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

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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. Decisionmakers 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 overlayed 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

Figure 1. Generalized Contents of the Information Delivery System.

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. 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 "reachabilty" 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.

REFERENCES

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