FREIGHT TRAVELER INFORMATION CLEARINGHOUSE: MISSISSIPPI VALLEY FREIGHT COALITION

Project MVFC 06
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A regional organization that cooperates in the planning, operation, preservation, and improvement of transportation infrastructure in the region. Managed by CFIRE.

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Summary

Timely and reliable traveler information is essential for efficient and safe commercial vehicle operations, which play a significant role in the Mississippi Valley Region. Despite the variety of information available, the inconvenient decentralized structure of the region"s information infrastructure remains a barrier. A centralized, one-stop shop for information would allow freight-travelers to make more accurate and up-to-the-minute adjustments in their routes and schedules, thereby bolstering efficiency and lowering freight movement costs across the region. The primary audience for this concept are motor carriers.

The scope of this project includes exploring intelligent transportation system (ITS) architectures among the ten member states and other multi-state organizations, collecting input from motor carriers and regulators on their ideas for better travel information, exploring the feasibility of an information clearinghouse, outlining a concept of operations, suggesting next steps, and developing a web-based prototype mock up. The project is sponsored by the Mississippi Valley Freight Coalition (MVFC) and was carried out by the Wisconsin Traffic Operations and Safety Laboratory (TOPS Lab) at the University of Wisconsin-Madison in collaboration with the Center for Freight Infrastructure Research and Education (CFIRE). This phase was completed in May 2009.

A key objective for this project was to explore the current state of traveler information useful to motor carriers. A web- and telephone-based survey was done to collect feedback from those involved in different aspects of the motor carrier industry. The findings from these surveys aided the project team in focusing on the type of information a web-based information clearinghouse ought to provide. It also served to inform this effort about what types of information are most valuable to motor carriers and dispatchers, as well as revealing some different perceptions between motor carriers and government regulators of what content and delivery methods were most effective.

An important finding from both the literature review and the survey effort from this study is that motor carriers – the primary customers envisioned – are overall generally less interested in a new or enhanced traveler information portal than they are interested in improved regulatory and permitting service. That is, if DOTs have resources available to improve freight operations, the industry is saying those resources would be better spent streamlining the permitting process, including across borders. This was not a question asked during this survey, but it is a sentiment echoed in the open ended feedback received.

Coupling the survey findings with information on current and planned data systems in each of the states, this report outlines high-level feasibility and operational concepts for a potential clearinghouse, including a web-based prototype mock-up built on top of a Google Maps interface.

Following this phase of the project, if the MVFC chooses to fund further work toward a clearinghouse, the initial next steps would be completing system requirements and system

design, then system integration and implementation, followed by testing and validation. Several alternative approaches and levels of investment for next steps are available, but besides a do-nothing alternative, these can be divided into four broad categories.

- First is the lowest cost option of completing the ten-state website with limited functionality and minimal operations and maintenance commitment. This site would provide some information such as congestion and truck parking locations, but it would primarily serve as a single stepping-off point to restriction and permitting resources and more detailed travel condition information provided by and maintained by each state.
- A second tier would entail the integration of additional information such as road weather and seasonal load restrictions. This would be achieved in a manner that would require, upon build out, no ongoing personnel commitment from the states and minimal maintenance and website hosting resources.
- The third tier would include development of automated and standards-based load and size restriction information for each state. This would require ongoing maintenance and support, primarily technical. With this option it could also be designed with secure access for state regulators to populate a conditions database with any construction or emergency changes to permits or load restrictions.
- The top tier of the clearinghouse concept would entail all of the above, but also would pursue much of what the federal Commercial Vehicle Information Systems and Networks (CVISN) program seeks to implement, but at a ten-state regional level. For example, it would be feasible to integrate the permitting system among the ten states to provide uniform access and consistency for motor carriers. Refer to the CVISN program for more information.

The Clearinghouse is not expected to be marketed until further development is completed. The tool would be expected to be completely free to users and sponsored by the stakeholders, although alternative business models should be explored upon further work on this concept.

This project and the website prototype were presented to the MVFC Technical Committee and the Mississippi Valley Traffic Operations Coalition (MVTOC) in March 2009, and a draft report and a presentation of the prototype were circulated for review. This material was also presented at the MVFC annual meeting in Kansas City in April 2009. A project website is available via the Mississippi Valley Freight Coalition website (mississippivalleyfreight.org/clearinghouse) that includes the prototype, this report, and other relevant information and links.

In addition to the recommendations and possibilities for further work on the clearinghouse concept, there are two key recommendations that are somewhat ancillary to the core objective of this project and that potentially direct resources elsewhere. The first is the greater desire for improved permitting mentioned above. The second is the role of DOTs in providing traveler information given the emergence of new technologies and numerous third party providers. Most states do not currently have platform-neutral, standards-based real

time traveler information available, and the recommendation here is to encourage those jurisdictions to develop those resources. By doing so, not only does the 10-state clearinghouse concept become more viable, but any third party private or public provider can access that information and provide it to the motor carrier industry across any platform or technology.

These issues and the project process, findings, and recommendations are all discussed in greater detail in the chapters of the report.

Chapter 1 – Introduction

1.1 Problem Statement & Background

Reliable and timely information is essential to efficient and safe commercial vehicle operations, which play a significant role in the Mississippi Valley region. Many transportation-related information systems have been developed by agencies and governments to serve various local needs. However, as freight-travelers make their way through multiple localities in the region, the current decentralized structure of the region"s information infrastructure results in suboptimal driving decisions being made by motor carriers. Proliferation of the current information systems is a problem, as is the consistency and completeness of the information in these systems. A centralized, regional hub that presents cross border information would allow freight-travelers to make accurate and up-to-the-minute adjustments in their routes in a more convenient manner, which would improve efficiency and lower costs for freight travel throughout the region.

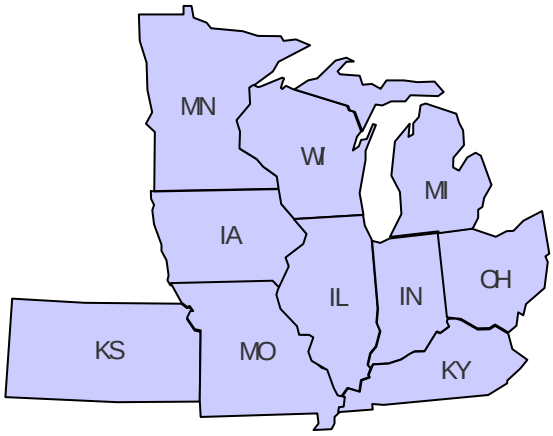


Figure 1. Ten-State Mississippi Valley Region

The freight travel information clearinghouse project emerged in part from four projects previously proposed and considered of high importance by the Mississippi Valley Freight Coalition (MVFC) and the Mississippi Valley Traffic Operations Coalition (MVTOC). Those four projects were:

- Identification of advanced traveler decision points;
- Combine state static closure information;
- Real-time traveler information needs of the trucking industry; and
- Identification of alternative routes.

This project emphasizes the integration and delivery of information related to two of those projects – closure information and real-time traveler information specific to motor carriers. The aspects related to routing – decision points and alternate routes – are partially capture by this project.

Consolidation of these four topics into this research will result in more helpful and comprehensive information for the end-users in the form of the proposed prototype freight information clearinghouse.

There are two related and concurrent projects following a timeline similar to this clearinghouse exploration. Those are focused on long-term or overnight parking across the region and on major bottlenecks to commodity flow across the ten-state road network. Each of those have information components which are already integrated into the Clearinghouse web prototype – in part for internal Coalition review and discussion, but also for potential provision to the motoring public in the future.

1.2 Research Objectives & Scope

A main objective is to reassess the real-time travel needs of motor carriers and design the basic architecture of a reliable traveler information clearinghouse for the ten-state Mississippi Valley region. The clearinghouse would potentially provide 24/7, up to date, and accurate information to commercial vehicle operators and associated industries to improve region-wide mobility and safety.

The clearinghouse would serve as the center of information from which motor carriers get information regarding travel time (e.g., congestion), work zones, special events, unplanned incidents, critical routing decision points, lane closure and restriction information, rest areas, and applicable regulations (e.g., weight). As part of a regional approach to dealing with transportation problems, the clearinghouse will propose a platform on which multiple states in the Mississippi Valley region manage and share critical travel-related information specifically for commercial vehicle operators. Another focus of this study is on clarifying the needs from the motor carriers, transportation planners, and traffic operations perspectives.

Within the ITS systems engineering development process, this phase is only conceptual and falls early in the process. It does not address data structural issues such as storage requirements, searching/indexing, or computational and networking requirements of the hosting servers. Important sources of information that are well worth careful examination include existing 511 traveler information or similar systems, ITS standards such as the Transportation Management Data Dictionary (TMDD), and existing ITS architectures. This level of detail follows this concept phase and a subsequent functional requirements phase.

Highway freight carriers depend on a variety of information to make driving decisions in a time-sensitive industry. Providing actionable information to allow drivers to make effective decision will help to:

- Improve overall freight network efficiency (fewer delays translate to lower freight costs);
- Maximize use of available road network capacity;
- Minimize traffic congestion; and
- Reduce crashes and other incidents.

1.3 Organization of the Report

This supplemental report consists of three chapters.

- Chapter 1 introduces the problem, presents the background information, and outlines the research objectives.
- Chapter 2 is a literature review on previous research results and findings, along with previous surveys conducted regarding information provided to/desired by freight travelers and freight companies (usually through dispatch offices).
- Chapter 3 discusses tasks of the project including a compilation of data/information sources currently available to freight travelers, and also a list of agencies/organizations in charge of relevant traveler information systems for motor carriers.
- Chapter 4 covers the two-part, multi-platform stakeholder survey, process, results and discussion of some of its implications.
- Chapter 5 outlines the intelligent transportation system (ITS) architecture, including the stakeholders, high level information flows, and the relationship to the national ITS architecture.
- Chapter 6 covers in some detail the issues and process involved in the web prototype development.
- Chapter 7 concludes with some recommendations and high level remarks about what subsequent options may entail and what the next steps ought to be, within the framework of ITS systems development.

Chapter 2 – Literature Review

While literature on the specific subject of a freight traveler information clearinghouse is limited, several studies and reports have been written on areas of freight transportation that touches on the subject area. Small portions of these reports are applicable to the present project, and are discussed herein. Several other reports related generally to the subject of improving freight travel were obtained in the preparation of this review (NCHRP Synthesis 314, 2003), (Adams et al., 2005), (Hallenbeck et al., 2003), but were not specific to information clearinghouse-type activities.

In 1998, Regan and Golob (Regan & Golob, 1998) surveyed freight operators in California to determine their perceptions of congestion and specifically how advanced technologies might be used to alleviate these issues. They attempted to survey 5,238 freight operators (selected from a pool of over 46,000 possible operators), and through a computer aided telephone survey (conducted by Strategic Consulting and Research) a 22.4 percent response rate was obtained. These 1,200 responding freight operators were asked about views on the impact of traffic congestion on efficiency and safety, proposed infrastructure improvements and policies, *the use of information technologies in day-to-day operations*, and the use of intermodal facilities (emphasis added).

Since the majority of the Regan and Golob research is not focused on areas of interest to this research, only "the use information technologies" section will be discussed in this review. The "Use of Technologies" section offers the following description of their areas of interest: "Questions were used to elicit information about carriers‟ current use of technologies including mobile communications devices, Electronic Data Interchange (EDI), Automatic Vehicle Location (AVL), an electronic clearance system (PrePass™), as well as publicly available traffic information updates. Company spokespersons were asked to rate the usefulness of various technologies and information sources.

Looking specifically at the traffic information updates discussion, several different sources of information (as available in 1998) were rated by freight operators.

Table 1: Relative Merits of Information Sources Used by Drivers on the Road

Median Score (1 to 3 with 1 being the most positive) assigned to various information sources used by drivers	
How useful are CB radio reports from other drivers?	1
How useful are freeway changeable message signs?	1
How useful is dedicated highway advisory radio?	2
How useful are face-to-face reports among drivers at truck stops and terminals?	2
How useful are traffic reports on commercial radio stations?	2

(on a scale of 1 = "very useful," 2 = "somewhat useful" and 3 = "not useful")

In Table 1 above, CB radio reports from other drivers and freeway changeable message signs were rated at the most useful, while other sources of information were considered only somewhat useful.

Table 2: Relative Merits of Information Sources Used by Dispatchers

Median Score (1 to 3 with 1 being the most positive) assigned to various information sources used by dispatchers	
How useful are reports from your drivers on the road?	1
How useful are phone calls to CalTrans or other information services?	2
How useful are traffic reports on commercial radio stations?	2
How useful are computer traffic maps on the world wide web?	3
How useful are traffic reports on television?	3

(on a scale of 1 = "very useful," 2 = "somewhat useful" and 3 = "not useful")

Dispatchers had different opinions from drivers (as shown in Table 2 above), with only direct reports from their drivers considered very useful, with traffic reports obtained by calling CalTrans and those obtained from commercial radio stations being somewhat useful. Again, hopefully simply showing the infancy of the technology in 1998, distributed internet-based computer mapping and television traffic reporting were not useful to dispatchers. The authors surmise that this is "presumably because of the lack of availability of televisions and computer terminals (in dispatch offices)."

The authors conclude that even as "more sophisticated information systems for commercial vehicle operations become available, simple technologies (such as CB radio reports) may in fact continue to provide reliable and regular information updates."

Another somewhat related study came from Iowa State University in 2005 (Maze, Kroeger, & Berndt, 2005). This study looked at truck traffic management in the Twin Cities, and sought to identify strategies that would reduce congestion for trucks traveling within and through the Twin Cities. As part of this study, the authors conducted a survey of the motor carrier industry to determine which attributes of the highway system presented the greatest challenges, and then compiled a list of 23 attributes for which solutions ("strategies") were developed. While none of the five high-priority strategies were related to information dissemination, several of the other strategies did.

The survey was distributed by the Minnesota Trucking Association to 483 of their members. There was an 18 percent return rate (88 surveys). The survey itself consisted of three parts, and only some of the questions in Part 2 are related to the present study. Questions 13-17 are all related to various information needs and provisions. The average rating of the adequacy of information provision for all the questions was 2.8 (on a 5.0 scale).

The relevant strategies identified by the authors were: Improved information to truckers; Weather and Road Conditions; Information on roadway hazards; Update "Truckers" Guide"; Improve CARS to provide road and traffic information on city and county road networks through 511; and a CB alert system. These items were only discussed in the appendices. The "Driver-Oriented Strategies" section of Appendix A lists pros and challenges for each item:

Table 3: Driver-Oriented Strategies

Strategies	Pros/Challenges
Improved information to trucks (through fixed or portable changeable message signs)	Pros: • Increases awareness • Educates public drivers Challenges: • Developing effective signs
Weather and Road Conditions	Pros: • Allows for advanced planning • Increased safety
Improved information on road conditions, construction, incidents, weather	Pros: • Allows drivers to take detours • Increased safety Challenges: • Coordinate with other agencies • Compare results
Information about roadway hazards	Pros: • Increases roadway safety • Allows for detours Challenges: • Information must be consistent and reliable

Table 3: Driver-Oriented Strategies (continued)

Strategies	Pros/Challenges
Improve CARS to provide road and traffic information on city and county road network	Pros: • Added information for other roads Challenges: • Keep information accurate and current • Coordination with cities and counties
"CB Alert" system	Pros: • Drivers surveyed generally support additional information • Provides added alert of work zones, especially at night • Can provide additional information not available on DMS Challenges: • Only warns truck operators; no warnings for other (car) drivers

Appendix D of the Minnesota report provides slight expansion of the strategies listed in Appendix A of that report, and gives places where certain aspects of each strategy have already been implemented. For most, the authors also provide a detailed explanation of how the strategy is supposed to work, and what it is expected to accomplish.

Discussed later is the survey development and findings from this Clearinghouse project and similarities with these previous investigations. There are several continuing themes as well as some new findings and a distinction made between the motor carrier industry and government regulators.

This project has also drawn on experiences from other multi-state organizations or coalitions who have pursued cross-border information. These are not cited specifically here, but examples include the following, some of which are discussed in further detail in the next section.

- North/West Passage – I-90 and I-94 between Chicago and Seattle
- Lake Michigan Interstate Gateway Alliance – Wisconsin, Illinois, Indiana, and Michigan
- The I-95 Corridor Coalition – Heavily traveled east coast corridor

- Multistate Transportation Operations Programs (MSTOP) – broad federal moniker covering a variety of organizations

As stated in the opening paragraph of this chapter, the literature on the specific subject of a freight traveler information clearinghouse is limited. While several studies and reports have been written on areas of freight transportation that touches on the subject area, only small portions of these reports are applicable to the present project. The evident priority for the motor carrier industry is improved regulatory and permitting environment rather than day-to-day information on conditions. Specifically, the sentiment appears to be that if DOTs have resources to make improvements to freight movement, those would be better dedicated to things such as streamlined or multi-state permitting. Regardless, this project research and analysis represents a look into the subject of multi-state freight information clearinghouses.

Chapter 3 – Organizations and Information System Resources for Freight Travelers

This section covers tasks of the project to develop a synthesis of agencies and organizations in charge of relevant traveler information systems for motor carriers and develop a list of currently available data and information sources available to freight travelers.

3.1 511 Traveler Information Programs

On July 21, 2000 the Federal Communications Commission (FCC) designated 511 as the single travel information telephone number to be made available to states & local jurisdictions across the country. The FCC ruling leaves nearly all implementation issues & schedules to state & local agencies & telecommunications carriers. There are no Federal requirements or mandates to implement 511. The goal of the 511 Deployment Coalition is "the timely establishment of a national 511 traveler information service that is sustainable and provides value to users." The intent is to implement 511 nationally using a bottom-up approach facilitated by information sharing and a cooperative dialogue through the national associations represented on the Policy Committee, the governing body of the program.

Out of the ten states in MVFC, Wisconsin, Michigan, Ohio, Indiana, and Missouri are in the process of developing their 511 programs. The other MVFC states, Minnesota, Kansas, Kentucky, and Iowa have deployed their 511 programs, some as early as 2002. Although Ohio does not have a statewide system, the Cincinnati metropolitan area 511 service is the oldest in the country. Wisconsin deployed their statewide system in December 2008.

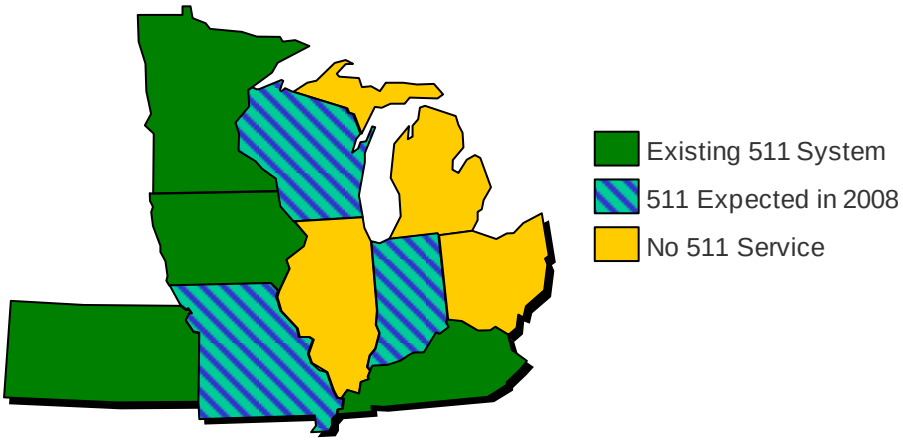


Figure 2: Current 511 Deployment Status

A current initiative, 511 model deployment, indicates that 511 programs do not have a standard format. It also attempts to integrate various sources of information into a telephone supported information query system. There is a significant overlap between stated 511 information coverage and the intended design of the freight travelers‟ information clearinghouse. As in a work report by Battelle Memorial Institute (2004), the 511 program intends to serve stakeholders in multimodal transportation systems. Its status quo does not seem to indicate a clearly defined standard or content in information serving freight travelers. In this direction, we are still in the process of locating relevant documents. A consensus is that 511 program contains road closure, weather, and congestion. Ideally, in the future, the 511 program and the freight travelers‟ specific information clearinghouse will find ways of cross referencing each other‟s database. Until progress is made in standards and more importantly public provision of 511 information in a technology-neutral fashion, this will continue to be a barrier to multi-state traveler information systems as the one envisioned by this project.

Another important feature about 511 is the program is primarily a telephone supported information query system. In contrast, the intended freight travelers information clearinghouse is primarily web-based but might look into many alternative ways for information dissemination such as changing message signs, internet, wi-fi supported short range information exchanges, emails, and so on. The freight traveler information clearinghouse, in this sense, might be a way to complement the 511 program in terms of information delivery. A key here is still to identify the freight related information (needs) in the 511 program, which will definitely help establishment of the freight travelers‟ information needs and the information content in the data architecture.

Additional information about the 511 program is available from the FHWA (http://www.fhwa.dot.gov/trafficinfo/511.htm) or the National 511 Deployment Coalition (http://www.deploy511.org).

3.2 Multi-State Corridor Coalitions

Lake Michigan Interstate Gateway Alliance

The Lake Michigan Interstate Gateway Alliance (LMIGA) is the new name for the former Gary-Chicago-Milwaukee (GCM) ITS Priority Corridor. The acronyms are still used interchangeably, including in this document. Over this 130-mile-long, 16-county corridor home to more than 10 million people, state transportation departments of Illinois, Wisconsin, and Indiana formed a partnership to address the regional mobility issues. Through the deployment of advanced technologies, the use of existing transportation services and infrastructure, and the cooperative efforts of several transportation and planning agencies in the three states, the GCM Corridor Program worked to make transportation in the corridor smarter, safer, better coordinated, and more efficient.

The LMIGA maintains a website that provides real time information to travelers covering congestion, time, incidents, and road closure (http://www.gcmtravel.com). Similar to the 511 program, LMIGA is not geared particularly towards serving freight travelers, although freight travelers also benefit from having the provided information.

LMIGA maintains its own information through sharing with its stakeholders and automated detector information. Some of the elements in the LMIGA information system might be directly used when establishing a freight traveler clearinghouse, such as locations and contents of message signs. As can be seen, a great amount of information in LMIGA data system could be drawn upon directly into the clearinghouse. Sustainable funding mechanisms for groups like LMIGA and initiatives such as the freight traveler information clearinghouse warrant careful consideration. The following is an interface on the GCM Travel website.

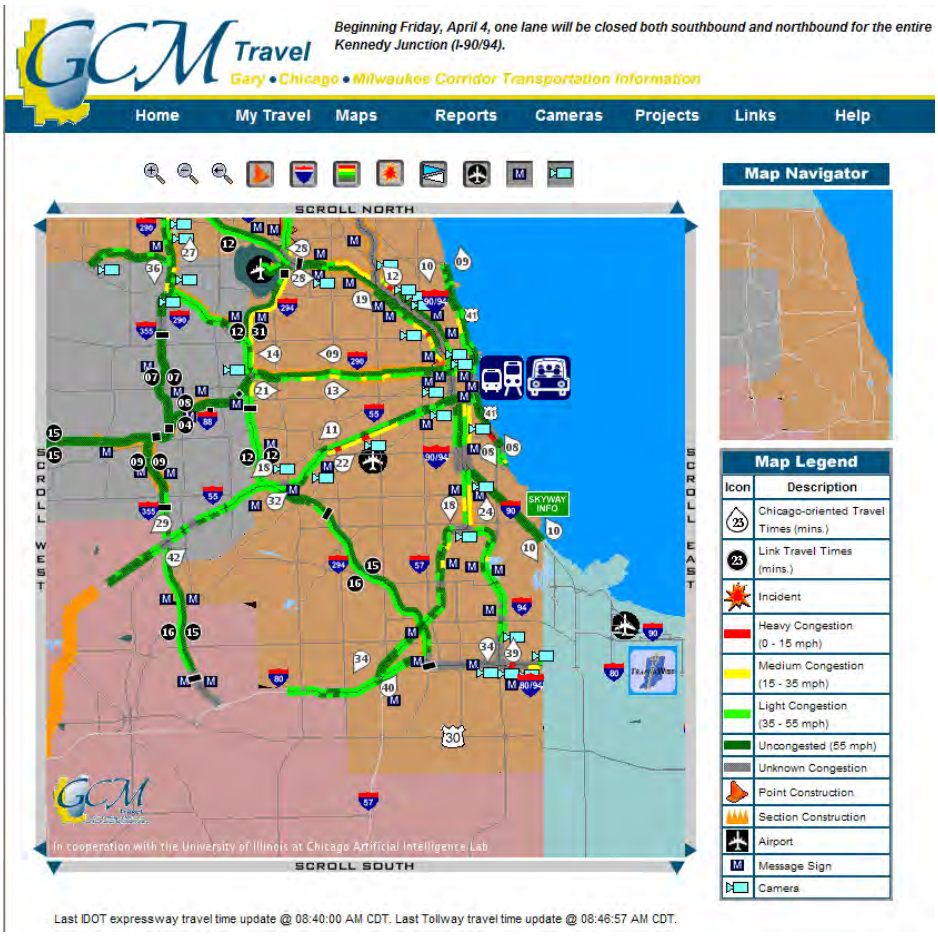


Figure 3: LMIGA (GCM) Web Interface

North/West Passage (http://www.nwpassage.info)

The North/West Passage Corridor encompasses the states along I-90/I-94 from Wisconsin to Washington and is an FHWA Transportation Pooled Fund (TPF) Study. Genesis of this organization was based on the fact that many states were currently developing their rural ITS projects as stand-alone or site-specific systems. However, rural travelers and transportation managers need seamless road information systems with the latest information on weather, road conditions, detours, safety, and security on all routes to make transportation decisions. Several multi-state efforts to coordinate the sharing of data and other ITS resources have been started but no program for corridor-wide coordination of ITS programs and integration of efforts has evolved.

The vision of the North/West Passage Corridor is to immediately influence ongoing standards development and utilize effective methods for sharing, coordinating, and integrating traveler information across state borders. While travel information reflects the initial destiny, maintenance and operations and planning and programming are long term visions. The North/West Passage Corridor is similar to the MVFC in its long term goal of providing seamless traveler information.

Some key goals of the corridor are to:

- Integrate traveler information systems that can provide information appropriate to the location and need of the traveler.
- Develop and promote cross-border jurisdictional cooperation and coordination in the planning, deployment, operations, and maintenance of ITS infrastructure.
- Integrate ITS projects for the North/West Passage Corridor into the state, regional, and local planning and programming processes.

In the North/West Passage Corridor states (North Dakota, Wisconsin, Minnesota, Washington, Idaho, Wyoming, Montana, and South Dakota) there are currently numerous systems for collecting, processing and integrating traveler and road maintenance information, and for delivering the information to users. However, this information is not readily shared across state borders.

Table 4 shows a list of the current Phase III work plan to indicate the scope of the NW Corridor.

Table 4: Phase III Work Plan Projects

Phase III Work Plan Projects	Cost Estimate
Traveler Information	
3.1. Corridor-Wide Consistent Major Event Descriptions	$ 45,000
3.2. Clarus Regional Demonstration Concept of Operations	$ 37,500
3.3. CAD to Reporting System Integration - Workshop	$ 40,000
3.4. North/West Passage Traveler Information Web Site	$ 30,000
Operations and Maintenance	
3.5. Cross Border O&M Collaboration - Workshop	$ 40,000
Program Management	
3.6. Administrative Support	$ 25,000
3.7. Pooled Fund Annual Meeting - State Rep Travel	$ 8,000
Total	**$ 225,500**

3.3 Various State DOT Websites Regarding Road Closure Information

Road closure due to maintenance, repair, construction, and traffic incidents is important information to travelers, especially freight travelers. Different from passenger travelers who can easily divert onto alternative routes on the local streets, freight travelers are more restricted by load weight/size and/or route regulations. Advance knowledge of road closure would help freight travelers better plan their route and delivery.

Various states maintain their road closure information on the web by providing a static map, some also provides weather and road condition.

Examples include:

- National Traffic and Road Closure Information (http://www.fhwa.dot.gov/trafficinfo)
- Wisconsin Department of Transportation (http://www.dot.state.wi.us/travel/incident-alerts.htm)
- Maryland Department of Transportation (http://www.chart.state.md.us/road_closures/road_closures.asp)

Current problems with the road closure information include inconsistent provision of road closure information in terms of format and content and infrequent updating. Some states only include road closure information while others also provide alternative route. In terms of format, some states adopt web GIS system while others just provide a downloadable pdf file.

Table 5 provides summary of facilities available for the ten states in the mid-west region. The abbreviations used are defined here.

- 511-511 is the Federal Communications Commission"s (FCC) designated nationwide three-digit telephone number for traveler information. Established in 1999, information provided by 511 services varies widely both by provider (ranging from state DOTs to local transportation and transit agencies) and by information provided (from traffic delays and weather to transit and tourism information).
- TOC-Traffic Operations Center
- Real-time traffic feeds-Information on real-time traffic condition from various states
- Maps- Real time traffic condition shown on maps from the ten states.
- Weather/Road weather- Current weather and road weather information along the interstate highways, mainly providing advanced traveler information system.

Table 5: Summary of Available Facilities for the Ten States

Facilities	IL	IN	IA	KS	KY	MI	MN	MO	OH	WI
511(Phone/Web)	N	P	Y	Y	Y	N	Y	P	P	Y
TOC(s)	N	Y	Y	Y	Y	Y	Y	Y	N	Y
Real-time traffic feeds(XML/RSS)	XML*	XML*	Y*	Y*	Y*	Y*	Y*	Y*	Y*	XML*
Maps	1**	1**	2	3	4	5	6	7	8	1**
Weather/Road Weather	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y

P - Progress
*These are also obtained from a Google web service; XML stands for extensible markup language; RSS is really simple syndication
1** Obtained from GCM Corridor Gateway Traveler Information System
2 - http://511ia.org
3 - http://511.ksdot.org/
4 - http://mapclient.kytc.state.ky.us/
5 - http://mdotwas1.mdot.state.mi.us/
6 - http://www.511mn.org/
7 - http://maps.modot.mo.gov/
8 - http://www.buckeyetraffic.org/

More information about 511 for the ten state mid-west region is provided in Table 6 and Traffic Operation Center information are provided in Table 7.

Table 6: Availability of 511 Facility for the Relevant States and Metropolitan Regions

State	511 Website
IL	Exploring options
IN	Expected 2008
IA	http://www.511ia.org/
KS	http://511.ksdot.org/
KY	http://www.511.ky.gov/
MI	Exploring options
MN	http://www.511mn.org/
MO	Expected 2009
OH	Expected 2008
WI	http://www.511wi.gov/

Table 7: Traffic Operations Center (TOC) Availability for the Relevant States

State	TOC Website
IL	N/A
IN	http://www.trimarc.org/perl/home.pl TRIMARC is part of a national initiative to deploy Intelligent Transportation Systems to 75 of the nation's largest metropolitan areas.
IA	http://www.iowaontrack.com/efficiency_fs.htm Transportation Management Centers serve as the main hub for monitoring traffic sensors and controlling traffic management devices.
KS	http://www.kcscout.net/ The Kansas and Missouri departments of transportation (KDOT, MoDOT) designed Scout to lessen traffic jams, to increase safety, and to improve emergency response to traffic situations.
KY	http://transportation.ky.gov/operations_center/ The Kentucky TOC is organized to provide an appropriate response to traffic and weather conditions in accordance with established procedures.
MI	http://www.michigan.gov/mdot/0,1607,7-151-9615_44489_44992-119729--,00.html The Michigan Intelligent Transportation Systems Center is the hub of ITS technology applications at the Michigan Department of Transportation.
MN	http://www.dot.state.mn.us/tmc/ The Regional Transportation Management Center is to integrate Mn/DOT's Metro District Maintenance Dispatch and Mn/DOT's Office of Traffic, Security and Operations with the Minnesota Department of Public Safety's State Patrol Dispatch into a unified communications center.

Table 7: Traffic Operations Center (TOC) Availability for the Relevant States (continued)

State	TOC Website
MO	http://www.kcscout.net/ The Kansas and Missouri departments of transportation (KDOT, MoDOT) designed Scout to lessen traffic jams, to increase safety, and to improve emergency response to traffic situations.
OH	N/A
WI	http://www.dot.wisconsin.gov/travel/stoc/ The Wisconsin Department of Transportation (WisDOT) State Traffic Operations Center handles traffic management for the state of Wisconsin.

3.4 Oversize/Overweight Operations across Various State DOTs

Most oversize and overweight freight activities are related to superloads. In the United States a superload is a truck tractor with an attached trailer with an over-dimensional object (the load) on it. Usually, a superload is more than 13' 6" high, 8' 6" wide and 80' in length. The load could be a large piece of equipment, manufactured home, control room, crane, construction tractor, boat, and must be non-reducible (cannot be reduced to legal dimension).

Both the size and weight of a superload is regulated by the State the oversize load is moving in. This is done by requiring the hauler to obtain an oversize/overweight permit before traveling on their highways. This is done to assure that the load will not travel through any unsafe construction zones, which may have reduced lane widths, cross any bridges that were not made to handle over 80,000 pounds, or hit any overpasses if they are overheight. An overweight load is an oversize load which usually weighs more than 80,000 pounds. Many states have adopted the Federal Bridge Formula to determine legal weight on a group of axles.

Pulling a superload transport is a complex procedure that involves preparing a number of technical and logistical elements before you even start. Knowing how to deal with the legal considerations, permits and the technical challenges of pulling a heavy load is critical to having a successful oversized load journey.

Six state DOTs within the ten state midwest region have developed formalized procedures or impact analysis tools for permitting superloads. The states are:

- **Illinois**: Superload permit requirements address the assessment and adjustment of underground utilities by utility companies, and placement of earthen or crushed stone padding to protect pavement.
- **Indiana**: INDOT‟s Superload Permit Section utilizes the Overload Routing System and Bridge Analysis and Rating System to evaluate applications for permits.

- **Kansas**: The Kansas Trucking Connection, a partnership involving the Kansas DOT, posts a 12-point checklist on its Web site of ways that customers can help expedite the Superload permit process.
- **Michigan**: MDOT Transport Permits Unit policy stipulates that an overweight permit will not be issued for a vehicle when any wheel load exceeds 700 lbs. per inch of tire width; permits are approved for empty self-propelled earth moving equipment that does not exceed 850 lbs. per inch of tire width.
- **Ohio**: Topics addressed in ODOT"s *Operational Guide for Vehicles Operating with an Oversize/Overweight Special Hauling Permit* include the minimum vehicle configuration for Superload movement. "Non load equalizing, air lift and combination air/mechanical groupings are not acceptable. Close groupings of three and four axle combinations at high group weights have been shown to have the potential to damage certain type structures and generally are not permitted."(A)
- **Wisconsin**: The Wisconsin Department of Transportation operates a comprehensive oversize/overweight permit program providing for safe, efficient movement of oversize/overweight vehicle and loads with minimal impact on infrastructure. The department is receiving a growing number of requests for permits to operate exceptionally heavy trucks of 400,000 lbs. or more on state roadways (A).

Various resources on information related to Oversize/Overweight permits are provided in Table 8.

Table 8: Oversize/Overweight Web Resources

Agency	Address	Description
Federal Motor Carrier Safety Administration	http://www.fmcsa.dot.gov	[where in the website, what content, for whom, e.g., IA and IN]
Federal Highway Administration	http://www.fhwa.dot.gov/	Information on permits related to various states is provided here.
IL DOT	http://www.dot.il.gov/ https://permits.dot.state.il.us/	IL DOT maintains and provides information of legal dimensions and weights with a provision to apply for permits.
IN DOT	http://www.in.gov/indot/	IN DOT provides information on manuals and legal permits in the state.
KS KYTC	http://dmc.kytc.ky.gov/owod/	Kentucky Transportation Cabinet/Division of Motor Carriers maintains the legal permits information.

Table 8: Oversize/Overweight Web Resources (continued)

Agency	Address	Description
MI State Gov	http://www.michigan.gov/	Michigan state permit information is provided at this particular website along with other valuable links to resources.
MO DOR	http://dor.mo.gov/	Missouri State Department of Revenue provides manuals for oversize/overweight permits.
MN DOT	http://www.dot.state.mn.us/	Minnesota State DOT maintains information related to weight limits and a provision for applying permits.
OH		
WisDOT and WisTrans	http://www.wistrans.org/ http://www.dot.wisconsin.gov/travel/truck/	Wisconsin state DOT and also Wisconsin Transportation Center (WisTrans) provide information on the legal weights and dimensions of trucks for the state of Wisconsin.

3.5 Weather Information

Weather information could play a significant role in the freight related activities. More precisely, real-time weather and winter road weather conditions help extensively in planning the freight movement accordingly. Winter road conditions in general are important owing to the huge snow impact on the driving conditions such as speed and visibility in winter. In this context, a transportation weather observation and forecasting system along with a road weather observation system have been studied.

3.5.1 Clarus

Clarus is an initiative to develop and demonstrate an integrated surface transportation weather observing, forecasting and data management system, and to establish a partnership to create a Nationwide Surface Transportation Weather Observing and Forecasting System. The objective of *Clarus* is to provide information to all transportation managers and users to alleviate the effects of adverse weather (e.g., fatalities, injuries and delays) The U.S. Department of Transportation (DOT) Federal Highway Administration (FHWA) Road Weather Management Program, in conjunction with the Intelligent Transportation Systems

(ITS) Joint Program Office established the *Clarus* Initiative in 2004 to reduce the impact of adverse weather conditions on surface transportation users.

The goal of the initiative is to create a robust data assimilation, quality checking, and data dissemination system that can provide near real-time atmospheric and pavement observations from the collective state's investments in road weather information system, environmental sensor stations (ESS) as well as mobile observations from Automated Vehicle Location (AVL) equipped trucks and eventually passenger vehicles equipped with transceivers that will participate in the Vehicle Infrastructure Integration (VII) or IntelliDrive Initiative.

States included in the Clarus (within the ten states) are Illinios, Indiana, Iowa, Kentucky, Minnesota, Ohio and Wisconsin. The website for more information can be found at http://www.clarus-system.com/.

3.5.2 RWIS

A Road Weather Information System (RWIS) can be defined as a combination of technologies that uses historic and current climatological data to develop road and weather information (for example, nowcasts and forecasts) to aid in roadway-related decision making.

Aurora is an international program of collaborative research, development and deployment in the field of road and weather information systems (RWIS), serving the interests and needs of public agencies. The program, launched in 1996, brings together a number of U.S., Canadian, and European agencies.

The three main elements of RWIS are

- environmental sensor system (ESS) technology to collect data;
- models and other advanced processing systems to develop forecasts and tailor the information into an easily understood format; and
- dissemination platforms on which to display the tailored information.

States known to utilize RWIS within the ten-state Mississippi Valley region are

- Illinois DOT
- Indiana DOT
- Iowa DOT
- Michigan DOT
- Minnesota DOT
- Ohio DOT
- Wisconsin DOT

One current effort is to incorporate weather and road weather information from various web services for the major cities in the ten-state region. Information regarding real-time weather and winter road weather conditions is shown in Table 9.

Table 9: Weather and Winter Road Weather Information

State	Weather and Road Weather Information
IA	http://www.iowaroadconditions.org http://www.dotweatherview.com/ Iowa DOT maintains the information from sensors located in and along Iowa's Interstate and primary roads as a part of RWIS also from Iowa Aviation Weather Information System and regional forecasts.
IL	http://www.gettingaroundillinois.com/ IL DOT maintains statewide interstates road weather information along with interstates near St. Louis.
IN	http://netservices.indot.in.gov/rwis/ Road Weather Sensors Map provides the public with access to up to date weather information for thirty locations throughout the state from INDOT‟s Road Weather Information System (RWIS)
KS	http://511.ksdot.org/KanRoadPublic_VE/ KS DOT maintains a thematic map containing the real-time road weather conditions.
KY	http://transportation.ky.gov/RWIS/index.htm http://511.ky.gov/ KY Transportation Cabinet provides information about the live road weather information by RWIS and through cameras from north KY, Lexington and Louisville.
MI	http://mdotwas1.mdot.state.mi.us/public/drive/rtt.cfm#1 – general traffic
MN	http://www.511mn.org/ Minnesota state DOT provides information on live driving conditions along various highways in the state.
MO	http://maps.modot.mo.gov/travelerinformation/ MO state DOT provides an interactive map showing the current road weather conditions in the state.
OH	http://www.buckeyetraffic.org/ Ohio state DOT provides a map interface for the current road conditions in the state.
WI	http://www.dot.wisconsin.gov/travel/road/winter-roads.htm Wisconsin state DOT provides information about winter road conditions on interstate and major highways for the state of Wisconsin.
Other	There is a third party web service available from Weather Bonk providing live weather, cams and other information. http://www.weather.gov/alerts/ http://www.weather.gov/xml/current_obs/ http://weather.com/ http://www.clarus-system.com/ http://www.accuweather.com RWIS(Road Weather Information System)

3.6 Industry/Government Traffic Information System

Traffic information has value on the market. Numerous companies conduct business in disseminating travel information. Again, no freight specific travel information is available in industry. Some examples in industry include Traffic.com, Yahoo, Google, and Microsoft.

It is also worth noting that Yahoo provides road closure information, and Google Maps has a function to read traffic information from Yahoo in providing the traffic and road conditions.

More information on web prototype could be obtained in chapter 6.

Chapter 4 – Stakeholder Survey

This section discusses the survey and interviews of motor carrier representatives that were completed to identify challenges with current information systems and needs for information; and to conduct survey/interviews with planners/regulators to estimate potential volumes of inquiries from travelers to the clearinghouse) in the work plan for the Mississippi Valley Freight Coalition-sponsored freight traveler information clearinghouse project.

4.1 Motor Carrier Representatives Survey and Interviews

This survey was distributed in two different manners. The primary method of distribution was through announcements in newsletters for the trucking associations of each of the ten states in the Mississippi Valley Freight Coalition. The announcements placed in the newsletters directed the reader/respondent to a website where they were presented with an eleven question web-based survey, a copy of which is attached in the appendix (due to the limitations of the web survey software, multi-part questions had to be split into two separate question numbers, therefore the total number of questions appears to be 14).

The short web-based survey has three sections:

- Section 1 (questions 1, 2, & 3) consists of three background/demographic questions (company name, respondent‟s position/title with the company, and the number of trucks in the company‟s fleet). Beyond this information the survey is anonymous.
- Section 2 (questions 4 through 10, inclusive) consists of questions regarding types of traveler information (what, if any, types of information the company currently uses; opinions on information delivery methods for their usefulness to the company in route planning/optimization; opinions on types of information for their usefulness to the company in route planning/optimization; opinions on delivery methods for various types of traveler information; and opinions on how companies prefer their drivers obtain real-time travel information).
- Section 3 (questions 11 through 14, inclusive) consists of final questions regarding information sharing and providing an opportunity for other comments.

The second method for distribution of this survey was by direct contact with trucking firms in the ten-state region. The primary method for this contact was by telephone, where the caller either asked to conduct the survey over the phone rather than online, or provided the contact with the website of the survey directly.

4.2 Motor Carrier Representatives Survey and Interview Results

Several attempts to promote the survey were conducted through a variety of means, including: advertisements in email and print newsletters to the motor associations of the ten-state region; requests for member contact information from the motor carrier associations of the ten-state region; and direct appeals to email lists gathered at various motor carrier events. None of these methods yielded more than a few web survey responses each. As a direct result, two student researchers were hired and trained to make direct phone calls. They were working from a list of firms provided by the Wisconsin Motor Carriers Association, which has a primary membership of Wisconsin firms, but also has many members headquartered in surrounding states but conducting business in Wisconsin. The initial list contained hundreds of firms, and the overall survey efforts online and by telephone yielded a total of 54 responses.

The survey results are broken up into analysis of each question, and are discussed in the following sections:

Questions 1, 2, and 3

This portion of the survey was three questions dealing with the demographics of the interviewee/survey respondent. While the survey was anonymous, the name of the company the respondent works for, the respondent‟s job for with that company, and the size of that company‟s truck fleet were all collected. Table 10 below lists the various occupations and the number of respondents who indicated for each.

Table 10: Respondent Occupations and Counts

Response totals	
Compliance Manager	1
Dispatcher	1
Driver	5
General Manager	3
Office Manager	1
Operations/Ops Manager (incl. Traffic, Transp. & Logistics)	12
Owner	6
President/CEO	14
Publisher	1
Safety/Risk Management Director	4
Vice President	6

The major occupations of the respondents were President/CEO of the firm, or Operations Manager (or Traffic, Transportation, or Logistics Manager). Since the size of the firm also dictates the actual work many of these people do (and in many cases, the Owner or President is also a driver, when the firm only has a few trucks), the breakdown in firm size is also an important piece of demographic information. Figure 4 below details this firm size breakdown.

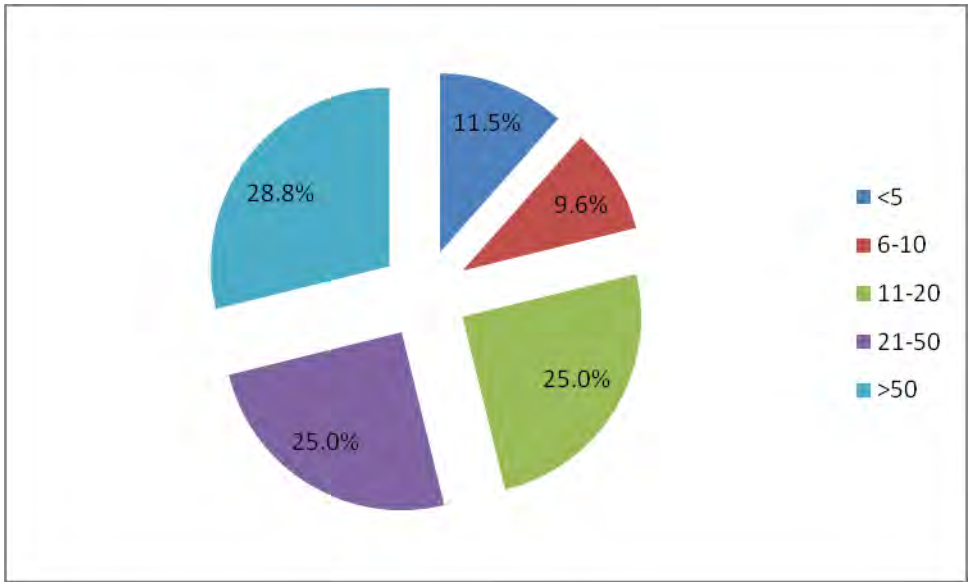


Figure 4: Size of Truck Fleet

As can be seen, there is a good split between large and small trucking firms, with approximately 21 percent of respondents coming from firms with 10 or fewer trucks, and 46 percent of respondents coming from firms with 20 or fewer trucks. This helps provide a diversity of opinion, and not just represent the interests of the large, corporate, trucking firms, but also accounts for the small owner-operator type firms.

Questions 4 & 5

Question 4 asked "From which of the following sources does your company (dispatchers & drivers) obtain current, up-to-date traffic/weather information?" Respondents were told nine different methods of delivery (CB radio reports from other drivers, freeway changeable message signs, highway advisory radio, face-to-face reports among drivers at truck stops and terminals, traffic reports on commercial radio, reports received by dispatchers from drivers on the road, phone calls to DOT or other information services (e.g. 5-1-1), real-time traffic maps on the internet, & television traffic reports), and were asked which of them their firm was currently using. After responding to the nine different delivery methods, Question 5 asked respondents if there were any other methods they were using that weren't in the survey list. Figure 5 lists each of the nine delivery methods and the percentage of "yes" and "no" responses to each.

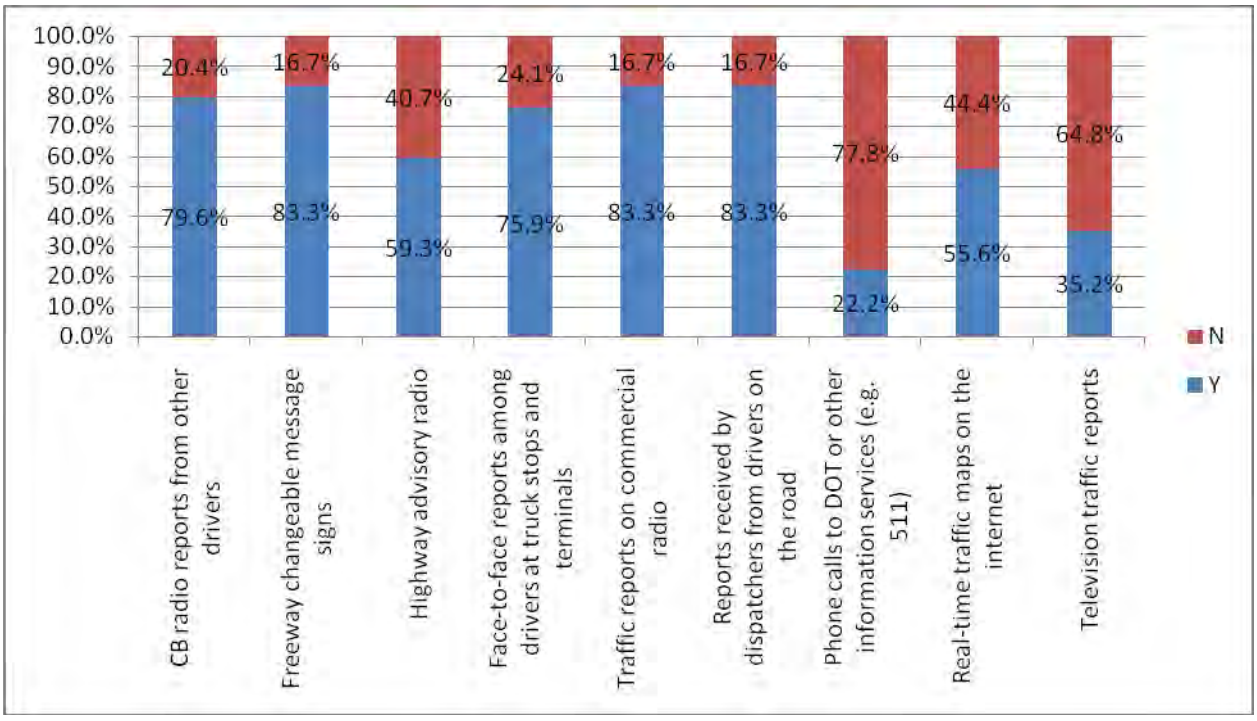


Figure 5: Current Usage of Information Delivery Methods

Other delivery methods were provided as well, and are shown in Table 11.

Table 11: Other Sources Used for Information Delivery

Other sources listed
DOT Website
Word of mouth Internet
Weather.com, etc other internet sources for weather.
Local news channel website for current radar information
Company's satellite based system
Theamericandrive.com has weather and road conditions for the 48 contiguous states, listed by state
State Police road reports.
XM Radio has certain cities with 24/7 road reports and also has a channel 247 which is emergency radio on weather and road reports for the whole country.
Don't receive information from dispatchers
Weatherband Radio Internet for weather information such as weather.com

Question 6

This question asked respondents to "evaluate the following sources of traffic information for their value in planning or optimizing travel/delivery routes." The respondents were given the same nine sources of information listed in Question 4, and asked to evaluate them on the following scale: high value (HV), some value (SV), neutral (NTL), little value (LV), no value (NO), or no opinion (N/A). The results for each source of information are shown in Figure 6 through Figure 15, inclusive.

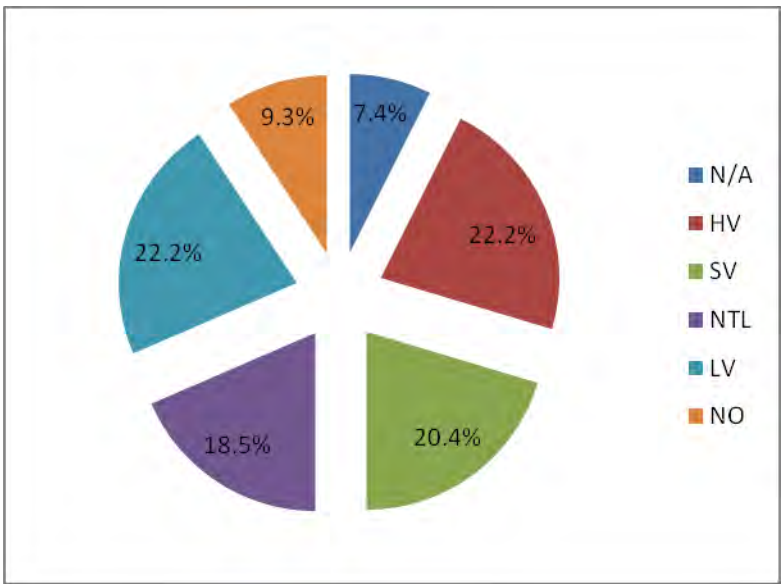


Figure 6: CB Radio Reports from Other Drivers

Figure 6 indicates that those in the trucking industry find CB radio reports to be only partially valuable, with 57.4 percent of respondents having either no opinion, a neutral opinion, or indicating they had little or no value. This is one of the lower-rated methods of information delivery when it comes to route planning or optimization.

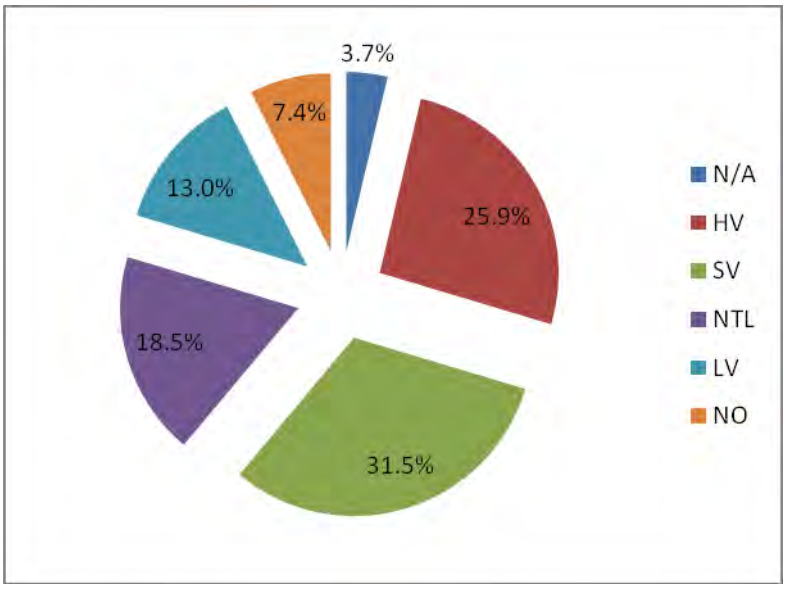


Figure 7: Freeway Changeable Message Signs

Figure 7 indicates that those in the trucking industry find freeway changeable message signs to be somewhat useful, with 57.4 percent of respondents having a positive opinion (rated either high value or some value) of the information delivery method. This is a more useful method of information delivery when it comes to route planning or optimization.

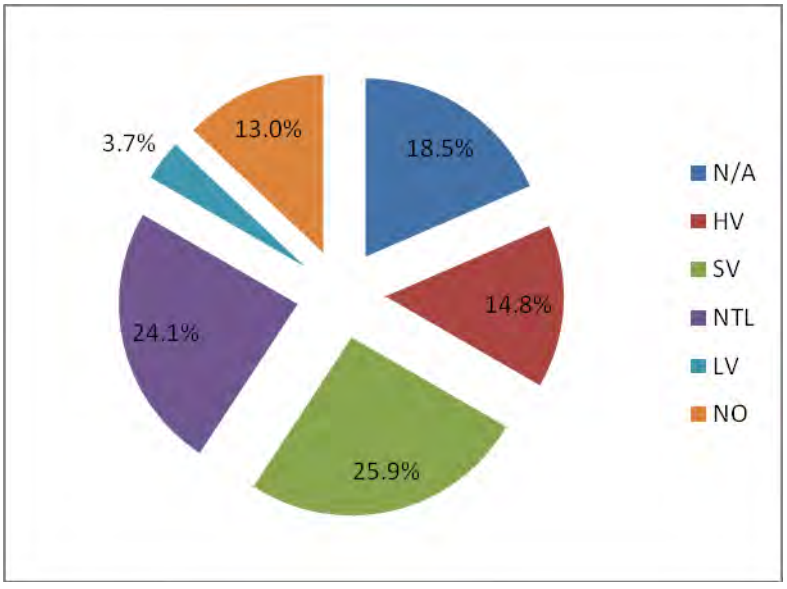


Figure 8: Highway Advisory Radio

Figure 8 indicates that those in the trucking industry find highway advisory radio (HAR) to be marginally useful, with 40.7 percent of respondents having a positive opinion (rated either

high value or some value) of the information delivery method, but a large percentage (18.5%) having no opinion of HAR. Nearly one-quarter of respondents (24.1%) had a neutral opinion, and the negative opinions (little or no value ratings) totaled only 27.8 percent. Given the respondent opinions, this method of information delivery does not appear to have much utility much for planning or optimizing routes.

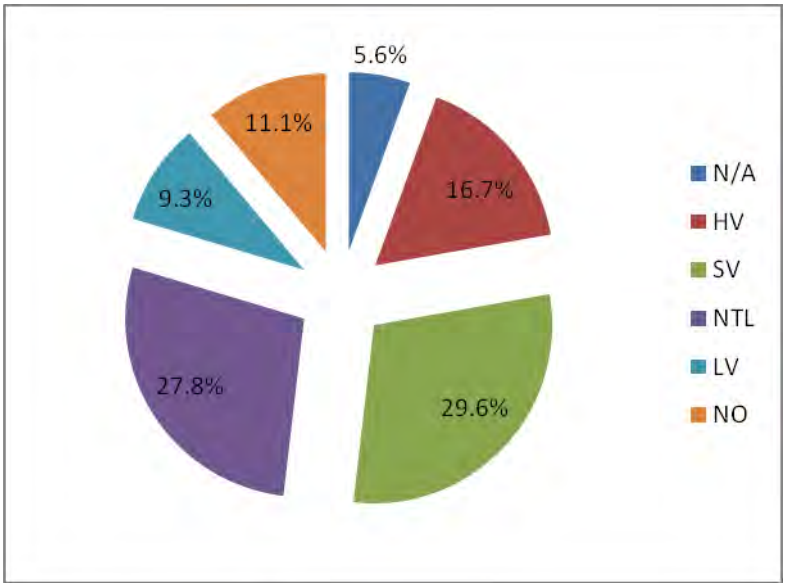


Figure 9: Face-to-Face Reports among Drivers at Truck Stops and Terminals

Figure 9 indicates that those in the trucking industry find face-to-face reports among drivers at truck stops and terminals to be fairly useful, with 48.3 percent of respondents having a positive opinion (rated either high value or some value) of the information delivery method, with a small percentage (5.6%) having no opinion of these reports. More than one-quarter of respondents (27.8%) had a neutral opinion, and the negative opinions (little or no value ratings) totaled only 20.4 percent. Given the respondent opinions, this method of information delivery appears to be relied on for planning or optimizing routes, at least some of the time.

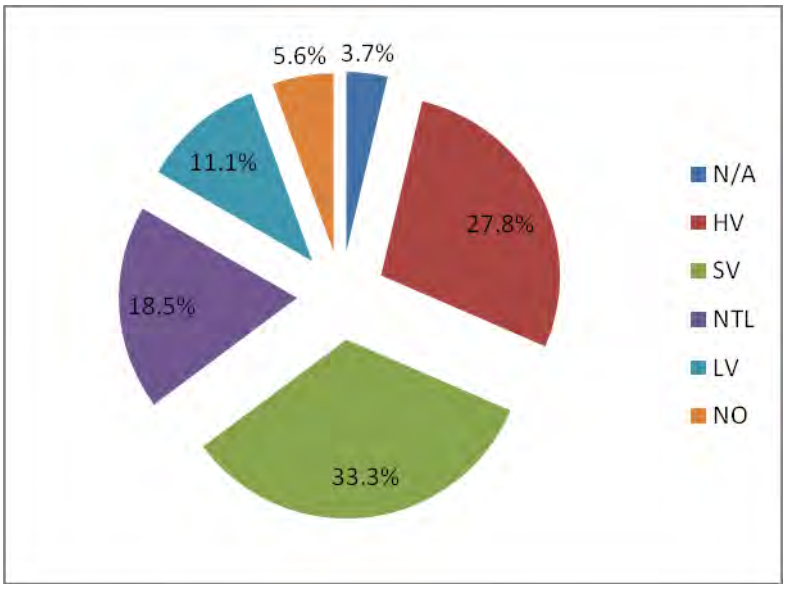


Figure 10: Traffic Reports on Commercial Radio

Figure 10 indicates that those in the trucking industry find traffic reports on commercial radio to be very useful, with 61.1 percent of respondents having a positive opinion (rated either high value or some value) of the information delivery method, with a very small percentage (3.7%) having no opinion of these reports. Only 18.5 percent of respondents had a neutral opinion, and the negative opinions (little or no value ratings) totaled only 16.7 percent. Given the respondent opinions, this method of information delivery appears to be heavily relied on for planning or optimizing routes.

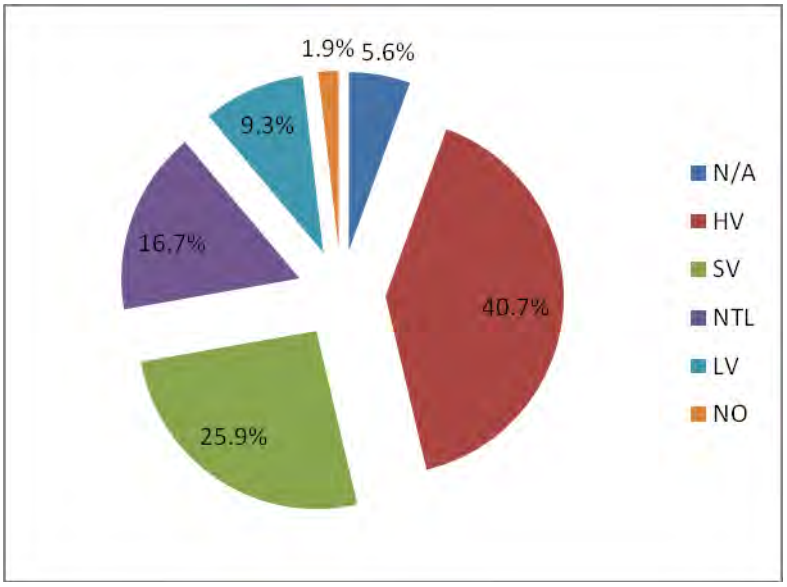


Figure 11: Reports Received by Dispatchers from Drivers on the Road

Figure 11 indicates that those in the trucking industry find reports received by dispatchers from drivers on the road to also be highly useful, with 66.6 percent of respondents having a positive opinion (rated either high value or some value) of the information delivery method, with a small percentage (5.6%) having no opinion of these reports. Only 16.7 percent of respondents had a neutral opinion, and the negative opinions (little or no value ratings) were slightly over 10 percent (11.2%). Given the respondent opinions, this method of information delivery appears to be important for the planning or optimizing of routes.

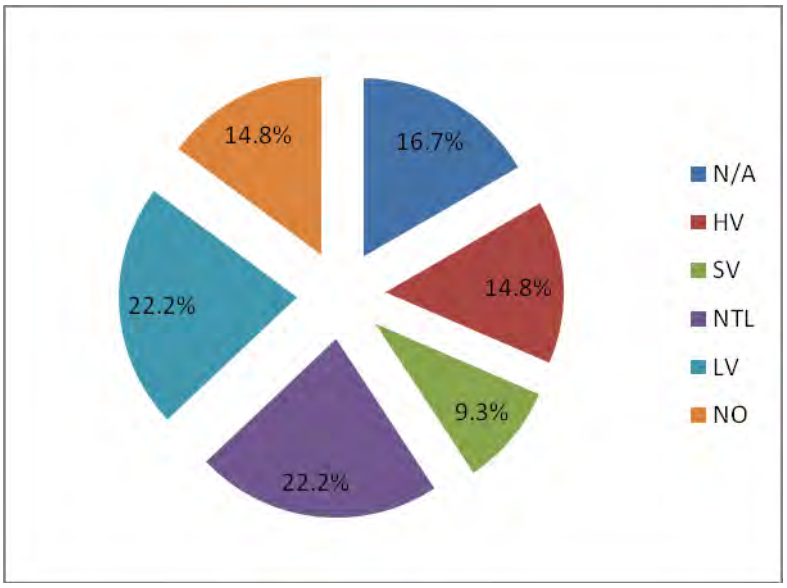


Figure 12: Phone Calls to DOT or Other Information Services (e.g. 5-1-1)

Figure 12 indicates that those in the trucking industry find phone calls to DOTs or other information services (such as 5-1-1) to have very little use, with only 24.1 percent of respondents having a positive opinion (rated either high value or some value) of the information delivery method, with almost 17 percent having no opinion (16.7%) of these reports. Nearly one-quarter of respondents (22.2%) had a neutral opinion, with an equal opinion stating it had little value, and a further nearly 15% saying it had no value at all (total of the negative opinions was 37.0 percent.) Given the respondent opinions, this method of information delivery appears to currently have almost no value for planning or optimizing routes.

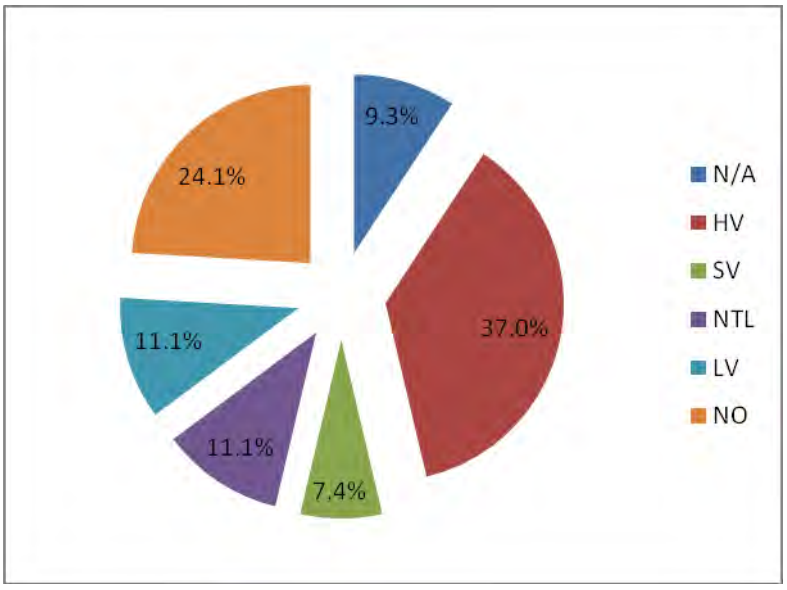


Figure 13: Real-Time Traffic Maps on the Internet

The results in Figure 13 stand in stark contrast to the phone-based information services. Figure 13 indicates that those in the trucking industry find real-time traffic maps on the internet to have a very high utility, with 44.4 percent of respondents having a positive opinion (rated either high value or some value) of the information delivery method (37.0% rated this as high value information). About one in every nine responses (11.1%) had a neutral opinion, with an equal share stating it had little value, and a further nearly 25% saying it had no value at all (total of the negative opinions was 35.2 percent.) The respondent opinions here show a strong divide, with over 60 percent of responses being either high value or no value. Table 12 looks more closely at which size firms find this information important or useless, since it is hard to tell at first glance if this method of information delivery is or is not valuable for planning or optimizing routes.

Table 12: Real-Time Traffic Maps on the Internet (Valuation by Fleet Size)

Fleet Size	HV	SV	NTL	LV	NO	NA	Totals
5 or fewer	2	1	1	0	1	1	6
	33%	17%	17%	0%	17%	17%	
6 to 10	1	0	1	1	2	0	5
	20%	0%	20%	20%	40%	0%	
11 to 20	5	1	1	2	2	2	13
	38%	8%	8%	15%	15%	15%	
21 to 50	5	2	1	0	3	2	13
	38%	15%	8%	0%	23%	15%	
more than 50	6	0	2	3	4	0	15
	40%	0%	13%	20%	27%	0%	
Totals	19	4	6	6	12	5	

While the individual cell values end up rather small at this level of detail, there is some better indication as to which respondent firms (based on size) actually value internet-based real-time traffic maps. Larger firms (those with 11 or more vehicles in their fleet) and very small firms (those with 5 or fewer trucks, typically owner-operators) found these online traffic maps to be more valuable than not. For each of these categories, the percentage of responses in the "HV" (high value) was greater than any one other rating. In only the 6 to 10 vehicle fleet size did the "NO" (no value) option rate the highest overall response. It stands to reason that larger firms split sharply between "high value" and "no value" because of their fleet size. Some may have already made investments in private information systems, thereby not finding any value in internet-based sources, while others may rely heavily on internet-based sources in lieu of contracting with private systems. Although not significant enough to incorporate into the overall responses, there were occasional mentions of the use of portable GPS systems that provide real-time traffic downloads as well, which might account for some of the negative feelings to internet-based maps. One could also speculate that, at least for some truckers, access to the internet (and therefore the internet-based real-time traffic maps) is limited or non-existent at times when it would probably be most useful.

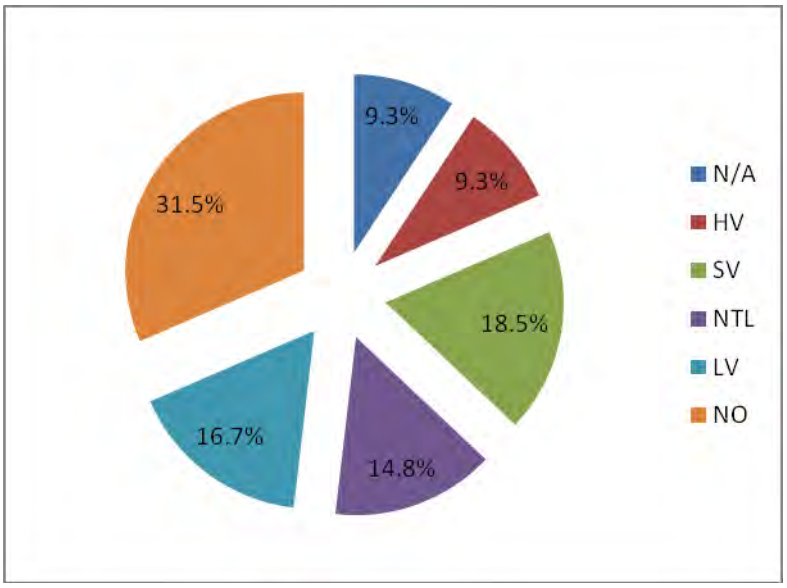


Figure 14: Television Traffic Reports

Figure 14 indicates that those in the trucking industry find television traffic reports to have very little use in route planning or optimization. Only 27.8 percent of respondents having a positive opinion (rated either high value or some value) of the information delivery method, compared to 31.5% who rated it as having no value at all. Almost 15 percent (14.8%) had a neutral opinion, a further 9.3 percent had no opinion, and the total of the negative opinions (little or no value) was 48.2 percent.) Given the respondent opinions, this method of information delivery appears to currently have almost no value for planning or optimizing routes.

Question 7

This question asked respondents to "evaluate the following types of real-time information on their overall value for optimizing or modifying routes." The respondents were given five "types" of information: atmospheric weather information; weather-related road-condition information; congestion information; incidents, crashes, & other delays; and construction, lane closures, & detours. The respondents were asked to evaluate them on the following scale: high value (HV), some value (SV), neutral (NTL), little value (LV), no value (NO), or no opinion (N/A). The results for each source of information are shown in Figures 15 through 19, inclusive.

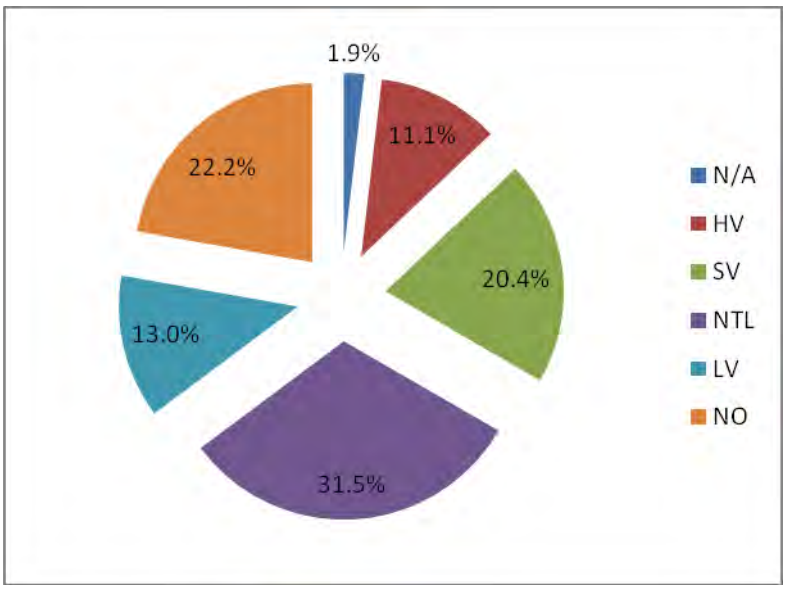


Figure 15: Atmospheric Weather Information

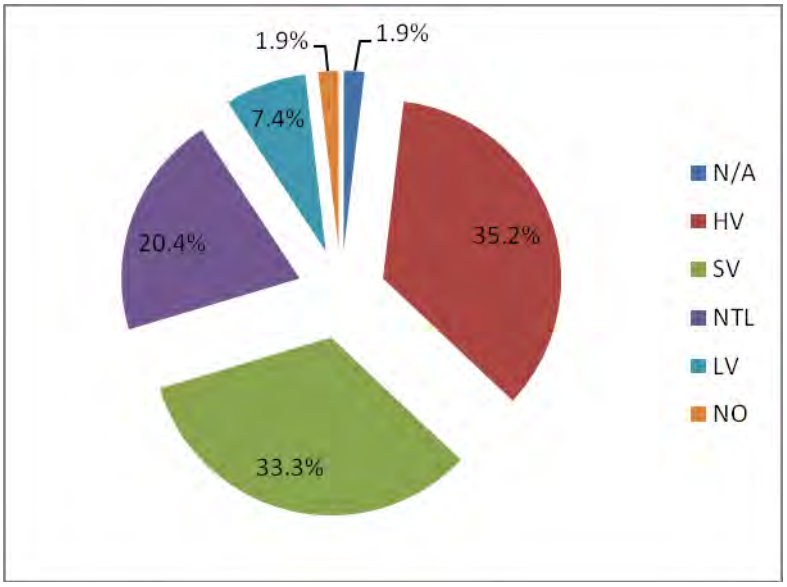


Figure 16: Weather-Related Road-Condition Information

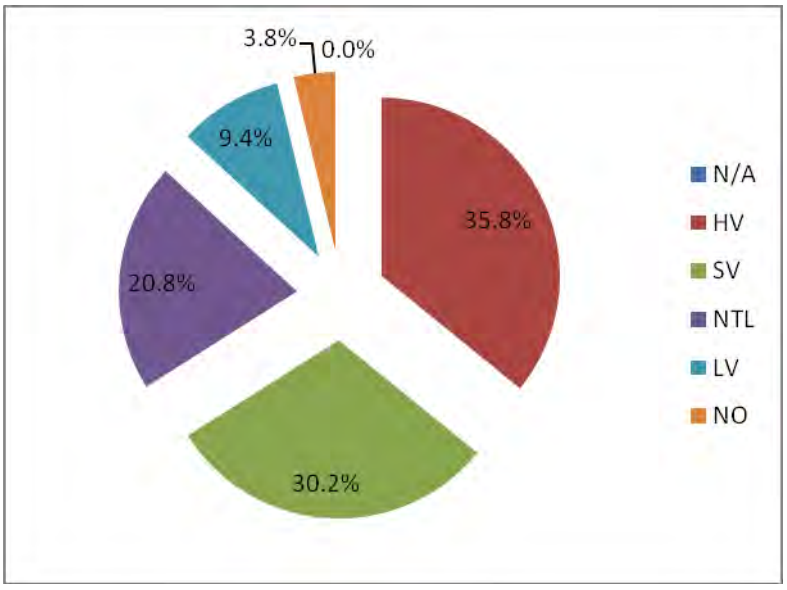


Figure 17: Congestion Information

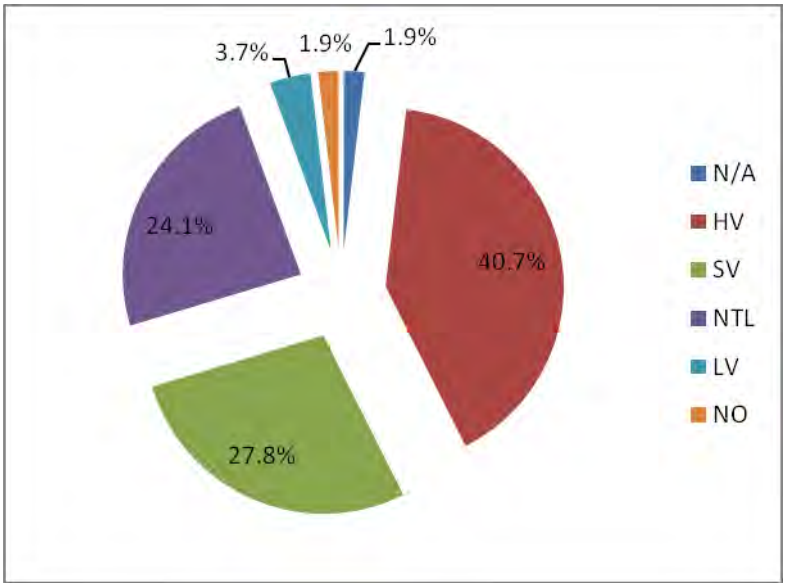


Figure 18: Incidents, Crashes, & Other Delays

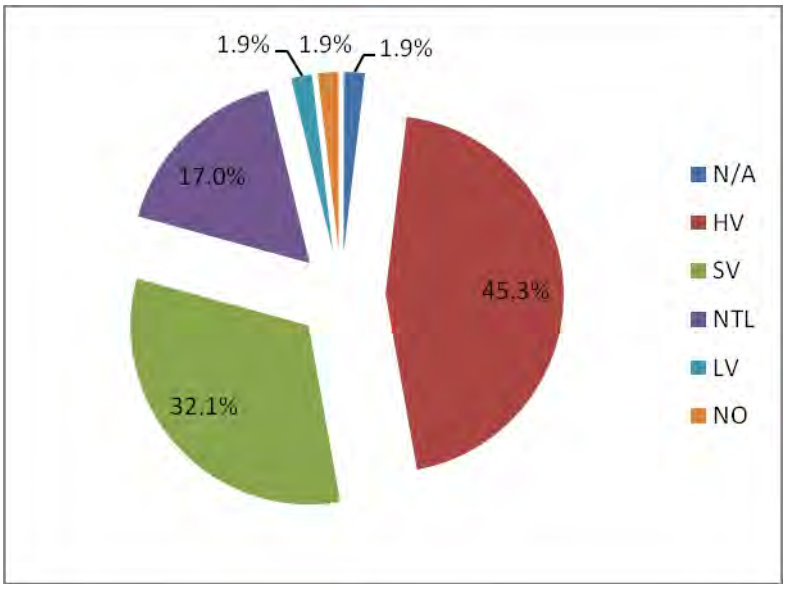


Figure 19: Construction, Lane Closures, & Detours

Questions 8 & 9

Question 8 asked respondents "what method(s) of delivery would you find most useful for the following types of information. Please select one or more delivery methods for each type of information. If you select „other" for any item, please list the item and the delivery method in the comments area in the next question." The respondents were given five "types" of information: atmospheric weather information; weather-related road-condition information; congestion information; incidents, crashes, & other delays; and construction, lane closures, & detours. The results for each source of information are shown in Figure 20 and Table 13. Question 9 of the survey was the data entry box asking for "other" methods of delivery.

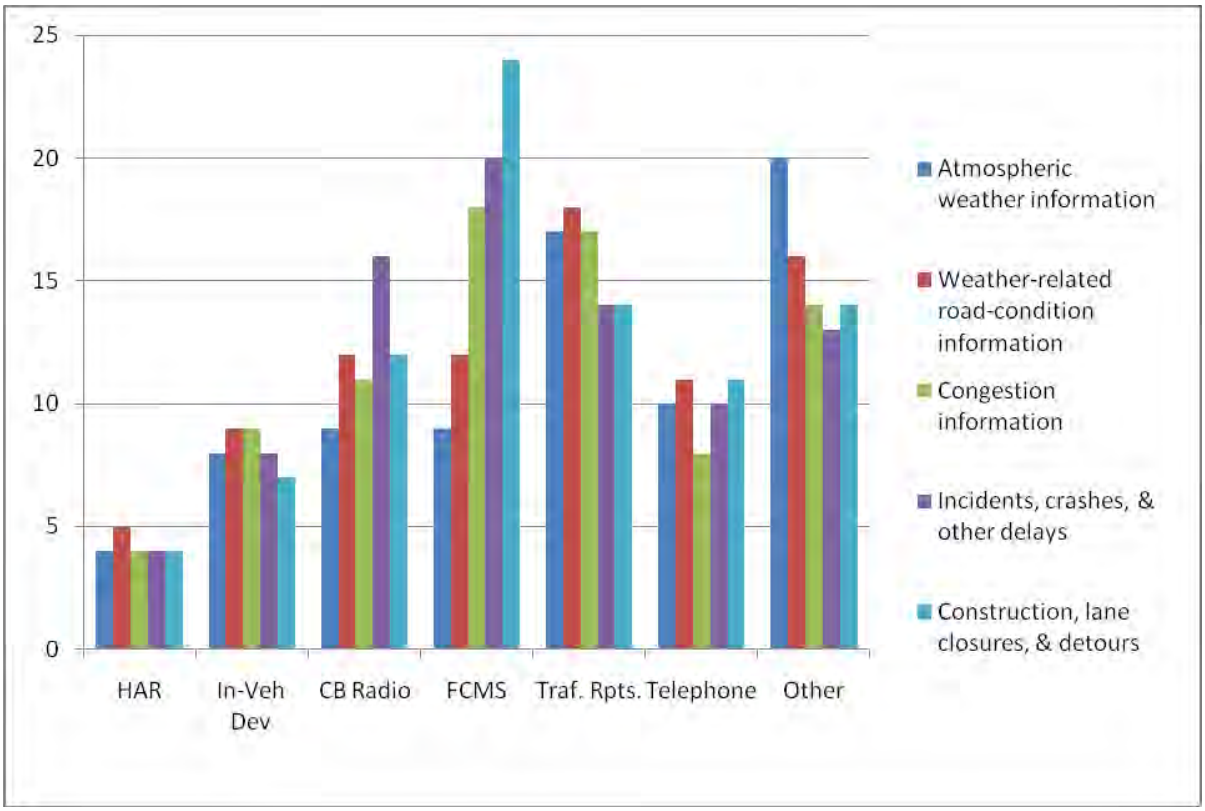


Figure 20: Preferred Delivery Methods for Information Types

Table 13: Other Suggested Delivery Methods for Information Types

Delivery Method	Count
Internet	15
Dispatch push to drivers	7
Weatherband radio	2
No need for weather info	1
GPS	1
Satellite radio	1
E-mail	1
Weather Channel (TV)	1

Question 10

This question asked respondents how their "company would prefer drivers obtain real-time information." The respondents were given three choices: "through in-vehicle devices"; "from dispatchers"; and "other, please specify". Figure 21 below shows the breakdown, and Table 14 lists the "other" methods of delivery that the respondents provided.

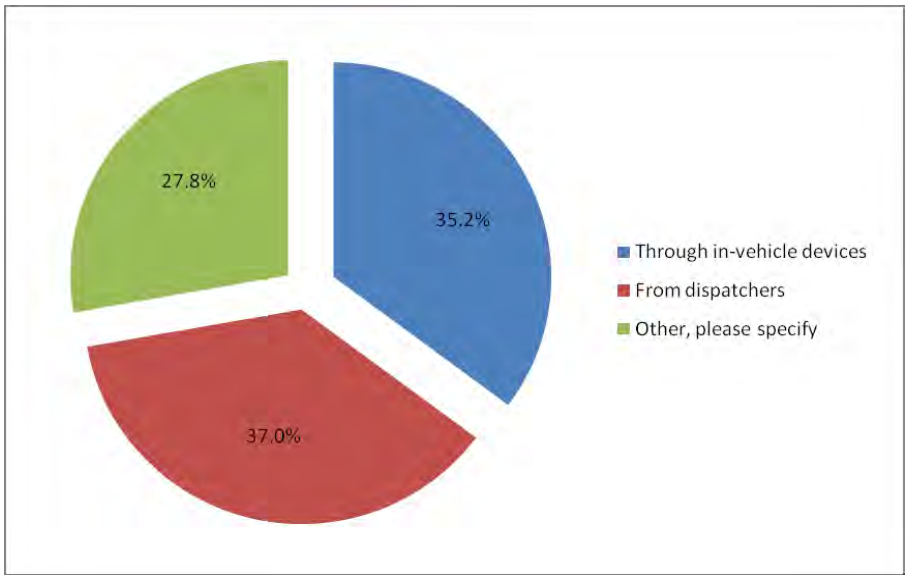


Figure 21: Preferred Methods for Real-Time Information Delivery

Table 14: Other Specified Delivery Methods

Weather channel and/or radio
Drivers are out of their trucks so much---the info needs to get to them on-person.
Satellites (although they are too expensive)
Radar
ANYWAY other than through dispatchers.
D.O.T. and State Police Reports
Onboard satellite radio
(could not decide on what they would prefer, but did not like from dispatchers or from in vehicle devices)
Preferred drivers are notified over CB.
Cell phone calls from a service.
CB Radios, Freeway Changeable Message Signs
Local company, these are unnecessary for them
Preferred commercial radio because it was easiest and everyone would be able to access it
Some sort of public service like radio
Road signs or a radio broadcast

Questions 11 & 12

These questions asked respondents first, if their company already shares (or sells) real-time information with media outlets or other companies; and second, if their company or drivers be willing to provide observed information to an information clearinghouse once one is established. Figure 22 shows the breakdown of companies in the first part, and Figure 23 shows the breakdown of companies in the second part.

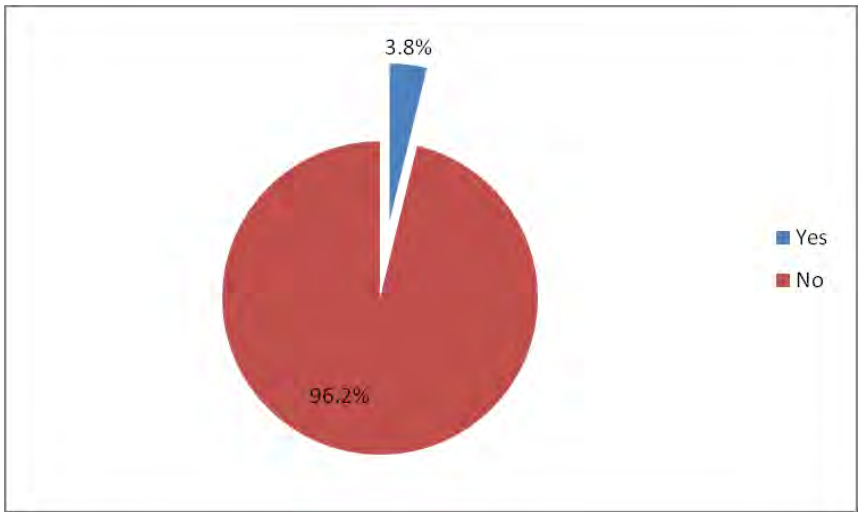


Figure 22: Companies Currently Sharing or Selling Real-Time Information

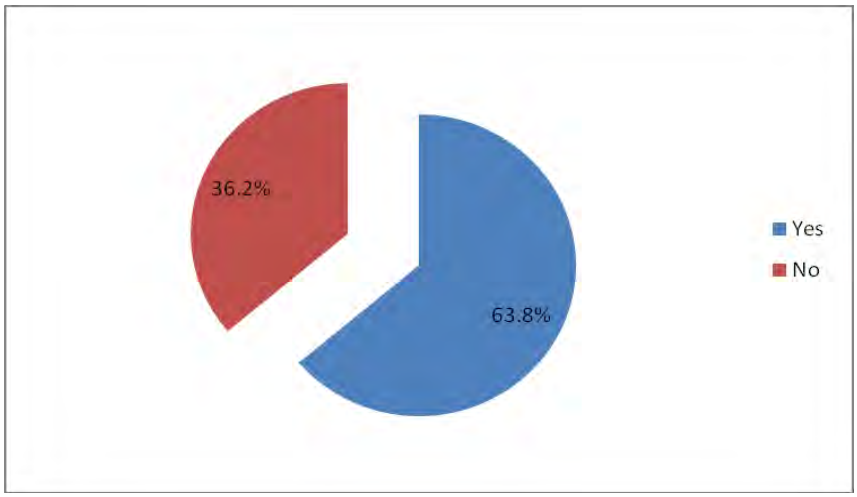


Figure 23: Companies Willing to Share or Sell Real-Time Information

4.3 Planners & Regulators Survey-Interviews

This survey was distributed only as a telephone interview. A list of federal and state officials involved in planning and regulation of the trucking industry in the ten-state region was developed from several information sources, and distilled to just those individuals most appropriately involved with the industry to offer both diverse and informed opinions on various truck traveler information needs. Of many potential names on the list for contact, 29 were contacted and willing to participate. The caller was given a short, two-page interview script, a copy of which is attached in the appendix, consisting of 8 questions (three of which had multiple parts).

The interview survey script has three sections:

- Section 1 (questions 1, 2, & 3) consists of three background/demographic questions (respondent‟s name, respondent‟s organization, and respondent‟s position/title with the organization).
- Section 2 (questions 4 through 7, inclusive) consists of four questions regarding types of traveler information (what, if any, types of information the organization currently makes available, and if so, through what sources; opinions on the value of various types of information to motor carriers; opinions on information delivery methods for their usefulness to the motor carriers; and what, if any, types of information might be of value to motor carriers that weren‟t previously discussed).
- Section 3 (question 8) consists of one final question providing an opportunity for suggestions or other comments.

4.4 Planners & Regulators Survey-Interview Results

Section 1 (Questions 1, 2, & 3) provided demographic information on those contacted for the survey. A primary use of this information was to verify that at least one individual from each of the 10 Mississippi Valley Freight Coalition member states were contacted. Respondents represented the following agencies/organizations:

Table 15: Planners & Regulators Agencies/Organizations

LMIGA
NW Indiana Regional Planning
FHWA – Michigan
FHWA – Kansas
FHWA – Illinois
Illinois State Police
Des Moines Area MPO
KY Transportation Cabinet
FHWA – Wisconsin
WisDOT
USDOT - Federal Motor Carriers Admin
Ohio DOT
MN DOT
FHWA – Missouri
Iowa DOT
Illinois DOT
Kansas DOT

Table 16: Planners & Regulators Position Titles

Project Manager / Facilitator
Transportation Planner
Transportation Planner and Research Coordinator
Planning and Research
Transportation Operations Engineer
Lieutenant
Senior Transportation Planner
Branch Manager in Division Planning
Planning Program Development Engineer
Traffic Operations Engineer
Field Agent – Kansas
Office of Technology Services, Traffic Engineer
Director of External Partnering
Director of Freight and Commercial Vehicle Operations
Director of Administration
Freight Planning Manager
Traffic and Safety Office Director
Engineer of Operations
State Traffic Operations Engineer

Section 2 (questions 4 through 7, inclusive) consists of four questions regarding types of traveler information.

Question 4 asked respondents "what, if any, types of information the organization currently makes available, and if so, through what sources." The primary types of information suggested in the question were: atmospheric weather information; weather-related road-condition information; congestion information or speeds; incidents or crash information; and construction, lane closures, or detours. Respondents were asked to answer "yes", "no", or "don't know". Figure 24 below details the responses for the primary information types suggested. Respondents were also asked to provide other types of information they were making available, and those are listed in Table 17.

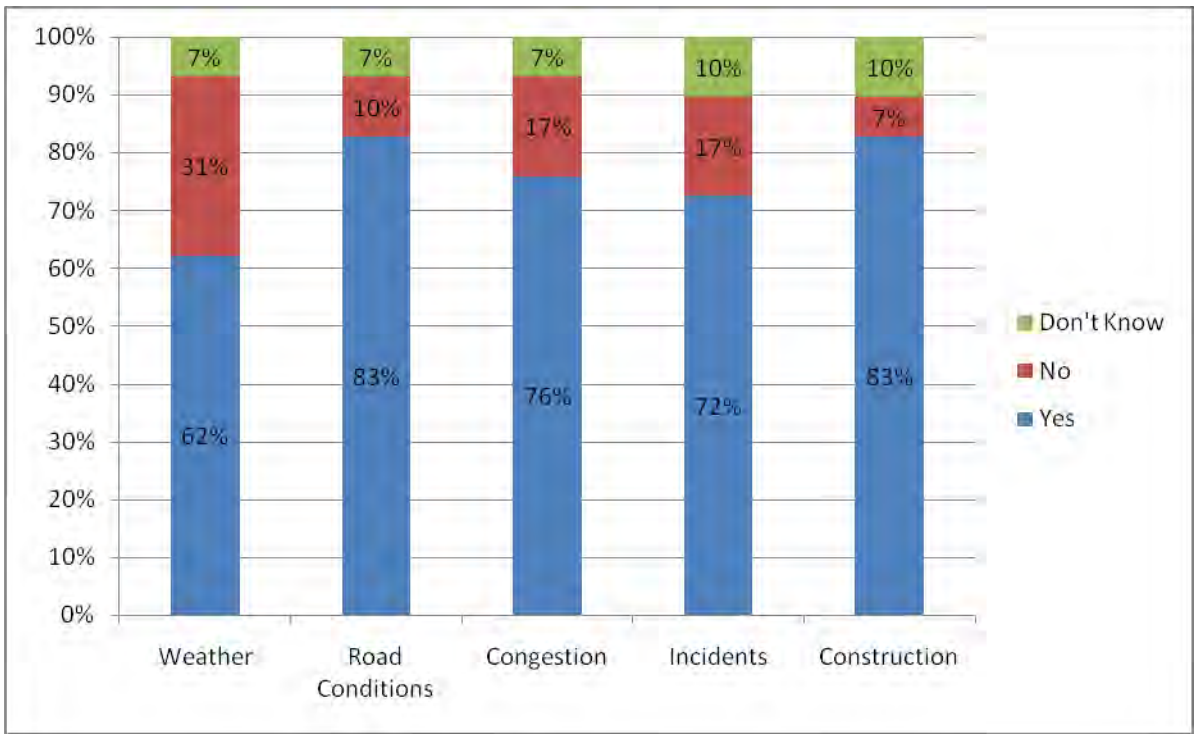


Figure 24: Primary Types of Information Provided

Table 17: Other Types of Information Provided

Type of Information	% Providing
Commercial vehicles link - Permitted Trucks	10.3%
Incident Management – Louisville	3.4%
Email Based Distributions	3.4%
Travel times	3.4%
Electronic Message signs	3.4%
Specialized Routing Info - Special Events Info	6.9%
Web Cameras - Camera Images	6.9%
Standardized road closure form	3.4%

Question 5 asked respondents their opinions on the value of various types of information to motor carriers. The primary types of information suggested in the question were: atmospheric weather information; weather-related road-condition information; congestion information or speeds; incidents or crash information; and construction, lane closures, or detours. Respondents were asked to answer "very valuable", "somewhat valuable", "not valuable," or "don't know". Figure 25 below details the responses for the primary information types suggested. Respondents were also asked to provide opinions on other types of information they were making available, and those are listed in Table 18.

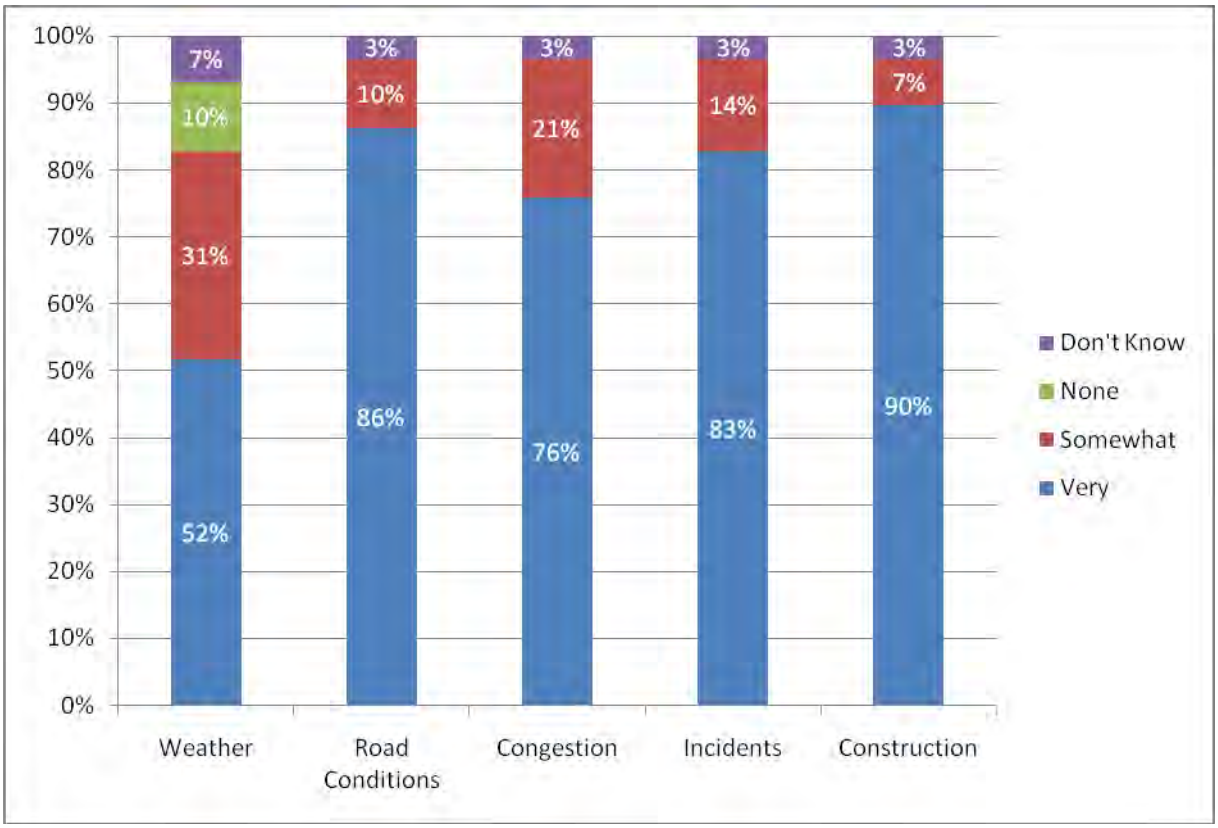


Figure 25: Value of Primary Types of Information Provided

Table 18: Value of Other Types of Information Provided

Other Types of Information	Very	Somewhat	None	Don't Know
Commercial vehicles link - Permitted Trucks	10.3%	3.4%	0.0%	86.2%
Incident Management - Louisville	0.0%	0.0%	0.0%	100.0%
Email Based Distributions	0.0%	0.0%	0.0%	100.0%
Travel times	3.4%	0.0%	0.0%	96.6%
Electronic Message signs	3.4%	0.0%	0.0%	96.6%
Specialized Routing Info - Special Events Info	0.0%	0.0%	0.0%	100.0%
Web Cameras - Camera Images	3.4%	0.0%	0.0%	96.6%
Standardized road closure form	0.0%	0.0%	0.0%	100.0%

Question 6 asked respondents their opinions on information delivery methods for their usefulness to motor carriers. The primary methods of information delivery suggested in the question were: CB radio reports; reports from dispatchers; face-to-face reports at truck stops; freeway changeable message signs; highway advisory radio; phone calls; internet traffic maps (real-time); commercial radio traffic reports; TV traffic reports. Respondents were asked to answer "very valuable", "somewhat valuable", "not valuable," or "don't know".

Figure 26 below details the responses for the primary information delivery methods suggested.

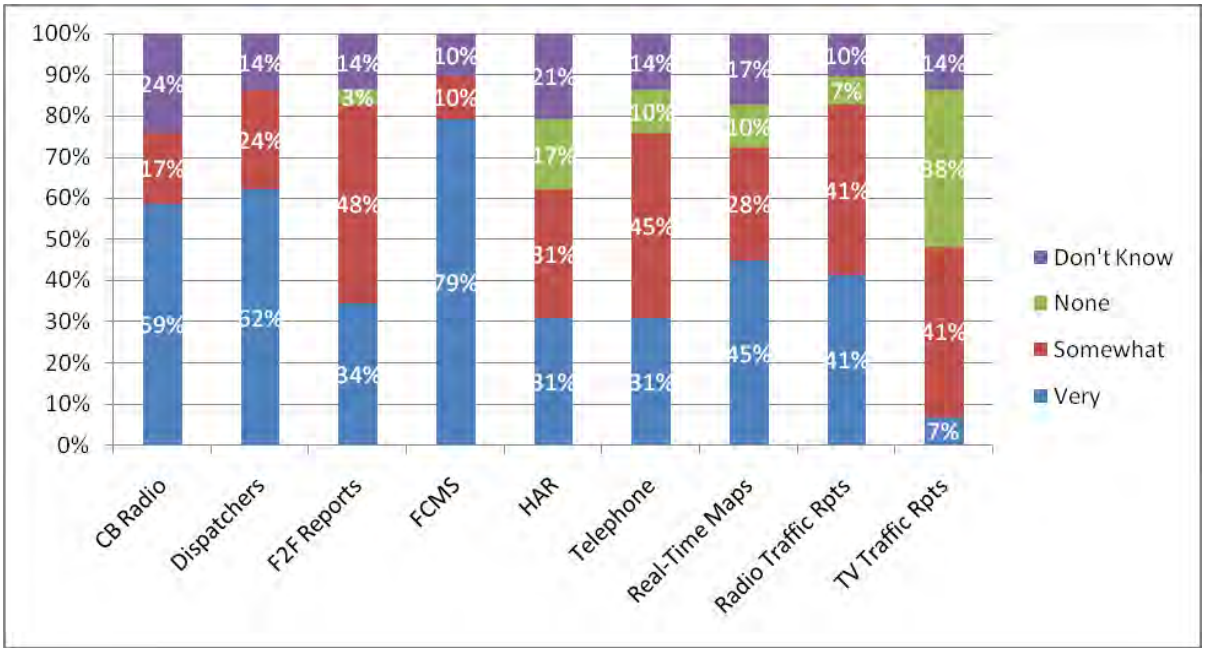


Figure 26: Value of Primary Methods of Information Delivery

Question 7 asked respondents "what, if any, types of information might be of value to motor carriers that weren't previously discussed)." Respondents were asked to answer "very valuable", "somewhat valuable", "not valuable," or "don't know". If a respondent didn't mention a source, or wasn't asked about a source, it was listed in the "don't know" category as "Not asked." Respondent opinions on other methods of information delivery are listed in Table 19.

Table 19: Value of Other Methods of Information Delivery

Other Methods of Information Delivery	Very	Somewhat	None	Don't Know / Not Asked
Text Messages / Email	10.3%	3.4%	10.3%	76.0%
Cell Phone	6.9%	0.0%	0.0%	93.1%
VII (IntelliDrive)	3.4%	0.0%	0.0%	96.6%
XM Satellite Radio	3.4%	0.0%	0.0%	96.6%

4.5 Survey Remarks

Surveys are challenging and can be costly and time consuming. While the scope of this project is limited, the survey efforts have been valuable. With the motor carrier portion a good distribution across firm size was achieved, as well as a good cross section of roles among respondents. Likewise, the DOT or regulator portion received responses from participants in all ten states and in a good variety of roles.

From the two populations there were both similarities and differences of opinion on the type of information that is most valuable and the preferred method of delivery. Both agree the freeway changeable message signs (CMS) are a valuable information delivery method. Unfortunately, the detail able to be conveyed via CMS is very limited, and this technology will continue to be sparsely available. Both also indicated information channeled through dispatchers is more valuable, although this is a case of how information is transmitted within in a firm rather than how it is provided by DOTs. Motor carriers thought commercial radio is more valuable than regulators thought. Conversely, regulators thought the phone services (e.g., 511) were more valuable than did the motor carriers.

As for information type, while regulators felt a variety of information was valuable, the motor carriers more strongly favored information on unpredictable and irregular events to be more valuable, e.g., construction, road weather conditions, and incidents.

In a more anecdotal vein, although not explicitly asked in the surveys, a sentiment heard in previous surveys was also echoed here. That is, the industry suggested that improved permitting and more streamlined regulation was even more important than any of the traveler information discussed in the surveys. That would necessarily direct potential clearinghouse resources toward other priorities sought more highly by the DOT customers – the motor carriers in this case.

Chapter 5 – ITS Architecture

This chapter outlines a high-level conceptual architecture for the Freight Traveler Information Clearinghouse project.

5.1 National ITS Architecture (www.iteris.com/itsarch/)

The National ITS Architecture probably is one of the most relevant platforms to the MVFC freight traveler information clearinghouse. It provides a common framework for planning, defining, and integrating intelligent transportation systems. It is a mature product that reflects the contributions of a broad cross-section of the ITS community (transportation practitioners, systems engineers, system developers, technology specialists, consultants, etc.). The architecture defines:

- The functions (e.g., gather traffic information or request a route) that are required for ITS.
- The physical entities or subsystems where these functions reside (e.g., the field or the vehicle).
- The information flows and data flows that connect these functions and physical subsystems together into an integrated system.

This mature system has a physical architecture, logical architecture, standards, and market packages as detailed on its webpage. It has considerations for users and marketing, and for developers. In terms of its technical essence, it is designed consistent with computer engineering principles.

5.1.1 Equipment Packages

The term *"equipment package"* was used in the National ITS Architecture development effort to group like functions (PSpecs) of a particular subsystem together into an "implementable" package of hardware and software capabilities. Documented as part of the Physical Architecture, the grouping of functions also took into account the user services and the need to accommodate various levels of functionality within them. The equipment packages are associated closely with market packages and were used as a basis for estimating deployment effort. The specific set of equipment packages defined is merely illustrative and does not represent the only way to combine the functions within a subsystem. The National ITS Architecture has defined 208 equipment packages in total.

5.1.2 Market Packages

Some of the user services are too broad in scope to be convenient in planning actual deployments. Additionally, they often don‘t translate easily into existing institutional environments and don‘t distinguish between major levels of functionality. In order to

address these concerns (in the context of providing a more meaningful evaluation), a finer grained set of deployment-oriented ITS service building blocks were defined from the original user services. These are called *"market packages"* in the documentation.

Market packages are defined by sets of equipment packages required to work together (typically across different subsystems) to deliver a given transportation service and the major architecture flows between them and other important external systems. In other words, they identify the pieces of the National ITS Architecture required to implement a service. As such, they are directly grounded in the definition of the Architecture. Most market packages are made up of equipment packages in two or more subsystems. Market packages are designed to address specific transportation problems and needs and can be related back to the user services and their more detailed requirements.

The major service areas and packages are listed in Table 20 below. Those shaded grey are potentially relevant to freight traveler information.

Table 20: ITS Architecture Market Packages

Service Area	Market Package	Market Package Name
Archived Data	AD1	ITS Data Mart
	AD2	ITS Data Warehouse
	AD3	ITS Virtual Data Warehouse
Public Transportation	APTS01	Transit Vehicle Tracking
	APTS02	Transit Fixed-Route Operations
	APTS03	Demand Response Transit Operations
	APTS04	Transit Fare Collection Management
	APTS05	Transit Security
	APTS06	Transit Fleet Management
	APTS07	Multi-modal Coordination
	APTS08	Transit Traveler Information
	APTS09	Transit Signal Priority
	APTS10	Transit Passenger Counting
Traveler Information	ATIS01	Broadcast Traveler Information
	ATIS02	Interactive Traveler Information
	ATIS03	Autonomous Route Guidance
	ATIS04	Dynamic Route Guidance
	ATIS05	ISP Based Trip Planning and Route Guidance
	ATIS06	Transportation Operations Data Sharing
	ATIS07	Yellow Pages and Reservation
	ATIS08	Dynamic Ridesharing
	ATIS09	In Vehicle Signing
	ATIS10	VII Traveler Information
Traffic Management	ATMS01	Network Surveillance
	ATMS02	Traffic Probe Surveillance
	ATMS03	Surface Street Control
	ATMS04	Freeway Control
	ATMS05	HOV Lane Management
	ATMS06	Traffic Information Dissemination
	ATMS07	Regional Traffic Management
	ATMS08	Traffic Incident Management System
	ATMS09	Traffic Forecast and Demand Management

Table 20: ITS Architecture Market Packages (continued)

Service Area	Market Package	Market Package Name
Traffic Management	ATMS10	Electronic Toll Collection
	ATMS11	Emissions Monitoring and Management
	ATMS12	Roadside Lighting System Control
	ATMS13	Standard Railroad Grade Crossing
	ATMS14	Advanced Railroad Grade Crossing
	ATMS15	Railroad Operations Coordination
	ATMS16	Parking Facility Management
	ATMS17	Regional Parking Management
	ATMS18	Reversible Lane Management
	ATMS19	Speed Monitoring
	ATMS20	Drawbridge Management
	ATMS21	Roadway Closure Management
Vehicle Safety	AVSS01	Vehicle Safety Monitoring
	AVSS02	Driver Safety Monitoring
	AVSS03	Longitudinal Safety Warning
	AVSS04	Lateral Safety Warning
	AVSS05	Intersection Safety Warning
	AVSS06	Pre-Crash Restraint Deployment
	AVSS07	Driver Visibility Improvement
	AVSS08	Advanced Vehicle Longitudinal Control
	AVSS09	Advanced Vehicle Lateral Control
	AVSS10	Intersection Collision Avoidance
	AVSS11	Automated Highway System
	AVSS12	Cooperative Vehicle Safety Systems
Commercial Vehicle Operations	CVO01	Fleet Administration
	CVO02	Freight Administration
	CVO03	Electronic Clearance
	CVO04	CV Administrative Processes
	CVO05	International Border Electronic Clearance
	CVO06	Weigh-In-Motion
	CVO07	Roadside CVO Safety
	CVO08	On-board CVO and Freight Safety and Security
	CVO09	CVO Fleet Maintenance
	CVO10	HAZMAT Management
	CVO11	Roadside HAZMAT Security Detection and Mitigation
	CVO12	CV Driver Security Authentication
	CVO13	Freight Assignment Tracking
Emergency Management	EM01	Emergency Call-Taking and Dispatch
	EM02	Emergency Routing
	EM03	Mayday and Alarms Support
	EM04	Roadway Service Patrols
	EM05	Transportation Infrastructure Protection
	EM06	Wide-Area Alert
	EM07	Early Warning System
	EM08	Disaster Response and Recovery
	EM09	Evacuation and Reentry Management
	EM10	Disaster Traveler Information

Table 20: ITS Architecture Market Packages (continued)

Service Area	Market Package	Market Package Name
Maintenance and Construction Management	MC01	Maintenance and Construction Vehicle and Equipment Tracking
	MC02	Maintenance and Construction Vehicle Maintenance
	MC03	Road Weather Data Collection
	MC04	Weather Information Processing and Distribution
	MC05	Roadway Automated Treatment
	MC06	Winter Maintenance
	MC07	Roadway Maintenance and Construction
	MC08	Work Zone Management
	MC09	Work Zone Safety Monitoring
	MC10	Maintenance and Construction Activity Coordination
	MC11	Environmental Probe Surveillance
	MC12	Infrastructure Monitoring

Pertaining to the immediate interests of freight travelers are the areas of traveler information, traffic management and commercial vehicle operations. The traveler information area covers information for general traffic. The commercial vehicle operations are especially dedicated to commercial fleets. The following is a description of one of the components in CVO: CVO01-Fleet Administration.

"This market package provides the capabilities to manage a fleet of commercial vehicles. The Fleet and Freight Management subsystem provides the route for a commercial vehicle by either utilizing an in-house routing software package or an Information Service Provider. Routes generated by either approach are constrained by hazardous materials and other restrictions (such as height or weight). Any such restricted areas are determined by the Commercial Vehicle Administration. A route would be electronically sent to the Commercial Vehicle with any appropriate dispatch instructions. The location of the Commercial Vehicle can be monitored by the Fleet and Freight Management subsystem and routing changes can be made depending on current road network conditions. Once a route has been assigned, changes must be coordinated between the Fleet and Freight Management subsystem and the Commercial Vehicle. Commercial Vehicle Drivers would be alerted to any changes in route from the planned route and given an opportunity to justify a rerouting. Any unauthorized or unexpected route changes by the Commercial Vehicle will register a route deviation alert with the Fleet and Freight Management subsystem. The Fleet and Freight Management subsystem can also notify local public safety agencies of the route deviation when appropriate (e.g., if there is safety sensitive HAZMAT being carried), by sending an alarm to the Emergency Management subsystem."

5.2 European ITS Architecture

It went from Version 1.0 of 2002 to 3.0 in 2004. No new update since then is available (http://www.frame-online.net).

The functional areas covered by this architecture are as follows.

- Electronic Payment Facilities
- Safety and Emergency Facilities
- Traffic Management
- Public Transport Operations
- Advanced Driver Assistance Systems (ADAS)
- Traveler Journey Assistance
- Support for Law Enforcement
- Freight and Fleet Operations

Of particular interest is the last area, consisting of:

- **User Needs:** provide the formal definition of what the stakeholders want an ITS deployment to provide in terms of the services they want to see delivered and any constraints they wish to place on the delivery of these services.
- **Functional Viewpoint:** defines the functionality needed by the ITS System to fulfill the User Needs and interface with the outside world. It also includes a definition of the data used by the System as input or output. It is divided into Functional Areas, which are further divided into Functions. All the Areas are provided with diagrams (called Data Flow Diagrams) which show how the functions relate to each other, to Data Stores and to the Terminators (the outside world) through the Data Flows.
- **Physical Viewpoint:** describes the various ways the Functional Architecture can be used by defining how the functionalities can be grouped into physical locations to form implementable Systems, taking account of any User Needs that have physical (as opposed to functional) requirements. It consists of a series of "Example Systems" and also provides a description of the methodology for deployment and implementation.
- **Communications Viewpoint:** developed from the Physical Architecture and describes the kind of communications links needed in a System in order to support its physical data flows. It may include some requirements from the User Needs, where they relate to specific communication requirements. It consists of an analysis of the communications requirements for several of the "Example Systems" in the Physical Architecture. It also describes the best current communication technologies and standards.
    - **Deployment Study:** shows how the Systems derived from the Architecture can be deployed and describes some of the ways in which existing systems can be migrated to conform with the European Framework Architecture.
    - **Cost Benefit Study:** provides a prediction of the likely costs and benefits that can be expected to accrue from the deployment of the Architecture.
    - **Organizational Viewpoint:** looks at how the organizations responsible for owning, managing or operating systems can work together in order to deliver the ITS services being developed.

- **Risk Analysis:** describes the risks to ITS deployment and categorizes them according to the seriousness of their impact. Mitigation strategies may are provided for some of the most severe risks.

5.3 High Level Physical Architecture

The high level physical architecture that identifies which portions of the ITS architecture are being used for the project is illustrated in Figure 27. The project includes fixed-point to fixed-point connections between Traffic Management Subsystem, Emergency Management Subsystem, Commercial Vehicle Administration Subsystem, Maintenance and Construction Management Subsystem, Information Service Provider Subsystem, and Fleet and Freight Management Subsystem. This project also includes a fixed-point to fixed-point or wireless connection to Personal Information Access Subsystem, a vehicle to vehicle connection to Commercial Vehicle Subsystem, and a dedicated short range connection to Commercial Vehicle Check Subsystem.

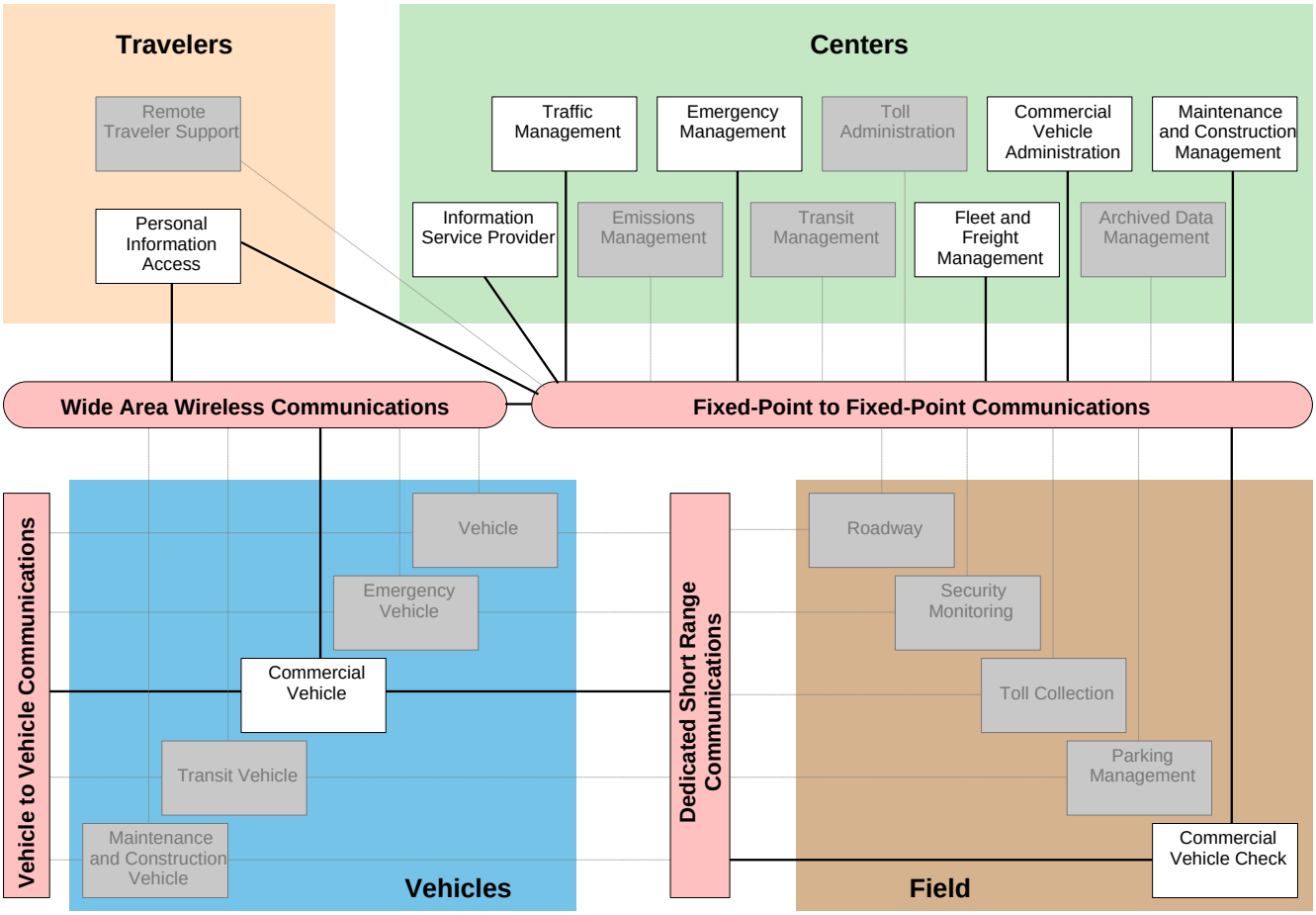


Figure 27: High Level Physical Architecture

5.3.1 Interconnect Diagram

The interconnect diagram shown in Figure 28 helps define participating stakeholders involved in the Freight Traveler Information Clearinghouse project. The stakeholders are aggregated into groups, for instance, the ten state DOTs are shown as one stakeholder group.

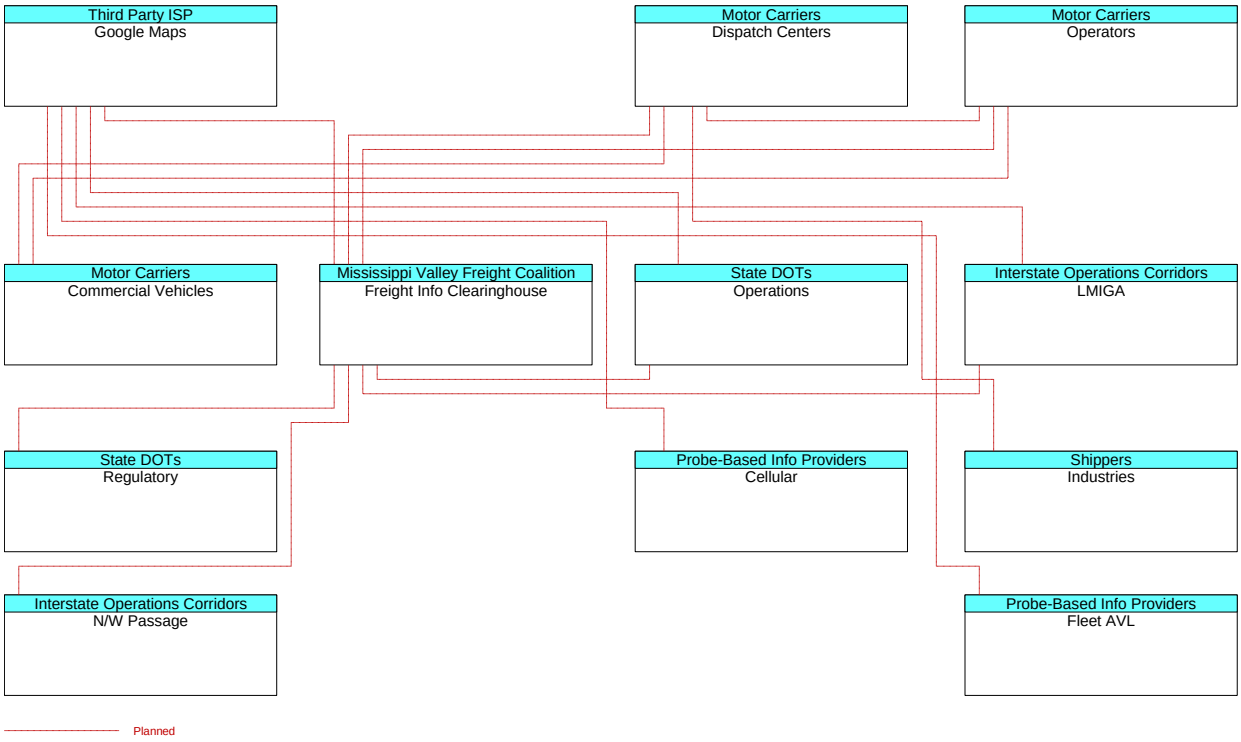


Figure 28: Interconnect Diagram

Here are brief descriptions of some of the stakeholders and elements that appear in Figure 27 and 28.

Mississippi Valley Freight Coalition - The Mississippi Valley Freight Coalition (MVFC) is a regional organization that cooperates in the planning, operation, preservation, and improvement of transportation infrastructure in the Mississippi Valley region. The Mississippi Valley region includes ten states (Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Ohio, and Wisconsin) that share key interstate corridors, rail infrastructure, and inland and Great Lakes waterways. The Information Clearinghouse is the central subsystem for this project and architecture.

Shippers - Companies or industries which prepare goods for shipment, by packaging, labeling, and arranging for transit, or who coordinates the transport of goods.

State DOTs - Ten States Department of Transportation including Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Missouri, Ohio, and Wisconsin.

- Operations - Transportation systems operations.
- Regulatory - Guidance/regulations of the transportation systems.

Motor Carriers - A company which employs large semi-truck and bus drivers.

- Dispatch Centers - Centers where commercial vehicles are managed and assigned to a freight operation.
- Operators - Commercial vehicle drivers.
- Commercial Vehicles - A type of vehicle that is used for carrying goods.

Interstate Operations Corridors

- LMIGA - The Lake Michigan Interstate Gateway Alliance.
- N/W Passage - Northwest corridor.

Probe-Based Information Providers

- Fleet AVL - Fleet Automatic Vehicle Location.
- Cellular - Cell phones.

Third Party ISP - The third party Internet Service Provider such as Google maps.

5.3.2 Architecture Flow Diagram

Figure 29 shows anticipated data exchanges between subsystems for the Freight Traveler Information Clearinghouse project. The architecture flow diagram also provides a visual illustration of high-level project functional requirements.

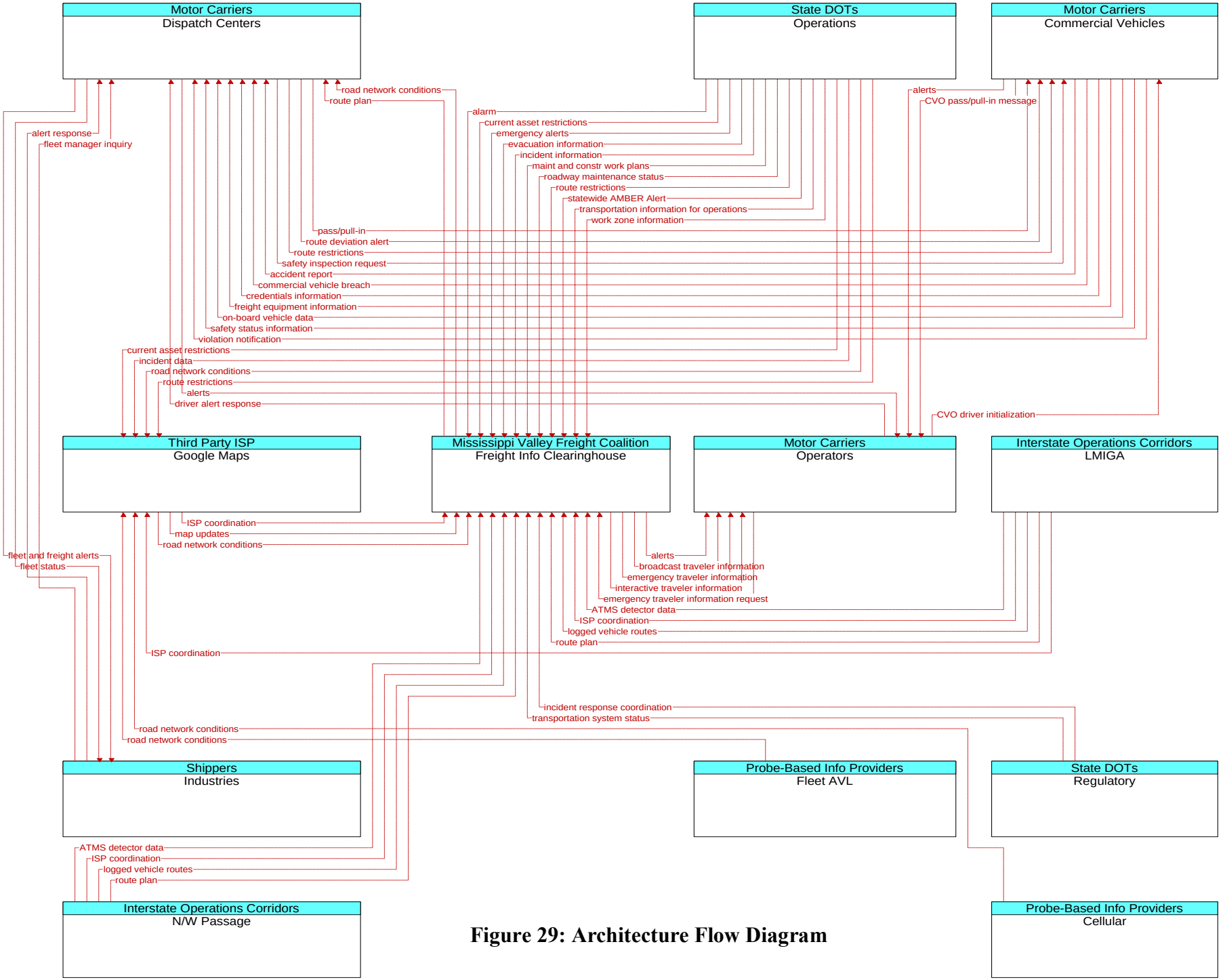


Figure 29: Architecture Flow Diagram

5.3.3 Architecture Flow Definitions

The following flow definitions describe the data being exchanged between subsystems in the Architecture Flow Diagram.

Alarm - Information about a Commercial Vehicle or Freight Equipment breach, non-permitted security sensitive hazmat detected at the roadside, route deviation, or Commercial Vehicle Driver / Commercial Vehicle / Freight Equipment assignment mismatches which includes the location of the Commercial Vehicle and appropriate identities.

Alerts - This flow represents the visual or auditory interface with ITS equipment containing specific alerts and messages related to commercial vehicles (e.g. trucks not advised, trucks over 10 tons not allowed on bridge, route details).

ATMS Detector Data – Traffic detector data from the ten state DOT regions.

Broadcast Traveler Information – General traveler information that contains traffic and road conditions, link travel times, incidents, advisories, transit service information, weather information, parking information, and other related traveler information.

CVO Driver Initialization - This flow represents the tactile or auditory interface with ITS equipment containing the commercial vehicle driver and vehicle information.

Current Asset Restrictions - Restrictions levied on transportation asset usage based on infrastructure design, surveys, tests, or analyses.

Emergency Alerts – Generated by the state DOTs.

Emergency Traveler Information - Public notification of an emergency such as a natural or man-made disaster, civil emergency, or child abduction.

Emergency Traveler Information Request - Request for alerts, evacuation information, and other emergency information provided to the traveling public.

Evacuation information – Evacuation instructions and information including evacuation zones, evacuation times, and reentry times. (From National Architecture)

Incident Information - Notification of existence of incident and expected severity, location, time and nature of incident.

Incident Response Coordination - Incident response procedures and current incident response status that are shared between allied response agencies to support a coordinated response to incidents.

Interactive Traveler Information - Traveler information that is customized based upon traveler requests or traveler profiles. The information is comprised of traffic and road conditions, advisories, incidents, payment information, transit services, parking information, weather information, and other travel-related data updates and confirmations.

ISP Coordination – Coordination and exchange of transportation information between centers. This flow allows a broad range of transportation information collected by one ISP to be redistributed to many other ISPs and their clients. (From National Architecture)

Maintenance and Construction Work Plans - Future construction and maintenance work schedules and activities including anticipated closures with anticipated impact to the roadway, alternate routes, anticipated delays, closure times, and durations.

Road Network Conditions - Current and forecasted traffic information, road and weather conditions, traffic incident information, and other road network status.

Roadway Maintenance Status - Summary of maintenance fleet operations affecting the road network. This includes the status of winter maintenance (snow plow schedule and current status).

Route Plan - Tailored route provided by ISP in response to a specific request.

Route Request - Request for a tailored route based on given constraints.

Route Restrictions - Information about routes, road segments, and areas that do not allow the transport of security sensitive hazmat cargoes or include other restrictions (such as height or weight limits).

Transportation Information For Operations - Information on the state of transportation system operations including traffic and road conditions, advisories, incidents, transit service information, weather information, parking information, and other related data.

Transportation System Status - Current status and condition of transportation infrastructure (e.g., tunnels, bridges, interchanges, TMC offices, maintenance facilities).

Work Zone Information - Summary of maintenance and construction work zone activities affecting the road network including the nature of the maintenance or construction activity, location, impact to the roadway, expected time(s) and duration of impact, anticipated delays, alternate routes, and suggested speed limits.

The following flows are not necessarily central to the current Information Clearinghouse concept, but some already exist and are noted here for illustrative purposes.

- Accident Report - Report of commercial vehicle safety accident. The information may be provided as a response to a real-time query or proactively by the source.

- Alert Response - This flow represents the tactile or auditory interface with ITS equipment containing the response by a Commercial Vehicle Driver or Fleet-Freight Manager that confirms or cancels an alert.
- Commercial Vehicle Breach - Information about a breach or tamper event on a Commercial Vehicle or its attached freight equipment.
- Credentials Information - Credentials information such as registration, licensing, insurance, check flags, and electronic screening enrollment data.
- CVO Pass/Pull-In Message - This flow represents the visual or auditory interface with ITS equipment containing a message sent to commercial vehicle driver indicating whether to bypass or requesting pull in to inspection/verification stop along with inspection results.
- Driver Alert Response - Commercial Vehicle Driver response to a breach alerts for a Freight Equipment breach or tamper event.
- Fleet And Freight Alerts - This flow represents the visual or auditory interface with ITS equipment containing security alert status information regarding commercial vehicle fleets and freight equipment.
- Fleet Manager Inquiry - This flow represents the tactile or auditory interface with ITS equipment containing an inquiry from fleet manager.
- Fleet Status - This flow represents the visual or auditory interface with ITS equipment containing fleet status information.
- Freight Equipment Information - Container, trailer, or chassis information regarding identity, type, location, brake wear data, etc.
- On-board Vehicle Data - Information about the commercial vehicle stored on-board. (for maintenance purposes, gate access, cargo status, lock status, etc.)
- Pass/Pull-In - Command to commercial vehicle to pull into or bypass inspection station.
- Route Deviation Alert - An alert that indicates a deviation from a planned route has been detected. The alert will contain the current Commercial Vehicle location and identity.
- Safety Inspection Request - Request for safety inspection record.
- Safety Status Information - Safety information such as safety ratings, security ratings or flags, inspection summaries, and violation summaries.
- Statewide AMBER Alert – All AMBER Alerts in ten states.
- Violation Notification - Notification to enforcement agency of a violation.

5.4 Identification of Applicable ITS Standards

ITS Standards are fundamental to the establishment of an open ITS environment, the goal originally envisioned by the U.S. Department of Transportation (USDOT). Standards facilitate deployment of interoperable systems at local, regional, and national levels without impeding innovation as technology advances and new approaches evolve. Below are some ITS standards figured out for the Freight Information and Clearinghouse project. The

descriptions are extracted from the Research and Innovative Technology Administration (RITA) web site (http://www.standards.its.dot.gov).

- National ITS Architecture

  The National ITS Architecture provides a common framework for planning, defining, and integrating intelligent transportation systems. It is a mature product that reflects the contributions of a broad cross-section of the ITS community (transportation practitioners, systems engineers, system developers, technology specialists, consultants, etc.). The architecture defines:

  - The functions (e.g., gather traffic information or request a route) that are required for ITS
  - The physical entities or subsystems where these functions reside (e.g., the field or the vehicle).
  - The information flows and data flows that connect these functions and physical subsystems together into an integrated system.

- SAE J2354 - Message Set for Advanced Traveler Information System (ATIS)

  This standard defines messages for advanced traveler information systems (ATIS) for general use independent of medium of transmission or bandwidth availabilities. The messages themselves consist of data elements (DEs), formerly defined in the companion standard SAE J2353, but now incorporated into this version of SAE J2354.

  This standard also provides two basic types of ATIS, based on whether or not the traveler (data consumer) interacts with the traveler information provider (data provider). One-way communication of traveler information includes predefined information broadcast to travelers, such as radio and TV broadcasts and some web pages. Two-way, transactional traveler information includes all means whereby the traveler makes specific, personalized requests and receives customized information.

- AASHTO-ITE TM 2.1, Standards for Traffic Management Center-to-Center Communications

  The AASHTO-ITE TM 2.1, Standards for Traffic Management Center-to-Center Communications standard is comprised of both a functional level data dictionary and a message set, and is designed to be independent of any specific communications protocol.

  The data dictionary consists of and defines a set of data elements (DEs) necessary to support data exchange within and among traffic management systems. Specifically, it provides meta-attributes for each DE including definitions (semantics) and specific format (syntax).

The message sets include three message groups (i.e., Manage Assets, Manage Transportation Related Information and Remote Operational Control of Traffic Control Devices) necessary to convey key data within and between traffic management centers and other ITS centers. It provides a list of specific data elements for each message plus other format information such as message name, message number, and other mandatory and optional message attributes.

- IEEE 1512 - Family of Standards for Incident Management Message Sets

  The message sets defined by the IEEE 1512 family of standards aid in efficient sharing of information between agencies that participate in an incident response. (IEEE is a technology association and the name is no longer an acronym.) Information directly from the scene of the incident and information from participating agency centers can be shared. Combining information from all sources into a common set of messages for all agencies to use will aid in the safe and efficient management of the incident. Incidents include such familiar occurrences as vehicle crashes, breakdowns, work-zone lane closures, and, broadly speaking, any events (such as natural disasters, extreme weather, or special events) that affect the movement of traffic.

- NTCIP 1101 - Simple Transportation Management Framework (STMF)

  The National Transportation Communications for ITS Protocol (NTCIP) 1101 - Simple Transportation Management Framework (STMF) includes Amendment 1v08, specifies a set of rules for processing, organizing and exchanging information between transportation centers (management applications) and transportation equipment (traffic signal controllers, message signs, etc.) so they can communicate with each other. The STMF integrates the Internet-standard Simple Network Management Protocol (SNMP) and its derivative Transportation Management Protocol (TMP), which has been designed to be compatible with SNMP. TMP is a newly developed base standard designed to address limited bandwidth communications links that requires SNMP for its configuration. In the annexes of this standard, there are sets of definitions that specify the setup of the data as well as the parameters needed to enable the bandwidth-saving TMP.

  This standard does not address lower layer communications protocols such as TCP/UDP/IP or PPP. The specification for these protocols can be found in either "base protocols" that explain their setup or in "profiles" that assemble different base protocols into a "communications stack" that addresses the existing or desired communications infrastructure. SNMP has been designed to and should be used in conjunction with UDP/IP, while STMP may be used over either UDP/IP or with a null transport profile.

- NTCIP 1206 - Object Definitions for Data Collection and Monitoring (DCM) Devices

This standard, NTCIP 1206 - Object Definitions for Data Collection and Monitoring (DCM) Devices, provides the vocabulary - commands, responses and information - necessary for traffic management and operations personnel to control, manage, and monitor data collection and monitoring devices such as loop detectors, radar detectors and other sensors. This standard contains object definitions to support the functionality of these devices as used for transportation and traffic monitoring applications. The standard includes conformance group requirements and conformance statements to support compliance with the standard, as well as configuration and operations examples demonstrating different communications profiles.

Chapter 6 - Web Prototype

As a part of the mockup phase of this project, a study on the design aspects of the implementation is done. This chapter deals with web technologies/methodologies studied and in further consideration.

Introduction:

The traditional way of web-based GIS applications in transportation engineering requires preparing interactive maps from scratch using GIS data for various highways, cities, states etc. In that way, system manager is required to maintain a web-server separately for the same. However, with the advancements in WWW technology and inception of web 2.0, it has been possible to utilize free web-mapping services and save time and money involved in setting up and maintaining own GIS server.

6.1 Google Maps API

Google created the Google Maps applications programming interface (API) to facilitate developers integrating Google Maps into their web sites with their own data points. Google Maps API was released in 2006 coinciding with the O'Reilly Web 2.0 Conference. It is a free service based on terms and conditions, which currently does not contain ads, but Google states in their terms of use that they reserve the right to display ads in the future.

By using the Google Maps API we can embed the full Google Maps on any web site. We start by creating an API Key, it will be bound to the web site and directory we enter when creating the key. Creating our own map interface involves adding the Google JavaScript code to our page, and then using JavaScript functions to add points to the map.

The background geographic data appearing in Google Maps is hosted by Tele Atlas North America, Inc. and Navteq North America LLC. The Google Maps API provides a number of utilities for manipulating maps and adding aforesaid contents to the map. Google Map‟s greater user interactivity comes about by the use of Asynchronous JavaScript and XML (AJAX) technology to perform the asynchronous network requests through customized menus. This technology stands better than other client server interaction technologies because it does not reload all the information at the client‟s computer and just retrieves the information which is updated or changed during the period of client‟s session. The traditional client-server interactions send requests to server, retrieve required information and then close the connection to server until there is next query from the user. In contrast, AJAX keeps the connection open between client and server allowing web page to request small bits of information from the server instead of loading the whole page, which in turn increases the speed of this interaction.

By using Google Maps, there is no need to install any web-supportive GIS system on our web hosting server. Accordingly maintenance services to the GIS server are therefore not

necessary. All we need to implement this application is a server which can support at least one server-side language with a back end database.

6.2 Extensible Markup Language (XML)

XML is a markup language for documents containing structured information. It is the most common tool for data transmissions between all sorts of applications, and is becoming more and more popular in the area of storing and describing information.

6.3 Asynchronous JavaScript and XML (AJAX)

Ajax (Asynchronous JavaScript and XML), or AJAX, is a group of interrelated web development techniques used for creating interactive web applications or rich internet applications. With Ajax, web applications can retrieve data from the server asynchronously in the background without interfering with the display and behavior of the existing page.

6.4 Web Services

6.4.1 Introduction

The next generation of distributed computing has arrived through web services. A web service is a unit of managed code that can be remotely invoked/activated using Hypertext Transfer Protocol (HTTP) requests.

One can access web services using HTTP. Of all the protocols in existence today, HTTP is the one specific wire protocol that all platforms tend to agree on. Thus , using web services, a web service developer can use any language he wish and a web service consumer can use standard HTTP to invoke methods a web service provides. The bottom line is that we have true language and platform integration. **Simple Object Access Protocol (SOAP)** and **XML** are also two key pieces of the **Web services architecture**.

6.4.2 What is a Web Service

Web services constitute a distributed computer architecture made up of many different computers trying to communicate over the network to form one system. They consist of a set of standards that allow developers to implement distributed applications - using radically different tools provided by many different vendors - to create applications that use a combination of software modules called from systems in disparate departments or from other companies.

A Web service contains some number of classes, interfaces, enumerations and structures that provide black box functionality to remote clients. Web services typically define business objects that execute a unit of work (e.g., perform a calculation, read a data source, etc.) for

the consumer and wait for the next request. Web service consumer does not necessarily need to be a browser-based client. Console-based and Windows Forms-based clients can consume a Web service. In each case, the client indirectly interacts with the Web service through an intervening proxy. The proxy looks and feels like the real remote type and exposes the same set of methods. Under the hood, the proxy code really forwards the request to the Web service using standard **HTTP** or optionally **SOAP** messages.

6.4.3 Web Service Standards

Web services are registered and announced using the following services and protocols. Many of these and other standards are being worked out by the **UDDI** project, a group of industry leaders that is spearheading the early creation and design efforts.

Universal Description, Discovery, and Integration (UDDI) is a protocol for describing available Web services components. This standard allows businesses to register with an Internet directory that will help them advertise their services, so companies can find one another and conduct transactions over the Web. This registration and lookup task is done using **XML** and **HTTP(S)**-based mechanisms.

Simple Object Access Protocol (SOAP) is a lightweight protocol for exchanging structured information in a decentralized, distributed environment. It is an XML based protocol that consists of three parts: an envelope that defines a framework for describing what is in a message and how to process it, a set of encoding rules for expressing instances of application-defined data-types, and a convention for representing remote procedure calls and responses.

Web Service Description Language (WSDL), the proposed standard for how a Web service is described, is an XML-based service IDL (Interface Definition Language) that defines the service interface and its implementation characteristics. WSDL is referenced by UDDI entries and describes the SOAP messages that define a particular Web service.

ebXML (e-business XML) defines core components, business processes, registry and repository, messaging services, trading partner agreements, and security.

6.4.4 Implementing Web Services

Here comes a brief step-by-step on how a Web service is implemented.

- A service provider creates a Web service
- The service provider uses WSDL to describe the service to a UDDI registry
- The service provider registers the service in a UDDI registry and/or ebXML registry/repository.
- Another service or consumer locates and requests the registered service by querying UDDI and/or ebXML registries.

- The requesting service or user writes an application to bind the registered service using SOAP in the case of UDDI and/or ebXML
- Data and messages are exchanged as XML over HTTP

A sample diagram showing the workflow of a web service is shown in Figure 30.

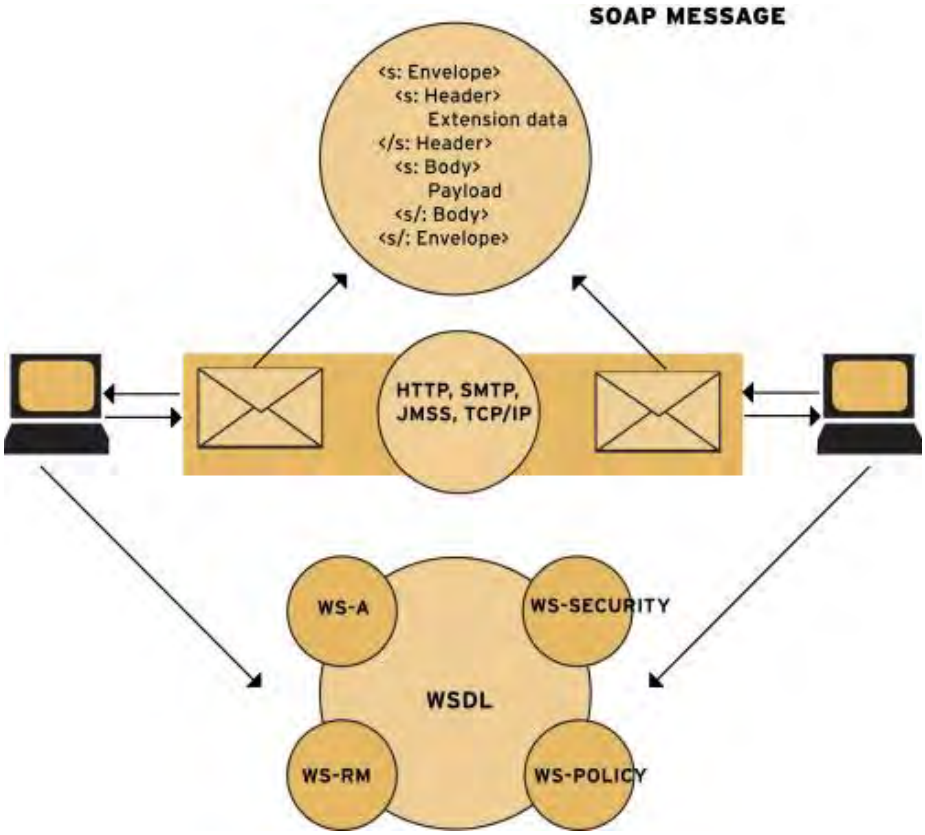


Figure 30: Sample Diagram Showing the Web Service Interaction

6.4.5 Web Services Technologies and Tools

There are a number of mechanisms for constructing Web services. Microsoft has come out with a new object-oriented language C# as the development language for Web services and .NET framework. Microsoft has an exciting tool called Visual Studio .NET in this regard. The back end database can be Microsoft SQL Server 2000 in Windows 2000 Professional.

Sun Microsystems has its own set of technologies and tools for facilitating Web services development. Java Servlets, Java Server Pages (JSPs), Enterprise JavaBeans (EJB) architecture and other Java 2 Enterprise Edition (J2EE) technologies play a very critical role in developing Web services.

There are a number of tools for developing Web services. They are Forte Java IDE, Oracle JDeveloper, and WebGain Studio.

IBM also for its part has already developed a suite of early-access tools for Web services development. They are Web Services Toolkit (WSTK), WSDL Toolkit, and Web Services Development Environment (WSDE).

6.4.6 Conclusion

For the last few years, XML has enabled heterogeneous computing environments to share information over the web. It now offers a simplified means by which to share process as well. web service architectures provide a very different way of thinking about software development. From client-server to n-tier systems, to distributed computing, web service applications represent the culmination of each of these architectures in combination with the internet. There are freely available web services such as from Geonames, WebServiceX.Net websites which can be utilized for further extension of the prototype.

6.5 KML

KML is a file format used to display geographic data in an earth browser, such as Google Earth, Google Maps, and Google Maps for mobile. A KML file is processed in much the same way that HTML (and XML) files are processed by web browsers. Like HTML, KML has a tag-based structure with names and attributes used for specific display purposes. Thus, Google Earth and Maps act as browsers for KML files.

KML can be used specifically to:

- Specify icons and labels to identify locations on the planet surface
- Create different camera positions to define unique views for each of your features
- Use image overlays attached to the ground or screen
- Define styles to specify feature appearance
- Write HTML descriptions of features, including hyperlinks and embedded images
- Use folders for hierarchical grouping of features
- Dynamically fetch and update KML files from remote or local network locations
- Fetch KML data based on changes in the 3D viewer
- Display COLLADA textured 3D objects

6.5.1 KML in Google Maps

Google Maps supports the following KML elements (that is, KML queries in the Search box and GGeoXml objects in the Maps API):

- Placemarks
- Icons
- Folders
- Descriptive HTML
- KMZ (compressed KML, including attached images)

- Polylines and polygons
- Styles for polylines and polygons, including color, fill, and opacity
- Network links to import data dynamically
- Ground overlays and screen overlays

The KML parser generally silently ignores XML tags it does not understand.

6.5.2 Size and Complexity Restrictions for KML Rendering in Google Maps

Google Maps currently has specific limitations to the size and complexity of loaded KML files. Below is a summary of the current limits:

Table 21: Limits for KML on Google Maps

Maximum fetched file size (KML or compressed KMZ)	3MB
Maximum uncompressed file size (uncompressed KML or GeoRSS XML)	10MB
Maximum number of Network Links	10
Maximum number of total document-wide features	1,000
Maximum number of features visible in any given viewport*	80

* Users can zoom in to see features hidden by this restriction

6.6 Plan for Technical Architecture for the Web-Prototype

In this project, we use Google Maps Application Program Interface (API) to develop the interactive map. The web-map based freight information clearinghouse interface comprises of a two-tier server-client architecture as shown in Figure 31. The client makes a service request and the server fulfills the request. In our case, the client side (e.g. internet users) is enabled with a web-browser. The server side is composed of a MySQL database and virtual host on a web-server. The client-side and server-side are explained separately in the following paragraphs.

The client side is being implemented in Hyper Text Markup Language (HTML), Cascading Style Sheets (CSS) and JavaScript. The HTML code prepares the content to be available on the respondent‟s web-browser. CSS are being used for formatting and layout of the pages. JavaScript is being used to implement the routines for supporting user interactions on the web interface. A major part of the JavaScript entails importing classes for styling the webpage and Google Maps API to incorporate Google Maps features embedded in the web-interface. Google Maps interface with its API acts as a liaison between the server side information exchange and the client side interaction and visualization.

The server side of this freight information clearinghouse involves PHP code and MySQL database tables. PHP code interacts with the web server in two ways. First, it queries the records from the server and MySQL database based on user-defined criteria. The user-defined criteria are actually the values entered at web-interface. The HTML is used to read

and then send the user‟s input values to the PHP files. The code written in PHP files prepares and executes the database queries and then sends results back to client side. Thus values retrieved from database cannot be directly sent to client-side JavaScript. In order to make JavaScript and PHP interact, we use Extensible Markup Language (XML). PHP outputs XML which is read by JavaScript and displays the queried records on the client‟s map interface. The second way PHP interacts with the web server is to gather data in XML or KML using AJAX from external sources like feeds and other web services to display on the map interface.

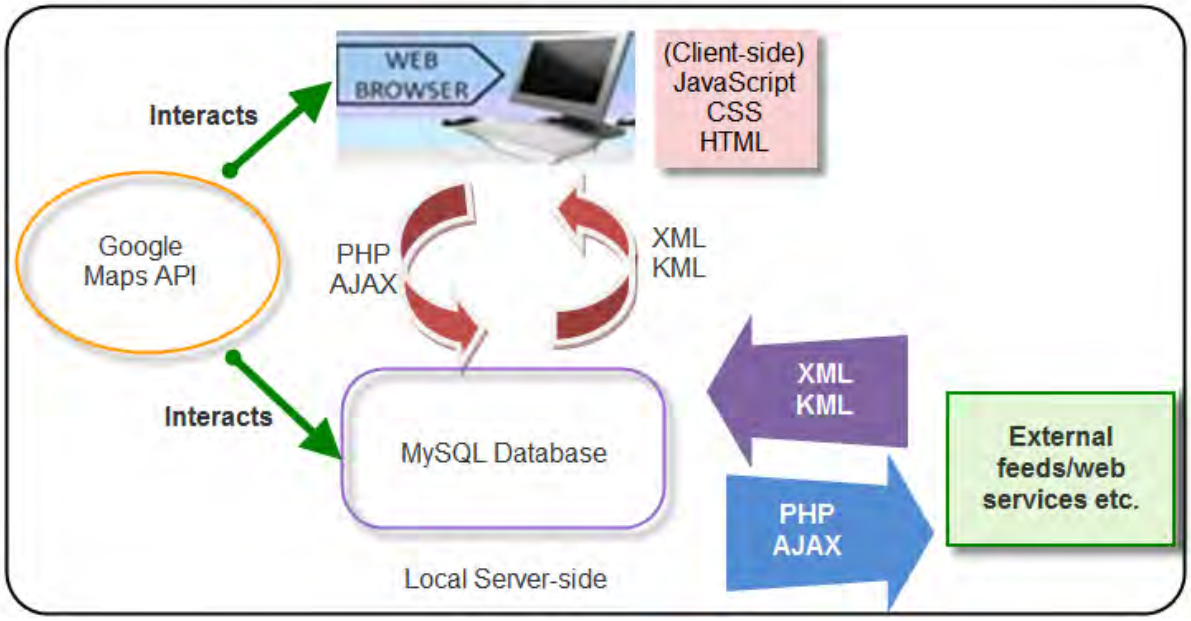


Figure 31: Technical Architecture for the Freight Information Clearinghouse Prototype

6.7 Current Work Related to the Prototype

One of the major hindrances encountered is that we converted an existing shape file to a KML file and it turned out to be a large one (3MB). It appears that the KML on maps is rendered by JavaScript. This limitation is expected to be overcome in the future. Attempts were made for reducing/obtaining the KML file through various software available online such as Shp2KML, FME, GPSTrackMaker, KMLReducer.xls but the size was still an issue. A better option could be to show the layer of KML only when required. This reduces the burden of initial map loading up. This reduced the initial map loading time and current work is headed using this method. A more robust way could be by using Google‟s polyline encoding which further reduces the rendering time for the application.

Other options which were explored for the prototype implementation were

1) To utilize flash functionality for the layers, which are fast compared to KMLs on Maps. But one of the drawbacks with this issue is that those flash layers hinder the general Google maps functionality like panning/zooming/clicks etc. in the surrounding features for flash.

2) Flash API for Google Maps – could be a potential approach in future. There are some limitations with this approach, mainly the traffic API cannot be overlaid on the map interface.

3) Incorporating other external web services onto an ESRI application containing layers hosted internally could serve our functionality. A local host has been setup initially using Apache web server and Jakarta Tomcat as the servelet engine. ESRI‟s ArcIMS server has been installed and the system is being configured for combining all these three for a successful web service creation. As a testing part, private truck parking service is published, coupled with interstate highways and states layer. But ArcGIS Server is a more robust version that ArcIMS, this could be also a direction for future exploration.

4) A tile based approach is proposed and there has been a significant success in this direction mainly through fast loading and rendering of the website. The approach then is to associate the attributes to these tiles. But it was observed that we cannot attach attributes to the tiles.

5) Several web-mapping technologies from Microsoft, Google, Yahoo and open source technologies like Open Layers and Map Server were explored as a part of feasibility study exploration.

Implementation:

1) We finally adopted Google Maps JavaScript API with a MySQL database in the backend for the prototype. The user interface of the web prototype along with brief descriptions of each section is shown in Figure 32. It contains a list of expandable menus for various kinds of information. “Quick Search and Zoom in” tool is one of the key functionalities to directly search for any location of interest and then display various kinds of information available from other menus at that particular location.

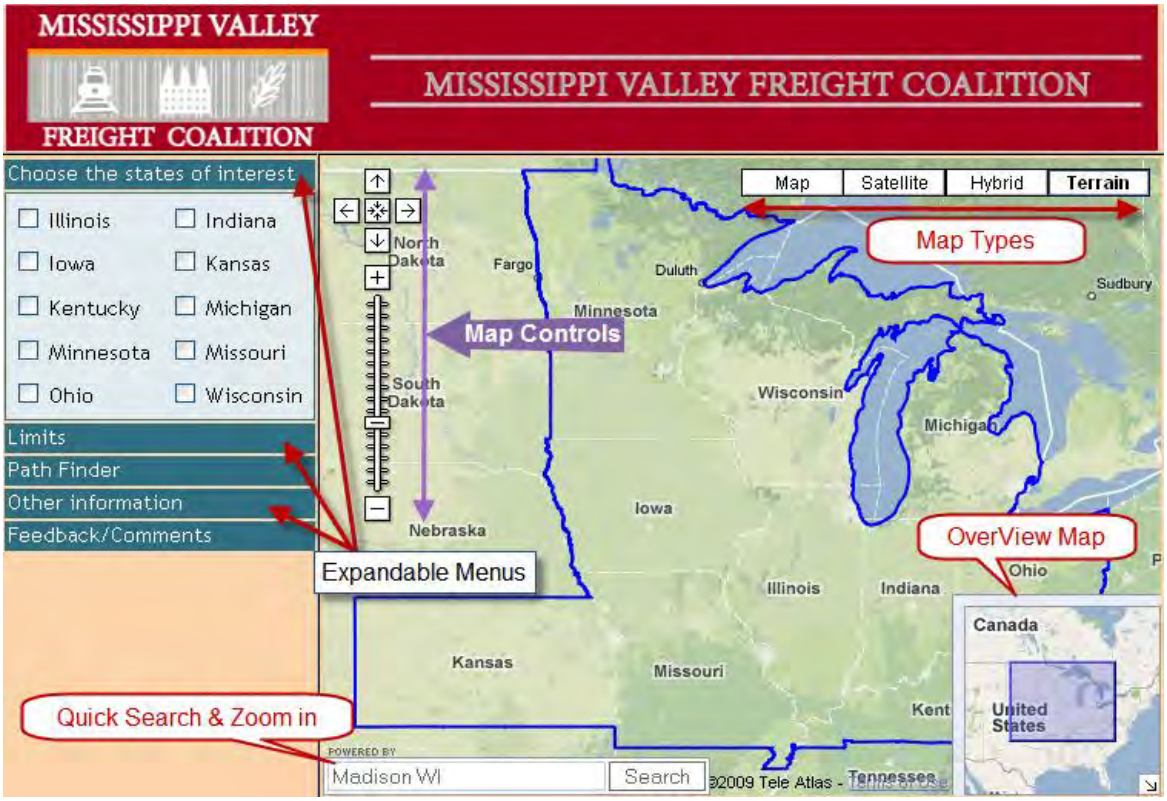
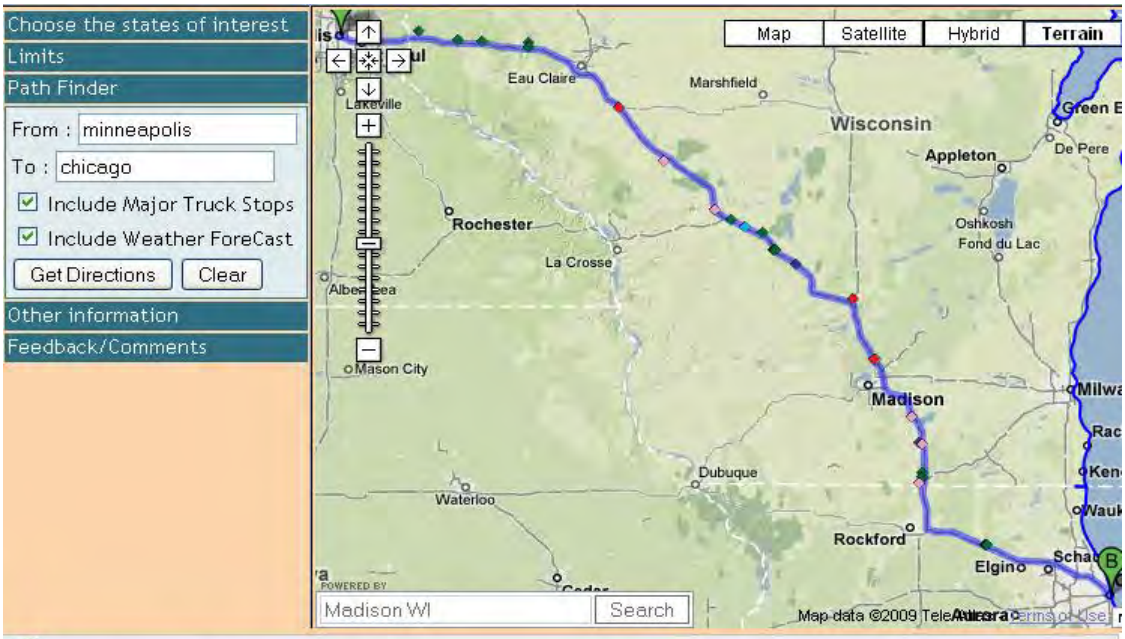


Figure 32: User Interface for the Web Prototype with Brief Descriptions

2) "Limits" menu along with the "Choose States of Interest" menu can potentially be used as a thematic visualization tool for interstates in chosen states of interest in the ten state region based on their weight limits, winter weight limits or truck dimensions.

3) Path finder menu provides path finder functionality in the prototype for finding the shortest- time path between any two places using the Google Maps API geocoder service. This particular feature has also a provision for showing major private truck stops along the route which are queried from the local server. This particular requirement can be considered as one of the major potential requirements for motor carriers (Figure 33). More information related to each truck stop on the route is obtained by clicking on the truck stop icon.



Minneapolis, MN

409 mi (about 6 hours 43 mins)

1. Head **southeast** on **4th St S** toward **5th Ave S/MN-65**	0.5 mi
2. Continue on **Washington Ave SE**	1.6 mi
3. Turn **right** at **Huron Blvd SE**	0.3 mi
4. Take the ramp to **I-94**	0.4 mi
5. Merge onto **I-94 E** Entering Wisconsin	262 mi
6. Continue on **I-39 S/I-90 E** (signs for **I-39/I-90/Chicago**) Continue to follow I-90 E Partial toll road Entering Illinois	143 mi
7. Take exit **51I** toward **Chicago Loop/Congress Pkwy**	0.4 mi
8. Merge onto **I-290 E**	0.5 mi
9. Continue on **W Congress Pkwy**	0.3 mi
10. Turn **left** at **S State St**	0.2 mi
11. Turn **right** at **E Jackson Blvd**	0.2 mi
12. Turn **left** at **S Michigan Ave**	456 ft
13. Turn **left** at **E Adams St**	23 ft

Chicago, IL

Figure 33: The Path with Driving Directions between Origin (Minneapolis, MN) and Destination (Chicago, IL) Highlighting the Major Private Truck Stops along the Route

4) Based on findings from the survey, weather related information is often sought by the motor carriers from various sources including internet. Hence, an additional functionality that is implemented here is to provide a four day weather forecast option for places along the route, in order to plan the trip and estimate any delays due to weather. This functionality is achieved by using the web-feed available from weather.com. Upon requesting the path from origin to destination, based upon the route obtained, an AJAX call is being made to that web-feed to retrieve the information for the places on the route obtained from Google geo-coding API and then show it along with the driving directions (Figure 34). For the route obtained above from Minneapolis to Chicago, a four day forecast is provided for the places along the route. This functionality is very unique being able to combine the route and weather information.

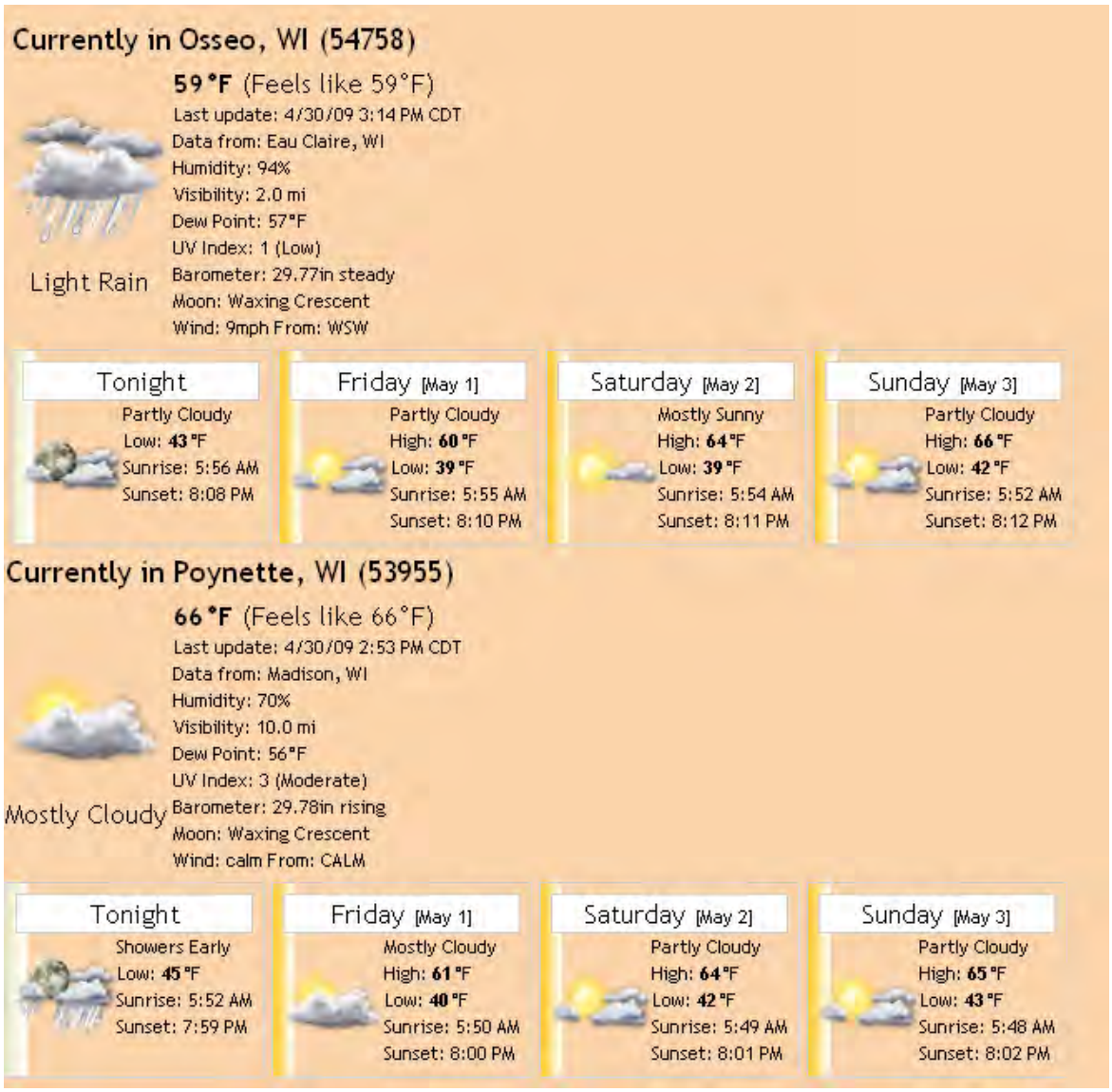


Figure 34: Four Day Weather Forecast for the Places along the Route from Minneapolis to Chicago

5) “Other information” menu contains information related to the weather, live camera images, truck parking information, survey information dissemination and live traffic conditions. A third party KML feed from Weather Bonk has been used for displaying the live weather and camera images thereby providing the road and weather information system(Figures 35 and 36).This feed also provides weather related warnings and current status of adverse weather conditions. Such information is very useful in planning freight movement (Ex: Mid-west floods 2008).

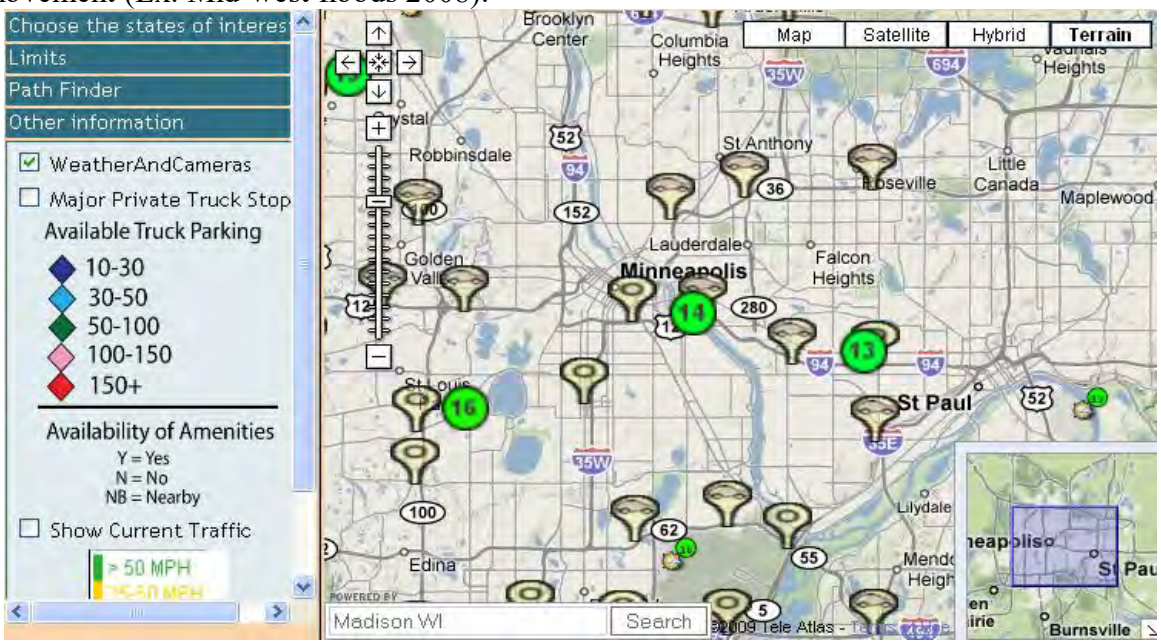


Figure 35: Highlighting the Live Traffic Images, Based on Map Extent and Zoom, Available and Temperatures near Twin Cities

Figure 36: Live Traffic Image on I-94 @ Snelling Ave near Twin Cities

6) As a one stop shop for freight, this application is tuned in such a way to show the available major private trucks stops within the ten state mid-west regions. Figure 37 depicts the same. Figure 38 shows more information of the each truck stop location, facilities available and panoramic view, if applicable

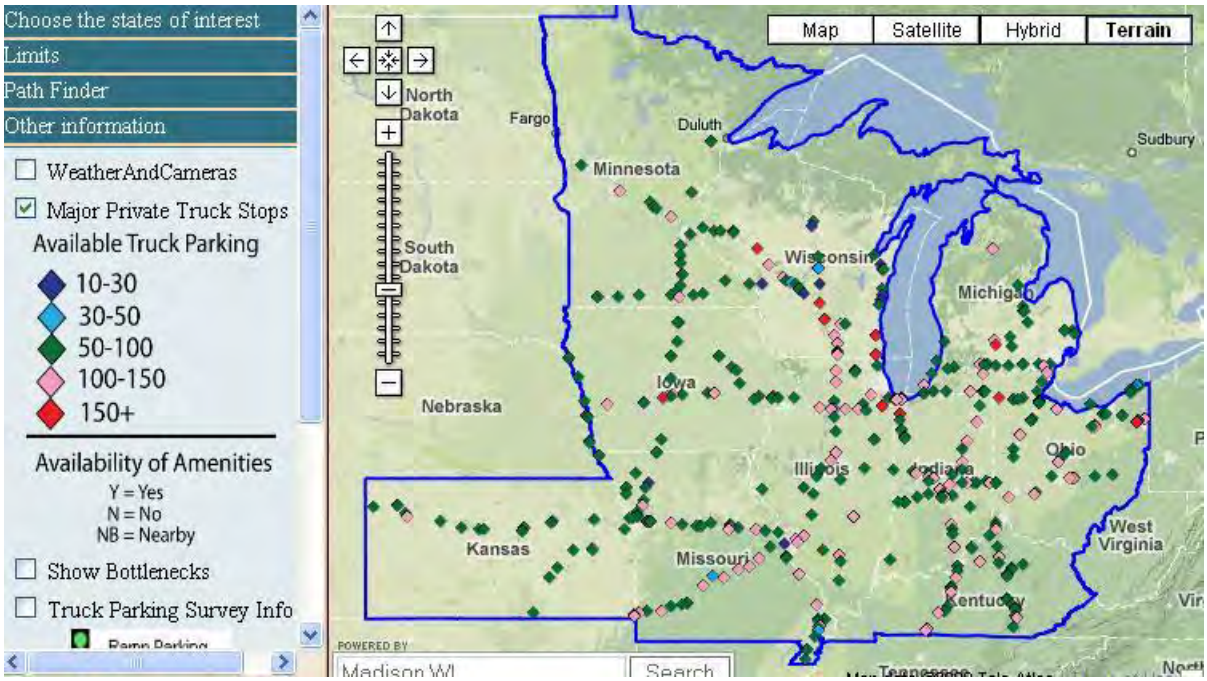


Figure 37: Major Private Truck Stops along Interstates in the MVFC Region

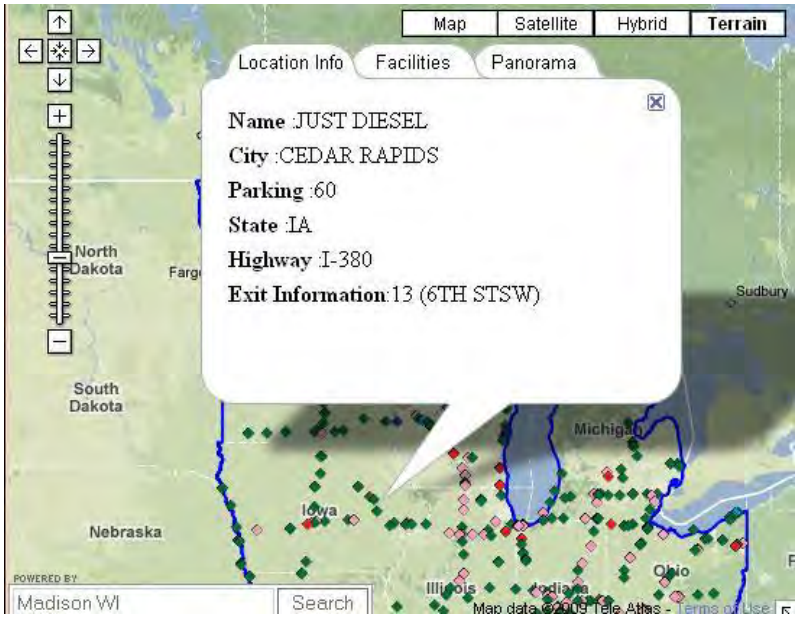


Figure 38: Truck Parking Location Information Details Shown on the Map

7) This particular prototype could be as well be used as a tool for spatial survey information dissemination. The survey information identifying various freight bottleneck locations along with their causes and solutions on the interstates identified by motor carriers and dispatchers from the MVFC‟s freight bottleneck project can be shown (Figure 39). This helps truck dispatching companies and other motor carriers in giving a rough idea of estimated delays/freight bottlenecks along their route. The additional tabs (Ex: Panorama) on the information window gives a quick panoramic image view of that location, which could be used as a measure to cross-check the information such as poor signal intersection or poor geometric design leading to the delays at that location, thereby fostering the access to the problematic locations by corresponding authorities.

Figure 39: Identified Freight Bottleneck Locations Showing Information of Location, Cause of Occurrence and Panoramic View, if Available

8) In continuation to the above discussed survey information dissemination process, this prototype could also serve as a mechanism for displaying and also partly as an analytical tool for the MVFC‟s truck parking project. Figure 40 shows the thematic visualization of truck parking locations based on their problem type (Ex: Always full, ramp parking or other reason) identified by various motor carriers, patrollers and planners from various organizations in the MVFC region. The legend for the same can be seen from the menu on the left side.

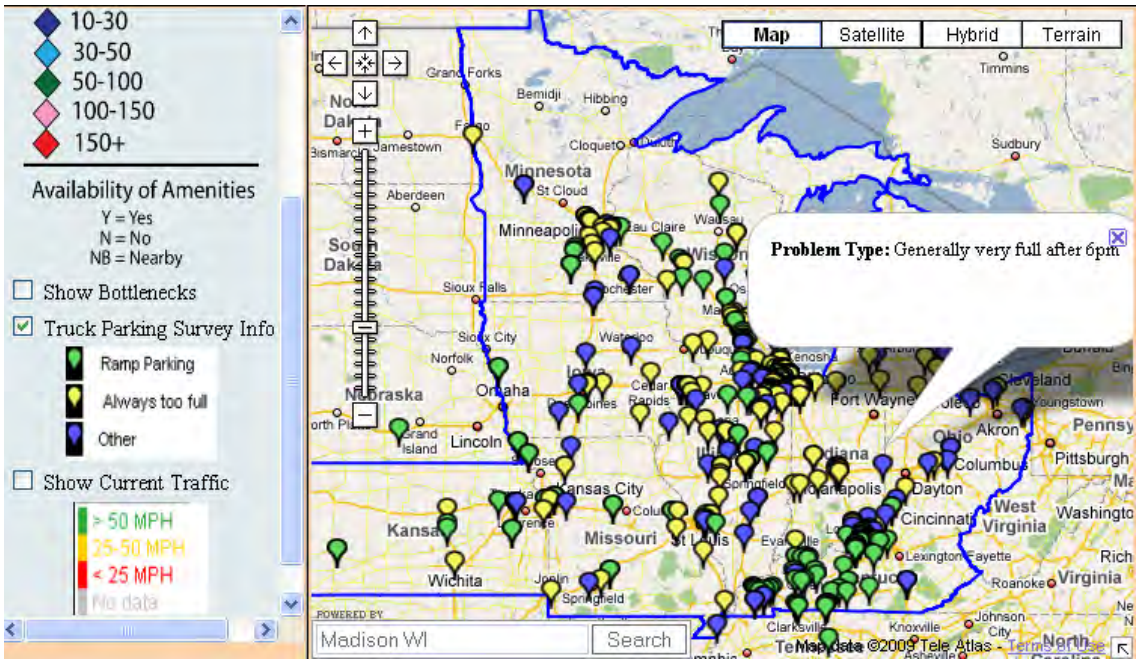


Figure 40: Thematic Mapping of Problematic Truck Parking Locations Based on Their Problem Type with a Snapshot of the Information on One of Those Locations

8) Google Maps API traffic feed is incorporated to show live traffic information with thematic speeds in and near major cities. A typical snapshot of live traffic conditions along with live road construction/lane drop information snapshot is shown in figure 41. The legend for the current state of traffic is provided in the left hand side menu below the show current traffic option.

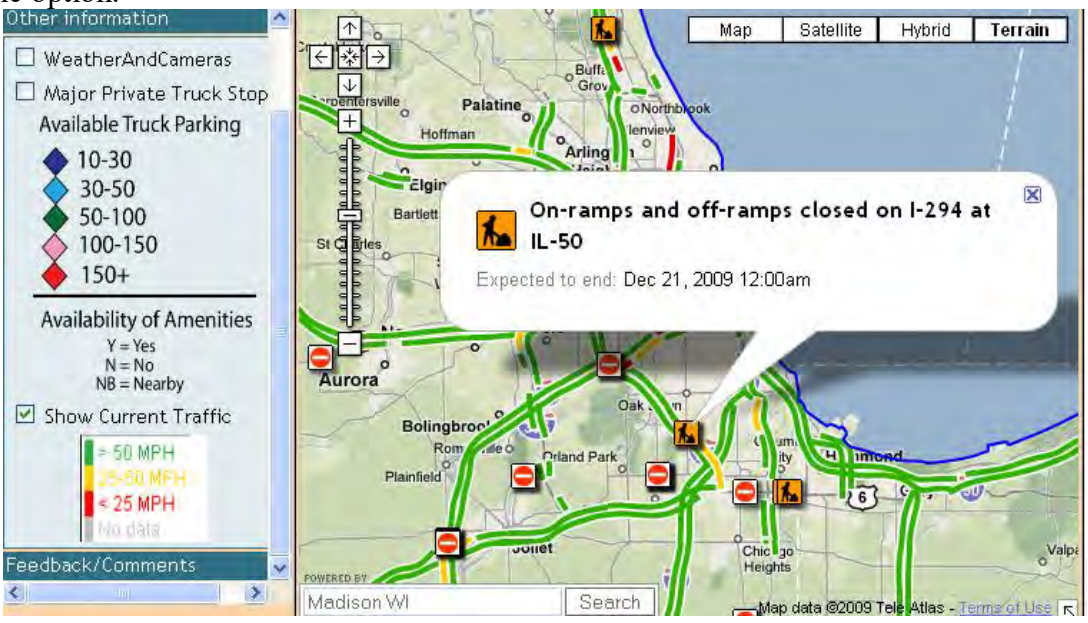


Figure 41: Live Traffic Conditions and Current Hindrances/Maintenance/Lane Drop Information on I-294 near Chicago

9) One of the directions in which this application can be used beyond the scope and of the current requirement is by providing a Travelling Salesman Problem. This helps various organizations for dispatching their goods with minimum amount of time for delivery. Also, this also helps organizations for mutual code sharing by providing a common platform for those trucks which return empty handed on their way back to the warehouses.

10) Maintenance aspect related to updates on the freight permit information is also being taken care of while developing this application. Currently information related to truck permits for the states are mostly maintained in a pdf file on their respective state DOT websites. The possibility of an update is expected in the future and motor carries needs to be informed about the same. So, in order to facilitate the ease to visualize such an update, an authorization can be provided to the state DOTs to logon to the system and interactively update the information on selected segment(s)/interstate(s). This can be visualized immediately in the application. This option could be really handy during any construction or emergency changes to permits or load restrictions. A typical snapshot of working demo of this functionality is presented (Figure 42).

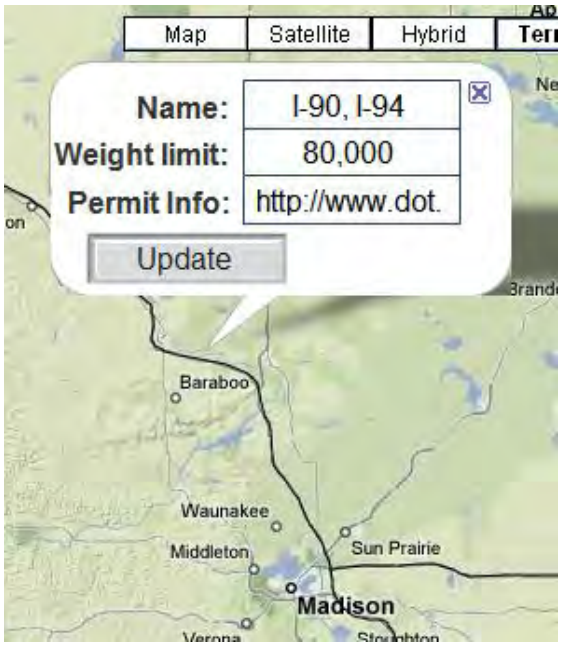


Figure 42: A Typical Snapshot of Interstate Attribute Display and Update

11) "Feedback/Comments" menu provides a provision for users to input their opinion on the prototype about the ease of interface, type and quality of information provided, usefulness of the application or any questions/concerns which paves way for a full fledged and more robust freight information clearinghouse. This can be seen in Figure 43.

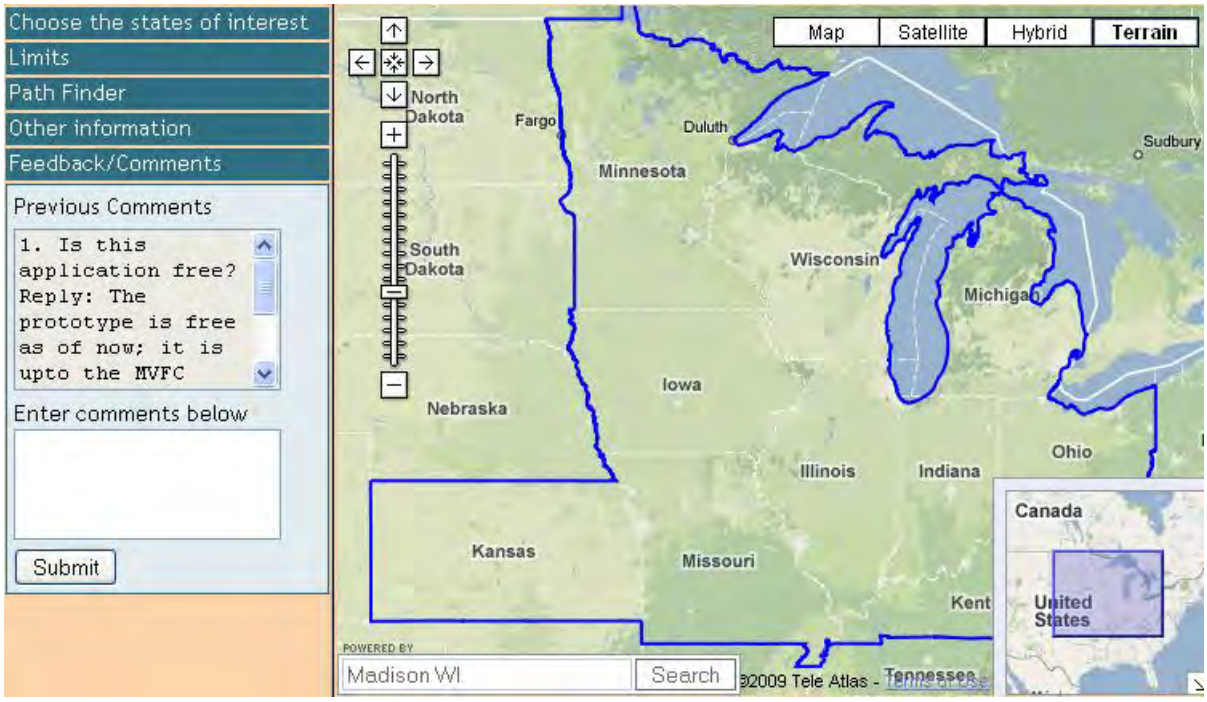


Figure 43: Snapshot of the Feedback/Comments Section Showing Previous Comments/Questions and Replies with a Provision for Users to Provide Their Comments

Chapter 7 – System Development and Operations

7.1 Stakeholders

The stakeholders of this project include Mississippi Valley Freight Coalition, shippers, ten state DOTs, and motor carriers. These stakeholders and their connections are illustrated on the Interconnect Diagram in Chapter 5 in the context of the ITS Architecture.

This project and the website prototype were presented to the MVFC Technical Committee and the Mississippi Valley Traffic Operations Coalition (MVTOC) in March 2009, and a draft report and a presentation of the prototype were available at the MVFC annual meeting in Kansas City in April 2009. This final report reflects all the feedback received by those reviewers.

It is important to bear in mind that this phase of development is conceptual and early in the ITS system engineering framework. It is expected that further development of a Clearinghouse would be led and coordinated by the MVFC with participation and financial commitment from each of the ten states. Private stakeholders, specifically the motor carriers and their associations, would be involved in the development, and there should also be exploration of whether any private interests would be contributing financially.

7.2 Clearinghouse Concepts

Within the systems engineering framework, this phase roughly covers the feasibility and concept exploration step of development. Following this phase of the project, if the MVFC chooses to fund further work toward a clearinghouse, the immediate next step is to complete a concept of operations with additional input from the ten states and additional stakeholders.

Several alternative concepts and levels of investment have been discussed throughout this study. The first option beyond the baseline do-nothing alternative is a so-called do-minimal alternative. Given the current fiscal constraints among state governments, this may be the most probably alternative, at least in the short run. This alternative, at a minimum, should include outreach by MVFC to the motor carrier industry to help showcase the myriad sources of real-time traveler information already available. While not in a one-stop clearinghouse, each source provides more complete information than an overarching clearinghouse could assimilate, so there will always remain value in understanding the individual sources of information. As examples, take the 511 systems of Kansas (511.ksdot.org), Iowa (www.511ia.org), Wisconsin (www.511wi.gov), and Ohio/Kentucky (www.artimis.org). These are four very different systems, deployed between 2001 and 2008, with different background sources and information types, different interfaces, and different web and phone content. While integrating them into a single website would be an enormous undertaking, alone they each provide efficient real-time travel information. Helping motor carriers,

operators, and dispatchers become aware of these and other individual resources can provide significant benefit with little or no cost. These and many other important links are already included on the MVFC Clearinghouse website prototype.

Further development alternatives these can be divided into four broad levels of effort and investment, and therefore functionality.

First is a relatively low cost option of completing the ten-state website with limited functionality and no operations and maintenance commitment. This site would provide some information such as congestion and truck parking locations, but most information would be static. The site would primarily serve as a single stepping-off point to restriction and permitting resources and more detailed travel condition information provided by and maintained by each state. This alternative would require a much smaller amount of additional planning and design. The additional development would primarily entail completing the backend design, discussed in Chapter 6, completing the integration and presentation of the static data, e.g., parking facilities, and identifying an appropriate host for the site, which could be on the same network that the prototype now resides. The estimated cost for this is $50,000-$100,000.

A second tier would add the integration of additional information such as road weather and seasonal load restrictions. The current prototype shows the interstate network, but this option would further the development of this into a time-varying display of different travel conditions. Where road weather is concerned, not every state collects and relays this information, and those that do are not providing it in any standard format, thus the integration would be more involved. As an illustration, researchers at UW-Madison collect winter road conditions from upper Midwest states‟ websites and display them together at www.WinterRoads.info. However, they way they achieve this is by manually establishing mapping segments and „scraping‟ the information from each website. This works, but it is not direct, reliable, or efficient. This second tier of development assumes no ongoing personnel commitment from the states and only minimal maintenance and website hosting resources beyond what is currently available where the prototype now resides. Development costs would be on the order of $150,000-$300,000.

The third tier would include development of automated and standards-based load and size restriction information for each state. This would require ongoing maintenance and support, primarily technical. With this option it could also be designed with secure access for state regulators to populate a conditions database with any construction or emergency changes to permits or load restrictions. The development cost for this level of work would be $300,000 and up, and the ongoing operations and maintenance cost would be greater, discussed below.

The top tier of the clearinghouse concept would entail all of the above, but also would pursue much of what the federal CVISN program seeks to implement, at the MVFC ten-state regional level. For example, it would be feasible to integrate the permitting system among the ten states to provide uniform access and consistency for motor carriers. There is a similar initiative along this line at the North/West Passage coalition, which at a minimum would be a reference and possibly a partner in coordinated development. The cost for this type of development would be $500,000 and up, possibly significantly more.

Each of the above tiers would require the finalization of system requirements. In this step of system development, the concept is already fleshed out and the functional requirements of the system are determined, documented, and signed off on by all stakeholders. Following this is the system design, then system integration and implementation, followed by testing and validation.

7.3 Operations and Maintenance

Operations & maintenance involves planning for, and executing, activities, such as operation the system, monitoring system performance, making repairs, hiring and training operators, testing the system after any changes are made, and tuning the system. All systems require regular maintenance. Preventive maintenance involves inspection and proactive action, such as cleaning, replacing components that have become obsolete and unsupported. Reactive maintenance involves correcting faults when they occur. Software maintenance involves correcting malfunctions/bugs when they are discovered, upgrading components that become obsolete and unsupported, and making minor modifications as needed to improve functionality.

The estimated ongoing operations and maintenance costs for the development options outlined above range from $50,000 to $150,000 or more per year, depending on the level of implementation pursued and the extent of personnel involvement with the information system.

7.4 Other Possible Directions

This phase of the clearinghouse exploration is focused first on the concept, then on the viability and feasibility. While a strong prototype was developed during this project, and the clearinghouse concept is technologically very feasible, there is considerable resource commitment required to move forward with this framework. The begged question is whether further taxpayer investment in this concept provides benefit to the customers greater than other options. This is reinforced by the sentiment revealed in the literature review and the motor carrier survey that if DOTs have resources to improved freight movement, spend it not on another traveler information website but on improving and streamlining the regulatory environment and the permitting process. As the clearinghouse is not a single-state concept exploration, but a 10-state coalition, the opportunity for improving multi-state operations is even greater.

There are two recommended alternative paths for further development. The first is to heed the feedback from the customers – the motor carrier industry – and devote what limited resources are available to improving the regulatory and permitting conditions. This includes better coherency of restrictions for size, weight, axle, configuration, etc. across state borders; streamlined permitting processes for oversize or overweight loads, including web-based and multi-state coordination; improved provision of restrictions as conditions change due to

seasons, hazardous road weather, construction activity, or emergency events – which may also fit into a clearinghouse concept; and improved multi-state routing and less circuitous alternate routing where possible.

The second key alternative direction is for DOTs to focus their efforts on collecting and providing quality traveler information rather than investing in a dissemination method such as a 10-state clearinghouse. Furthermore, while 10 states is an improvement over individual states, the border issues around the region remain and will continue to affect motor carriers. Information technologies evolve rapidly, and private third-party providers are more able to adapt than are governments. On the other hand, traveler information itself does not change. There are bad winter road conditions, incidents, closures, and other emergency events. The extent to which information on this is collected and furnished is more critical than how end users get it. The role of a DOT should be to collect this information, whether with their own in-house technologies or contracted, and then provide this information in real-time in a platform-neutral and standards-based method. For example, as TMDD and IEEE compliant XML feeds. By doing this, any third-party provider can get this information and provide it to consumers through whatever technologies they prefer. A major motor carrier is essentially its own third-party and may consume the automated feeds into their own information systems, thereby enabling dispatchers to respond rapidly and accurately to changing conditions.

If a clearinghouse website was pursued, an essential and early step would be to bring all ten states up to speed in terms of furnishing their automated traveler information to the clearinghouse. Accomplishing this would take us down the path of developing automated and standards-based transmissions protocols anyway, which would not only make the clearinghouse concept more viable but would also benefit all motor carrier customers via other third-party information dissemination. Thus the recommendation here regardless of ultimate end user technology is to encourage all states to work towards better real-time conditions collection and towards providing this real time information in a platform neutral and standards-based avenue. This information need not be limited to general traveler information, it could and should include routing and restriction information of interest to freight movement.

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Appendix – Stakeholder Survey

Survey Form for DOT Personnel, Freight Planners, Regulators, etc.

Surveyor‟s Name: _____ Phone Call Date: _____

Sample introduction: Hello, my name is [first name, last name]. I‟m with the University of Wisconsin in Madison, and I‟m calling on behalf of a research project with the Mississippi Valley Freight Coalition. We‟re exploring how to provide better information about real-time travel conditions to the motor carrier industry, and I‟m wondering if you have a few minutes to give your opinion on some types of travel information and methods of delivery? All responses are kept confidential and names will not be released.

[Allow time and an opportunity for questions or conversation. Freely add notes in margins.]

Name (write in from contact list): _____

Organization or representing (write-in): _____

Position or title (confirm): _____

Does your organization provide the following type of information?
[If yes, then:] **How is that information provided?** *[example types: web page, XML, telephone or 511]*

- Atmospheric weather information Y N _____
- Weather-related road-condition information Y N _____
- Congestion information or speeds Y N _____
- Incidents or crash information Y N _____
- Construction, lane closures, or detours Y N _____
- Other: _____

  _____

How valuable to motor carriers do YOU think each of the following is?
[No Opinion / Don't Know / Neutral, Very Valuable, Somewhat Valuable, Not Valuable]

- Atmospheric weather information NO/DK/N VV SV NV
- Weather-related road-condition information NO/DK/N VV SV NV
- Congestion information NO/DK/N VV SV NV
- Incidents or crash information NO/DK/N VV SV NV
- Construction, lane closures, or detours NO/DK/N VV SV NV
- Any others if noted in previous question NO/DK/N VV SV NV

How effective (reliable, timely, useful) do YOU think each of the following delivery methods are for motor carriers? *[No Opinion / Don't Know / Neutral, Very Effective, Somewhat Effective, Not Effective]*

• CB radio reports from other drivers	NO/DK/N	VE	SE	NE
• Reports received by dispatchers from drivers on the road	NO/DK/N	VE	SE	NE
• Face-to-face reports among drivers at truck stops and terminals	NO/DK/N	VE	SE	NE
• Freeway changeable message signs	NO/DK/N	VE	SE	NE
• Highway advisory radio	NO/DK/N	VE	SE	NE
• Phone calls to DOT or other information services (e.g. 511)	NO/DK/N	VE	SE	NE
• Real-time traffic maps on the internet	NO/DK/N	VE	SE	NE
• Traffic reports on commercial radio	NO/DK/N	VE	SE	NE
• Television traffic reports	NO/DK/N	VE	SE	NE

Are there any other sources of information you think are relevant to real-time travel conditions that haven"t been mentioned? *[Offer such as / examples if possible]*

_____

_____

_____

[If appropriate] Do you have any other suggestions, comments, or anything you"d like to add?

_____

_____

_____

_____

_____

[Thank them, sincerely, for their time and input.
Refer them to Peter Rafferty if they request more info: prafferty@wisc.edu or 608-890-1218.]

Survey Form for Motor Carriers, Dispatchers, Drivers, etc.

Surveyor‟s Name: _____ Phone Call Date: _____ Entered Into Web Survey: _____

Sample introduction: Hello, my name is [first name, last name]. I‟m with the University of Wisconsin in Madison, and I‟m calling on behalf of a research project with the Mississippi Valley Freight Coalition. We‟re exploring how to provide better information about real-time travel conditions to the motor carrier industry, and I‟m wondering if you have a few minutes to give your opinion on some types of travel information and methods of delivery? All responses are kept confidential and names will not be released.

[Allow time and an opportunity for questions or conversation. All responses are optional. Freely add notes in margins. Enter response into websurvey via link at freight.engr.wisc.edu]

Name (write in from contact list): _____

1. Organization or representing (write-in): _____
2. Position or title (confirm): _____
3. Approximately how many trucks are in your company's fleet?
   <5 6-10 11-20 21-50 >50

4. From which of the following sources does your company (dispatchers and/or drivers) obtain current, up-to-date traffic/weather information?

• CB radio reports from other drivers	Y	N
• Freeway changeable message signs	Y	N
• Highway advisory radio	Y	N
• Face-to-face reports among drivers at truck stops and terminals	Y	N
• Traffic reports on commercial radio	Y	N
• Reports received by dispatchers from drivers on the road	Y	N
• Phone calls to DOT or other information services (e.g. 511)	Y	N
• Real-time traffic maps on the internet	Y	N
• Television traffic reports	Y	N

5. Are there any other sources of information you use to obtain current, up-to-date traffic/weather information? *[list them here:]*

_____

_____

_____

6. Please evaluate each of the following sources of traffic information for their value in planning or optimizing travel/delivery routes: *(No Opinion, High Value, Some Value, Neutral, Little Value, or No Value)*

- CB radio reports from other drivers NO HV SV N LV NV
- Freeway changeable message signs NO HV SV N LV NV
- Highway advisory radio NO HV SV N LV NV
- Face-to-face reports among drivers at truck stops and terminals NO HV SV N LV NV
- Traffic reports on commercial radio NO HV SV N LV NV
- Reports received by dispatchers from drivers on the road NO HV SV N LV NV
- Phone calls to DOT or other information services (e.g. 511) NO HV SV N LV NV
- Real-time traffic maps on the internet NO HV SV N LV NV
- Television traffic reports NO HV SV N LV NV

7. Please evaluate the following types of real-time information on their overall value for optimizing or modifying routes: *(No Opinion, High Value, Some Value, Neutral, Little Value, No Value)*

- Atmospheric weather information NO HV SV N LV NV
- Weather-related road-condition information NO HV SV N LV NV
- Congestion information NO HV SV N LV NV
- Incidents, crashes, & other delays NO HV SV N LV NV
- Construction, lane closures, & detours NO HV SV N LV NV

8. What method(s) of delivery would you find most useful for the following types of information: Highway Advisory Radio; In-Vehicle Device; CB Radio; Freeway Changeable Message Signs; Traffic Reports (TV or Radio); Telephone (511 or DOT); Other.

[Please have the respondent select one or more delivery methods for each type of information. If they select "other" for any item, please list the item and the delivery method in the comments area in the next question.]

- Atmospheric weather HAR IVD CB FCMS TR T O
- Weather-related road-conditions HAR IVD CB FCMS TR T O
- Congestion HAR IVD CB FCMS TR T O
- Incidents, crashes, & other delays HAR IVD CB FCMS TR T O
- Construction, lane closures, & detours HAR IVD CB FCMS TR T O

9. If you selected "Other" for any types of information in the preceding question, please explain here:

_____

_____

_____

10. Would your company prefer drivers obtain real-time information: *[circle one]*

Through in-vehicle devices From dispatchers Other, please specify:

_____

_____

11. Does your company currently share (or sell) real-time information with media outlets or other companies? *[Real-time information could include: atmospheric weather conditions; weather-related road-conditions; congestion, incidents, crashes, & other delays; construction, lane closures, & detours.]*

Yes No

12. Would your company/drivers be willing to provide observed information to an information clearinghouse once one is established? [Types of observed information requested could include: atmospheric weather conditions; weather-related road-conditions; congestion, incidents, crashes, & other delays; construction, lane closures, & detours.]

Yes No

13. Do you have any other comments regarding the Mississippi Valley Freight Association's proposed information clearinghouse (or this survey)? *[The planned purpose of the information clearinghouse is to gather and disseminate real-time information of the types discussed earlier (and others) in Question 7, through the methods listed (and others) in Question 6.]*

_____

_____

_____

14. *[Thank the respondent for participating in this survey. Ask if they would be interested in the results of this survey. If so, obtain a contact name and email address, or have them contact Peter Rafferty by email at: prafferty@wisc.edu or by telephone at: 608-890-1218.]*

_____

_____