a major issue for our freeways, rails and waterways. And, the region lacks coordination in the implementation of traffic management technology. Only minor differences were noted in regulatory issues, since federal law controls vehicle size and weight issues on the Interstate system. Finally, the states of the region are their own best customers. Internal trade is robust.

Phase Two

- Goal was to agree on policy issues that would help them meet the needs of freight in the region
 - Some issues are regional in nature
 - Some are national
- Regional technology planning
- Regional data

Participants in the study recognize that freight does not stop at political boundaries. They also understand that the economies of the region are heavily interdependent and that, as a crossroads area, the region's needs in freight transportation are different from other parts of the country. Therefore, in phase two, they sought to develop an agenda

to guide their actions as individual states so they might implement programs and take actions that are regionally complementary. They also understand the importance of national actions in transportation and seek to define potential national issues and positions upon which they can agree as future national legislation is developed.

This document is the first step in the process. Its contents will be reviewed, debated and modified by the states. As it is adopted, it will guide future actions. Other products of phase two include continued development of a regional freight data system and conceptual planning on technology programs.

The Challenge

The Challenge

- Dependable and efficient freight movement is critical to the heavily industrial and agricultural economy of the region
- Congestion is threatening to make that movement difficult in all modes
- Our global competitors are improving

In a global market, the competitive position of a region or a country depends upon the cost and quality of delivered products. Cost is comprised of two elements: production and transportation. Production costs tend to be higher in the US. Our workers are paid more; we dedicate more to environmental protection; and, in some sectors such as agriculture,

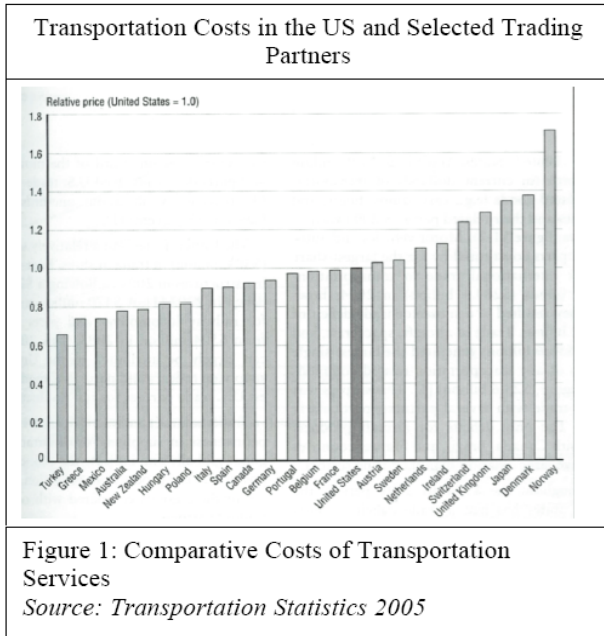
we are more capital intensive. These factors contribute to our high standard of living. Historically, higher production costs have been offset by lower transportation costs, keeping our products competitive. Quoting the AASHTO Bottomline Report (1):

To take a single example, the total production cost of a bushel of soybeans in the U.S. is well over a dollar higher than some South American producers — \$5.11 compared to the cost in Brazil. However, the U.S. internal transport and marketing cost is 43 cents compared to \$1.34 in Brazil, leading to a final price that makes U.S. soybeans competitive in world markets, which would not be the case without transportation efficiency. Competitors, however, do not sit still. Brazil is making inland-waterway improvements that will significantly reduce internal transportation costs for soybeans. To remain competitive, the U.S. must maintain and improve the efficiency of its transportation system.

Goldsby (2), in his evaluation of the comparative advantages of the US and Argentina, came to similar conclusions:

A review of the comparative transportation and logistics systems demonstrates that U.S. shippers maintain a significant advantage over their peers in Argentina. This advantage in movement and storage capacity is substantial enough to create an overall comparative advantage in the serving of common export markets. There is evidence, though, that the gap is closing. While the United States benefited from several decades of substantial public and private investment, yielding perhaps the world's most advanced logistical infrastructure, Argentina languished from nominal development of its own infrastructure. However, the privatization movement in Argentina has achieved great progress in a very short time. An influx of investment from domestic and foreign sources is largely responsible for Argentina's recent gain in movement and storage. The rate of change in the Argentine logistics environment is anticipated to remain high well into the foreseeable future.

Regional Freight Agenda for the Upper Midwest



Similar comments could be made about other products and other countries. Like Brazil and Argentina, China and India are making improvement to their water, rail and highway networks to improve their competitive position in the world. A recent report from the US Department of Transportation compared the cost of transportation services in the US and selected trading partners. The results are shown in Figure 1 (3). While the data used in the graph does not necessarily translate into shipping costs, it does indicate that the US has rivals in low cost transportation.

While other countries are improving their transportation infrastructure, congestion and inadequate investment plague American transportation systems. Congestion will increase as

auto travel expands and as freight, currently forecast to nearly double in the next twenty years, continues to grow.

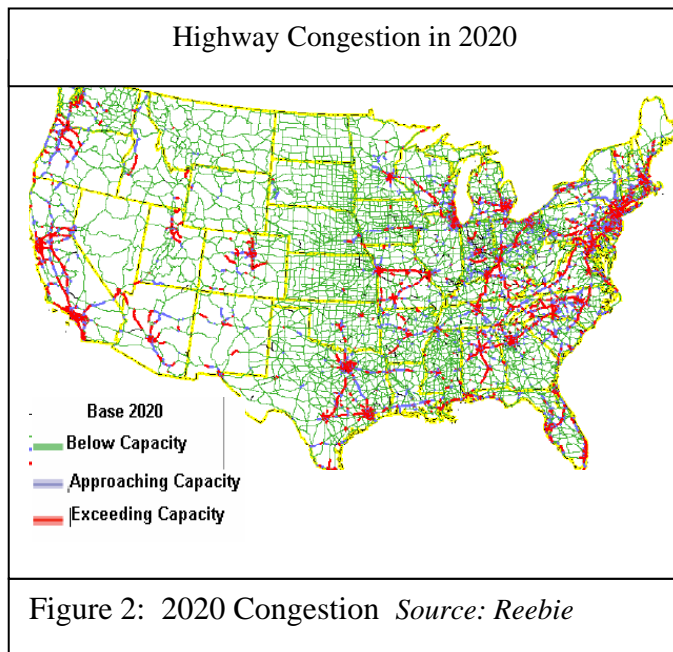
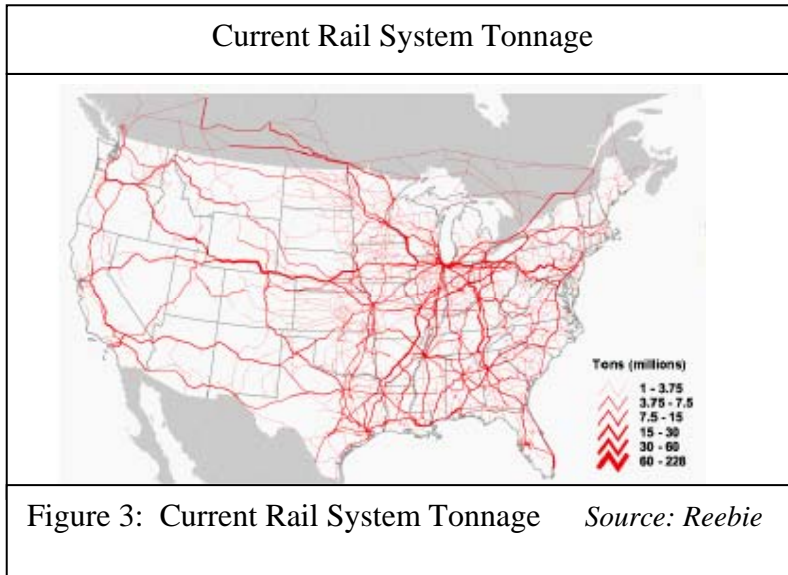


Figure 2 provides a forecast of highway congestion in the year 2020 (4). We might expect to see dark black lines, indicating congestion, in Chicago, the Twin Cities, Detroit, Cleveland, and Indianapolis, but in this map we also see these lines in generally rural areas of Wisconsin, Illinois, Michigan, Ohio and Indiana. Grey lines, signifying routes approaching capacity, are also evident throughout the region.

Congestion in rural areas indicates a system-wide capacity problem. It suggests that production centers, for example the Twin Cities, are positioned

farther from their markets in the South and the East. It also suggests that the delivered cost of products will be higher in the future. This confirms the capacity analysis of the Upper Midwest Freight Corridor Study (5) that shows many segments of the freeway system in our region operating at congested or near congested levels of service in 2002.



Highways are not the only congested mode. Figure 3 (4) shows the national rail network with the thickness of lines representing the current levels of freight carried on each segment. The lines in our region tend to be heavy, indicating a proportionately greater degree of utilization. This is consistent with the track utilization analysis (5) that

indicates that many corridors in the region are operating at or beyond their designed track capacity in 2002.

Our inland waterways suffer from inadequate investment. The last significant investment made on the Great Lakes was in 1966. Most of the locks and dams on the Upper Mississippi and Illinois date from the 1930s. Old locks and dams and major river bridges delay barges and increase costs.

The Vision

The Vision

- Cooperation across state and international borders
- Intermodal systems operation
- Adequate systems capacity

The vision for future movement of freight in the region, as defined by the Upper Midwest Freight Corridor Coalition, has three main elements: cooperation across state and international borders, intermodal systems operation, and adequate systems capacity. The vision defines a future in which the freight

demands of the Upper Midwest can be met. It is necessary to have the states of the region, along with the affected provinces of Canada, cooperate through efficient use of all transportation modes to ensure adequate capacity of systems.

The path to achieve this vision is through the prioritized initiatives identified by the Coalition.

Priority Initiatives

The Upper Midwest Freight Corridor Coalition Advisory and Steering Committees, at a meeting on April 25-26, 2006, reviewed and prioritized 26 potential initiatives as short-term and long-term activities. The short-term initiatives illustrate areas in which a regional effort can have immediate payoff with limited staff and funding resource allocation. The long-term initiatives illustrate areas in which a regional effort can have a high return from long-term support. The top six initiatives in each category, determined by a voting exercise among participants and listed in Table 1, are discussed and analyzed further in the following sections. After reviewing these twelve initiatives, the participants advanced a thirteenth--create an ongoing regional organization--because it is fundamental to many of the other initiatives.

Table 1: Results of Priority Voting Exercise	
Initiatives Identified as Short-Term Priorities	
Collect Data	1
Document funding needs and consequences	2
Improve Political and public understanding of freight	3
Support multi-modal bottleneck solutions*	4
Address regulatory bottlenecks at boarder crossing	5
Define freight focal point in each agency	6
Initiatives Identified as Long-Term Priorities	
Support multi-modal bottleneck solutions*	1
Support river and lake lock improvements	2
Define regional freight network	3
Define role and structure for public/private Partnerships	4
Develop model planning approaches	5
Implement regional freeway management technologies	6
Modify Jones Act	6
Additional Initiatives	
Create an ongoing regional organization**	
Modify Harbor Maintenance Tax	
Develop regional approach to tolls	
Define regional test projects	
Engage private sector in dialog	
Support nation rail policy	
Support maritime, rail and CVO research	
Encourage and facilitate shipper's associations and 3rd party providers	
Create rail dispute resolution process	
Initiate pilot projects for CVO safety regulation	
Address security issues	
Support categorical flexibility	
Increase awareness of crossing impacts	
Include truck lane issues in reports to Congress	
*Identified as both short- and long-term priority	
**Added to priority list following voting exercise	

Table 1 also lists initiatives presented to the Coalition but not selected as priorities.

Priority Areas Overview

Priority Areas
<ul style="list-style-type: none"> • Public and Political Understanding • Public Sector's Ability to Plan for and Deal with Freight • Intermodal Regulations and Capacity

The thirteen initiatives fall into three priority areas. One priority area addresses the need to improve the understanding among the public and political leaders about the importance of freight to our region's economies. Another addresses the

public sector's ability to plan for and deal with freight transportation needs. The final priority area deals with capacity and regulatory reform. Further explanation of each priority initiative, including a vision statement, draft action plan, and rough estimation of potential cost follows. The priority areas are not mutually exclusive and often linked to each other.

Priority Area 1 - Public and Political Understanding

1. Public and Political Understanding
1.1. Improve public and political understanding
1.2. Document funding needs

This area focuses on achieving the public and political understanding necessary to meet freight demand in the Upper Midwest. As research from phase one showed, freight demand will continue to grow in the region faster than capacity. Public

and political understanding of the region's needs will be necessary for freight issues to receive the attention and investment required to prepare the transportation system to meet the growing demand of freight.

Initiative 1.1: Improve public and political understanding of freight

The vision of this initiative is to: *Create a cross-state task group to develop a marketing plan, detailing audiences, messages and actions.*

The expected audiences for the effort include the general public, elected officials at the local, state and federal level, and transportation professionals in both the public and private sectors. The message that is envisioned includes:

- the regional, national and global nature of freight movement,
- the importance of efficient freight movement for a robust economy,
- the demands that freight places on the transportation infrastructure,
- the need to improve our infrastructure to meet the growing demands upon it,
- the importance of pursuing a multi-modal solution to freight transportation issues,
- the significant impacts that freight movement can have for safety, the environment, and our security, and
- the shared responsibility of both the private and the public sectors for efficient freight movement.

Four strategies should be considered to help elected leaders and the general public better understand the nature of the freight challenge and the importance of freight:

Define a clear message. Transportation professionals often see and attempt to explain their world with much too much detail and complexity. To be heard and understood the freight message must be simple, concise and relevant.

Use various methods for delivery. A single approach to transmitting the clear message will not be adequate. Written materials, after-dinner presentations, one-on-one conversations, and formal and informal presentations to large and small audiences of stakeholders will have to be used.

Enlist many messengers. Public officials have to be the key messengers in this process, but they cannot be the only messengers. Private sector people can also be key participants. In some cases, transportation agency personnel may have to assist these other messengers in understanding and preparing the message.

Make the economic case clear. Freight is fundamental to our economic wellbeing. Whether the freight is raw materials moving to a manufacturing plant or goods moving to retail shelves, our standard of living depends on the free movement of freight. This is the most basic “pocket-book” issue for our audiences.

The cost of this effort will range from modest to significant, depending upon how it is ultimately defined. At the low end, DOT and MPO staff can do most of the work and the message can be carried through the normal channels of agency speaker bureaus and other routine contacts. There will also be a need for MPOs to look beyond their region. At the other extreme, professional media firms can be employed and the message can be carried through funded media campaigns. The effort can begin shortly after the states agree to move ahead. The timeline for completion will depend upon the definition given to the project by the task group.

Initiative 1.2: Document the funding needs for freight transportation and the consequences of failing to meet those needs

The vision of this initiative is to: *Work with elected officials at the state, regional and federal levels to make them aware of the funding needs associated with freight transportation and the consequences of failing to meet those needs.*

This initiative should be coordinated with the effort to inform the public and political leaders of the importance of freight. The action plan for this initiative involves identifying funding needs to aid in the freight planning process, utilizing existing studies to help identify the portfolio and document conditions, and relying on existing public-private relationships to help improve understanding of freight. The effort will start at the local, state and regional level and mobilize regional organizations such as builders associations, AASHTO and others.

In the short-term, the focus will be on developing the materials, such as a region freight condition report, and strategies for MPOs and regional organizations to use in carrying the message. A committee of public and private individuals and interests who might participate in the effort will be formed. In the longer-term, the

focus of the effort will be the next transportation reauthorization bill and the effort needed to inform members of Congress of the needs for freight.

The cost of this effort will likely be in the medium range. Costs may be offset by what states normally expend to prepare for reauthorization.

Priority Area 2 - Public Sector's Ability to Plan for and Deal with Freight

2. Public Sector's Ability to Plan for and Deal with Freight

- 2.1. Create an ongoing regional organization
- 2.2. Collect data
- 2.3. Define agency focal point
- 2.4. Develop model planning approaches
- 2.5. Define regional freight network
- 2.6. Develop role and structure for public/private partnerships

This area focuses on improving the public sector's ability to plan for and deal with freight in the Upper Midwest. Public agencies will continue to take the lead on maintaining the transportation network and providing customers with quality transportation service. As the challenge of meeting freight demand grows, improvement in the public sector's ability to provide and manage the network grows in importance. The following initiatives

outline some ways in which the public sector can improve its ability to plan for and deal with freight.

Initiative 2.1: Create an ongoing regional organization

The vision of this initiative is to: *Develop and sign a regional memorandum of understanding (MOU) that will commit the states of the region to ongoing cooperation in meeting freight needs.*

The proposed MOU, drafted by the Upper Midwest Freight Corridor Coalition, calls for the establishment of:

- an executive committee made up of seven Department of Transportation CEOs to guide regional cooperative efforts to meet freight demand, and
- a technical committee made up of experts in the fields of freight operations and intermodal transportation to propose and recommend and implement a plan of action for improving the regional freight transportation systems.

Initiative 2.2: Data Collection

The vision of this initiative is to: *Develop an information resource to identify opportunities for freight transportation improvements in the Upper Midwest region.*

The primary providers and users of the data will be state DOTs, MPOs, other public agencies, universities, and the private sector.

To realize this vision two goals will have to be attained:

- State DOTs and MPOs will have to participate in the data collection effort and agree on the data sets to be collected.
- Data provided will have to be of high quality, current, accurate and honest, free from liability issues and proprietary conflicts, up to established standards and accessible.

This initiative will expand upon the work done in phase one of the Upper Midwest Freight Corridor Study. It will utilize the structure, content and accessibility features of the database now housed at the University of Toledo. They will consist primarily of DOT staff time necessary to define and find needed data and the cost of the continuing effort to keep the data current and readily available. Progress on this initiative can begin as soon as the states approve of moving ahead.

Initiative 2.3: Define freight focal points in each agency

The vision of this initiative is to: *Establish a freight coordinator position with an understanding of the policy and technical aspects of freight in each agency to participate on a multi agency working group on freight issues and to coordinate freight related issues inside the agency.*

These positions will be critical to the progress of a regional freight effort. Since the FHWA advocates that such positions be required in each state, the states of the region should work with the FHWA to define contacts in both directions to make the positions most effective. FHWA's *Position Description for a State-Level Freight Coordinator (6)* and *Improving Freight Transportation (7)* both define benefits and roles for these positions. An early and major effort of these freight contacts will be the development of a freight condition report for use by the states in addressing the next transportation bill.

The cost of this initiative will be the salary and related costs of at least one position in each state. Some of this cost will be offset by an expected reduction in the freight related workload of others in the agency and by increased efficiency made possible by the coordinating role of these positions.

Initiative 2.4: Develop model planning approaches

The vision of this initiative is to: *Create a multi-state, multi-modal plan, incorporating best practices that identify freight system trends, needs and issues.*

The action plan for this initiative is to use a collaborative approach to establish a

common framework and gather multi-modal inventory and commodity flow data. The effort may utilize the Freight Analysis Framework, with specific regional modifications, to define conditions and performance standards and identify needs. The product of the effort will be a freight condition report for the region, containing identification of a portfolio of investments and projects of regional significance. Accordingly, this effort will benefit from coordination with other related initiatives, such as the documentation of needs.

The cost of this initiative could be significant, but it will be offset by savings in other ongoing agency efforts. For example, some data will have to be purchased and analyzed, but this should reduce the need for individual states to make similar purchases.

Initiative 2.5: Define regional freight network

The vision of this initiative is to: *Define an interconnected regional freight network for efficient and cost-effective intra- and inter-regional movement of goods and commodities.*

This effort will require all of the elements of a planning study. Definitions will be required; boundaries must be drawn on which modes should be included; data must be collected on system usage, freight and commodity flows, major generators and other items; and public input and industry input will be required. When completed, the region may consider branding the network in much the same way that the Interstate system was branded to identify the quality network that will assure shippers, carriers and industries of the nature of the system.

This initiative can be accomplished on a short timeline, building on the work accomplished in phase one. It should be coordinated with other related issues.

Initiative 2.6: Define role and structure for public/private partnerships

The vision of this initiative is to: *Define the role and structure for public private partnerships (PPPs) where public and or private money could be leveraged in recognizing modal differences.*

The first step in this process is a literature search and survey to identify other areas of the nation that have successfully used PPPs, how they were used and the structure they acquired. Next, an inventory of programs and funding sources that might be available for PPPs is necessary. An analysis can determine how PPPs might best be used in the region. Finally a model contract will enable states in the region to pursue these partnerships.

This could be a short-term effort, but it must be coordinated with other related initiatives.

Priority Area 3 - Intermodal Regulation and Capacity

- 3. Intermodal Regulations and Capacity
 - 3.1. Modify Jones Act
 - 3.2. Establish regional traffic management technologies
 - 3.3. Support river and lock improvements
 - 3.4. Support multi-modal bottleneck solutions
 - 3.5. Address regulatory bottlenecks at borders

The third area selected by participants in the Upper Midwest Freight Corridor Coalition involves intermodal regulation and capacity. Freight movement within the Upper Midwest faces some restrictions on mobility due to inefficient or avoidable regulation. Similarly, capacity constraints can be a significant limiting factor on the mobility of freight within the region.

The initiatives outlined below focus on the removal or mitigation of regulatory and capacity limits on freight mobility within the Upper Midwest. Obviously, this part of the vision carries a cost, but the cost of the vision is lower than the cost of failing to attain the vision. Aggressively managing existing capacity, using all of the modes effectively, and adding new capacity selectively should keep costs low.

Initiative 3.1; Modify the Jones Act (Merchant Marine Act of 1920)

The vision of this initiative is to: *Revisit the Jones Act to remove a regulatory barrier to intermodal freight alternatives and to increase economic competitiveness and efficiency.*

Among other things, the Jones Act (Merchant Marine Act of 1920) requires maritime shippers operating in American waters to use American-made ships. When it was passed, the act was intended to protect and promote the American shipbuilding industry. Its effect now is to dramatically increase the cost of introducing new types of maritime service because it effectively requires that new ships will be used to provide new service. No American-built vessels of the type that might be considered for new inland waterway service are in the pool of used vessels. The result is the costs of starting a new service are prohibitive.

Completing a revision of the Jones Act will require several steps. First, a detailed analysis will be required of the economic and environmental impacts of the proposed change and of the potential market for short-sea-shipping on the inland waterways of the region and across the nation. Next, the specific statutory changes required must be defined. This will have to consider both of the need to make maritime shipping more competitive and of the interests of those who would maintain the current statute. Finally, a regional consensus on the specific change will be required before it can be advanced politically.

The cost of making this change is low. The benefit will depend upon the response received in the shipping community. Ideally, the steps outlined above will be completed prior to the next Congressional debate on transportation policy and funding, which will likely begin in about two years.

Initiative 3.2: Establish regional freeway management technologies

The vision of this initiative is to: *Develop a Midwest Multi-state Traffic Operations Partnership (MSTOP) that manages a virtual center for traffic and commercial vehicle operations.*

Establishing an MSTOP has both short- and long-term elements. In the short-term, a strategic plan must be developed that is compatible with FHWA and AASHTO guidelines. In the long term, this initiative requires a champion to promote the concept with regional DOT leaders to bring them and the FHWA and AASHTO together. Finally, funding will have to be found.

Funding for this effort could be significant. The model of the I-95 Corridor suggests that much of the cost could be met from federal sources.

Initiative 3.3: Support river and lake lock improvements

The vision of this initiative is to: *Improve the efficiency, capacity and navigability of the waterway systems, while mitigating environmental impacts.*

This initiative should be seen as part of an overall effort to enhance and grow the maritime mode of freight movement. It should be coupled with updates to the Jones and Harbor Maintenance Acts and also with an effort to inform the public of the importance of having a maritime alternative to land transportation of freight. It should also be accompanied by an effort to begin collecting maritime data in a manner that is consistent with the land modes. Finally, the various interest groups will have to be organized in the larger effort to secure funding for the lock improvements.

In the short-term, the focus should be on the effort to educate public agency staff on the importance of waterborne freight, the organization of stakeholder groups and the collection of data on waterborne freight.

Initiative 3.4; Support multi-modal bottleneck solutions

The vision of this initiative is to: *Remove regulatory constraints, improve infrastructure and make greater use of each of the modes through some modal shifts in order to address inefficiencies, safety and environmental issues that affect freight movements.*

This effort will focus on collecting and analyzing data to identify bottlenecks and potential solutions to those bottlenecks. Solutions will be documented and the bottlenecks prioritized. The first step will be defining a bottleneck. Subsequent steps will be collecting and analyzing data to find locations that meet the definition of bottleneck, identifying any planned fixes to the bottlenecks, and finally looking at the system to determine how the bottlenecks impact the region and how fixing them might impact other links in the system.

This effort is linked to other initiatives in the agenda, such as **Initiative 2.2** and **Initiative 2.3**. It will utilize data and analysis done in the planning and agency focal point efforts. It will have to be coordinated with each of these other efforts.

Initiative 3.5: Address regulatory bottlenecks at border crossings

The vision of this initiative is to: Address regulatory and infrastructure issues which restrict freight movements across the US/Canadian border, creating costly inefficiencies. Changes in the regulatory structure should be the first focus for improving the flow across the border.

This is a complex issue since it involves two federal governments as well as all states and provinces with border crossings. For the Upper Midwest, the major problem lies at the Detroit-Windsor crossing area. To expedite solving the problem, the states of the region should urge the USDOT to take an active role and make the crossing a high priority.

Performance Measures

The Upper Midwest Freight Corridor Coalition identified performance metrics that could be used to determine progress on each initiative. Since some measures are common to multiple initiatives, they are presented in Table 2 on the following page in a matrix format. The measures are listed vertically on the left; the various initiatives are listed horizontally across the top; and the checked cells indicate which measures and initiatives are linked.

If these performance measures are regularly monitored and used, they offer the possibility of helping to improve the condition of the freight transportation systems in the region.

Regional Freight Agenda for the Upper Midwest

Table 2: Performance Measures Related to Initiatives

		Initiatives												
	Measure	1.1 Improve Political and Public Understanding of Freight	1.2 Document Funding needs and Consequences	2.1 Create an Ongoing Regional Organization	2.2 Collect Data	2.3 Define Freight Focal Points in Each Agency	2.4 Develop model planning approaches	2.5 Define regional freight network	2.6 Define role and structure for public/private partnerships	3.1 Modify Jones Act	3.2 Implement Regional Freeway Management Technologies	3.3 Support River and Lake Lock Improvements	3.4 Support multi-modal bottleneck solutions	3.5 Address regulatory bottlenecks at border crossings
Accomplishment	Definition							x						
	Successful Implementation			x							x			
	Number of Projects								x					
Marketing	Model for contracts								x					
	Market research product									x				
	Marketing / Branding	x						x						
Money	A marketing plan													
	Amount of dollars leveraged								x					
	Dedicated funding				x						x			
	Obtaining funding							x						
	Costs													x
	Dollars saved		x									x		
	Dollar spent on freight facilities in region		x											
ROI	Economic Development Impacts (jobs creation)						x							
			x											
Traffic and Operators	Time delays, crossing time		x											x
	Safety						x							
	Level of service						x							
Facilities	Traffic Counts													x
	Age of facility							x				x		
	tonnage, tons accumulated, etc							x						
	rail (vol/day), water (tonnage), Air (tonnage)						x					x		
	Change in tonnage								x					
System Performance	Length of barge tows accommodated											x		
	System redundancy to accommodate maintenance and security concerns												x	
	Regional connectivity / interoperability									x				
	Bottlenecks		x											
Logistic	Route reliability		x				x							
	Modal Shifts						x					x		
	Commodity based flows						x							
Energy and Environment	Understand / Identify logistics patterns						x							
	Fuel efficiency / consumption		x				x					x		
Outreach	Air quality, environmental issues		x				x					x		x
	Each agency has a visible and effective coordinator (via survey of freight interest/partners)					x								
	Surveys measuring increased public awareness (baseline survey, follow-up)	x												
Data	Freight contact list	x												
	State DOT and MPO commitment / membership					x								
	Rate of data usage					x								
	User satisfaction survey/index					x								
Regulatory	Citations in measurable products					x								
	Weight restriction issues					x								x
	Consensus of Region on position									x				
	Repealed/Modified Jones Act									x				
Regulatory	Analysis of impacts of repeal/modification									x				

Summary

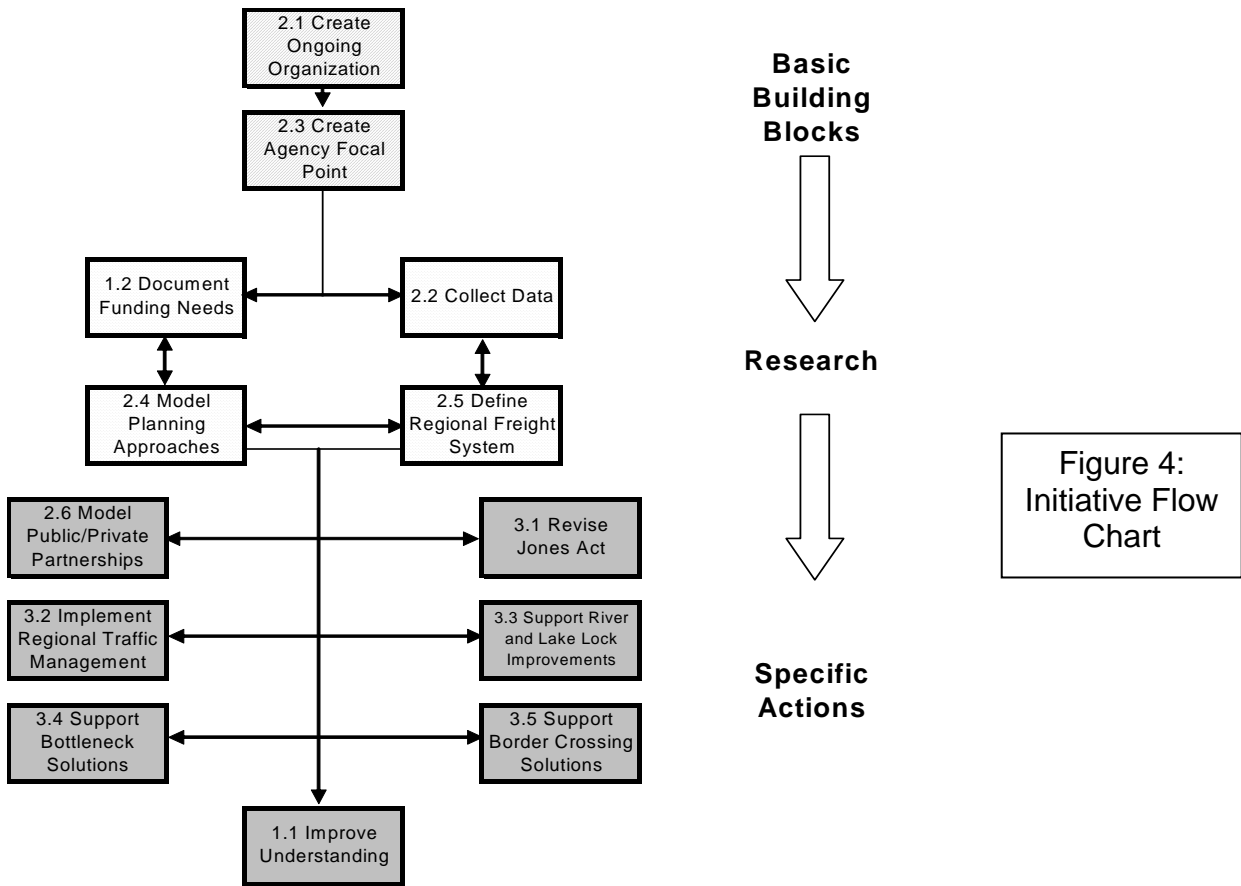


Figure 4: Initiative Flow Chart

The combination of these thirteen initiatives, prioritized by the Upper Midwest Freight Corridor Coalition, promises to be a sound starting point for the region’s efforts to address current and future freight needs. Logically, they should be coordinated and proceed in an orderly manner. Figure 4 illustrates how such a logical flow might progress. Under this suggested approach, the initiatives in the two cross-hatched boxes create an ongoing organization and an agency focal point—are done first as the basic building blocks of the regional freight agenda. The initiatives in dotted boxes are information gathering, formatting and presentation activities. They should precede the specific actions represented by the initiatives in the shaded boxes.

The Upper Midwest Freight Corridor Coalition’s vision is to have the states of the region, along with the affected provinces of Canada, cooperating through efficient use of all transportation modes to ensure the adequate capacity of systems. The prioritized initiatives in this Regional Freight Agenda can help the Upper Midwest realize that vision and meet the challenge of freight movement and economic vitality in the Twenty-First Century.

Next Steps

This Regional Freight Agenda is one part of the findings of phase two of the Upper Midwest Freight Corridor Study. In a parallel effort, traffic operations specialists from all of the states in the region have met and are meeting to develop plans for the complimentary deployment of traffic information and management technologies that might improve the flow of freight throughout the region. Their work will provide more detail for the related recommendation in this report. It will be complete by mid-summer.

This report, the work of the traffic operations group and a draft MOU has been presented to the Board of directors of the Mississippi Valley region of AASHTO in July. The Executive and Technical Committees created by the MOU have met via teleconference to plan and approve the next steps to be taken in the effort.

Acknowledgements

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Appendix

This Appendix to the Regional Freight Agenda for the Upper Midwest contains the additional initiatives identified by the Upper Midwest Freight Corridor Study

Additional Initiative Areas
<ul style="list-style-type: none">• Organizational• Capacity• Regulation• Research• Funding

Research Team. These initiatives were not selected as high priority for short-term or long-term by the Study's Steering and Advisory Committees, but still represent a valuable contribution to the regional dialogue on meeting freight demand. The initiatives are divided into the following areas: **organizational, capacity, regulation, research and funding.**

Organizational Issues

A number of changes could be made in the organizations of transportation agencies to improve their ability to deal with freight.

- **Engage the private sector in dialog.** Freight is controlled and managed in the private sector. Meaningful freight planning can only be done with much input from that sector. In the Upper Midwest, most of the major shippers, carriers and third party providers have a presence in several states. Therefore, a regional approach to dialog through a regional freight council makes sense as a first step.
- **Encourage and facilitate the growth of shippers associations and third party providers.** Shippers associations and third party providers are two tools that can be used to make freight movement more efficient. Both tend to increase the pool of shippers and carriers, minimizing deadheading and maximizing the impact of particular shippers in the marketplace.

Capacity

Several actions should be considered to address capacity constraints on freight movement within the Upper Midwest:

- **Increase awareness of crossing impacts.** More rail-highway crossings not only increase exposure to train-auto crashes, they also slow train movements, reducing capacity. State and local officials, who must approve new crossings, or the adjustments to old crossings, should be aware of the impact their actions can have on rail operations.

- **Include truck-only lanes issues in reports to Congress.** The recently passed transportation bill requires two reports to the Congress on the Interstate and National Highway Systems. The focus of these reports is on the future directions and needs of those systems. The reports should include information on the use, design characteristics and environmental and economic impacts of truck-only lanes on those systems.
- **Support a national rail policy.** The nation has a freight crisis on the horizon. Rail should be a key part of the solution to this crisis. The nation also has many needs and aspirations for passenger rail. But it has no established rail policy. With the exception of Amtrak, passenger and freight rail is handled by the private sector. We need a national policy that affirms and balances the importance of rail transportation for both passenger and freight and that makes and guides public investment in that mode.

Regulation

Current regulations and laws impacting the freight industry have effects that are counter to the efficient movement of goods; remedies might include:

- **Address Security Issues.** Heightened awareness of potential terrorist activities highlights the need for greater security for all of the transportation system. It is most obvious at the border crossings, but it is also a factor in all other areas of transportation. Solutions that provide needed security without sacrificing mobility must be found.
- **Modify the Harbor Maintenance Tax.** The Harbor Maintenance Tax is charged to ships entering port based on the value of their cargo. It was designed for the coastal ports and trans-oceanic shipping. For short-sea shipping of any kind, it presents a cost burden that is-in most cases prohibitive.
- **Create a rail dispute resolution process.** Competition was the underlying rationale for deregulating the rail industry. The rail industry is, however, unique in that companies are tied to their tracks; they are not free to compete head-to-head in many circumstances. Therefore, rail companies can assume a take-it-or-leave-it approach to many customers. Trucking, which may not be the most efficient option, is the only real competition. Existing federal laws make the Surface Transportation Board the decision body for resolving rail shipper disputes. It has become a very costly and very slow body for carrying out this specific responsibility. Therefore, the provisions of the law that concern operating in the public interest have become moot. A replacement must be found.
- **Initiate pilot projects for CVO safety regulation.** Federal rules for safety regulation allow for pilot projects to encourage new and innovative

approaches to enforcing the regulations. In some cases, the existing regulations have very detrimental impacts on the productivity and safety of truckers. For example, some truckers have said that the new hours of service regulations effectively reduce the number of trips allowed in a driver's day by half. (This is the result of being in service while waiting at terminals.) A pilot project that uses a performance-based approach to safety enforcement might solve this problem while maintaining or even enhancing safety. To be meaningful, this would have to be done on a multi-state basis.

Research

Research is key to increasing our understanding of the conditions that exist and to the viable options that are available to addressing those conditions.

- **Support commercial vehicle, rail and maritime research.** Better information is needed on the safety, environmental and economic impacts of alternative freight strategies. These issues and strategies cover all of the modes.
- **Define regional test projects for implementation.** Using specific tests of innovative approaches to freight will demonstrate the viability of the idea. Test projects are a very simple method for testing new ideas.

Funding

Dollars are the underlying need in many areas of freight. Some areas for consideration include:

- **Support categorical flexibility.** Congress tends to color money by mode and function, highways or rail, maintenance or construction. Some greater flexibility in the use of categorical funding would enhance the ability of states to meet their most pressing needs.
- **Develop a regional approach to pricing.** If the region is to have any significant growth in freeway capacity, tolls will likely play a role in paying for that capacity. Since the states of the region have widely varying rules on their use of tolls, some regional dialog should begin to find a common ground and cooperation on tolls to thus make any new system as simple and compatible as possible

Information Resources for Supporting the Regional Freight Agenda in the Upper Midwest

Dr. Peter S. Lindquist – University of Toledo

This paper provides an argument to support ongoing efforts in the assembly, management and dissemination of information dealing with freight in the Upper Midwest Region. Reliable information resources are essential for advancing the Upper Midwest Regional Freight Agenda in order to provide regional stakeholders with the means to evaluate the capacity of the system to support current and projected flows of goods among all modes of transport. This approach does not stop at the transportation system, however. It is also argued here that no comprehensive understanding of patterns of freight flows and capacity of the system is possible without a clear comprehension of the patterns of economic activity and population characteristics within the region, as these represent the origins and ultimate destinations of goods moving throughout the region.

Rationale

To date, the vision for this regional data resource has been structured upon a seamless coverage of the transportation freight infrastructure that embraces highway, water, rail, and air traffic along with their respective intermodal connections. Capacity, flow patterns and administrative constraints formed the principal focus for data encoded and managed in the system. Employment figures for all sectors of the economy and census information were also included. These data are currently managed and distributed from the Toledo site. However, additional data needs still exist for the region and have yet to be added to this system.

Past discussions within the Upper Midwest Freight Coalition have supported data collection and management efforts; much of the feedback from coalition members has underscored the need for a continuing data management efforts based on the following arguments:

Information needs transcend state boundaries. Public sector decision-making must extend to a regional scale because freight movements do not stop at metropolitan or state boundaries. For example, traffic characteristics in Chicago will influence goods moving from Toledo to Minnesota, Iowa and westward states. Decision makers and public officials at all levels need to expand their vision beyond their jurisdictions with regard to freight movements if they are to maintain their economic viability

Economic development efforts are directly affected by the ability of the transportation system to move commodities and goods within the region and beyond. It is essential to build and maintain a data resource that relates patterns of economic activity in the region (among all sectors) to patterns of

freight movement within the region. ***To date, no such data resource exists that stores and reports these data in one place.***

Increased Growth in Freight Volumes are testing the limits of the current system capacity to support existing and projected flows. Significant technological changes in commerce and in supply chain organization have influenced the movement of freight and will continue to do so:

- Development and growth of intermodal and containerized freight;
- Greater coordination of components among supply chain participants (e.g., Just-in-Time Manufacturing, Pull Logistics, etc.);
- Increasing availability of viable technologies such as web-based commerce and customer direct delivery [1].

Monitoring the capacity of the infrastructure is essential to support goods movement. By doing this it is possible to identify locations where potential bottlenecks and related capacity limitations can inhibit freight movements. Selective investment for infrastructure improvements based on these basic analyses can go a long way to facilitate the movement of freight as a means to strengthen the regional economy. Performance metrics can be developed and included in the database as a means to report on the reliability of the system over seasons, days or specific times of day. In addition, this system will enable analysts and officials to better understand relationships between modes and identify locations where selected modes can effectively be merged.

Tracking administrative regulations and monitoring the functions of administrative facilities within the system that produce delays or inhibit the movements of goods such as weigh stations, customs stations and toll gates can provide useful insights into streamlining these functions. Vehicle and weight restrictions on roads are also essential data to report. Inconsistencies across state and national boundaries are readily identifiable when reported in this comprehensive system.

National security issues dealing with the vulnerability of portions of the system to attacks, sabotage, or even natural hazards must also be incorporated into the system. Alternate network routes, redundancy in the network, and emergency planning can all be readily accomplished within this information delivery system.

Objectives for a Data Delivery System to Support the Regional Agenda

The question of what we wish to accomplish with this information delivery resource must first consider the users of the data. No database can be

sufficiently comprehensive to adequately meet the needs of every constituency in the region. Private firms are justifiably reluctant to share proprietary data that may deal with employment and production figures, volume and value of shipments, origins and destinations of shipments, *etc.* Other data needs dealing with current road construction, weather conditions and related data needs can be obtained elsewhere.

As a result, the design of this system is best suited to the needs of the public that is concerned with both the management of the transportation infrastructure and with economic development. We argue here that neither of these can be considered separately; the economic health of the region is strongly tied to the ability of the transportation system to safely and efficiently transport goods within and beyond the region [2]. Therefore our vision for the information delivery system must satisfy the following objectives:

Provide a single repository for regional data and provide convenient access to public sector officials to obtain information on freight movements for purposes of administration, policy analysis, and economic development. This single location enables users to conveniently gather data from a wide range of sources and a variety of forms that will support analyses that were previously difficult to carry out without extensive efforts to assemble and organize the data.

Establish and manage a comprehensive database that relates patterns of economic activity among all sectors, regional population patterns, import and export flows, and essential components of the freight transportation system that will enable analysts to begin to better understand the direction and volume of freight flows within the region and begin to develop predictive models of freight movements within the area.

Set up a comprehensive, seamless, spatially registered, and current data repository that is managed in a geographic information system framework. Data can be accessed and queried through structure query language database functions or through spatial queries within a GIS. Such a system can produce maps, graphics, tables and statistical output.

Focus on data and information support functions that enable public officials and policy analysts to gather evidence to argue for more efficient public investment in the transportation infrastructure within their jurisdictions and outside their jurisdictions that would impact their local economy. We therefore envision the users of the system to include public officials, analysts and related regional stakeholders from the following organizations:

- Federal, state, and local governments,
- Metropolitan planning organizations (MPOs),

- Transportation-related associations, and
- University research centers.

Data Needs and Contents

Detailed accounts and inventories of the current version of the information delivery resource are available elsewhere [3,4]. The main emphasis of the discussion provided here is to provide a general description of the types of data that are to be included within the data repository and to be made available in the information delivery system. The general content categories are listed in Figure 1. The data are currently stored in a GIS-based data delivery system that is accessible with an Internet connection and restricted access to the University of Toledo Server. Again, technical details of the delivery system are available elsewhere [3,4].

Efforts to date have focused on assembling existing public freight data gathered from diverse sources (*e.g.*, FAF, HPMS, Geofreight, BTS T-100 Air Data and Airports, BTS Port Data, *etc.*). Data from the Census Bureau and commercial sources are also included. As a result, the information repository has assembled considerable volumes of diverse data into one location that is organized into a continuous, seamless GIS.

The next phase of the development of the information delivery system however, will require the assembly of current primary data pertaining to transportation facility characteristics and capacities, network traffic and commodity flows within and beyond the Midwest Region (*e.g.*, traffic counts, OD patterns, *etc.*). Given budgetary limitations, lack of access to proprietary data, and other restrictions to current accurate data, efforts to assemble and manage data will focus on the following modes in descending order:

The Highway Network supports the highest volume of freight traffic and is the mode that conflicts most with the public. Large volumes of existing data have already been collected and compiled into the database. The volume of highway network data, coupled with economic data provides a useful resource for freight modeling. In addition, highway data can be overlaid with other data layers within the system in order to map locations for intermodal transfer onto rail and waterway systems in efforts to ease congestion on roadways.

Contents of the Information Delivery System

(OD) Flow Data

Local/Regional flows within the corridor
Flows into and out of the corridor
International Flows
Flows across international boundaries within the corridor
Flows by Commodity Type and by Mode

Traffic Flows by Link

Highway Truck Traffic Volume (AADT)
Air Freight Flows (annual) within and beyond the corridor
Maritime Traffic "Link" Volumes by Commodity (Great Lakes)
Railroad Traffic Volumes on Class I Links

Transportation Facilities (including attribute data)

Intermodal Terminals
Ports
Airports
Rail Yards
Weigh Stations
Toll Facilities
Customs Stations

Demand Data / OD Base Data

Economic Production Measures (Employment, establishments) by Sector
Population / Market Characteristics

Capacity Data and Level of Service Data

Travel Times
Congestion

Administrative Data

Vehicle Weight / Axle Limits
Vehicle Restrictions
Tolls

Safety Data

Accidents
HazMat Spills

Intermodal Facilities

Connections
Capacities

Documentation

Metadata
Data Dictionary
Technical Documentation
User Guides / Manuals

The Rail Network shows significant potential for intermodal connectivity within the region and still moves heavy volumes of bulk commodities within the region. Efforts are still underway to identify and report active rail links with heavy traffic volumes, currently the system contain class I rail volumes. A comprehensive system should include class II and III volumes as well. However, reliable data resources are extremely difficult to obtain and report in a public resource.

Water Transportation on the Inland Waterway System and the Great Lakes also show significant potential for intermodal connectivity within the region. This mode also presents an alternative to railroads and for international shipments into and out of the region.

Air Freight presents opportunities for movement of high value cargoes and for stimulating economic development in selected locations within the region. However, this mode also supports the lowest volume of freight movements into and out of the region.

Challenges to Developing the System

Challenges to the assembly of reliable and current data are based primarily on funding and staffing; significant effort must be expended to obtain primary data such as actual traffic counts on highways and infrastructure conditions that are obtained from state and local transportation departments. Data from carrier associations such as the Great Lakes Carriers also require significant labor input. In addition, current economic indicator data such as employment and production output figures are either expensive if obtained from commercial sources, or require significant effort to assemble and aggregate into reportable forms (e.g., ES 202 data). Additional commercial freight flow data from such sources as *PIERS*, *TranSearch* or *GTIS* are also expensive and require significant effort to reformat and encode into the database. Reporting restrictions also present a problem when working with data from commercial vendors. As a result, ample time must be allowed for assembly and distribution of these data. Sufficient funding must also be obtained for inclusion of these primary data sources into the information delivery system. Another issue deals with the frequency of data reporting; should data be delivered on an annual, quarterly, or monthly basis? These questions again are a function of funding and staffing.

Functionality of the Information Reporting System. Another significant challenge to the development of the regional information reporting resource deals with the functions available to users of the system. That is, to what extent should the query, manipulation and analysis of data within the regional database be supported within the system (e.g., vehicle routing, OD flow modeling, intermodal transfer simulation, etc.)? One significant impediment to the effective delivery of

information is the need for users to gain the necessary expertise in the use of the system. Currently the system incorporates a specialized application of *ArcView* GIS. Despite a detailed manual furnished at the site, users must spend the time to become accustomed to the operation of the information delivery system.

One attempt to overcome this problem was attempted at the Toledo site by offering a variety of functions at varying degrees of expertise required by users. These include:

- Basic prepared maps for viewing and download,
- Prepared tables and graphs for viewing and download,
- Simple mapping functions in the data viewer,
- Query functions for more advanced users, and
- Analysis functions and specialized functions in the database for advanced users.

The most basic and straightforward function is simply the display of a prepared set of maps that are on display as graphics files. The limitation to this approach is that only a limited set of maps have been prepared for viewing in the form of an atlas. In time, a more comprehensive set of maps can be prepared into an on-line atlas based on users' needs and interests. Additional data in the form of graphs and tables can also be prepared for online viewing.

The GIS mapping functions in the *ArcView* user interface can be accessed by more advanced users. Those users with a familiarity of *ArcView* can display specific variables that reside within the database on their own customized maps. Again, online directions for use of the software will be made available. Those same more advanced users may also choose to apply the GIS-based query functions to produce more advanced maps, charts and tables. In time, additional database software with more advanced query routines should be available to produce a wider variety of analyses, tables, and graphs.

One final set of procedures within the information delivery system will incorporate more simple analysis functions such as network routing, flow mapping, and accessibility mapping to enhance economic development planning within the corridor. Users will be able to compute and display network routes from one origin within the corridor to a variety of destinations within the corridor and beyond. The "reachability" of a given location to the regional and national market can also be computed to facilitate location studies within the corridor for such facilities as manufacturing plants, warehouses, intermodal connections, and related facilities.

Training, Education and Technology Transfer Issues. Significant effort must be devoted to training, education and other technology transfer problems if the system is to be used to its fullest extent. As mentioned above, the system must offer a wide range of services and functions from casual users to more advanced analysts. We present here four strategies for assisting users to gain mastery of the system and familiarity with the database. These include:

Workshop sessions for training users. The developers at the Toledo Site can travel to users' workplaces to offer training or could offer workshops at The University of Toledo. This alternative would incur the greatest expense, however.

Technical manuals are another alternative. Currently the Midwest FreightView Users Guide is available in *.pdf* format on line at the Toledo web site (<http://www.midwestfreight.utoledo.edu>)

Web-based documentation / tutorials for instruction can also be implemented on the Toledo web site in the form of short tutorials for specific functions that could include such topics as basic mapping, query functions, and more advanced analysis functions. Additional tutorials can be posted documenting the contents of the database.

On-line help functions can also be developed to solve routine problems that are encountered as users operate the system.

Technical support via telephone and email can also be developed using staff at the Toledo site to help users with more complex problems not available at the on-line help functions.

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Conceptual Regional Technology Plan

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Introduction

The Upper Midwest Freight Corridor Study, active since 2003, includes the states of Ohio, Indiana, Michigan, Wisconsin, Illinois, Minnesota, and Iowa, as well as the provinces of Ontario and Manitoba along with the Federal Highway Administration and researchers from the University of Wisconsin-Madison, the University of Illinois-Chicago, and the University of Toledo. The effort is coordinated by the Midwest Regional University Transportation Center.

Phase one of the study concluded that congestion was a major issue for our freeways, rails and waterways. It also concluded that the region lacks coordination in the implementation of traffic management technology.

Commercial vehicle operations (CVO)-related intelligent transportation systems (ITS) have the potential for improving the flow of truck freight through the region. Several states are moving ahead with some elements of it, but the region lacks a comprehensive plan of action.

In order to capitalize on the efficiency rewards of regional ITS deployment and management, the Upper Midwest Freight Corridor Coalition made the facilitation of a regional technology dialog a high priority for phase two of this study. One of the six primary tasks of phase two was to facilitate the beginning of a regional approach to deploying commercial vehicle-related intelligent transportation systems. This regional approach may ultimately result in the formation of a Multi-state Traffic Operations Program (MSTOP).

The task undertaken by the Upper Midwest Freight Corridor Coalition is divided into four sections:

- 1) Prepare a white paper outlining the current state of CVO-related ITS in the region.
- 2) Prepare white papers outlining the probable benefits of ITS implementation.
- 3) Facilitate a dialog within the region on ITS.
- 4) Draft a conceptual regional deployment plan.

Sections 1 and 2 have been completed and comprise the white paper *Using Highway Technology* (see Volume I of Final Report). Some additional information on the current state of CVO-related ITS in the region and the benefits of ITS implementation can be found in this report. This report also contains the results of the Coalition's successful effort to facilitate a dialog within the region on ITS and to draft a conceptual deployment plan (Sections 3 and 4 of task).

Interstate Corridor Characteristics

In an effort to identify specific areas which could benefit from regional ITS deployment, the Upper Midwest Freight Corridor Coalition researched characteristics of the interstate corridor. There are six major areas of focus:

- Traffic congestion
- Freight bottlenecks
- Key border crossings
- Critical travel decision points
- High incident areas affecting interstate travel
- Current CVO-related ITS within the Upper Midwest

Recurring and non-recurring congestion are the major challenges to efficient regional interstate operation. The first five areas of focus all relate to either recurring or non-recurring congestion. Identification of the points in the system that are congested is the first step in drafting a regional ITS deployment plan. The sixth area of focus identifies current CVO-related ITS within the Upper Midwest in order to identify potential areas of regional collaboration.

The hours of delay created by traffic is an important indicator of recurring congestion levels. Figure 1 displays hours of delay within the Upper Midwest, divided into groups based on population size. As expected, the largest delays occur within the very large population group average areas, namely Chicago and Detroit.

Upper Midwest Freight Corridor Study Technology Plan

	Delay per Traveler (Hours)	Travel Time Index Total Delay	Total Delay (1000 Hours)	Total Cost (\$ Million)	Delay per Traveler (Hours)	Total Delay (1000 Hours)
Very Large Average (13 areas)	61	1.48	194,317	325.1	38	154,841
Chicago, IL-IN	L	HH	HH	H	H	HH
Detroit, MI	L	LL	LL	L	0	LL
Large Average (26 areas)	37	1.28	33,647	42.9	28	30,784
Minneapolis-St. Paul, MN	H	H	HH	H	HH	HH
St. Louis, MO-IL	0	L	H	0	L	0
Cleveland, OH	LL	LL	LL	L	LL	LL
Cincinnati, OH-KY-IN	L	L	L	0	0	LL
Milwaukee, WI	LL	L	LL	L	LL	LL
Columbus, OH	LL	LL	LL	L	L	LL
Indianapolis, IN L	0	L	L	L	H	LL
Medium Average (30 areas)	25	1.18	9,598	7.8	20	8,263
Dayton, OH	LL	LL	LL	LL	LL	LL
Akron, OH	LL	LL	LL	LL	LL	LL
Grand Rapids, MI	LL	L	LL	LL	LL	LL
Toledo, OH-MI	LL	LL	LL	LL	LL	LL
Small Average (16 areas)	13	1.11	2,142	0.9	8	1,659
No cities in 7 state region						
O – Average congestion levels or average congestion growth (within 1 interval of population group average)						
H – Higher congestion or faster increase in congestion (between 1 and 2 intervals)						
L – Lower congestion or slower congestion increase (between 1 and 2 intervals)						
LL or HH – Lower / Slower or Higher / Faster by more than 2 intervals.						

Figure 1: Upper Midwest State Traffic Congestion (Source: 2005 Urban Mobility Study)

An estimated 40% of congestion is caused by bottlenecks. A bottleneck is defined as recurring congestion at locations where the volume of traffic routinely exceeds the capacity of the roadway, resulting in stop-and-go traffic flow and long backups (1). While there are several types of freight bottlenecks (steep grade, signalized intersection, lane drop), highway interchange bottlenecks cause the most problems. The direct user cost associated with interchange bottlenecks is about \$4 billion per year (1). Based on a Cambridge Systematics, Inc. report prepared for FHWA, there are 60 highway interchange bottlenecks with the Upper Midwest 7-state region, displayed in Figure 2.



Figure 2: Freight Bottlenecks in Upper Midwest (Source: (Source: US DOT FHWA White Paper prepared by Cambridge Systematics, Inc.)

Freight movement across the U.S./Canadian border accounts for a significant portion of freight traffic within the Midwest. Due to capacity and regulatory constraints, there tends to be significant delay associated with the following key border crossings, displayed in Figure 3. This recurring congestion could be improved through a regional ITS strategy.



Figure 3: Critical Border Crossings in Upper Midwest (Source: US DOT FHWA Freight Analysis Framework)

Identifying critical Upper Midwest travel decision points can be beneficial for a regional ITS strategy. Use of dynamic signage and other traveler information resources can lead to effective rerouting of traffic off of congested interstate segments. Communication with shippers and the traveling public at or before critical decision points enables rerouting to occur. A regionally coordinated and timely traveler information system can thusly mitigate the scale and duration of non-recurring congestion. Figure 4 identifies several critical Midwest travel decision points. It should be noted that this graphic is the product of a sketch exercise occurring during an April Workshop discussed in the Regional Dialog section and the graphic needs further analysis to be considered comprehensive.

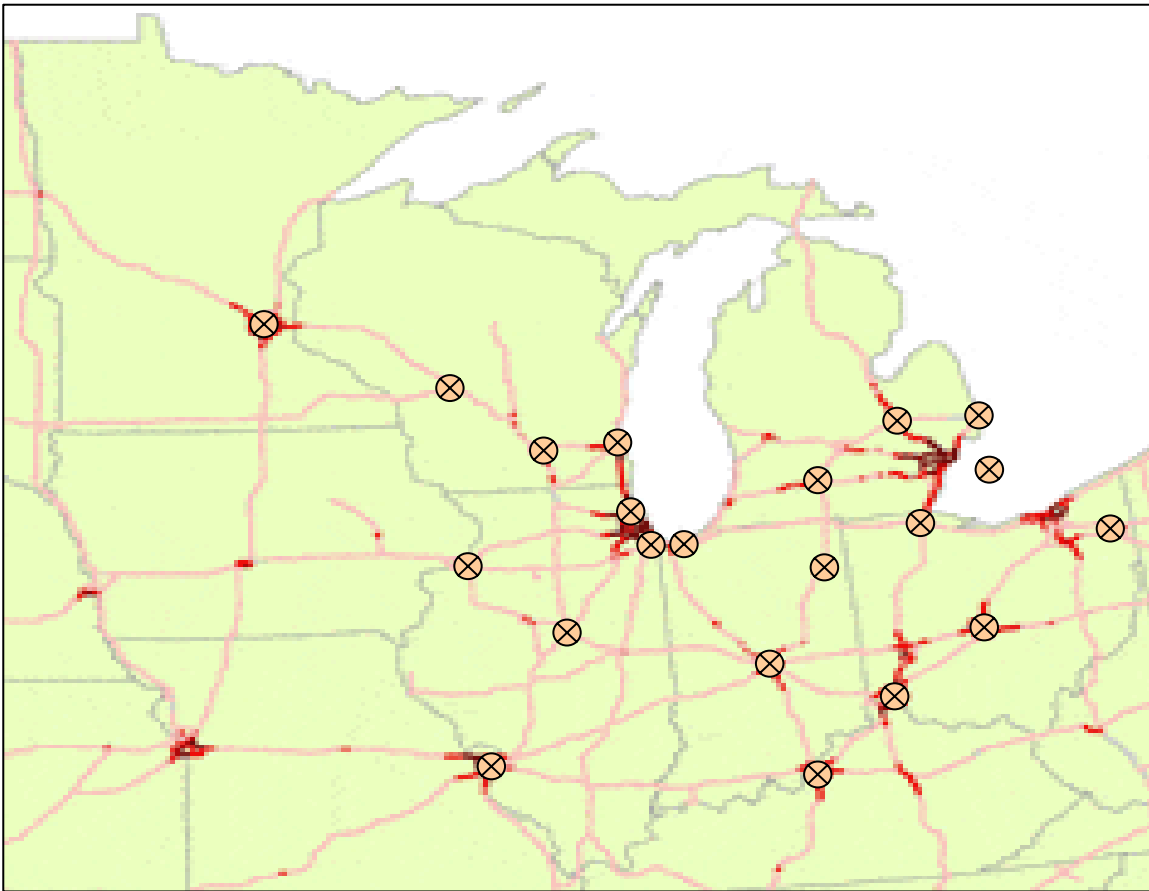


Figure 4: Travel Decision Points in Upper Midwest

As part of the assessment of the Midwest interstate corridor characteristics, participants in the April Workshop identified high incident areas affecting interstate travel. These points on the interstate highway system represent a significant portion of the non-recurring congestion that occurs within the Midwest. As with Figure 4, Figure 5 is the product of a sketch planning exercise and is not exhaustive.

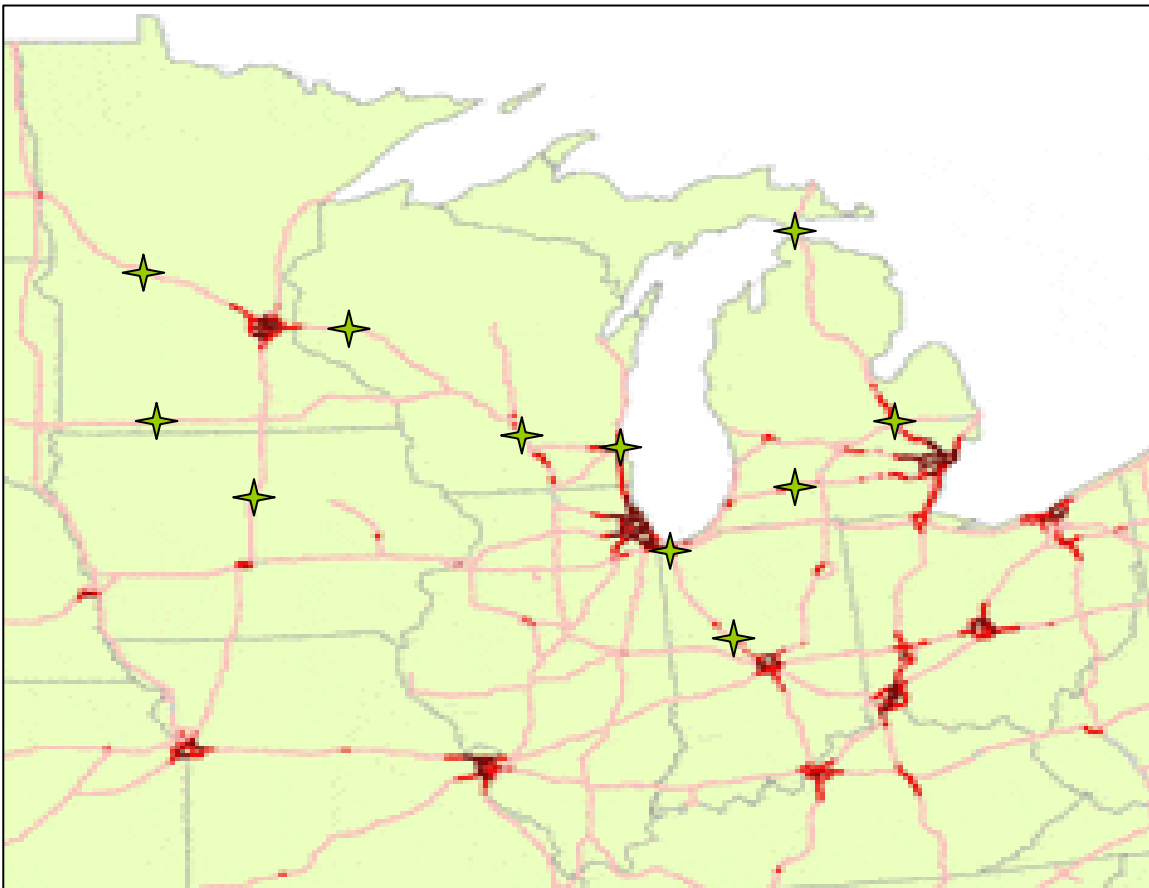


Figure 5: High Incident Areas Affecting Interstate Travel

Upper Midwest Freight Corridor Study Technology Plan

In order to identify potential areas of regional collaboration, the Upper Midwest Freight Corridor Coalition then researched existing CVO-related ITS programs within the region. See Table 1 below for the results of a survey of ITS professionals within the 7-state study region.

State	TRAVELER INFORMATION	CONGESTION MANAGEMENT	WORK ZONE MANAGEMENT and CONSTRUCTION COORDINATION	FREIGHT COORDINATION including INSPECTION and SAFETY	Projects or Initiatives that would benefit from Midwest Traffic Operations Coalition
Illinois	Gateway Traveler Information System in the Gary-Chicago-Milwaukee (GCM) Corridor	GCM Corridor including the Traffic and Incident Management Work Group, the Transit Operations Work Group, and the CVO Work Group	GCM CAT Regular multi-state coordination activities within the Bureaus of Design and Construction	Proposal for One-Stop Shopping initiative Pursuing CVISN Level 1	GCM projects Illinois Statewide ITS Strategic Plan and Architecture projects
	Gateway Guide in the St. Louis metropolitan area	CAT developed under GCM	CAT being formed to address I-94 corridor	GCM CPP currently under development	Northeastern Illinois ITS Strategic Plan projects
Indiana	GCM Corridor planning on sharing DMS information between IN, IL, WI.	Communications between TMC in Indianapolis and TMC in Gary	GCM Corridor "information cards" on summer construction activities	Indiana State Police Commercial Vehicle Division works with the FMCSA and other states GCM corridor freight coordination	New IDOT position for Commercial Vehicle & Freight Mobility issues
Iowa	CARS	IA/IL share DMS quad cities	Midwest Smart Work Zone Deployment Initiative (IA, KS, MO, NE)	PrePass / Safer & other CVISN compliant electronic credentialing, TRACS	
	511 LPFM (HAR), TMDD, ESS & 1512 Standards	Working on ITS Deployment Plan for quad cities		TRACS NAITC	
Michigan	MDOT and MTO coordinating to provide better, more accurate and timely information on the HAR at the Blue Water Bridge	MDOT and MTO coordinating to provide border delay times via web site		Discussions of partnering in the CVISN program	Study to improve border crossing efficiency, will likely include development of region-wide traffic management concept of operations with the intent of linking the MDOT Traffic Management System to the GCM, Compass, and Ohio systems to provide traveler information on regional basis
		Plans to provide border crossing delays at major decision points throughout MI and Ontario Steering committee for the Intelligent Border Crossing study being performed by MTO and Transport Canada			
Minnesota	North/West Passage Corridor Coalition participation	Coordination with WI on design and control of I-94 cameras that are programmed to be installed adjacent Minneapolis/St. Paul metropolitan region		Reviewing and building dialogue with border states on Truck Size and Weight regulations	Designation of a national Interstate Oasis Program, allowing for one-stop rest areas to be recognized on the interstate system
	Interface control document outlining how Minn CARS will interface with the traveler information systems in the Dakotas (partially deployed)	North/West Passage Corridor Coalition efforts to improve cross-border center-to-center coordination for traffic operations			
Ohio	not available at time of printing				
Wisconsin	Coordinated CMS and HAR Messaging standards across GCM Corridor	Limited with exception of cross border traffic management associated with alternate routes along the WI-IL border.	Feeds information to Gateway Traveler Information System from MONITOR Freeway Management System through direct fiber connection	CVISN Level 1 Compliant	ITS Sketch Planning Projects (Corridor Planning Methodology for ITS, Ramp Control and Surveillance, Travel Warning and Information Systems, Traffic Signal Systems)
	Feed information to Gateway Traveler Information System from MONITOR Freeway Management System through direct fiber connection Participant in GCM, North/West Passage		Additional Programming Coordination required to limit number of regional work zones encountered	Participating in Upper Midwest Freight Corridor Study	TransPortal Transportation Operations Data Hub and Archived Data Management System Development 511 Traveler Information Preliminary Engineering
Acronyms CAT Corridor Action Team CMS Changeable Message Signs CPP Corridor Program Plan CVISN Commercial Vehicle Information Systems Network CVO Commercial Vehicle Operations DMS Dynamic Message Signs ESS Environmental Sensor Stations FMCSA Federal Motor Carrier Safety Administration GCM Gary/Chicago/Milwaukee HAR Highway Advisory Radio MTO Ministry of Transportation-Ontario NAITC North American International Trade Corridor TMC Traffic Management Center TMDD Traffic Management Data Dictionary TRACS Traffic and Criminal Software					

Table 1: Cross Border or Multi-state Transportation Operations Activities

The six areas of interstate corridor characteristic research detailed in this section were used as a base for a regional dialog about technology deployment.

Regional Dialog

In the first quarter of 2006, a series of exploratory meetings were held with a collection of Midwest-based organizations with an interest in enhancing interstate traffic and commercial vehicle operations and sharing of traveler information. The Midwest Regional University Transportation Center (MRUTC) and the Traffic Operations and Safety Laboratory (TOPS) at the University of Wisconsin-Madison worked together to explore the establishment of a Midwest Traffic Operations Coalition, using the participants, framework, and existing funding of the Upper Midwest Freight Corridor Coalition as a launching platform. The proposed Midwest Traffic Operations Coalition would also use the Gary-Chicago-Milwaukee (GCM) ITS Priority Corridor as a guide, drawing on the exemplary work done by GCM and expanding their efforts to a broader region.

The organizations represented in discussions about the Midwest Traffic Operations Coalition included eight Midwest Departments of Transportation:

- Illinois Department of Transportation
- Indiana Department of Transportation
- Iowa Department of Transportation
- Michigan Department of Transportation
- Minnesota Department of Transportation
- Ohio Department of Transportation
- Wisconsin Department of Transportation
- Federal Highway Administration-Division Offices

In addition to the public sector organizations, the Midwest-based Connected Vehicle Trade Association provided private industry perspectives during initial discussions.

Two teleconferences were held in February and March and a workshop in Columbus, Ohio focused on traffic and commercial vehicle operations was held in conjunction with the Upper Midwest Freight Corridor Study in late April. The initial teleconference included brief presentations from several existing Multi-state Traffic Operations Program (MSTOP) representatives including:

- Gary-Chicago-Milwaukee (GCM) ITS Priority Corridor
- I-95 Corridor Coalition
- I-10 Freight Study
- High Plains Coalitions
- North/West Passage
- AASHTO MSTOP Research Activities

In addition to the short presentations, each DOT was allowed an opportunity to provide an overview of current and/or planned interstate coordination activities related to traffic management, traveler information, work zones, and special

event management. After the initial teleconference, the group agreed there was enough momentum to meet in Columbus in late April. Therefore, the March teleconference was dedicated to planning the agenda for the April workshop.

The April Workshop held in Columbus was structured to investigate if there was interest in moving forward with a Midwest Traffic Operations Coalition with the specific objectives of:

- better understanding Midwest traffic operations characteristics,
- developing a Midwest Interstate corridors vision and needs,
- discussing what could be done with little, some and significant funding, and
- developing a plan and schedule for future dialog.

The Workshop resulted in the formation of a draft Concept Development Report for a Midwest Traffic Operations Coalition. The contents of the Concept Development Report are further described in the subsequent sections of this report.

Concept Development Report Uses

The Concept Development Report, based on the results of the April Workshop, serves to:

- provide a mechanism to understand what issues are critical to the Midwest Traffic Operations Coalition,
- provide an initial listing of activities that could significantly impact interstate traffic operations, and
- serve as a basis for guiding the start-up of the Midwest Traffic Operations Coalition.

This Concept Development Report contains:

- a Vision for the interstate corridor,
- a needs assessment for the interstate corridor, and
- the results of a sketch planning exercise to identify potential activities.

Vision

After significant deliberations, the Midwest Traffic Operations Coalition developed a Vision that supports a variety of traffic operations, safety and economic development activities throughout the region:

MIDWEST INTERSTATE CORRIDOR VISION STATEMENT

Develop and implement a regional transportation operations system in the Midwest with expected benefits of:

- Coordinating efforts to respond to and minimize non-recurring congestion and improve network reliability
- Sustain and encourage economic competitiveness of the region
- Reducing crashes, personal injuries, and fatalities
- Supporting national emergency preparedness

Interstate Corridor Needs

The Midwest Traffic Operations Coalition also developed a statement of the specific needs of the Midwest traffic and commercial vehicle operations community. It includes:

- Organizational and technical support to foster learning and information sharing
- Provide a source of long-distance travel information to shippers and the traveling public
- Development of a mobility-oriented Midwest Regional Concept of Transportation Operations
- Development and maintenance of strategic, performance-oriented business plans
- Creation of frameworks and guidelines that will:
 - Assist members with system management and operations
 - Support investment decisions
 - Select and define standards for information sharing
- Accelerate coordinated system management and operations by facilitating deployments of cross-jurisdictional programs and services

Potential Activities

The final portion of the Concept Development Report drafted by the Midwest Traffic Operations Coalition is a list of potential activities that could be performed by the organization if it were formed. The following activities were the result of a portion of the April Workshop, dedicated to developing ideas that support the Midwest Corridor Vision Statement and associated needs. To capture a wide array of solutions, workshop attendees offered several solutions based on the level of funding available:

- No / Low Funding (up to \$100k)
- Limited Funding (\$100k to \$1m)
- Significant Funding (greater than \$1m)

Nearly all of the solutions offered by the group were related to interagency data sharing and/or traveler information. Table 2 lists the solutions developed during the workshop.

NO COST / LOW FUNDING
<ul style="list-style-type: none"> ▪ Catalog Existing Emergency Alternative Routes (local/state) ▪ Define Interstate Alternative Routes ▪ Phone List/Routing Requirements ▪ Equipment Asset Maps ▪ Share Road Closure Guidelines ▪ Develop Methods for Best and Approved Product Sharing/Peer Exchanges ▪ Publish Regional Clearance Laws, Dusting Legislation
LIMITED FUNDING
<ul style="list-style-type: none"> ▪ Combine State Static Closure Information (i.e., More than Weekly) ▪ Develop Upper Midwest Concept of Transportation Operations ▪ Develop and Program Performance Measures
SIGNIFICANT FUNDING
<ul style="list-style-type: none"> ▪ Connected Vehicle Pilot Program ▪ Real Time Traveler Information ▪ Traffic Technology Test-bed ▪ Upper Midwest Traffic Operations Center

Table 2: Initial Upper Midwest Traffic Operations Solutions

Summary

In order to capitalize on the efficiency rewards of regional ITS deployment and management, the Upper Midwest Freight Corridor Coalition made the facilitation of a regional technology dialog a high priority for phase two of this study. The meetings of the Midwest Traffic Operations Coalition and resulting Concept Development Report are significant stepping stones in this direction. The team formed through the coordination of the Upper Midwest Freight Corridor Coalition and TOPS Lab at the University of Wisconsin-Madison, using the GCM ITS Priority Corridor as a building block. The organization has the potential to put an effective Multi-state Traffic Operations Program into place in the Midwest.

Next Steps

The work of the traffic operations group was presented to the Board of Directors of the Mississippi Valley region of AASHTO in July. The results of the Upper Midwest Freight Corridor Study's phase two and a draft MOU promoting regional solutions to meet freight demand in the Upper Midwest was also be presented as

part of the briefing. The Executive and Technical Committees created by the MOU met in the summer and fall to plan and approve the next steps to be taken in the regional freight and technology efforts, which include consideration of the formal establishment of the Midwest Traffic Operations Coalition.

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