Vision and Operational Concept for Enabling Advanced Traveler Information Services

Operational Concept

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16. Abstract

EnableATIS is looking ahead to a future operational environment that will support and enable an advanced, transformational traveler information services framework. This future framework is envisioned to be enabled with a much more robust pool of real-time data through connected vehicles, public and private systems, and user-generated content. This Operational Concept does not seek to define specific future applications, but rather is formalizing a framework whereby multiple activities are envisioned to interact to support a diverse traveler information environment. Two operational scenarios are presented. One is a laissez-faire approach to an incremental build out and enhancement of traveler information services over time and with limited influence on the market from USDOT. The second represents a desired end-state of a robust, multimodal, multi-source traveler information environment that leverages new data sources and generates transformative uses of that information to benefit travelers as well as system operations and management by agencies.

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Executive Summary

Introduction

Enabling Advanced Traveler Information Systems (EnableATIS) is the traveler information component of the United State Department of Transportation (USDOT) Dynamic Mobility Applications (DMA) Program. EnableATIS was identified as a high priority application area by stakeholders, and is part of a bundle of regional information applications. It seeks to provide a framework for multi-source, multimodal data to enable the development of new advanced traveler information applications and strategies. It is unique among the various DMA program tracks in that it is dependent on a diverse industry and stakeholder group, and there will be market influences and dependencies that will drive the ultimate success of EnableATIS.

EnableATIS is looking ahead to a future operational environment that will support and enable an advanced, transformational traveler information services framework. This future framework is envisioned to be enabled with a much more robust pool of real-time data through connected vehicles, public and private systems, and user-generated content. This Operational Concept does not seek to define specific future applications, but rather is formalizing a framework whereby multiple activities are envisioned to interact to support a diverse traveler information environment.

An important part of this Operational Concept is to identify strategic directions and investment decisions, particularly on the part of USDOT and its role within EnableATIS. There are several opportunities for USDOT, with its national program leadership with the DMA and with its national perspective and influence, to be able to help shape the environment for unique public/private partnerships for the next generation of enabling traveler information services.

Motivation and Justification for EnableATIS

There are several pending influences and industry developments that are prompting this focused effort toward defining the federal role in the future traveler information marketplace and in supporting an environment that will leverage the strengths of public agencies and private industry.

- There is recognition that with connected vehicles and the growth in mobile-source data from smartphone and other applications, there is a wealth of new types of data that can support a potentially robust traveler information industry. Effectively harnessing this data, utilizing it for multiple purposes, and developing transformative applications that will integrate traveler information into daily decision making by users and daily operations by agencies is a significant shift.

- The impact of mobile communications and social media is a key trend that is envisioned to continue and expand. As traveler information sources become ubiquitous and 'travel with the traveler', there are unique opportunities to push multimodal, geographically relevant and user-specific information directly to travelers. There is also an opportunity for

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travelers to contribute to the data pool, either through opted in data sourcing to serving as anonymous data points along their journey.

- There is a growing competitive marketplace with hundreds of traveler information applications currently available. This has created a unique ecosystem within the industry, and will likely generate even more potential players as the application environment evolves. Recognizing that the private industry is largely comprised of silos of information, identifying ways to leverage and share critical data across a largely privatized industry could be a significant challenge.

Vision for EnableATIS

The following vision has been established, with stakeholder input, for EnableATIS:

Enable ATIS is a transformative concept of the traveler information community that will:

- Improve transportation system mobility and safety by better informing agency operational strategies as well as individual user decisions
- Foster multi-source data and information integration and delivery that will transform the user experience on the transportation network
- Advance planning, engineering and research with new forms of data about traveler behavior and response to transportation operations
- Promote development of dynamic and transformative applications for real-time, multi-modal, and traveler information partnerships

Transformative Goals for EnableATIS

EnableATIS has the potential to transform how traveler information is gathered and shared, how agencies are able to use information to better manage and balance the transportation networks, as well as transform how users obtain information about every detail of their trip. New forms of data will unlock the potential for a highly personalized, intuitive and predictive suite of traveler information services well beyond what is experienced today.

To guide the ATIS community toward achieving the vision set forth for EnableATIS, the following goals have been established:

- Goal #1: EnableATIS will transform the user experience on the transportation network. Future traveler information systems will intuitively provide users with trip, location and mode specific information to empower real-time decision making.
- Goal #2: As a result of EnableATIS, the transportation networks will experience measurable gains in performance, including mobility, safety and efficiency.
- Goal #3: A more robust traveler information suite of capabilities will be enabled through a rich and multisource data environment that leverages public sector system and operations data, and transportation network operations and user data from privately operated systems.
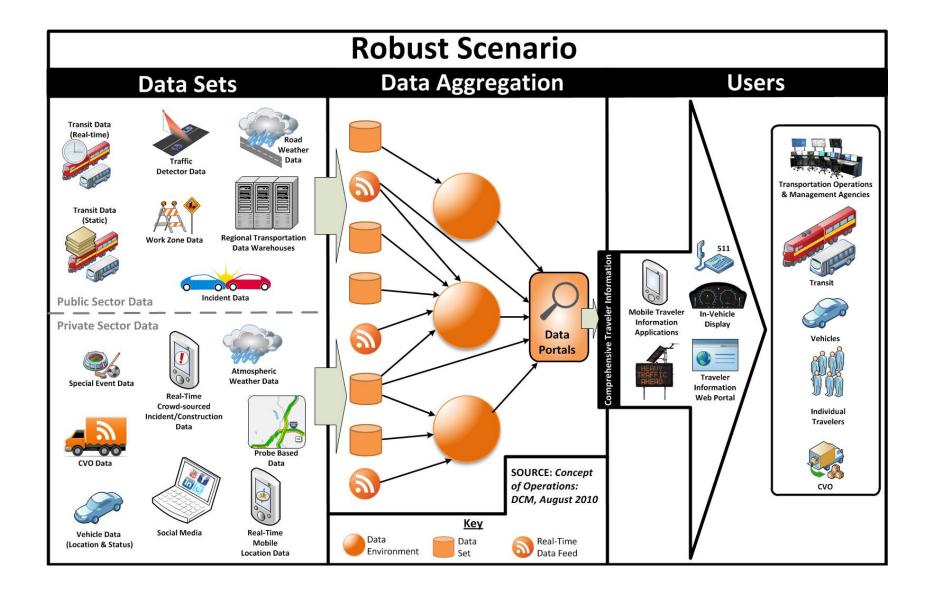
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Operational Scenarios for EnableATIS

To achieve the vision and goals for EnableATIS, there will be a number of activities that will need to occur within the traveler information market and industry. This Operational Concept presents two operational scenarios, which are not mutually exclusive, that illustrate the diversity of service evolution within EnableATIS program area.

The first operational scenario is very much a "laissez-faire", incremental build-out of enhanced traveler information capabilities over time. This scenario takes into account trends in market evolution and assumes an increasing (but not ubiquitous) level of new and expanded data and aggregation, and continued innovation in harnessing and delivering that data to users and others within the supply chain. While there is growth and innovation within this incremental build out, there is not much that is envisioned to be transformative. Within a "laissez-faire" scenario, there would be minimal intervention by USDOT to advance key initiatives or guide the market in any specific direction. As a result, the traveler information environment, although evolved beyond what is available today, is at risk for remaining fragmented.

The second, more robust scenario presents a desired future end-state for traveler information EnableATIS. The term "end-state" is a risk considering that the market is envisioned to be dynamic and evolving, so EnableATIS represents more of a vision for the marketplace rather than defining completion of a specific objective. It is characterized by a multimodal, integrated traveler information environment where there is active leadership in certain roles by both public and private stakeholders. It represents a transformative approach and integration of multiple products and services beyond what are feasible or capable today by pushing modally-relevant, location-specific, and personally relevant information to the end user to guide real-time decision making. In this future end state, users themselves and vehicles are important sources of real-time data, but there are also advances in applying analytics to generate transformative uses of new information in new ways, which supports a dynamic traveler information environment as well as directly benefits mobility management strategies by public agencies. This scenario is shown in the graphic on the following page.

This scenario assumes a comprehensive, multisource and multimodal data environment from which to enable a multitude of traveler information services. This robust end-state scenario will require strong leadership and influence from the USDOT to facilitate a collaborative partnership and direction among myriad stakeholders. This will help to ensure that important aspects of data management and data sharing, human factors, accessibility to information, and integrated transportation system management activities can merge with innovations in the technology market. To further formalize future directions, there will need to be a demonstration of these capabilities through a proof of concept or pilot project. This will also serve to gauge the feasibility of anticipated partnering structures and level of interest of the private sector to support future transformative initiatives.

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Robust Scenario

Data Sets

Transit Data (Real-time)

Traffic Detector Data

Road Weather Data

Transit Data (Static)

Work Zone Data

Regional Transportation Data Warehouses

Incident Data

Public Sector Data

Private Sector Data

Special Event Data

Real-Time Crowd-sourced Incident/Construction Data

Atmospheric Weather Data

CVO Data

Probe Based Data

Vehicle Data (Location & Status)

Social Media

Real-Time Mobile Location Data

Data Aggregation

Data Portals

SOURCE: *Concept of Operations: DCM, August 2010*

Key

Data Environment

Data Set

Real-Time Data Feed

Users

Comprehensive Traveler Information

Mobile Traveler Information Applications

In-Vehicle Display

511

Traveler Information Web Portal

Transportation Operations & Management Agencies

Transit

Vehicles

Individual Travelers

CVO

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Stakeholder Roles for EnableATIS

One of the key objectives of this Operational Concept is to help identify the federal role in EnableATIS going forward. The USDOT is in a unique position among all of the potential stakeholders to effectively leverage the programs and focus areas within the DMA and DCM programs, and utilize its national perspective to assess effectiveness of implementations for potential best practices and guidance, as well as establish a forum to initiate and sustain a national dialogue among the ATIS community. These are essential activities to be able to foster a collaborative environment to work toward the vision and concepts outlined in the robust scenario for EnableATIS.

As this key facilitator, the USDOT is not envisioned to prescribe a specific direction for the marketplace, but rather bring the diverse ATIS stakeholder community together to best leverage ongoing advances in the marketplace, and continue to identify and work through key issues among the diverse stakeholder interests as they arise. One limitation of this role is that USDOT is not a developer or deployer of technology and the pace of development, integration and delivery will be set by the private sector and determined by market penetration and user acceptance. There could be a risk in too narrowly defining a specific direction in a marketplace that stands to benefit from disruptive technologies and innovation.

Within the diverse traveler information marketplace, there are many stakeholders who will have a role in shaping the future market evolution. The following summarizes the key roles for USDOT and other stakeholders in working toward the vision for EnableATIS and its multi-source, multimodal data environment.

Facilitate Vision and Coalition Building

- The USDOT is uniquely suited to spearhead and facilitate the formation of a coalition or forum that will bring the ATIS community together into a national dialogue to advance EnableATIS.
- Agencies, the private sector, national organizations (such as ITS America and industry groups from wireless, mobile and other ATIS technology sectors), and the research community will have a role in actively participating in this forum.

Lead and Support for Public/Private Partnering

- The federal government will have a key role in providing guidance and leadership for continued public/private partnering for EnableATIS.
- Public agencies will have a role in seeking out and championing partnerships at the regional level, and integrating new data sources into their operations.
- Private sector stakeholders with a national footprint will have a key role in large-scale roll out of next generation applications, and these stakeholders should be part of the dialogue in terms of data format standards, performance metrics, and public/private partnering strategies

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Sponsor Fundamental Research and Research Initiatives

- The USDOT, in partnership with national research entities (such as the Transportation Research Board) can influence and elevate the ATIS research needs within the community.

- As part of the national dialogue, USDOT and ATIS community stakeholders need to collectively identify and prioritize research needs.

- Agencies and the private sector would be active participants in research and evaluations, and would support alignment of ATIS research with other program areas including system operations, safety, and human factors.

Encourage and Demonstrate Technology Innovation and Implementation

- The private sector will continue to have a role as a direct connection to the end user in the form of applications to support daily decisions about travel, and will continue to use information generated by users to enhance and improve the available offerings in the commercial marketplace.

- There is a role for the USDOT and agencies to serve as stewards of equality, and ensure that markets or areas not served by the private sector have access to some level of traveler information

Operate and Manage Systems

- The public sector will continue its role in operating roads, freeways, and transit systems, and will be looked to for leadership for establishing regional data sharing strategies among public and private partners.

- Agencies will have a continued role in disseminating information using dynamic message signs, 511 systems and through other established information sharing strategies.

- Agencies also will have a role to modify operational strategies to incorporate new data sources and operate transportation networks at an optimum level of efficiency and in response to real-time conditions and demand.

- There is a role for USDOT to ensure the public good of all of private sector collected data is preserved and useful to public agencies seeking to better manage and operate their transportation networks and systems.

Next Steps

The traveler information industry is comprised of many players. USDOT will need to use its national presence and focus to help facilitate the conversation among multiple partners, including transportation agencies, private sector companies, and others within the ATIS supply chain to begin working through the specific data needs, expectations, and strategic goals; the latter of which will involve each of the partners in a key role.

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An important recommended near-term activity is for USDOT to establish a forum or stakeholder group that can provide multimodal traveler information input to USDOT to help guide future directions. This forum should strive to engage federal, state and local agencies, the private sector, national organizations (such as ITS America and industry groups from wireless, mobile and other ATIS technology sectors), and the research community. This group can provide valuable feedback on the Operational Concept and future strategic direction such as:

- Establishing a proof of concept and pilot system that leverages the Research Data Exchange data sharing and federation concept utilizing real-time and non-real time data sources;

- Engage the private sector data providers to assess what data formats are most useful to the private sector, and similarly engage the public sector to identify what types of connected vehicle and mobile-source data could be integrated into agency transportation system operations;

- Engage the private sector on what data they would be willing to exchange for public agency use; and

- Begin testing agency acceptance and operations with integrating connected vehicle and/or mobile source data within their operations.

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Chapter 1 Background

1.1 Overview of Enable ATIS

Enabling Advanced Traveler Information Systems (EnableATIS) is the traveler information component of the United States Department of Transportation (USDOT) Dynamic Mobility Applications (DMA) Program. Traveler information, and in particular the next-generation of transformative advanced traveler information enabled with data from connected vehicles and other sources, was identified as a high priority application area by stakeholders through the USDOT Mobility Workshop series held in December 2010.

Dynamic and multimodal real-time data is envisioned to be generated from a variety of sources, including vehicles (cars, buses, trucks, and trains), environmental monitoring stations, roadside infrastructure, and even users themselves. Some of these sources, such as roadside environmental monitoring and traffic control and management systems already exist and provide data that are widely used as part of current traveler information applications. There are new forms of data emerging through connected vehicles and traveler data, and the USDOT's DMA program is researching, exploring, and testing a range of potentially transformative applications, uses and impacts of this data. Traveler information is one of several areas that are envisioned to benefit from this dynamic and multisource information, and there is the potential to transform how users interact and apply this next generation of traveler information capabilities to their travel, trip and daily decisions.

Impacts and benefits of this information on system management and operations, human factors and end-user interactions with next generation systems and technologies, as well as market impacts and dynamics (including growth and sustainability of a robust traveler information marketplace) are all important considerations that will shape the future EnableATIS environment. The USDOT DMA and Data Capture and Management (DCM) Programs are working through many important data capture, ownership, sharing and management and these findings will play an important role in the evolution of and framework for a robust multi-source, multimodal data environment to enable future traveler information systems. From a traveler information perspective, data ownership and management of diverse data sources (with many of these anticipated to be generated through private proprietary systems) will be an important challenge and one that will need to be addressed to effectively enable multiple uses of this data to support traveler information and other applications. The DCM program recognizes this, and although data governance, stewardship, accessibility and other parameters are among the key focus areas of the DCM, the USDOT recognizes that there will need to be some clear guidance and demonstrations of these techniques going forward.[1]

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[1] U.S. Department of Transportation, Research and Innovative Technology Administration, ITS Joint Program Office, "Real-Time Data Capture and Management Program: Transforming the Federal Role," May 2010.

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Figure 1 below shows the relationship between the data harnessing and capture activities within the Real-time DCM and the various Mobility and Environmental Applications, of which traveler information is a key part.

Source: USDOT

Figure 1 – Data Capture and Management and Mobility Applications

Traveler information, in a broader perspective, is one of the most diverse functional areas within the USDOT DMA Program. It represents a broad collection of data, functions, services, business models, potential partners, and a wide range of delivery mechanisms, many of which are outside of the public agency operating paradigm. It is a complex environment on many levels. Successful enabling of a future traveler information environment and its required partnerships, data management and delivery mechanisms will require demonstrating such activities through proofs of concept and pilot tests.

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1.2 Enable ATIS Operational Concept Overview

EnableATIS represents a unique application area within the USDOT DMA Program. EnableATIS is not developing a specific application or system, but rather is formalizing a framework whereby multiple activities are envisioned to interact to support a diverse traveler information environment. There are diverse operational relationships within current and future traveler information paradigms, there is a unique and evolving supply chain and commercial marketplace, and there is a rapidly changing technology environment. This leads to some level of uncertainty about future roles for agencies, in particular the USDOT, relative to the next generation of traveler information services. As a result of these and other factors, USDOT has opted to explore EnableATIS at the Operational Concept level rather than a Concept of Operations.

A Concept of Operations is intended to map out specific system interactions, user interactions, dependencies, stakeholder roles, the operational environment within which a specific system will operate, and other parameters, such as how a particular system will fit within a particular organization's (or group of organizations) operational responsibilities. It is intended to describe operational characteristics and high level functions. While some of these may apply to the EnableATIS environment, EnableATIS is not defined well enough at this stage for a detailed Concept of Operations. An Operational Concept is also a planning-level document and represents a more suitable level to focus given the diverse activities within EnableATIS and the decisions that are yet to be made relative to roles and responsibilities of this rapidly emerging environment.

The Operational Concept helps to set the stage for strategic directions and investment decisions, particularly on the part of USDOT and its role within EnableATIS. Further, the Operational Concept identifies potential roles for other partners. Feedback from various stakeholders throughout the process has provided important input into these future roles.

A key role for USDOT will be to align EnableATIS capabilities among the other emerging DMA and DCM program bundles and applications. In some instances, EnableATIS needs to coordinate with or leverage activities being carried out through initiatives such as FRATIS (freight-focused traveler information applications) and through the Data Capture and Management Program. There are data governance and management strategies, data privacy and data exchange formats that are being established through these other program focus areas that will influence or impact EnableATIS.

1.3 Methodology to Develop the Operational Concept

This Operational Concept for EnableATIS included the following components and steps:

- ***Review of Applicable Literature and Current Research** –* This initial task included a review and synthesis of relevant and recent traveler information research. An internal working deliverable, "Synthesis of Current Programs, Research and Concepts" focused on industry trends and influences, recent advances with standards and data interoperability, and innovative traveler information program approaches and activities at the state and local levels.

- ***Stakeholder Feedback** –* Multiple channels for stakeholder input and feedback were used to obtain a wide range of industry and agency perspectives on the vision, needs, transformative goals and potential performance measures for EnableATIS.

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- ***Establish Vision and Operational Concept for EnableATIS –*** the proposed vision for EnableATIS was revised based on stakeholder feedback at the October 2011 workshop. The Operational Concept structure and format was developed with consideration for applicable portions of the Concept of Operations structure, and factored in the unique aspects of a dynamic traveler information market, industry and stakeholder base.
- ***Market Readiness Assessment –*** This assessment was developed following the Operational Concept, and identified the potential for the market to support the identified goals and objectives for EnableATIS.

1.4 Stakeholder Input to the EnableATIS Operational Concept

Stakeholder input played a key part in the development of the Operational Concept. A broad range of stakeholders were engaged at several points during the development process, including:

- Introductory Webinar – October 12, 2011;
- Stakeholder Workshop and Webcast – October 27, 2011;
- Electronic Feedback Form – Open from November, 2011;
- Interviews with additional stakeholders from private industry; and
- Stakeholder review of the Operational Concept.

Feedback from stakeholders shaped development of the initial draft vision, and also provided important inputs to the future roles of USDOT, agency and private sector stakeholders in an EnableATIS framework. While several efforts were made to engage a broad range of stakeholders from the ATIS community, quantitative feedback came primarily from public sector agency representatives. There were several different types of private sector stakeholders that provided input, including consultants, technology and system developers/vendors, and research entities; feedback from the technology and system developers/vendors was limited.

A "Stakeholder Feedback Summary", dated December 30, 2011, included a summary of the October 2011 workshop/webcast as well as the results of the electronic feedback form, which was made available to stakeholders for input in November. For the feedback form, there were some respondents who opted to remain anonymous. In some cases, stakeholders who participated in the workshop also responded to the feedback form. Table 1 summarizes the stakeholder composition.

Table 1 – Stakeholder Feedback Composition

Workshop/Webcast	Feedback Form*
6 USDOT/Federal	8 USDOT
12 state/MPO/local agency	8 state/MPO/local agency
6 transit	5 private sector/consultants
12 private sector consultants	1 vendor/developer
3 vendors/developers	1 university/academia
3 university/academia	

*some respondents were anonymous

As part of the workshop and the electronic feedback form, stakeholders provided their input to the following:

- Primary roles for the USDOT, non-USDOT public agencies and the private sector;

- How the underlying data of EnableATIS should be made available;

- Impacts of intellectual property stewardship;

- How traveler information will be delivered and/or used in the five and ten year horizon, and what will be "transformative" about traveler information;

- Sustainability of EnableATIS, including dependencies and requirements;

- Primary barriers or constraints to EnableATIS; and

- How success will be measured.

Input from the workshop and feedback form was factored in to the vision, operational scenarios, constraints and risks identified in this Operational Concept. There was recognition that there will continue to be several stakeholders and participants in the traveler information marketplace. Although stakeholder feedback indicated some shifts in current roles for traveler information, many indicated that the USDOT, the public sector and the private sector should continue in roles that leverage their respective strengths. Feedbacks on these roles were primarily from federal and local agency perspectives, which may not reflect the opinion of the broader traveler information community. Figure 2 below shows a summary of roles that stakeholders identified during the outreach process.
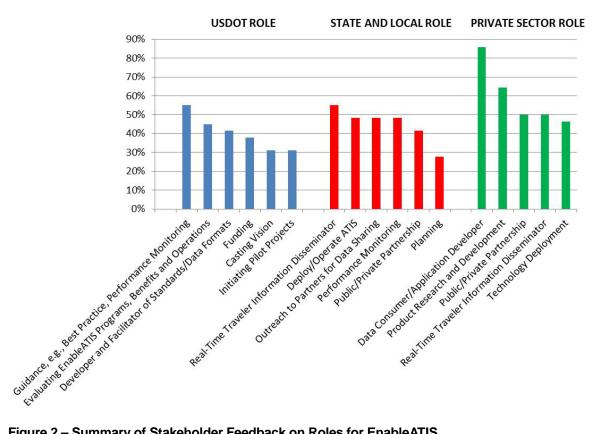

Figure 2 – Summary of Stakeholder Feedback on Roles for EnableATIS

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Chapter 2 Motivation for Establishing an Operational Concept for EnableATIS

A more transformative environment for traveler information requires data providers, data collectors, and data disseminators to shift to potentially new and uncharted roles in the marketplace. There are a number of factors that may inhibit or promote the ability for partners to do so. Furthermore, there are market dynamics that are evolving rapidly, and adoption of new technologies by users will greatly shape the near-term technology focus of the private sector traveler information market.

An overarching motivation for seeking out new and innovative ways to gather and disseminate traveler information is the growing need to address increasing congestion in many areas around the country. The emphasis on improved operations at a system wide level as a means of maximizing available transportation system capacity necessitates new ways and approaches to delivering important alert information to travelers. Additional influences and motivators include:

Increasing Availability of Data

Connected vehicles, and the USDOT research program supporting connected vehicles, will result in a much richer and broader data set than what is available today. With this data comes significant potential for how it can be used to support mobility and safety strategies, and many potential uses are being explored through the USDOT connected vehicle research program, including the Dynamic Mobility Applications and Data Capture and Management.

Traveler information will be enabled with new types of data, which could include data generated from the vehicle, from mobile devices, generated from users themselves (including location, travel behavior, and usage frequency), as well as state and local agency transportation systems operations data. Data from mobile devices has the potential to cross modes and provide a full picture of traveler routes, modes, mode shifts, information preferences, frequency of usage, and user confidence in the information provided, among others. With this emerging market, the industry is only beginning to see the potential for what types of data will be most valuable to consumers, to agencies and to technology developers.

Traveler information, as an agency service, has typically been comprised of and dependent on operational data collected for other purposes, such as road network management, transit operations, system maintenance, among others. The emerging opportunity is that new forms of disaggregate data about travel context, experience and outcomes can inform or transform agency operational strategies. Effectively harnessing this data, utilizing it for multiple purposes, and developing transformative applications that will integrate traveler information into daily decision making by users and daily operations by agencies is a significant shift.

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Advances in Consumer Technology and Social Media

With the rapid evolution and market impact of mobile technologies, these will continue to be a powerful tool for connecting to the end user. The previous paragraphs discussed the potential of harnessing user data from mobile devices; however, mobile devices will continue to serve as a platform for applications that inform, alert, and navigate users through their daily transportation choices. There are several hundred applications currently available to support traveler information, and new applications continue to emerge. As traveler information sources become ubiquitous and travel with the traveler, there are unique opportunities to push multimodal, geographically relevant and user-specific information directly to travelers. Wireless communications have improved in delivery and cost effectiveness, which adds to the widespread appeal by the public. Furthermore, mobile applications provide a wide range of opportunities for the private sector supply chain to be able to develop, implement and market tools to the end users.

The iPhone, Android and Microsoft platforms all offer mobile applications for real-time traffic conditions. The internet hosting market provides an open-ended method of creating a user interface that travelers can access whenever they need to access it. Competitive services such as these drive innovation and winners and losers will be decided through consumer choice and word of mouth.

Another important factor of mobile communications points to safety concerns of in-vehicle and mobile device usage while driving. EnableATIS will seek to continue the efforts of USDOT, mobile technology developers and vehicle manufacturers to find innovative ways to safely deliver information to travelers.

The increased usage of social media for transportation-related purposes has opened the door to allowing users to influence other users during their travel. As location tracking and status updates have allowed the user to define conditions as they are experiencing them, this method of real-time reporting has been introduced into agency traveler information priorities. Incorporating social media into agency-generated traveler information is already occurring, and additional agency buy-in to the power of social media is expected.

Agency Resources and Business Operations

With many agencies experiencing competing priorities for limited resources, traveler information provides some options for innovative delivery; this includes being open to new models such as a sponsoring partnership with the private sector for 511/web traveler information services or looking for alternatives to activities such as data collection and information dissemination. Some agencies may be hesitant to utilize newer technologies or services because they have not been time-tested; other constraints may include agency procurement processes and timeframes, as well as compatibility with legacy equipment. Partnerships between agencies to provide traveler information services, as well as partnerships with the private industry where applicable, will move the industry toward streamlining resources and potentially costs in providing the same or better traveler information to the public.

The USDOT, state and local agencies, and the private sector will all have to be willing to take on roles that may be challenging and may require changing standard practices and policies. Creating an environment with more data, more access, more user-specific information, and more predictive and intuitive systems will require all those involved to be open to new methods of practice. "Entrenched paradigms", or business as usual mindset, was identified by stakeholders as one of the key barriers for EnableATIS.

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Chapter 3 Current State of Advanced Traveler Information Systems

3.1 Research Conducted

Research for the EnableATIS Operational Concept focused primarily on recent reports and activities through the USDOT Connected Vehicle program, as well as recent market and technology scans, including the Real-Time Traveler Information Market Assessment (2010), which identified key trends and gaps in traveler information systems across multiple modes and from public and private sector perspectives.

As identified in the Real-Time Traveler Information Market Assessment, as of 2007, 39 percent of urban freeway centerline miles within 64 metropolitan areas were equipped with real-time data collection technologies. Private sector coverage showed a much larger footprint, although primarily focused on metropolitan areas because this is where most of the congestion impacts occur and where consumer demand for congestion information is greatest. Since the publication of that Market Assessment report, there is increasingly expanding informational available (geographically speaking) from private sector sources that are utilizing different forms of data collection (including Bluetooth and GPS location data) to derive estimates of corridor travel conditions on interstates and other key routes, including those in rural areas.[2]

The types of traveler information that were identified in 2011 research study conducted for the Michigan Department of Transportation documented agency-operated traveler information systems in 23 areas (states and regions). Information identified as having the most maturity as well as coverage level were:

- incidents;
- construction and lane closures;
- road weather information;
- live camera feeds; and
- road conditions.

Regarding the list above, travel times also were identified as components of many of the traveler information programs of the agencies surveyed; however, many agencies noted that geographic

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[2] Deployment statistics researched were as of published documents with 2007 data. Results are detailed in the following: Booz Allen Hamilton and Kimley-Horn and Associates, Inc., "Real-Time Traveler Information Market Assessment White Paper," Prepared for U.S. Department of Transportation, Intelligent Transportation Systems Joint Program Office. February 2010.

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coverage was not substantial in the context of a statewide system, as travel times, if provided, were available primarily for urban area freeway segments.

These mark the "baseline" of many traveler information systems. This research showed strengths in the traditional DOT or transportation agency core business functions in lane restrictions and relatively strong in operations-focused data such as incidents, road weather information and travel conditions. The research also found that from a dissemination standpoint, the most common dissemination strategies from agencies included:

- dynamic message signs;
- 511 programs;
- agency-operated web sites with interactive maps;
- closed circuit television (CCTV) camera feeds; and
- push dissemination strategies including Twitter and e-mail alerts.

Predicted travel times, alternative route information, weight restrictions, multimodal information such as ridesharing or bicycle routing were identified as among the least mature – although being considered or developed in some areas of the country. Least common of the strategies included other social media (non-real-time platforms such as Facebook and LinkedIn), kiosks and rest area traveler information systems.[3]

Notable research has been completed regarding the accessibility and usability of traveler information including the *Real-Time Traveler Information Market Assessment*, prepared for the USDOT ITS Joint Program Office (February, 2010) and the SHRP2 Reliability research undertaken as part of L14. Existing traveler information programs are centered on improving the dissemination methods of the data that is already being collected. Advances in collecting new types of data are prevalent in the private sector market. The interest in new data has spurred test corridors and a willingness to partner with the private sector to support dissemination as well. One of the most notable examples of the latter is the partnership of the I-95 Corridor Coalition with a private sector data provider to be able to offer corridor-wide travel times and road conditions information, which is accessible to the public as well as to the transportation management agencies along the corridor to support interstate operations.

3.2 Agency-operated Traveler Information Systems

States and regions have been actively deploying and operating traveler information systems for nearly three decades. Much of the public sector roles and offerings for traveler information have been a product of the traffic management infrastructure put in place to support freeway management systems in urban areas. Outside of the metropolitan areas, the technology focus remains primarily on weather detection and monitoring systems with limited speed and flow information from agency operated systems. With the 1201 Rule, there will be an increased focus on geographic coverage of information, as well as timeliness of reporting. Section 1201 of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU) requires the establishment of a Real-

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[3] Cambridge Systematics and Kimley-Horn and Associates, Inc., "Strategies for Improving Traveler Information," Prepared for the Michigan Department of Transportation, November 2010.

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Time System Management Information Program for monitoring and providing traffic and travel conditions on key regional routes of significance in metropolitan areas that are one million in population. The Rule makes an important distinction between information provision and dissemination, and applies only to provision.

The historical role of DOTs is rooted in collecting urban area data and transmitting that information in the form of dynamic message signs and traveler alerts (which typically includes a phone-based information system and traveler information web site). Rural information has been traditionally challenging for DOTs to have a consistent and reliable role due to lack of coverage of real-time data collection infrastructure in rural areas. It is not uncommon for agencies to deploy CCTV at certain points along a rural corridor, utilize environmental sensor data for real-time weather conditions, and some agencies to have detection systems deployed on segments of rural corridors.
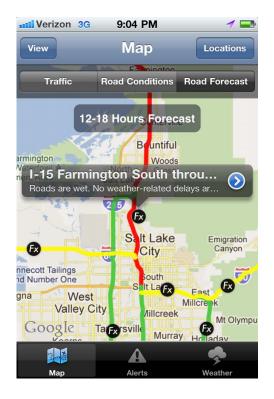
Prior to 511 as a brand for agency traveler information systems, there were many states that operated and provided some form of road conditions information or alerts, which typically consisted of a recorded message or hotline, or more location specific information available through roadside devices such as dynamic message signs or highway advisory radio. This allowed state DOTs to alert travelers to conditions such as weather, closures, or other hazards, even on rural corridors. Agencies too have adopted newer technologies and have migrated these hotlines to a more interactive platform with 511, as well as implemented web sites that are capable of providing more location specific details, planned event information (such as scheduled road construction and maintenance), weather conditions and other impacts on a corridor-wide or statewide level.

The national 511 phone number providing a common platform for phone-based traveler information has been available to states and local jurisdictions across the country for more than a decade. The phone number has been adopted by 33 state agencies and 7 regional areas, many with both 511 phone service and 511 website capabilities. 511 implementation and operations has followed a traditional business model of public agency leadership (procurement, funding, and operational responsibility) with varying levels of private sector involvement which has typically been in a contracted role or supporting 511 and traveler information capabilities such as data collection or dissemination. 68% of the country has access to 511 services.

Recent years have seen a shift in some of the public/private partnering approaches for traveler information systems, in particular willingness among some areas to implement sponsorship business models. These sponsorships may extend beyond the phone and web-based traveler information tools to include sponsorship of more traditional roadside signs.[4] Web and mobile technologies are ideally suited for advertising models such as banner ads. Several states and regions are also considering as well as implementing new business models and approaches, such as sponsorship of certain services (such as web-based advertising on web and mobile services or sponsorship of road sign programs), implementing more personalized "My511" concepts and applications, and providing more access to multimodal data through their 511 systems.

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[4] Colton, Hugh, "511 Sponsorship: The Georgia Perspective," Presentation to the 511 Deployment Coalition. September 2010.

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Tools such Twitter and Facebook offer a powerful medium not only for reaching travelers, but also for allowing the travelers themselves to share information with their own network of friends and contacts. Several agencies are making information available through a mobile interface to their existing 511 and traveler information sites, and others also are developing their own applications for download on iPhone, iPad and Android smart phones and tablets. Figure 3 shows an example of the Utah Traffic Application available for the iOS and Android, and Figure 4 is the real-time transit application developed by the Metropolitan Transportation Commission in the San Francisco Bay Area, California, as part of their 511 system.

Source: Utah DOT Traffic Application

Figure 3 – Utah's Traffic Application

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Source: Image from 511.org

Figure 4 – MTC Transit Application for Smartphone

3.3 Private Sector Traveler Information Services

The evolution of traveler information services and delivery options from the private sector continues to evolve at the pace of mobile computing. Media (radio and television) were the first private sector entities focused on providing travelers with current road conditions, particularly in urban areas during peak morning and afternoon travel times, and media remains one of the most predominant private sector partners in the traveler information industry.

The roles for the private sector have undergone a significant shift in recent years. What was traditionally a role largely focused on information dissemination, now also involves the private sector at all levels within the traveler information industry, including data collection and data aggregation. Roles for the private sector are quite varied, due largely to the diversity within the private sector supply chain. The term "private sector" encompasses many different facets and business areas, such as:

- System and technology developers (hardware, software, vehicle systems and equipment, among others);
- Vendors and equipment manufacturers;
- Application developers;
- Automotive original equipment manufacturers (OEMs);
- Mapping providers;
- Data collection, data aggregation and third party firms that package data for multiple purposes;
- Telecommunications system providers;
- Media and traffic reporting companies; and
- Contractors and consultants to support design, operations, and evaluation.

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One of the most notable areas where the private sector has taken on a much stronger role than in years past is data collection. Recognizing a need for alternatives to traditional agency-operated data collection mechanisms (such as loops or other infrastructure-based sensor technology), there are private companies that have applied a number of technologies and approaches, including cell phone location data, Bluetooth, and GPS location data to be able to obtain a sample of vehicle speeds and locations to be able to derive corridor travel conditions and travel times. This has helped to address the gaps in agency-operated data collection infrastructure, particularly on key corridors outside of urban freeway management systems.[5] This data is used by a number of partners, both public and private, to support traveler information as well as system operations and management. Archived data also is being used by agencies to support planning and analysis activities.

Private sector companies have been the leaders for developing the tools necessary for more mobile communications and real-time transmission of data across boundaries that have been traditionally difficult for agencies (physical distance, accessibility of information, standards of data). With the changing mobile market space, implementing applications that are fully functional on smartphones (iPhone, Android, Windows 7, etc.) is an important consideration. Other considerations include leveraging built-in smart phone capabilities such as global positioning system (GPS) location based information and the impact of hands-free legislation becoming more common.

The following sections are some examples of the types of current operations that agencies are utilizing for their traveler information programs around the country as well as trends that have developed as enhancements of those current operations toward more accessible, real-time, and user-specific information. The following sections also include challenges and constraints within the current ATIS environment which, when addressed, will support more transformative, user-specific, data intense traveler information services than what is currently being provided today.

3.4 Data Collection and Management

Providing vehicle detection on freeways using sensors embedded in the pavement or mounted on the side of the road is typically the most detailed form of data collection still available, providing volume, occupancy as well as speed. Other technologies which can be more specifically placed for data collection purposes include, but are not limited to, Bluetooth sensors, and magnetic mid-block sensors (for arterials). Several private sector firms are also generating speed data from a sample of vehicles on the network using GPS location data.

Freeway management systems including mainline and/or ramp meter detection is deployed in most major metropolitan areas. While some local agencies have deployed spot detection at intersections for traffic signal control purposes, consistent detection of the entire arterial network in urban areas is generally limited and for most agencies this strategy would be cost and resource prohibitive. Closed-circuit television is widely used as part of freeway and arterial operations throughout the country. Real-time video system deployment and operations is envisioned to remain with the public sector, although there are partnerships with the private sector that support distribution of video from agency-operated CCTV networks to other agencies as well as to commercial customers.

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[5] Booz Allen Hamilton and Kimley-Horn and Associates, Inc., "Real-Time Traveler Information Market Assessment White Paper," Prepared for U.S. Department of Transportation, Intelligent Transportation Systems Joint Program Office. February 2010.

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A recent USDOT study (Data Capture and Management State of the Practice Assessment and Innovations Scan Overview) has identified crowdsourcing as an innovation in facilitating traveler information data collection.[6]   Crowdsourcing traveler information data is creating an 'open call' that pulls anonymous data from the public that enables applications to be developed to serve the traveling public, support strategies by traffic management agencies, inform commercial fleet managers, and be used for analysis by transportation planners. Data typically includes traffic speed data or incident data. Private sector developers are currently at the forefront of collecting crowd sourced data and developing applications to then disseminate traveler information to the public.

3.5 Regional Multi-Agency and Multi-Modal Data

To date, there are very few examples of integrated regional multi-agency, multi-modal data for traveler information. The term "region" can mean:

- Urban area comprised of freeways, arterials, transit operations, and parking;
- Corridor that connects multiple areas;
- Statewide area comprised of multiple large and small urbanized areas, highways connecting those areas and multiple transit providers; and
- Multiple states with multiple corridors

It is a challenge for multiple agencies to be able to work through the institutional, financial, and stewardship issues with collecting, sharing and centralizing multi-source and multi-modal data. Advancements in corridor coalitions and partnerships across state and jurisdictional boundaries are generating more coordinated broadcast of traveler information to travelers, although integrating modal data at a regional level remains a challenge. There are some examples, including the I-95 Corridor Coalition and the Western States rural Transportation Consortium that do provide for some initial multi-agency efforts toward accomplishing this:

- The I-95 Coalition implemented a corridor-wide traveler information web site (www.i95travelinfo.net) which provides color-coded traffic congestion information for 13 states along I-95 as well as other linked corridors, trip time calculator, and links to Coalition states' 511 services. An important lesson from a development perspective is that the institutional and partnering arrangements were largely in place to facilitate this kind of corridor-wide data available via the Web.
- The Western States Rural Transportation Consortium is beta testing a One Stop Shop Web site (www.westernstates.org/Projects/OSS/) using CLARUS Environmental Sensor Station data as a basis, but also including multi-state road conditions, incidents, weather forecast data, CCTV images and commercial vehicle information (where available). The One Stop Shop currently includes California, Oregon, Washington, Nevada and plans to expand into other western states.

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[6] "Data Capture and Management State of the Practice Assessment and Innovations Scan Overview," Presentation by Mohammed Yousuf, August, 2011.

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3.6 Transit

Data for transit is collected though many different mechanisms, including on-board vehicle devices for location, vehicle diagnostics, passenger counters, headway and speed, and other operational parameters. Traveler information for transit continues to rely on a combination of static transit traveler information (printed schedules, system and route maps, and fare information), customer service operators and call centers, trip planners, and real-time technologies such as GPS-based automatic vehicle location (AVL) to support next bus arrival times and real-time schedule information.

Only recently has there become a consensus on data standards which has emerged organically by group consensus and not by government led committee. There seems to be greater progress on transit data formats than traffic data formats, such as in the progress of Google's Real-Time Feed Specification (GTFS) usage of automatic feeds of data in GTFS format[7]. There has been significant focus in recent years on providing more dynamic transit information, including next bus arrival times, which is often accomplished through partnering with a vendor to make real-time information available to users. Another key achievement within the transit traveler information industry has been the provision of transit schedule data to Google to support the Google Transit Trip Planner, which currently has data for more than 475 transit agencies in the US and worldwide, and is accessible to transit users through web and mobile interfaces.[8]

Although the standard technologies described above are widely used by many agencies, there is a lack of real-time information across the entire system. Transit agencies are pursuing real-time next bus information displays at transit stops as well as a more mobile real-time application function using GPS-AVL data in newer ways to inform the traveling public.

3.7 Parking

A majority of parking facilities throughout the country does not have real-time parking availability information available; much of the parking technology innovation has focused on revenue/fare collection. However, in recent years, the major metropolitan areas in the United States have seen an increased focus on parking apps that provide both static (garage locations, hours of service, rates, entry points) as well as dynamic (parking space availability and navigation to the closest spots available), as well as the ability to reserve and pay for spots using a smartphone application. Although limited to large urban areas where demand for parking and interest in these apps is high (such as San Francisco, New York, Boston, Seattle, Washington DC, among others), several application developers are indicating that they will be expanding into additional cities. Dynamic pricing based on demand is continuing to be a popular trend to encourage drivers to park in underused areas and garages and reducing demand in overused areas.

With all of the parking facilities across the nation, only a handful have implemented real-time parking information systems which provide customers with information related to current parking facility

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[7] https://developers.google.com/transit/gtfs/reference defines the files and fields that comprise the specification. Accessed May 1, 2012.
[8] The Google transit trip planning site identified more than 475 locations were available. www.google.com/intl/en/landing/transit/index.html, accessed May 2, 2012.

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availability, the ability to automate reservations, or provide variable pricing information. There is a further challenge in getting participation from multiple parking operators to be willing to provide this kind of information.[9] Private parking operators need to be able to see a benefit for their business operations for participating in this kind of regional parking information strategy.

3.8 Challenges and Gaps

Data Coverage: The availability of transportation data on all roads remains a significant gap in both cities and rural areas across the country. Within urban areas, resources to maintain or expand current agency-operated systems are limited by funding and personnel. Real-time information on arterials remains a key gap. Instrumenting arterials with real-time detection is cost-prohibitive. The private sector has begun to utilize crowd sourced mobile data to develop high level speed data for arterials in addition to interstates and highways, but with the nature of variability on arterials (due largely to traffic signal operations), this is a challenge. Rural areas pose additional challenges due to large areas to cover and limited infrastructure. With respect to transit data, some agencies that have implemented real-time systems while others have not. Even where data is available, information is typically not shared among public agencies for system wide operations. It is a goal of EnableATIS to help bridge this data gap, by fostering an enhanced level of agency data sharing, as well as integrating new sources of data from the private sector and from connected vehicle strategies.

Another element of coverage needs to consider availability of non-public sector data and information. The private sector is going to seek to serve markets where it can realize some level of market penetration and where there is demonstrated demand. Rural areas, for example, may not represent a high demand, yet there still is a need for travelers to have access to information about road and travel conditions. In the traveler information context, rural areas may have little market potential for private traveler information services, but due to weather and safety concerns, these areas are a high priority for the public sector. An example from another industry is the postal service; there are places where it does not make sense for private competitors to operate (or operate at the same level of service and timeliness as more urbanized areas), but which the postal service is required to serve.

Data Management and Governance: Data governance is also a gap in current practice. This can be defined as how data is managed by an organization in terms of its availability, usability, integrity and security. Currently, some public agencies are making their data available through developer portals, which are geared toward application developers, but which could also be leveraged by regional aggregators, but this is not commonplace. Many agencies are still hesitant to make their data available to third parties because of concerns over its quality. The USDOT DCM program is beginning to address some of these data harnessing, management and governance issues. EnableATIS, with its focus on multi-source data, can help to elevate the priority of effective data management and governance strategies. Even with virtual or cloud-based data sharing mechanisms, there will need to be effective data governance principles and roles in place.[10]

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[9] Booz Allen Hamilton and Kimley-Horn and Associates, Inc., "Real-Time Traveler Information Market Assessment White Paper," Prepared for U.S. Department of Transportation, Intelligent Transportation Systems Joint Program Office. February 2010.

[10] U.S. Department of Transportation, Research and Innovative Technology Administration, ITS Joint Program Office, "Real-Time Data Capture and Management Program: Transforming the Federal Role," May 2010.

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Policy, Regulatory and Safety Concerns in a Mobile Environment. USDOT has placed significant emphasis on limiting distracted driving. To date, 36 states and the District of Columbia have banned texting while driving, and 10 states and the District of Columbia have banned handheld phone use while driving. There are significant fines for commercial vehicle drivers in many states that are cited for using handheld phones or texting. With the rapid evolution in the app marketplace and emphasis on mobile devices as a means of obtaining and receiving information, there is a key risk in placing too much emphasis on these devices as a primary means of users' interacting with traveler information, unless there is functionality within the device that can offset the safety risks. EnableATIS will have a responsibility to make this a priority for traveler information guidance and best practices.

Lack of an Industry-Wide Forum for Traveler Information. There have been various coalitions and interest groups established over the years focused on traveler information, such as the 511 Coalition and the ITS America Information Forum. Both of these groups included broad agency and industry representation, with a focus on advancing traveler information strategies and deployment. The ITS America Information Forum disbanded several years ago, and the 511 Coalition is undergoing some changes. There is a need to establish a group at the national level that brings together the ATIS community – agencies, technology developers, the automotive industry, equipment manufacturers, researchers and others – to further the next-generation traveler information dialogue. Such an entity will help to support coalition building among traveler information partners, identify and advance critical issues affecting the industry, and foster a coordinated focus toward national traveler information goals.

Standard Data Formats: A significant gap in current traveler information systems is standard data formats, although some of this standardization is taking place. For traveler information, it will become increasingly more important to adopt nationwide mapping standards that are used by the dominant providers of traveler information. EnableATIS can help to foster a broader movement toward more open data standards, considering the diversity of data sources that will be required to support an integrated future traveler information environment.

Agency Funding Constraints: Public agencies have limited ability to deploy additional infrastructure to provide for broader real-time coverage. Several factors contribute to this:

- Uncertainty about available future Federal funding levels to support ITS infrastructure;
- Constrained operations and maintenance budgets, which may require some agencies to defer or reduce routine maintenance on ITS infrastructure; and
- Cost of replacing equipment approaching its end-of-life.

Due to these factors, faster adoption of alternative sources of data may be required to support key traffic operations and management functions, including traveler information.[11] Several agencies are purchasing both real-time and archived data to support operations and planning, and future agency budget constraints may prompt more agencies to take a closer look at alternatives and partnerships to acquiring network speed data, particularly if detection infrastructure is getting too expensive to maintain or expand.

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[11] "Real-Time Traveler Information Systems – A Synthesis of Highway Practices," National Cooperative Highway Research Program Synthesis 399, Transportation Research Board, 2009.

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Chapter 4 Vision, Needs and Goals for EnableATIS

4.1 Vision for EnableATIS

A vision for EnableATIS has been established to guide future decisions, focus areas and objectives. The intent of the vision is not to be prescriptive in terms of specific applications or roles, but rather it is to serve as an overarching strategic summary of desired end-states for an EnableATIS environment. Within the vision there is reference to availability of multi-source data to support an evolving traveler information marketplace, and the ability of an EnableATIS environment to facilitate traveler decision in real-time as well as support enhanced network-level management and operations by agencies. The vision also establishes an important link between an enhanced ATIS environment and transportation system mobility and safety.

A draft vision was presented to stakeholders for comments, and it resulted in the following revised vision and supporting principles:

Enable ATIS is a transformative concept of the traveler information community that will:

- Improve transportation system mobility and safety by better informing agency operational strategies as well as individual user decisions

- Foster multi-source data and information integration and delivery that will transform the user experience on the transportation network

- Advance planning, engineering and research with new forms of data about traveler behavior and response to transportation operations

- Promote development of dynamic and transformative applications for real-time, multi-modal, and traveler information partnerships

4.2 Needs

There were a number of needs identified by stakeholders as well as emerging from research on existing traveler information services and the growth of specific areas of the marketplace. The user needs and priorities have changed over time through the development of technologies and applications to support more real-time traveler information. This section includes capabilities that stakeholders envision in the five-to-ten year horizon. The following summarizes the needs that this EnableATIS operational concept focuses on addressing:

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Overarching:

- Next generation framework for traveler information should be predictive, integrated, multimodal, ubiquitous, and intuitive;

- There needs to be a strong focus on obtaining user Origin-Destination data to support predictive applications and information, as well as support agency operations and planning;

- Regardless of the private application developed, the public sector agencies in particular would still need to augment with incident, construction and traffic sensor data;

- The public sector needs to be a source of quality data;

- Standardize the approaches for how information is collected and shared with the public;

- Funding and governance structures to support regional data clearinghouses;

- The right business incentives and legal protections need to be in place to foster participation by private and state/local government stakeholders;

- Entrenched paradigms ("business as usual") shifting to involving and integrating partners in new and innovative ways; and

- Need to leverage the DCM program for the logistics of how data is harnessed and stored, and EnableATIS needs to specify what data elements are critical to supporting traveler information and specify parameters to promote consistency in the accuracy, latency, quality and reliability of that data.

Data Integration:

- Optimize multi-agency, multi-partner data sharing for a more comprehensive user-specific experience;

- Need to leverage USDOT's efforts within the DCM program to ensure privacy and security of anonymous probe, mobile-source and user data to support an enhanced level of traveler information; and

- Need to partner and work through data integration issues with the private sector to ensure accessibility to critical data types from mobile sources, and identify ways to preserve commercial value of unique data for traveler information.

Data Types:

- Content needs to be presented in such a way that the user can find the information they need and that the information be perceived as useful and accurate;

- Public agencies need to actively champion data sharing within their respective regions, and there needs to be guidance on how to overcome institutional barriers to sharing multimodal data; and

- There needs to be a common denominator of data that can be shared between the private and the public sectors to help better support real-time network operations and management.

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4.3 Transformative Goals and Measures of Success

The following represents an initial set of goals and objectives to guide next steps and the USDOT role for EnableATIS. The goals align with the concepts in the Vision, and the goals are intended to convey what EnableATIS intends to accomplish. It is important to establish objectives against which progress can be assessed, reviewed and measured. Some objectives will be easier to measure than others, and in some cases, it may be challenging to assess progress against these on an aggregated level; some of the measures (such as user confidence) may be more effective when applied to a specific region.

Goal #1: EnableATIS will transform the user experience on the transportation network. Future traveler information systems will intuitively provide users with trip, location and mode specific information to empower real-time decision making.

Users will have confidence in the information they are receiving via their personal devices, vehicles, en-route alerts because they are experiencing benefits of improved travel times, safety, route and trip information, and travel options. EnableATIS will support systems that predict what information users need, based on their travel patterns and behaviors, Users will have access to the full range of trip details, beyond surface travel options and conditions, which will enable complete trip decision making. Users also will be important data contributors to traveler information.

Potential measures of success:

- User awareness, confidence, and satisfaction in the information they are receiving
- User adoption of available traveler information tools, demonstrated by numbers of users, downloads of applications
- User mode shift as a result of accurate information provided to them about travel conditions and travel options
- Demonstrated growth in the traveler information marketplace through increased demand, innovation, and market sustainability

Goal #2: As a result of EnableATIS, the transportation networks will experience measurable gains in performance, including mobility, safety and efficiency.

Agencies will have robust, comprehensive, and real-time performance data about how transportation systems are functioning and how users are reacting to travel conditions and operational strategies in real-time. This information will support real-time operations strategies, balancing system demand across transportation networks and modes, as well as better inform long-range system management strategies and planning based on heightened understanding of aggregate travel behaviors.

Potential measures of success:

- Measurable network performance improvements enabled through richer data for analysis, including freeways, arterials, and transit networks
- Successful integration of new data types into real-time operational strategies and agency operational decision making

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- Improved mobility as a result of maximizing capacity and balancing demand across regional networks

Goal #3: A more robust traveler information suite of capabilities will be enabled through a rich and multisource data environment that leverages public sector system and operations data, and transportation network operations and user data from privately operated systems.

EnableATIS will foster standard data formats to broadly enable sharing and utilization of multi-source data, and will encourage participation from public and private traveler information stakeholders. Through EnableATIS, partnerships will be forged and sustained which will actively contribute to a successful data sharing environment that enables richer traveler information applications. Partners recognize that this environment and ongoing dialogue results in: better transportation system performance; a dynamic, sustaining and successful market environment; and continued innovation to meet user expectations.

Potential measures of success:

- Successful, sustaining and expanding data sharing relationships, leveraging connected vehicle research and initiatives
- Successful partnerships among public partners, public/private and private/private
- Measurable growth in the traveler information market as a result of widespread implementation, continued user satisfaction, and a resilient and dynamic market to innovate to keep pace with consumer preferences and demand

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Chapter 5 Operational Scenarios

The following EnableATIS scenarios are not the traditional user scenarios one would find in a concept of operations or even in most traditional operational concepts. The ATIS environment is one with a multitude of players, both public and private. This operational concept is not intended to define a single system; it is intended to define an approach to an evolving marketplace of products and services and to define the "enabling" component of EnableATIS. There will be many influences on the traveler information marketplace, some of which are difficult to predict. Although these operational scenarios address some of the application innovation (and potential for such), the primary focus is on how new data sources will enable a richer and more diverse traveler information market and services.

The time horizon for this EnableATIS operational concept is 5-10 years. This time horizon would allow enough time for a reasonable level of influence from the marketplace while not forecasting too far out into the future, which is a risk given the rapid pace of technology evolution.

There is a range of different approaches that can be taken for EnableATIS to realize the vision put forth in this document. This Operational Concept presents two operational scenarios that illustrate the diversity of service evolution within EnableATIS program area:

- The first represents a laissez-faire approach, which will be an incremental build out over time, assuming an increasing (but not ubiquitous) level of data and data aggregation, and continued innovation in delivery mechanisms. There is minimal concerted effort by USDOT to influence the market; rather this first scenario illustrates how traveler information services and partnership would potentially evolve given advances that are happening in today's environment. There are key gaps in this scenario that are preventing EnableATIS from achieving the vision.

- The second scenario for EnableATIS is a future robust, multimodal integrated traveler information environment, where there is active leadership in certain roles by both public and private stakeholders. This scenario assumes a comprehensive, multisource and multimodal data environment from which to enable a multitude of traveler information services. This scenario represents a desired end state, with active participation by all members of the ATIS community toward achieving common objectives.

These scenarios are not necessarily mutually exclusive. Either one could be adopted in whole or in part. Likewise, the first scenario could be viewed as a near-term approach since it is not dependent upon any new programs or policies by USDOT. The second scenario, on the other hand, will require more coalition building and planning and it may not be fully realizable until several elements of the federal connected vehicle program have been implemented.

5.1 Guiding Principles for Operational Scenarios

The scenarios are not intended to prescribe specific applications or technologies, but they do address some functional elements at a high level. These scenarios describe an environment in which the boundaries are unclear and the stakeholders will evolve over time; this is very different from

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developing an operational concept for a single system to be developed. The emphasis is on potential capabilities of traveler information services in a connected vehicle, mobile data, and multimodal data environment, and how those services will be enabled. This new environment is transformative in where transportation data comes from, which stakeholders manage the data, how data and information is shared or used by a variety of end users, the type and resolution of data available, and how it is disseminated. Usability of the information generated within a connected vehicle and EnableATIS environment represents a significant transformative aspect.

Within the operational scenarios presented in this section, the USDOT and state and local transportation agencies would not seek to duplicate services offered by the private sector. Rather, they would utilize new data coming from private sector sources to augment or replace current data collection technologies, while continuing to fund existing programs through their current lifecycles. Agencies will likely continue to support systems for traveler information programs, as traveler information will remain an important part of agency system operations. Even with continued innovation and expansion of the private sector traveler information capabilities, agencies are envisioned to remain engaged in providing some level of information to travelers, particularly in rural areas where market forces or presence may lag behind. A basic level of information that is accessible to all Americans would still be provided, such as on dynamic message signs and websites or through other alerts. The public sector is still identified as being the primary source of incident data, work zone data, planned special event data, and perhaps road weather data. From a multimodal perspective, transit agencies would still have responsibility for real-time operations data, and parking data would include a mix of public and private sources.

Table 2 identifies anticipated data that will support EnableATIS, including public and private sources. Where applicable, new data types available through connected vehicles, mobile sources and future applications is noted with an asterisk.

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Table 2 – Multi-Source Data Types

Multi-Source Data			
	Public Data	**Public & Private Data**	**Private Data**
Vehicle Data		• Toll tag data	• Connected vehicle data (speed, braking, windshield wiper, headlight, temperature, and traction)**
Infrastructure Data	• Environmental road conditions • Bridge monitoring data • Maintenance & repair data	• Weather conditions / forecasts**	• Crowd-sourced social media data (i.e. equipment malfunctions)
Traffic Operations Data	• Construction Data • Transportation video feeds • Speed, volume & occupancy data • Incident data • CLARUS Environmental Sensor Station data	• Special event data	• Probe-based speed data • Mobile-source data/traveler opted in data** • Crowd sourced social media data
Parking Data		• Parking facility utilization data • Parking availability data • Parking location data • Parking rate information	• Crowd sourced social media data
Transit Operations Data	• Vehicle diagnostic data • Situational awareness data (silent alarms & CCTV monitoring) • Vehicle headways • Passenger boarding & alighting counts • Automatic Vehicle Location (AVL) data • Security wait times	• Transit vehicle location data and next transit vehicle arrival times • General Transit Feed Specification (GTFS)	• Carpool and Vanpool data • Crowd sourced social media data • Airline data (location & arrival/departure schedules)
CVO Data	• Vehicle registration data • Weigh in motion data	• Freight operations data/records (private & DMV records) • Vehicle location & speed data	• Historical manifest data
Transportation Demand Management Data	• Origin/Destination data • Ramp meter monitoring data	• Carpool / vanpool data • Telework availability/location • High Occupancy Toll (HOT) lane data (utilization & toll rates) • Bike sharing locations and availability	• Origin/Destination data (mobile source based)**
**Indicates data type enabled through new sources			

*Note: The entire table is labeled along the left side as **Multi-Modal Data**.*

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5.2 Laissez-Faire Scenario – EnableATIS in a Non-Integrated Traveler Information Data Environment

This operational scenario is an incremental evolution of current ATIS programs and strategies, factoring in some level of enhanced data through evolving mobile and connected vehicle advances, and assuming continued leadership from the private sector in data aggregation and dissemination through mobile and in-vehicle applications. This scenario further assumes that there will be a continued role for the public sector in traveler information, although these publicly-operated systems will benefit from an enhanced data environment that continues to build out over time.

EnableATIS anticipates new sources of data. Although in-vehicle technologies have been in existence for many years (e.g., On-Star by General Motors), the explosive growth in mobile computing is leading more and more vehicle manufacturers, navigation system providers and others, to create a new generation of in-vehicle technologies that provide increasingly sophisticated location-based services. Many are providing accompanying smartphone applications for connectivity to the "cloud." In this scenario, the harvesting of this connected vehicle data will be more the domain of the private sector companies that will innovate and create new traveler information products and services. In addition to in-vehicle data, there will be increasing amounts of crowd sourced data, where travelers themselves are sources of data, obtained from their mobile devices. This would include location and potentially context information about travel patterns. Under this scenario, USDOT is content to let the private sector innovate and lead into new products and services while encouraging and facilitating the public sector to be consumers of those products and services rather than seeking to drive the market.

5.2.1 Traveler Information in This Scenario

While public sector traveler information programs will evolve incrementally under this scenario, new sources of data from the vehicle and from users (e.g., mobile applications, social media) are emerging. To date, such mobile-source data is collected from variety of sources, including individual mobile devices as well as in-vehicle devices on fleet, transit, and passenger vehicles. Firms that sell traffic speed data to DOTs, navigation system providers, among others, gather data from vehicle fleets and other places where a single agreement or contract can yield as much data as possible.

What is driving this new market is not only traveler information but other location based services (e.g., gas price information, movie show times, restaurant reviews, etc.) which need consumers to willingly disclose their current location to obtain the most relevant information. There are already several free applications that provide a basic level of navigation and traveler information; others have a one-time fee, and others are subscription based. There are several existing applications available for transit information which includes static (schedules and routes) as well as real-time, many developed by private entities although several have been implemented by transit agencies. The private sector is making use of available public sector data and developing tools targeted to the end user.

A graphical schematic of this scenario is shown in Figure 5.
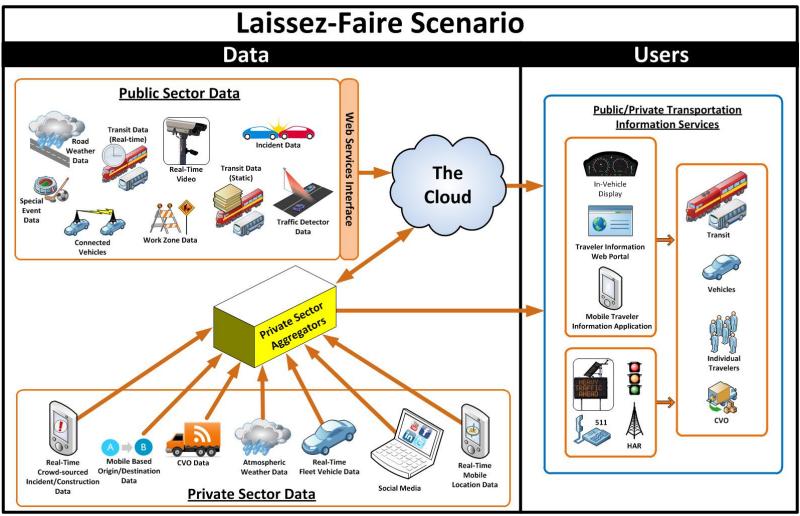
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Figure 5 – EnableATIS in a Laissez-Faire Approach

5.2.2 Needs and Activities to Support This Scenario

In this scenario, USDOT leverages private sector innovation but does not remain passive as there is still an important public sector role for traveler information. In the stakeholder involvement done as part of this project, it was clear that leaving traveler information entirely to the private sector would be an abdication of a social and fiduciary duty. Transportation agencies that own public roads are charged by taxpayers to effectively manage those roads. That includes a responsibility to collect and share real-time information on road conditions.

For this scenario to succeed there needs to be a widespread acceptance of private sector traveler information services as a complement to agencies' own efforts. There must be recognition that the private sector may be better suited to some functions than the public sector. As more instances of public/private partnering emerge for integral components of traveler information, there could be a benefit to some level of support or assistance (in the form of best practices) in risk management, qualified vendor pre-selection or other mechanisms to help states effectively partner with the private sector.

Agencies must make their data available in published data formats (incidents, construction, etc.), as compliant as possible with documented standards, so it may be incorporated into others' traveler information services. Currently, many agencies are willing to share their data through developer portals and other data sharing agreements. However, some agencies are reluctant to do so because of real or perceived concerns over their data quality.

With a multitude of players using their current position in the marketplace to introduce end-to-end products, different data formats will emerge. It is not feasible for government to regulate these data formats since they are likely to be integrated within a variety of products and services, of which traffic information is only a part. Furthermore, industry has demonstrated that it can quickly influence adoption of certain standards and formats (such as eXtensible Markup Language [XML] or transit data feed specification).

Until standards emerge, individual companies will likely control the data by seeking to expand their own footprint by distributing their own in-vehicle systems or mobile applications as widely as possible. Automakers and navigation system providers, for instance, are developing technologies that integrate with smartphones or their own back-end products. The more users each service can gather, the more data points it will have, which will make it more attractive to prospective users. While the marketplace is new and while different players are identifying their best roles, strategic partnerships may not readily emerge; these will be essential to achieving a broader sharing of available data.

This scenario will require some level of dialogue among the ATIS community to address issues with emerging data and provide a mechanism to support more widespread partnering.

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5.2.3 Transformative Aspects of This Scenario

Crowd source data has the potential to create transformative applications. Because this scenario represents largely more of what is currently being done today, there are very few "transformative" elements. That being said, current trends point toward things that could one day transform traveler information services. Crowd source data is already being used for these purposes but its growth would greatly improve the coverage and quality of information available. Further, because it is not necessarily tethered to the roadside or the vehicle, it will be useful for modes besides personal automobile trips. And, this vast new supply of data will not require costly roadside infrastructure. For example, clustered data points could signal a bus or train. On dedicated bicycle paths, bicycle congestion could be detected (an emerging problem in some urban areas).

Crowd source data also presents the possibility of true end-to-end trip information as well as customized travel information based on stated or revealed preferences.

Another transformative aspect would be the integration of connected vehicle data into agency operations. There is an opportunity to influence the availability of data coming out of new technologies, particularly connected vehicle technologies, and identify how that can be used to support not only traveler information, but also real-time traffic management, mode shift, incident response, and historical analysis.

Transformative traveler information services will be multi-modal. To date, there are limited examples of truly integrated multimodal transportation data at the regional level. A focused and successful effort to bring together surface transportation conditions on the freeways, arterials, highways, and public transportation systems, and to have that data available for agencies to use in real-time to balance demand across modes would be considered transformative. Current data silos and limited data sharing across modes to support real-time system management over multiple networks are a limitation of existing barriers to data sharing and lack of experience using multi-agency data in real-time to manage an overall transportation network.

5.2.4 Assumptions

The USDOT and State DOTs will continue to invest in ATIS programs and services for years to come. This was a clear outcome of the stakeholder feedback and involvement of this effort. Such a critical public service cannot be totally left to the private sector. While there are definitely key roles and opportunities for private sector involvement, and in some cases private sector leadership, ATIS is a key component of the management of public roads and highways, transit and other modes that the public sector will continue to have an important stake in the quality of ATIS services as they relate to publicly-operated infrastructure. Many states and regions have made significant investments in traveler information infrastructure, 511 systems and customer service call centers. Some may maintain current practice, others will seek to expand and innovate their traveler information capabilities, and others may seek to augment their services with tools and capabilities from the private sector.

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The private sector marketplace will evolve, but the USDOT will not seek to define the direction in which innovation should occur. The marketplace could evolve in any number of ways and his highly dependent upon consumer demand for products and services that do not yet exist. History has shown, however, that people are not willing to pay a great deal of money for traveler information, regardless of its quality. This is partially a function of historically poor information quality and partially a function of the inability to obtain it when it is needed while en route. Whether this can be overcome with better data quality and the ability to deliver the information via mobile sources remains to be seen. With several applications already in the market, some free and some for a small one-time or recurring fee, trends will emerge about what consumers are willing to pay.

Crowd source data will become the fastest growing source of traveler information. Current sources of information, many of which are locked away behind agency firewalls in disparate and sometimes proprietary data formats, are inaccessible on a large scale. Breaking down these silos is an intractable problem and the way forward is to look to emerging fast-growing sources of data for future traveler information services.

5.2.5 Risks

As with any strategy there are risks of undesirable outcomes. This section identifies some risks with this laissez-faire scenario.

- **Data silos and a fragmented marketplace.** It is a natural tendency for data silos to develop as different groups pursue their own ends in the most optimal way. It takes an agent with a will to standardize, harmonize or otherwise unite different efforts into a mutually beneficial situation. Without that, the current situation could be replicated where different groups have different data that is not or cannot be shared in a unified way. Without USDOT intervention in the marketplace, this could happen.

- **Fragmented, closed data formats.** Without an agent to promote open data formats, with sufficient clout to affect the industry, different groups collecting mobile source data may not be able to share their data even if they wanted to. The effort to reconcile large data sets in different formats could be a challenge and a barrier to doing so. This is a risk to multimodal, multi-source data.

- **Closed systems with no access by public agencies.** If the USDOT, states and localities rely on private firms to collect, aggregate and provide data because they can do it more efficiently and because they have more access to the customer from which crowd source data is derived, there is a risk that they could be closed out of the data they need for operations and analysis. An example from the present day is Google, which provides rich traveler information services, but which is not forthcoming about sharing their data with public agencies.

- **Private sector providers,** upon which public sector agencies can become dependent for a particular product or service, leave the industry. Similar to the previous point, private sector firms upon which public sector agencies rely for their data may shift their priorities toward more profitable or faster growing markets. There is a risk that they could leave the market, scale back the products and services they offer, or charge higher prices. The amount of lock-in risk an agency customer is subject to is largely dependent on the amount of competition in the market.

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In conclusion, this scenario leaves a lot to chance and market evolution. The USDOT is in a position to lead the industry toward desirable outcomes that represent the needs of industry stakeholders while not impeding innovation or impacting intellectual property. Particularly with the DMA program, there are a number of initiatives such as DCM that can support EnableATIS. For this reason, a second, alternative scenario is presented in the following section with a more active Federal role.

5.3 Robust Multimodal Integrated Traveler Information Data Environment Scenario

This scenario describes an ultimate end-state of a transformative EnableATIS environment with active leadership and investment by the public sector as well as an active private ATIS industry and supply chain. This future robust scenario is dependent on data from disparate sources being standardized and aggregated in some fashion, either through cloud-based strategies or some level of data federation to support virtual data exchanges. For regions that meet certain need thresholds (freeway, arterial, transit, parking), there may be an opportunity to establish a role as a facilitator for multi-modal data collection, transformation, archive, analysis and ultimately travel information providers and portals to the private sector. Outcomes from the USDOT DCM program will influence this data portal or clearinghouse strategy, as there are cost, data governance, scalability and data security issues that would need to be tested and resolved.

These concepts will be expanded upon in the sections to follow, but this scenario contrasts with the first in that USDOT takes an active role in helping to facilitate the aggregation of data to "enable" ATIS. The private sector would be a participant, but private firms would of course pursue their own business models, innovations and strategies in concert with EnableATIS or independently. Public sector agencies could participate to share data with neighboring jurisdictions. The greater the participation the more momentum will be established and the more successful it will ultimately be for all participants.

5.3.1 Traveler Information in This Scenario

EnableATIS will understand multimodalism, and be capable of providing integrated road, transit, parking information, as well as traveler options, in real-time as well as to support pre-trip planning. The full end state of this scenario may look at the private sector operating and delivering to the end-user a customized service according to the needs of the individual consumer. The data will be high quality and reliable, and will benefit from standard data formats that allow for multiple uses and integration opportunities across platforms. Different from the first laissez-faire scenario, this robust scenario will consider travelers' end-to-end trips, which may include decision points and information needs that are not necessarily related to the surface transportation conditions. Although this data may be outside of the traditional ATIS community, the EnableATIS environment may seek to expand its reach to incorporate other types of data, information or services that are beyond the typical traveler information data considerations.

The private sector will have an important leadership role in developing, marketing and implementing application-based traveler information and data collection systems for vehicles and for mobile devices. It is challenging to predict what these applications will look like in a 10-year horizon. The private sector continues to partner and seek out creative business models in the application environment, and there will be many different business models, partnerships and delivery/marketing strategies emerging with the mobile application marketplace.

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Agencies also will benefit from an enhanced and aggregated data resource, and will be able to integrate connected vehicle data into their system operations and management. Public agency traveler information systems are also likely to undergo an evolution with this scenario. Over the next 10 years, dynamic message signs are likely to remain a core part of urban area and rural area traveler alerts and travel time messages. From an arterial perspective, there is a growing trend of deployment of arterial dynamic message signs. With EnableATIS and an enhanced level of regional data, these signs will be able to be used for real time alerts and travel times, in addition to traditional planned event, work zone and other non-real time impact warnings.

A graphical schematic of this scenario is shown in Figure 6. This concept and schematic was developed based on the principles outlined in the Concept of Operations for the Research Data Exchange (Draft, August 2011). This assumes multiple data environments which could consist of multiple data sets (including real-time data feeds from various sources). This concept is still being further researched, developed and tested; it addresses an important need of providing access to multiple data management systems and data sources, but does not rely on physical aggregation and storage on individual servers. There are, however, important data exchange, governance and stewardship issues that will be explored through the DCM program that will directly impact future concepts for EnableATIS data environments.[12]

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[12] U.S. Department of Transportation, Research and Innovative Technology Administration, ITS Joint Program Office, "Research Data Exchange Concept of Operations," Draft, August 2011.

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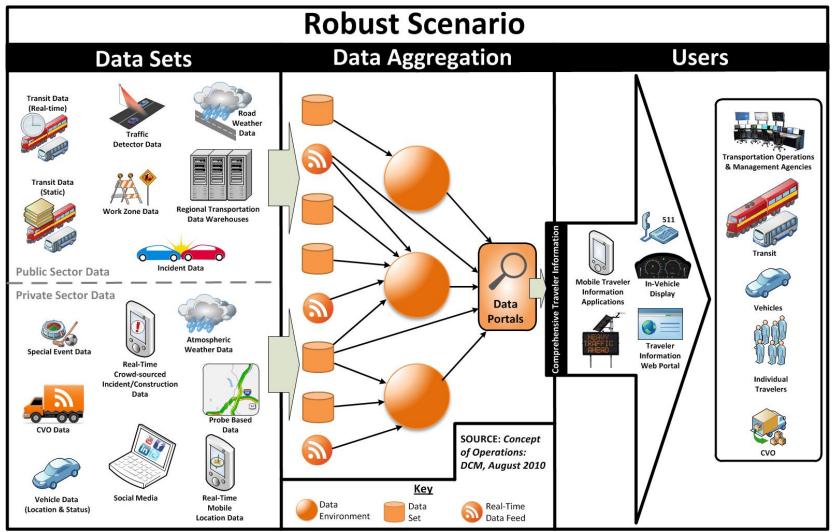
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Figure 6 – Robust Multimodal Integrated Traveler Information Data Environment

5.3.2 Needs and Activities to Support This Scenario

Data governance is a critical need. The virtual data sharing in this scenario will require a governance structure, which would need to be defined by stakeholders. This defined governance may take the form of regional boundaries, state or grouping of state boundaries or corridor boundaries. Governance may be different and lead stakeholders may be different depending on the leadership and stakeholder participation and sponsorship. They may be led by DOTs, Metropolitan Planning Organizations, transit operators, corridor or multi-state coalitions, and/or universities, although others may emerge, possibly even led by the private sector in partnership with the public sector stakeholders. There is an important role in defining the requirements for virtual data aggregation and sharing, and in particular what the requirements are for connected vehicle data to support next-generation traveler information services.

EnableATIS must leverage DCM program initiatives. In addition to currently available data, this operational scenario will leverage the USDOT DCM Program, which will facilitate obtaining data from vehicles, mobile devices, and roadside infrastructure, and will be validating that data which can then be used to support myriad operational functions, including traveler information. To effectively support an EnableATIS environment, it will be essential that the DCM has matured to a level that will be able to facilitate and support dissemination of real-time information to support applications developers, transportation management agencies and other key stakeholders in the traveler information arena. Traveler information is one component of the DCM and DMA programs, so these efforts by USDOT are aimed at multiple objectives. The DCM program is currently working toward demonstrating the viability of data management and establishing protocols for how data will be transferred from vehicles and mobile devices through a mechanism that can support multiple uses. Furthermore, the DCM program is also testing and evaluating data-related policies and models for how data can be potentially shared among various entities.

Standard data formats must emerge. There are an incredible number of data formats in use today by agencies and third parties. Even with the standardization activities, there is significant potential for establishing standard data formats that will allow multiple uses by multiple interests The ability to utilize a standard data format to support multiple agency needs, for real-time network operations as well as to support regional modeling, planning, routing algorithm development and other functions is a need that would enable the potentially transformative application of this data. This is not to say that a single standard must prevail, but rather that the array of existing data formats must consolidate marketplace must determine winners. There needs to be acknowledgement that data format standards will likely be addressed by multiple partners in the ATIS community, and may not necessarily require the public sector to take the lead.

This scenario is dependent on a rich set of data and available to both the public and the private sectors. To maintain a competitive marketplace requires preserving some level of commercial value to data. There needs to be a mechanism that will incentivize the private sector (i.e., auto manufacturers, mobile device providers, and others) to provide data critical to transportation network operations and management while still providing these private partners the ability to generate revenue through innovative applications. The private sector will have access to real-time and near-real time road and network conditions through mobile devices and connected vehicles well beyond what the public sector will be able to capture. While data, in and of itself, might have limited monetary value, it is the aggregation of data into usable applications, and transforming that data into integrated capabilities within the vehicle and mobile platform where the private sector will be able to realize a profitable commodity.

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5.3.3 Transformative Aspects of This Scenario

More virtual sharing data within a region and at a national level would create fewer points of entry for data consumers, such as application developers or redistributors. This would reduce friction and facilitate multi-modal, inter-jurisdictional traveler information services. These steps would enable transformative applications to be developed and facilitate data analyses from disparate data.

Data from connected vehicles will provide an unprecedented level of information about road and travel conditions, including data sent directly from the vehicle about current operating parameters, such as speed, braking frequency, on-board vehicle activities (windshield wiper activity, headlight activity), and information about external conditions such as pavement temperature and traction, atmospheric temperatures, among others. Mobile-source data from users can potentially be providing important insights in to how users actually use the network, shift modes, request and use alternate routes or transit operations.

The possibility of rich origin-destination data would transform traveler information by enabling predictive information based on past data, preferences and trends. This O-D data also can provide context to travel conditions and traveler behavior, and can be further enhanced through detailed analysis of mode shift and effectiveness of transportation strategies. Origin-destination data also facilitates total trip context, which is valuable for real-time and research purposes; there is value to this information for both the public and the private sectors. Furthermore, it would enable richer transportation network management (including demand management), and system analysis. This data would be a rich source of information about which traveler information options and information types are most frequently used (or not used), what information is most in demand, and it can also provide a threshold for frequency of usage.

5.3.4 Assumptions

This robust scenario assumes several factors:

Continued growth in the mobile marketplace, providing sources of data as well as mechanisms for disseminating information. Much of the connected vehicle and mobile strategies are assuming a consistent increase and growth in mobile device market penetration as well as in increasing levels of sophisticated applications. Granted, with the recent explosion of applications and mobile-enabled capabilities, within 10 years' time there could well be an even more ubiquitous device. An important risk, however, is the timeframe for a sufficient market penetration of connected vehicle data. Mobile devices are abundant, however the lifespan of typical light-duty vehicles and trucks is long (approximately 12 years on average. Vehicle fleet turnover rate for light-duty (passenger) vehicles is approximately 13 years, so it is feasible that within a 10-year timeframe there may not be a sizeable majority of vehicles equipped with this technology. A recent AASHTO report on Connected Vehicle Deployment Analysis estimated that pending the 2013 decision by the National Highway Traffic Safety Administration for DSRC, the first full fleet roll-out with on-board connected vehicle capabilities would occur in 2019 for the 2020 model year.[13] Furthermore, there are characteristics

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[13] U.S. Department of Transportation, Research and Innovative Technology Administration, ITS Joint Program Office, "AASHTO Connected Vehicle Infrastructure Deployment Analysis," FHWA-JPO-11-090, June 2011.

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within the automotive market that may make it difficult to accelerate the pace of adoption across all new models.

In the mobile and connected vehicle environment, data is envisioned to be abundant. However it is the aggregation and integration of data into usable applications, and transforming that data into integrated capabilities within the vehicle and mobile platform where the private sector will be able to realize a profitable commodity beyond the data itself.

Mutually-beneficial data sharing agreements to share mobile-source data, including connected vehicle data, to support traveler information and system wide operations and management. There will be a wealth of important data available through mobile devices and connected vehicles, including critical O-D data. There needs to be a focused effort to be able to extract and use that data to support the next generation of traveler information services; ones that can truly be predictive and intuitive based on users' travel patterns. Overcoming the traditional unwillingness on the part of the private sector to share certain types of data will need to be a primary initiative, either through incentives or a federal mandate for specific data types that will support not only traveler information but important system operations and management. Furthermore, there needs to be guidance and support to help the public sector integrate private sector data into their operations, which includes procurement guidance, perhaps prequalification of vendors that meet specific criteria, and strategies for how to incorporate new types of data into public agency traffic management systems and processes.

USDOT's continued interest and support in advancing traveler information strategies. USDOT has been an important leader in advancing nationwide strategies such as 511, supporting data standards to improve consistency, and integrating traveler information as a key component in its mobility program investments. The role and focus for USDOT may change, and should be one that leverages its national perspective and national influence, particularly in an industry like traveler information that is dependent on a rich network of partners.

There will be a continued focus on improving freight efficiency, which can be supported by innovative traveler information approaches. The EnableATIS environment will be closely coordinated with the FRATIS effort that is developing specific applications to support improved freight information. Freight is integral to the nation's economy, and informing freight of impacts, delays or long-term closures is an important strategy in keeping freight moving.

There will be a national dialogue and coalition that represents the ATIS community. Traveler information, and EnableATIS, recognizes that there is a wide range of stakeholders and partners that will be required to achieve the desired objectives. An essential component to this will be a forum that brings together representatives from the public sector, the private technology community, equipment manufacturers and the automobile industry, and the research community. Groups such as the ITS Information Forum and 511 Coalition were successful in bringing these partners together, and an important factor to that success was strong leadership and involvement by national organizations.

The private sector will continue to innovate. Applications are being generated within the private sector supply chain at the speed of mobile computing, and the private sector will continue to seek out innovative strategies for providing unique services that consumers are willing to support with their dollars. Applications of convenience will transition into applications of necessity for traveler information, and the private industry partners will continue to foster relationships within the supply chain to meet (and generate) consumer demand.

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5.3.5 Risks

Risks under this robust scenario include:

- **Data Environment –** There is an extensive set of data that is currently collected, which may not be reported or used by the private or public sectors in a consistent manner. When additional data is introduced by a robust connected vehicle platform, the full set of data available for use may become overwhelming and rendered unusable if it is not organized and provisioned to support both public and private sector purposes. Standard data formats are a key technical challenge in establishing regional data warehouses or portals. The DCM program and virtual portals being tested will seek to work through these data capture, sharing and governance issue.

- **Business Models –** Transition of traditional business models will be challenging for the public sector which has established policies and laws for the particular state or local agency. Not only will new business models be introduced to support a more data-intense environment, there will need to be some introduction to some public sector agencies of business models that are not yet being utilized that have proven to be effective in areas throughout the country.

- **Low level of participation -** A key risk is that participation will not reach the levels needed to reach a critical mass and create the central point of coordination that is needed to reach the vision. Participation is the crucial factor that will ultimately determine success, and there may be little that USDOT can do to force participation, particularly by private sector participants. This risk can be addressed, at least in part, by focusing on establishing a coalition or forum of the ATIS community to work through issues that might otherwise impact participation of key partners.

- **Competitive Commercial Marketplace –** The marketplace will grow quickly and many different players will develop their own applications, data formats, data stores, etc. Similar to the first laissez-faire scenario, there is a risk of these siloing into competing and proprietary systems that do not or cannot interact. The multitudes of different silos that exist today make it difficult to integrate them all into a single view of the transportation system that crosses modal and jurisdictional boundaries. These silos are not envisioned to be easily overcome in the 10-year horizon without government intervention and demonstrated benefit.

- **Roles and Role Shift –** The traditional roles for the public and private sectors have been developed through the introduction of newer technologies and applications to support traveler information. Non-traditional roles will need to be introduced to facilitate a more transformative environment for how traveler information is collected, aggregated, transmitted, shared and received. Role shift may also impact agencies beyond transportation operations, and may require modifications to business and procurement processes to facilitate new partnerships.

- **User Acceptance –** All efforts to establish comprehensive and effective traveler information is for the benefit of the user. However, the user plays an equally important role in allowing innovation to use their travel route, behavior, and response to road conditions to support a robust platform. This requires, in some cases, that the user accept that anonymous subset of location and conditions

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information from technology such as smart phones, vehicles, or transit usage may be necessary to achieve truly transformative, predictive, and intuitive services in the future.

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Chapter 6 Roles for EnableATIS

The operational scenarios presented in the previous section have identified several transformative aspects, activities, as well as risks that will need to be addressed through EnableATIS. There are some fundamental roles that will need to be undertaken by various stakeholders in the ATIS community, including USDOT. This section captures those roles as well as what ATIS stakeholders would be best suited to leading or participating.

One of the key objectives of this Operational Concept is to help identify the federal role in EnableATIS going forward. Recognizing that the USDOT is not in the business of developing specific applications or operating systems, traditional roles for USDOT typically focus on establishing national-level guidance, conducting and reporting on evaluation outcomes, and serving as a facilitator in establishing consistent program practices or requirements. For EnableATIS, the USDOT is in a unique position among all of the potential stakeholders to effectively leverage the programs and focus areas within the DMA and DCM programs, and utilize its national perspective in being able to assess effectiveness of specific implementations for potential best practices and guidance.

There will continue to be a role for public agencies in an EnableATIS environment. It is not envisioned, at least within the 10-year horizon identified in this Operational Concept, that public sector's role for traveler information will diminish. With much of the application and mobile-source data collection focus on urban, multimodal and congested areas, there will always be geographic segments of the country that may be underserved by privately operated ATIS. The public sector has a responsibility to provide some basic level of information to ensure that travelers in these areas, or travelers that do not have mobile applications, have access to road conditions and trip planning capabilities.

The private sector will have a key role in developing, implementing and marketing their applications for traveler information, consistent with current business models today. The private ATIS providers are envisioned to continue to push the envelope with innovative applications and foster partnerships within the ATIS supply chain to provide enhanced and bundled content options, some of which may or may not be solely focused on traveler information.

Private sector and third party applications provide a direct link to the consumer/end-user, and it is the private sector who will have access to important user-generated data, such as locations, a wealth of O-D information and details about travel patterns, usage activity and consumer acceptance/reliance on the information they are provided. On the one hand, making data available to the private sector is a critical component to ensuring that they have the data available from public agencies to be able to integrate within their application platforms, transform that data (as well as their own or other privately collected data) into usable information, and transmit that data to users. With the reliance on mobile-source data as a key data component in an EnableATIS environment, there needs to be a dialogue among national ATIS providers about how to be able to share and maximize mobile-source data that could be critical to agency transportation operations, network mobility and safety.

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Roles for EnableATIS have been grouped into the following areas:

- Facilitate Vision and Coalition Building
- Lead and Support for Public Private Partnering
- Sponsor Fundamental Research and Research Initiatives
- Innovate and Implement Technology
- Operate and Manage Systems

Table 3 – EnableATIS Roles

Needed Activities	Roles and Considerations
Facilitate Vision and Coalition Building	
Cast a national vision for EnableATIS at a programmatic level Ongoing coalition-building and outreach to support a national dialogue to address policy and partnering to support next-generation traveler information activities and partnerships	The USDOT is uniquely suited to spearhead and facilitate the formation of a coalition or forum that will bring the ATIS community together into a national dialogue to advance EnableATIS. Agencies, the private sector, national organizations (such as ITS America and industry groups from wireless, mobile and other ATIS technology sectors), and the research community will have a role in actively participating in this forum.
Lead and Support for Public Private Partnering	
Foster a framework at the national level for beneficial public/private partnerships to support data exchange and traveler information service delivery. Facilitate the development of guidance and best practices for system operations and information delivery in an EnableATIS environment	The federal government will have a key role in providing guidance and leadership for continued public/private partnering for EnableATIS. Public agencies will have a role in seeking out and championing partnerships at the regional level, and integrating new data sources into their operations. Private sector stakeholders with a national footprint will have a key role in large-scale roll out of next generation applications, and these stakeholders should be part of the dialogue in terms of data format standards, performance metrics, and public/private partnering strategies
Sponsor Fundamental Research and Research Initiatives	
Establish a national research agenda and national resource for evaluations of enhanced traveler information services. Establish national and comprehensive statistics on regional traveler information activities, usage, and lessons learned.	The USDOT, in partnership with national research entities (such as the Transportation Research Board) can influence and elevate the ATIS research needs within the community. As part of the national dialogue, USDOT and ATIS community stakeholders can identify and prioritize research needs.

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	Agencies and the private sector would be active participants in research and evaluations, and would support alignment of ATIS research with other program areas including system operations, safety, and human factors.
Innovate and Implement Technology	
Develop products and services that will be sustaining through ongoing and widespread user acceptance. This includes active market research to determine what customers want, how to acquire and retain customers, what business models and partnerships will succeed. Foster a cooperative environment within the ATIS supply chain to leverage trends and advances across multiple technology platforms and considerations (applications, wireless communications, devices, in-vehicle systems)	The private sector will continue to have a role as a direct connection to the end user in the form of applications to support daily decisions about travel, and will continue to use information generated by users to enhance and improve the available offerings in the commercial marketplace. There is a role for the USDOT and agencies to serve as stewards of equality, and ensure that markets or areas not served by the private sector have access to some level of traveler information
Operate and Manage Systems	
Enhance current system operations with new forms of data and new services made available through EnableATIS. Integrate new forms of real-time information into system and network operations, and actively partner with other agencies to use this information to balance network demand and maximize capacity of the transportation system	The public sector will continue its role in operating roads, freeways, and transit systems, and will be looked to for leadership for establishing regional data sharing strategies among public and private partners. Agencies will have a role modifying operational strategies to incorporate new data sources and operate transportation networks at an optimum level of efficiency and in response to real-time conditions and demand. There is a role for USDOT to ensure the public good of all of private sector collected data is preserved and useful to public agencies seeking to better manage and operate their transportation networks and systems.

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Chapter 7 Next Steps

EnableATIS, at the Operational Concept stage, is helping to first establish roles and priorities relative to moving forward with considerations for the next generation of traveler information in a connected vehicle environment. There are several activities over the next few years that will influence the direction of EnableATIS, most notably the Data Capture and Management program. EnableATIS will ultimately rely on a strategy of collecting and managing data, initially through regional data collection strategies then migrating to a more virtual data portal concept. These concepts are being tested as part of the DCM program, and if feasible, could provide a platform, or at the very least a blueprint, for a similar concept for traveler information data. If it does indeed become a platform, there will be a myriad of uses for that data, including access by (and to) traveler information providers.

The scenarios presented represent an incremental evolution (laissez-faire) as well as a more focused effort to achieve a desired end state in the second scenario. Ideally, the second scenario would represent an EnableATIS framework that leverages anticipated technology innovations, the strengths of the partners, and aligns with ongoing USDOT initiatives with the DCM and DMA program areas. The second scenario represents a five to ten year horizon with USDOT leadership.

Steps to achieve the vision for EnableATIS and the desired end state of a robust, multimodal, multi-source traveler information environment, as described in the Operational Scenarios, will require incremental activities on the part of USDOT and the ATIS community. Next steps in terms of key activities include:

Near-Term Activities (one to three years):

- Align scenarios with timing of the DCM portal testing activities to determine initial feasibility of portal concepts to support EnableATIS data sharing objectives.

- USDOT to take the lead with establishing a stakeholder group or forum that can begin a national dialogue among the ATIS community. This could include members of the 511 Coalition (both public and private), ITS America, and representatives from the application development community, who may have not been a part of previous ATIS discussions. This should be a group who is willing to serve in a longer-term role (at least the next five years) and provide critical inputs to the future direction of the EnableATIS strategies.

- Identify EnableATIS high-level requirements for the data capture strategy, or verify that established requirements will meet needs of EnableATIS (access, data types, etc.) Reach out to the stakeholder community with the two scenarios for feedback.

- Establish a research agenda for the next five years that will address high priority needs such as human factors, safety and EnableATIS applications, or other priorities that emerge from the forum and ATIS community

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Longer Term Activities (three to five years):

- Define a pilot system based on scenario #2 that defines requirements for these aggregators. This pilot test could provide funding to support one to three data aggregators as part of an industry-wide proof of concept.

- Create a challenge grant for aggregators based on scenario #2 that rewards innovation within certain goals and objectives (as documented in this operational concept).

- Begin testing agency acceptance and operations with integrating connected vehicle or mobile source data within their operations. This would ideally be an established, mature ITS program in an urban area, with multimodal capabilities as part of the system operations. This would require a Concept of Operations, Implementation Plan, Pilot Test and Evaluation. USDOT could select areas of the country through a competitive grant process, or coordinate with the Pooled Fund Study to identify a potential location.

- Focused engagement with private sector data providers to assess what data formats would be most useful to the private sector for public sector data (e.g., incident, road work, planned special events).

- Focused engagement with public sector stakeholders on what vehicle data would be of most use for traveler information and in what formats, within the specific roles defined for public agencies: rural ATIS, DMS, websites. This could also be a research opportunity.

- Focused engagement with private sector stakeholders on what data they would be willing to share for public agency use, as well as develop mutually beneficial data sharing strategies (leveraging current contracted relationships as a starting point). This effort may need to bring in additional, non-traditional stakeholders from technology companies to work through legal, privacy and intellectual property issues.

- Engage the ATIS community in establishing strategic long term objectives and priorities utilizing outputs of the pilot tests, continued advancement of connected vehicle initiatives, and industry trends.

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Acronyms

AVL – Automatic Vehicle Location

CCTV – Closed Circuit Television Camera

DCM – Real-Time Data Capture and Management Program

DMA – Dynamic Mobility Applications Program

DMS – Dynamic Message Sign

EnableATIS – Enabling Advanced Traveler Information Systems

GPS – Global Positioning System

GTFS – General Transit Feed Specification

ITS – Intelligent Transportation System

O-D – Origin-Destination

SAFETEA-LU – Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users

SHRP2 – Strategic Highway Research Program Phase 2

USDOT – United States Department of Transportation

XML – eXtensible Markup Language

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Lexicon

Aggregators: Entities that are in the business of collecting, consolidating, and organizing data. Data can include incident data, work zone and construction project data, segment speed data, transit data, planned special event data, and road weather data.

Business model: A planned approach taken to achieve a desired return on an expense or investment. For a private sector for-profit entity, this is the plan to achieving a profit that will sustain or grow the business. For the public sector, it defines its role with respect to the private sector for the procurement or exchange of goods to meet goals of the agency; it also refers to public/public partnering approaches for the delivery of a service. For traveler information, business models may provide the basis for agreements or contract mechanisms.

Connected vehicle: Refers to growth in mobile-source data from smartphone or in-vehicle devices and is used in this document as an important source of data that is expected to expand exponentially in years to come. Connected vehicles represents a broad program of data acquisition from public and private sector entities, applying that data to safety, mobility and environmental programs, and researching potential safety, mobility, human factors, policy, and system operations strategies incorporating multi-source data from mobile and vehicular sources.

Data Capture and Management (DCM): Effort to standardize and streamline data formats to support aggregation of multi-source information into comprehensive regional and traveler specific uses.

Dynamic Mobility Applications (DMA): USDOT Program Focus Area which identifies bundles of regional information applications applying to freight, transit, weather, traffic, safety, and other types of data capture opportunities. Mobility applications focus on real-time uses of data to support system operations and traveler decision making.

Geographically relevant: Focused on the users' location information for which they are most interested in receiving traveler information. This may be based on current location of the user (situational awareness) or the pre-subscribed location/route that user is interested in knowing more real-time information about.

Integrated data: Multiple sources of data that have identified relationships with one another to support a specific and separate purpose. For example, weather data related to in-vehicle metrics can help to define the safety of road conditions.

Meta-data: Information about the data itself: how it was collected, when, by whom, to what tolerance, among other parameters. This helps in defining the quality and potential aggregation of the data.

Mobile communications: Mobile wireless devices are capable of not only receiving information, but transmitting information, either for specific user requests, or information about a user's location. This could include mobile phones, automated vehicle location devices, integrated vehicle-based information systems, or other mobile tracking tool/device that can be used for collecting information.

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Multimodal: Refers to the various modes of travel for people or goods (car, bus, rail, freight) and is used in this document as a comprehensive term for the types of information that could be provided through traveler information services.

Multi-source data: Refers to the multiple sources of data that could support the traveler information environment that are important to consider when integrating that data and creating relationships where they may or may not have existed before.

Origin-Destination Data: Data that identifies a specific link (start and end point of a trip) on the network. Origin-Destination is a key concept for EnableATIS in that it captures not only start and end points, but has the potential to capture user behavior on the link, mode shift, user route decisions during the trip, and total trip dynamics. This type of data supports predictive applications and information, as well as supports agency operations and planning.

Operational Concept: This is a planning-level document that represents a more suitable level to focus given the diverse activities within EnableATIS and the decisions that are yet to be made relative to roles and responsibilities of this rapidly emerging environment. EnableATIS is not defined well enough at this stage for a detailed Concept of Operations.

Private Sector: This term is used to represent a broad range of stakeholders within traveler information. In some instances the term private sector refers to technology developers and manufacturers (hardware, software, and vehicles), data collectors and aggregators, vendors, contractors, or consultants. There is a diverse supply chain within the private sector industry for traveler information, and there are many instances where partnerships among the supply chain are required to deliver a service.

Public Sector/Public Agencies: Local, regional, state, or federal agencies that are responsible for operating and managing road transportation systems as well as public transit systems. For many agencies, a key part of system operations and management includes some level of traveler information provision. The public sector also has a role for data collection through their systems (such as detectors, CCTV, road weather information systems) and operations. This data includes incidents, construction and maintenance (planned and current work zones), road weather conditions, emergency alerts, among others.

Real-time: Refers to the collection and aggregation of data to be able to support traveler information that is within a small timeframe of being accurate. True real-time (second-by-second) information is typically in the form of CCTV video where an ongoing up-to-the-second data set is actively managed. In the context of traveler information, "real-time" can refer to dynamic information or information that is regularly updated (within one to five minute intervals). In some cases, real-time information might not be updated quickly, but is technically still valid (such as an incident and its associated impacts).

Regional: Term used when defining the physical or logical scope/groupings of an application, system, service, or set of involved parties. Regional typically refers to the collection of multi-agency multimodal data within a physical region but could also refer to logical groupings that extend to multiple physical areas. For EnableATIS and traveler information, region can refer to a metropolitan area consisting of more than one operating agency and one or more transit providers; a state that includes several small and/or large urban areas; a major corridor that links two or more urban regions or traverses multiple states; or a multistate area that is focused on common corridors or travel patterns.

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Social media: This describes social media outlets such as Twitter and Facebook. Social media is used by individuals to share information and personal updates, but also has gained popularity among agencies as a means of disseminating real-time and non-real-time information.

Stakeholders: Those involved in the process for providing input toward the EnableATIS Operational Concept. Involves industry representatives, public agencies on the state and local levels, and federal agencies.

Transformative: In the context of EnableATIS, transformative refers to utilizing or providing information in a way that changes how agencies or users are able to make decisions on travel choices.

Traveler information services: Describes general services that could provide traveler information, such as 511 phone or website, mobile applications, dynamic displays (roadside DMS or in-vehicle displays), and media alerts. Traveler information services also include activities such as data collection and aggregation, which are essential to supporting user notification systems.

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