Gateway Traveler Information System: Regional Traveler Information Services

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Abstract

The Gateway Traveler Information System (Gateway) and www.travelmidwest.com web site (formerly www.gcmtravel.com) provide timely, accurate, and useful traffic information to a variety of public and private constituents. Recurring and non-recurring congestion directly impacts the economy, the environment, and the safety of the transportation network. The services and data provided by the Gateway have become a mission-critical service of the Illinois Department of Transportation (IDOT) and the geographically-connected roadway operators that are members of the Lake Michigan Interstate Gateway Alliance (LMIGA).

This paper details the background and history of LMIGA and the Gateway, specifically www.travelmidwest.com. It highlights the goals of the Gateway and identifies four challenges and the associated resolutions that IDOT and the LMIGA partners use to ensure the Gateway is able to maximize the dissemination of quality traveler information to the staffs of operating agencies, the traveling public, and third party data subscribers. This paper also describes the elements that will impact both the system and the regional partnership as technologies advance, traveler information demands increase, and policies evolve.

Traveler Information Benefits and Congestion Costs

Benefits of Traveler Information

Traveler information studies from across the country are available via the U.S. Department of Transportation Research and Innovative Technology Administration (RITA), through the Intelligent Transportation System (ITS) Benefits Database. The Federal Highway Administration (FHWA) study "Managing Demand Through Traveler Information Services" revealed that the state of Washington experienced benefits including reduced trip times, more predictable travel, less stressful conditions, and safer travel conditions as a result of their traveler information efforts.

Cost of Congestion

The Texas Transportation Institute's (TTI) "Urban Mobility Report" (Shrank and Lomax 2009) placed the Chicago region second in rush hour travel among major metropolitan regions and third worst in the nation for wasted time, fuel, and total congestion costs ($4.2 billion annually).

The Metropolitan Planning Council's Report "Moving at the Speed of Congestion" (MPC 2009) painted an even more severe picture of regional congestion.

- The $7.3 billion total regional cost includes the cost of lost time ($6.98 billion), fuel ($354 million), and environmental damages ($33 million).
- Gridlock also increases labor costs, impeding the creation of 87,000 jobs.
- Lost time costs the Chicago-area economy and its drivers nearly 20 times more than the cost of wasted fuel.

Regionally, congestion adds 22 percent to peak period travel times. Within Chicago itself, congestion increases peak period travel times by about 40 percent.

The region has neither the space nor the financial resources required to build its way out of congestion. Traffic operations and traveler information play a vital role in helping support roadway users in the region by providing the best information possible to support time, route, and mode of travel choices.

Regional Background

The Gateway system has a long history of serving as a central traveler information repository for the three-state Gary-Chicago-Milwaukee (GCM) ITS Priority Corridor established in 1993. Since 1998, the Gateway has provided traveler information to a growing geography. The mission originally centered on the Chicago area expressway system with www.travelinfo.org, which disseminated travel time and congestion information collected from the IDOT Traffic Systems Center (TSC). In 2001, as additional regional traffic data collection systems came on-line in Wisconsin and Indiana, and at the Illinois Tollway, www.gcmtravel.com became the new web site.

(Billerbeck 2009)The LMIGA is a multi-state, multi-disciplinary organization that includes the following members: Illinois Department of Transportation (IDOT), Illinois State Toll Highway Authority (ISTHA), Wisconsin Department of Transportation (WisDOT), Indiana Department of Transportation (InDOT), Michigan Department of Transportation (MDOT), Chicago Skyway, and Indiana Toll Road. Recently, LMIGA supported a web site rebranding effort which includes an updated look and feel and an opportunity to begin initiating new services.

The Gateway and www.travelmidwest.com web site provide tools that promote the value of ITS technologies and services, and represent the face of traveler information in the region. Figure 1 depicts the history of the Gateway and web site interface.
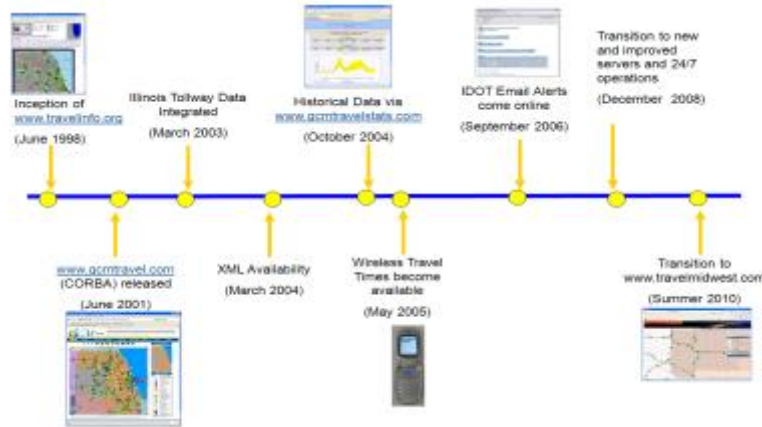
Figure 1: Gateway Development Timeline and Milestones

Summary of Services

The Gateway provides an integrated electronic clearinghouse of regional real-time traffic data for consumption by public and private users. Information on a variety of roadway classes from interstate highways to locally-maintained roads in the LMIGA region is collected, concatenated, and then provided to the user community through a broad collection of reports, web pages, and standardized data feeds. The raw data from roadside detection equipment is used to compute travel times and congestion information, and provide visual interpretations via map displays. Additional information obtained from roadway signage and video cameras provides context for absolute travel times and computed congestion.

Numerous reports provide detailed information in tabular form for construction, incidents, congestion, travel times, special events, dynamic message signs, and vehicle detectors. While much data is automated; incident, special event, and construction data is manually entered from emails, faxes, radio frequency monitoring, and telephone notifications.

The Gateway provides data to approximately eighty external entities including research institutions, private sector traveler information service providers, and the media. The monthly web site demand includes 375,000 site visits and over 4,500,000 total page views.

The Gateway was selected as the Intelligent Transportation Society of the Midwest 2009 Project of the Year. It also garnered two national projects of the year and traveler information web site awards from FHWA and ITS America in the mid-2000s.

Mission

The LMIGA mission is to ensure that traffic moves safely and efficiently. This is realized through interagency communication and coordination, improvement projects, training efforts, and region-wide planning.

IDOT and the LMIGA partners are committed to providing timely, useful, and accurate traffic information from a variety of agency sources via the latest technologies. This mission is accomplished with a focus on reliability and usability for the end users.

Challenges

Four challenging areas influence operations and policy/investment decisions for IDOT and the LMIGA membership.

1) The Gateway's long-running use of standards in message and data formatting has had a national influence on Center-to-Center (C2C) systems. While the Gateway architecture and interfaces have remained stable for nearly ten years, there are both programmatic and human factors that remain a critical part of the Gateway's success.

2) The Gateway collects data from six unique systems and an array of technologies. Conveying a consistent definition of timely, accurate, and useful information requires commitment and routine evaluation of data within the Gateway and the source system processing.

3) The Gateway needs to maximize the utility of the system for everyday commuters, discretionary travelers, the trucking community and other commercial users, third party data subscribers, and regional transportation management system operators.

4) As situations change, the Gateway must balance being at the forefront of technology with the reality that not all contributing systems will necessarily be on the same timeline.

Challenge #1: Technology Standards

The Gateway has long been a leader in the formation and application of national Intelligent Transportation System (ITS) standards programs which promote commonality of traffic data exchanges and provide all stakeholders ease and efficiency in utilizing the data. IDOT and the Gateway staff served on FHWA and American Association of State Highway and Transportation Officials (AASHTO) standards committees as early as the mid-1990s and played a major role as an early implementer of C2C standards using Common Object Request Broker Architecture (CORBA) and in the migration to Extensible Markup Language (XML) based data exchange.

The Gateway is designed to be the central hub to facilitate corridor-wide system integration and inter-operation of various ITS systems. Additionally, the Gateway is also the primary information dissemination channel to the general public and to private sector traveler Information Service Providers (ISP).

When the Gateway system architecture was defined in the late 1990s, two C2C communications approaches were being addressed by the National Transportation Communications for ITS Protocol (NTCIP) C2C Work Group: DATEX (Data Exchange) and CORBA. These standards attempted to harmonize use of the Traffic Management Data Dictionary (TMDD) and Message Sets for External Traffic Management Center Communication (MS/ETMC2). It is noteworthy that the bulk of the original Gateway development occurred while these standards were under development.

(Lee 2005) In the early 1990's, the region chose to adopt CORBA as the primary

system interface platform for the Gateway primarily because it is an open and object oriented system integration platform that is independent of hardware platform, operating system (OS), and programming language. The adoption of CORBA provided a reliable and open platform for corridor-wide system integration and inter-operation.

Even though XML was not on the radar screen of the NTCIP C2C work group at that time, the great potential of XML technology and planning blossomed to support a transition to XML-based system interfaces and data services.

XML was originally used in the Gateway to manage internal system configuration data. Later, a mechanism was developed to map the Gateway's CORBA data structures to XML. Data logged in XML formats allowed system developers to efficiently perform various system debugging and monitoring activities.

Though the Gateway's CORBA-based interface was successful, it became clear that the cost and effort associated with developing and maintaining a CORBA application presented an obstacle to a number of existing and potential Gateway user systems, from both a private sector ISP perspective, and the perspective of existing and future agencies wishing to exchange data. Some of the ISP's elected to 'scrape' the web pages for data, employing a user program to read and extract information from html-encoded data. One of the major issues inherent in web scraping is that the web scraping process will fail if changes, such as a table layout change, are made to the web pages.

To encourage broader usage of information provided by the Gateway, XML was added as a distribution method. XML drastically reduced the overhead of providing data to ISPs on several levels. The XML subscribers are presently comprised of a variety of ISPs. No sensitive information is part of the data sets making the internet a suitable method of transport to the ISPs, so no additional routers nor networking equipment are required. Similarly, the use of XML meant that third party subscribers had easier access to interface expertise. Thus, IDOT no longer had to provide additional software support.

Notably, the Gateway has also seen a migration of all C2C exchanges to XML. For example, the Illinois Tollway TIMS has migrated to XML exchanges as they have made internal system upgrades and found the migration is more cost effective to implement due to licensing arrangements for CORBA. Additionally, the XML interface is easier to maintain. Simply stated, as a production system serving real-time users, LMIGA agencies, and researchers alike, the technologies used by the Gateway, specifically XML, have been selected to support and attract traffic management and traveler information data sharing and maximize the Gateway's overall utility. The Gateway fuses the data from individual agencies and their collection technologies (inductive loops, radar, transponders, Bluetooth) into a best-fit common view of traffic data for the entire region.

Challenge #2: Consistency in Quality and Timeliness

The Gateway uses standard interfaces and a few custom interfaces, where needed, to bring the region's data to a single access point and a common format that is

appropriate for all users. Since going to a 24/7 operation, IDOT has been able to support a more aggressive approach to evaluate data accuracy and consistency. A few specific examples stand out.

Dynamic Message Sign (DMS) Performance Monitoring: The Gateway staff monitoring of DMS reports has resulted in the following changes:

- The Gateway has updated its approaches to status monitoring, time stamping of source information, and handling of multi-phase messaging.
- The source systems have been able to use the Gateway review to support identification of operational issues and DMS maintenance activities.
- Regional message consistency has gained a renewed focus through this effort and the efforts of the LMIGA's Traffic Center Communications Work Group.
- DMS sign information is validated against congestion data and travel time information to ensure that all contributing systems are in synch.

Travel Time and Congestion Monitoring: Travel times and congestion information are served to the public and private data consumers through a variety of reporting mechanisms including several technology modes (web map, html report varieties, Really Simple Syndication (RSS), and feeds).

The partner agencies deploy multiple technology solutions to measure congestion and travel times. Travel times distributed through any Advanced Traveler Information System (ATIS) provide either a series of estimates from a wide variety of technologies with specific behaviors or direct collection of travel times that immediately are past tense once collected. As the Gateway has monitored the data and feedback from the public, the partner agencies have made additional commitments to ensure accuracy.

Incident Data Collection: Traffic incidents and their severity have at least as much impact on the transportation system users as recurring congestion. A combination of distribution mechanisms, including emails and forwarded electronics reports, monitoring of responder radios via scanner, monitoring of broadcast radio, and electronic interfaces (such as Lake County and the Illinois Tollway connections to dispatching), support Gateway incident data collection. The Gateway operations staff monitors congestion patterns to identify potential incidents before they become major traffic events. This also ensures the location and impact of incidents are accurately conveyed to the public.

Challenge #3: Maximizing Data Utility and Usability

The Gateway has had a long history of providing the following datasets to both web site users and data subscribers:

- Incidents
- Construction
- Special Events
- Vehicle Detectors
- Congestion Links
- Travel Times
- Dynamic Message Signs

- Closed Circuit Television (CCTV) Images
- Links to other traveler information services

The web site data is available through RSS feeds, XML data subscriptions, mobile device-friendly web pages, customized travel times, and standard data reports. Additional links are also available throughout the web site to more generic DOT pages, major construction project links, and transportation-related services. The current www.travelmidweststats.com web site provides historical travel times and is directly integrated with the Gateway. This information serves as a tool to support trip planning and to compare specific current travel time conditions with historical data. The data provides a relative comparison of congestion - Is this route experiencing worse than normal congestion levels and, if so, how much worse?

The effort to establish www.travelmidwest.com was undertaken with an understanding that www.gcmtravel.com was already a very successful endeavor. The GCM acronym was consistent with the GCM Corridor through 2001. The LMIGA partnership reflects the geographic addition of Michigan along with expansion of Illinois coverage to the Quad Cities (Iowa-Illinois) area. The www.travelmidwest.com web site provides coverage for the entire LMIGA region. The web site contains an easier to identify brand with a more recognizable URL, improved presentation methods, usability options, web site navigation, expanded graphics use, and a new Truckers Report.

The Truckers Report has been introduced in order to better meet the needs of the freight community. IDOT participated in the Midwest Truck Show in both 2009 and 2010 with an explicit goal of generating more awareness for the web site and soliciting feedback to improve its utility to freight users, a major stakeholder and consumer of the data. The rebranding effort uncovered the fact that the commercial vehicle operators were underserved by the available traffic information providers even though they were a significant source of traffic. The trucking community expressed an interest in streamlining the available information to filter the data down to reflect the most critical conditions in the region – highest travel times, highest impact construction, and highest impact incidents.

While the Gateway itself is a production system serving transportation system users (the public) and transportation system operators as the primary audiences, the availability of a wide variety of data has supported numerous and varied transportation research efforts and ITS standards development since its inception in 1998. Both CORBA and XML feeds have been provided to numerous public research institutions and private researchers since 2001.

Third parties interested in becoming a data subscriber must submit an application to IDOT and LMIGA partners defining their proposed use of the data and desired data elements. Once approved, the users are assigned permissions and are provided the Gateway External Interface User Guide (Parsons 2005) that documents detailed available traffic data elements and the fundamentals of how the users should configure their data subscription.

Feedback from web site users, third party data subscribers, and LMIGA traffic operation center officials is encouraged through webmaster@travelmidwest.com, and

drives the evaluation and deployment of system changes. User feedback was the driving force in the rebranding effort. Realistically, IDOT and the LMIGA partnership recognize that feedback is more likely when users perceive problems in presentation or quality of information provided. Fortunately, over the eight year history of www.gcmtravel.com, the majority of feedback has centered on requests for more services or enhanced presentation of traffic information.

Challenge #4: Keeping the Gateway System at the Leading Edge

IDOT and the LMIGA partners have monitored regional changes in operations and national/international technology developments as they apply to traveler information. This includes monitoring the requirements contained in the FHWA proposed rule to establish a Real-Time System Management Information Program (FHWA 2009).

The rule being considered recommends the following traveler information service requirements:

Category of Information	Timeliness for Delivery		Availability (%)	Accuracy (%)
	Metropolitan Areas (min)	Non-metro Areas (min)		
Construction Activiites: Implementing or Removing Lane Closures	10	20	90	85
Roadway or Lane Blocking Traffic Incident Information	10	20	90	85
Roadway Weather Observation Udpates	20	20	90	85
Travel Times Along Highway Segments	10	NA	90	85

Figure 3: FHWA's proposed rule for Real Time System Management Information Program Minimum Requirements

Fortunately for the LMIGA region, the Gateway and the supporting systems already in place provide a significant head start in fulfilling this rule, particularly in the metropolitan areas connected through the Gateway. This rulemaking will impact the design and implementation of all future roadway improvement projects. IDOT has already implemented changes in construction projects on the Dan Ryan and Eisenhower Expressways where temporary detection technologies replaced out-of-service permanent sensors to measure speed and congestion.

Another major impact of the rule is the focus on non-metropolitan areas and arterials across the region. Presently, there is limited availability of mature systems to provide some of the proposed data.

Arterial Data

The Gateway has expanded its commitment to providing users construction data for arterials. Collection of real-time congestion data on the arterial network has been historically difficult.

The Lake County, Illinois Passage System is providing arterial congestion data to the Gateway as of this paper's conference date. Overlaying many data types and sources for expanded services on arterial streets provides a very complete picture of the surface transportation network. Keeping the site usable, while accommodating a growing geographic area and inventory of data types, will be an on-going challenge.

The aggregation of transit data from sources such as the Regional Transportation Authority (RTA) and its service boards (Pace, Metra, and the Chicago Transit Authority) will also add to the challenge.

Expanding the collection of arterial data on the Gateway will follow the development timelines of arterial systems. Traffic condition data will be collected in a manner similar to that used by Lake County and the City of Chicago Midway Airport Advanced Traffic Management System (ATMS).

Trending Technologies

While IDOT and substantial portions of the LMIGA region are relying on the traditional ITS technology choices to collect traffic data, IDOT has remained an engaged observer of new technologies such as probe data projects and Vehicle Infrastructure Initiatives (VII). IDOT expects to implement economically feasible technologies that have matured from the "bleeding edge" to the "leading edge". During the 2010 highway construction season, IDOT deployed Bluetooth technologies to support real-time travel time collection during resurfacing of Interstate 290, where pavement milling eliminated the existing detection infrastructure.

It can be anticipated that probe data and some of the national initiatives being considered to collect a national data set of speed and congestion conditions will help fill the data gaps in arterial and non-metropolitan regions.

The age of social media, such as Twitter, provides one example of change in accepted end-user technology that impacts the expectations for systems such as the Gateway. Fundamentally, the Gateway is committed to ensuring that the users who need the information have the best possible access. Providing information in formats that the users find most comfortable is as important as providing correct and timely information.

The impact of incidents on travel times and congestion is recognized by traffic operations staff and motorists. The Gateway and its partners are committed to promoting electronic integration among dispatch services, traffic management centers, and traveler information hubs. The safety of responders and motorists approaching an incident scene is not limited to the physical location of vehicles, debris, and responders associated with the incident. Informed motorists can choose alternative routes or modes of travel and help reduce congestion near an incident scene. Just as important, those motorists remaining on their selected route will arrive at an incident scene aware and prepared to encounter congestion and response teams, thus resulting in a safer environment.

Similarly, the standards-based implementation for basic traffic data and traveler information can be expected to undergo a detailed review by IDOT and LMIGA partners as data sources mature and evolve over the coming three to five years.

Summary

The Gateway compiles and provides a wealth of real-time traffic data and traveler information to the regional traffic management systems, planners, researchers, third party information service providers, and the public. The system's success has hinged

on its ability to provide timely, accurate, and useful information to all consumers. The Gateway agency partners, through LMIGA and the Gateway's development and enhancement team managed by IDOT, are committed to the use and maintenance of advanced technologies for data processing and distribution. These technologies are implemented to meet the needs of the data consumers, encourage system feedback, and focus a keen eye on the future of traffic information collection and dissemination.

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