IOWA DOT

SMARTER | SIMPLER | CUSTOMER DRIVEN

TRAVELER INFORMATION SERVICE LAYER PLAN

TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS (TSMO)

REVISION HISTORY

This document will be periodically updated by Iowa DOT. The following table provides the date and a brief description of each revision to track revision history.

Revision Number	Date of Revision	Description of Revision
1.0	06/12/17	Initial version

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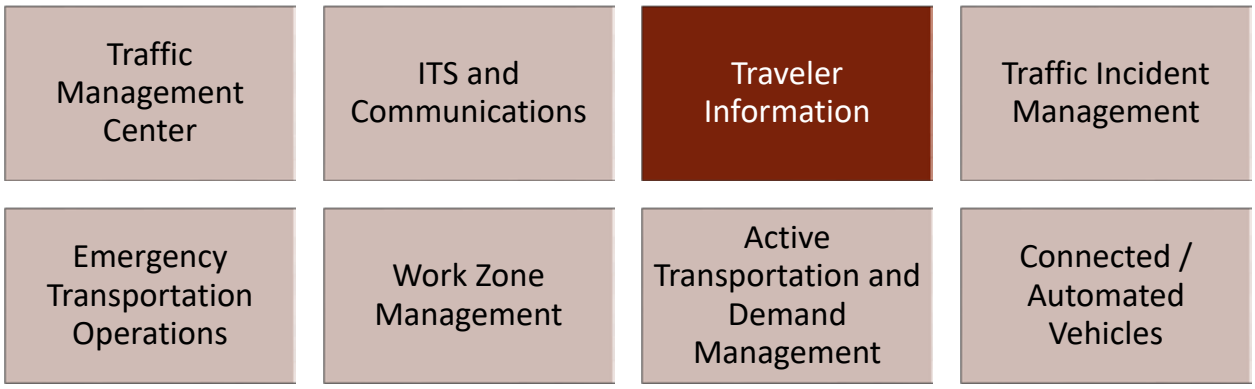
INTRODUCTION

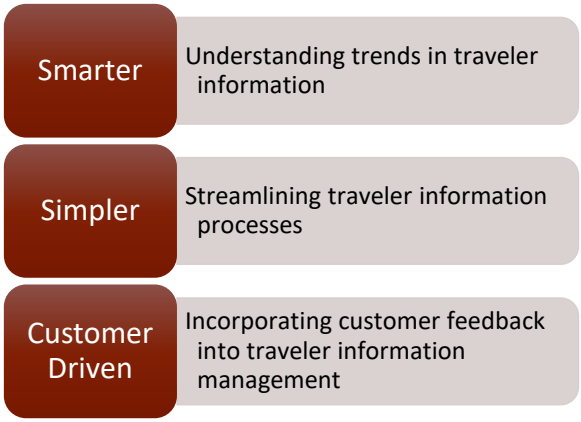
The 2014 Iowa DOT Strategic Plan defined a vision of ***Smarter, Simpler, Customer Driven***. The Iowa DOT Transportation System Management and Operations (TSMO) Strategic Plan, and accompanying Program Plan describe a TSMO-oriented approach towards managing and operating the transportation system in a way that will help achieve this vision. TSMO is an approach to optimize existing infrastructure through better integration, coordination, and a systematic implementation of key operational strategies. As stated in the TSMO Strategic Plan, *"Within Iowa DOT there are multiple disciplines, offices and regions with the responsibility and ability to deliver safe and reliable mobility at the statewide and regional level. TSMO does not replace any of the current responsibilities; instead, if offers resources and strategies to realize the full capacity of the existing transportation system, increase reliability, improve safety, and target safety and operational problem locations."* In Iowa, TSMO is organized into eight service layers, as illustrated in Figure 1.

Figure 1 Iowa DOT TSMO Service Layers



This document defines the Service Layer Plan for the Traveler Information Service Layer by describing challenges and opportunities, existing services and conditions, future direction, gaps and actions to bridge them, performance metrics, and estimated costs. Figure 2 summarizes how Traveler Information, as part of the overall TSMO approach, will help Iowa DOT continue working toward its vision to be smarter, simpler and customer driven.

Figure 2 Traveler Information Contributions to Iowa DOT Vision

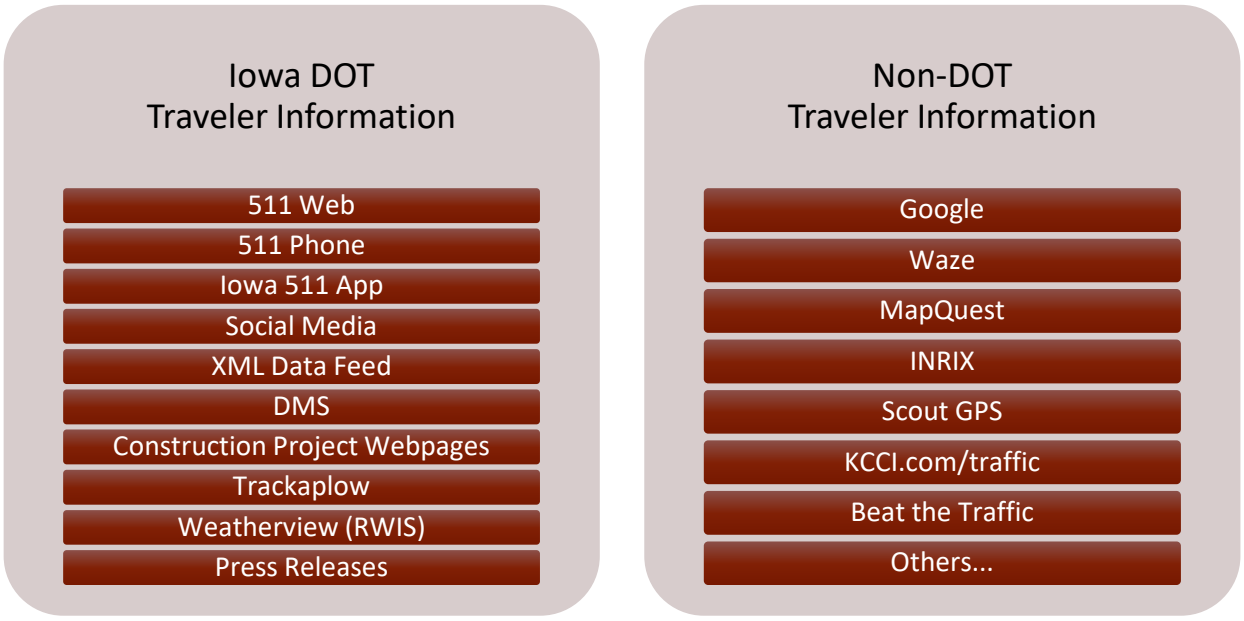


DEFINITION OF TRAVELER INFORMATION

Traveler information is the means by which transportation agencies gather and make available the data for traffic and travel conditions. Such means may involve agency-only activity (including cooperative activities engaging multiple other agencies), agency partnerships with commercial providers of value-added information products, or other effective means that enable an agency to report traffic and travel time conditions.[1] . Real-time traveler information is typically generated using data about traffic and travel conditions obtained from a variety of sources. Sources of data often include other systems (e.g. emergency management, traffic management, weather monitoring), as well as reports from staff and travelers. Information is synthesized and then disseminated to the traveling public and other transportation professionals via websites, telephone, social media, apps and other service providers.

Iowa DOT provides real-time traveler information with a variety of technology approaches to reach travelers both pre-trip and en-route. Other Iowa DOT offices also disseminate traveler information (e.g. construction project webpages, Trackaplow, Weatherview, press releases). Beyond Iowa DOT, there are other entities (public and private) that disseminate information to Iowa travelers. These information providers include news media offering television and radio reports, and a growing set of third-party providers who offer information through mobile devices and websites (e.g. Google, Waze, etc.). Figure 3 illustrates these three categories of traveler information in Iowa. Collectively, these are all considered Iowa Traveler Information. While this Traveler Information Service Layer Plan focuses actions and recommendations on Iowa DOT activities, the full spectrum of public and private information dissemination is considered throughout the document.

Figure 3 Range of Available Traveler Information

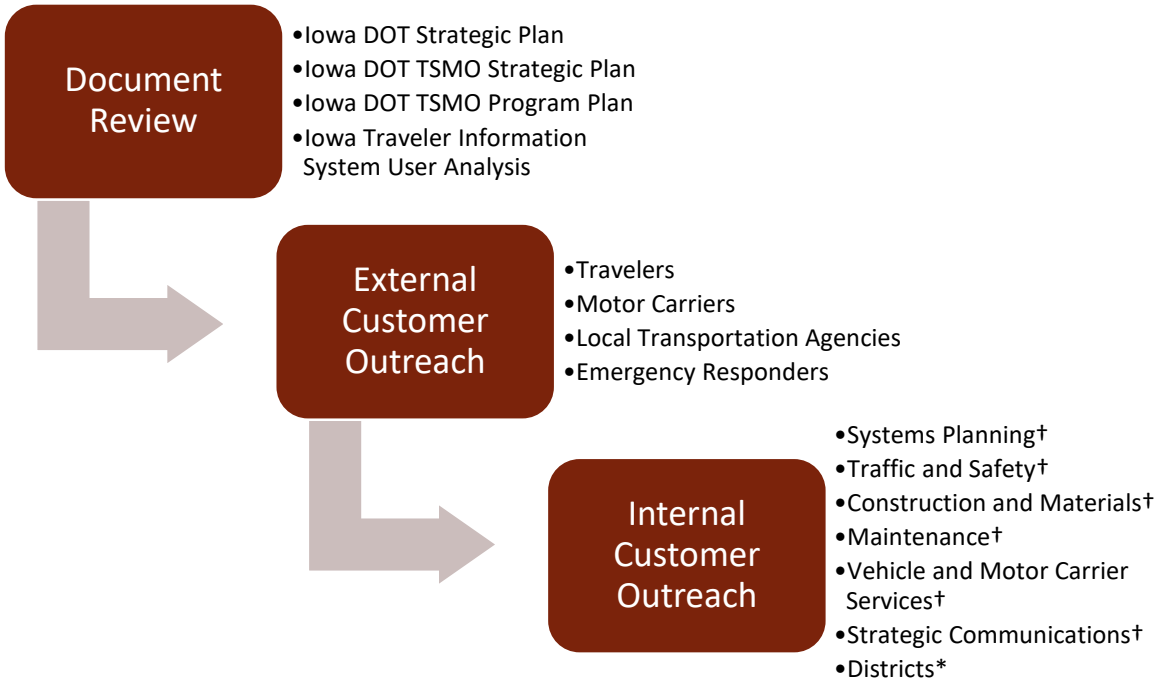


[1] Code of Federal Regulations, Title 23-Highways, Chapter I, Subchapter F, Part 511-Real-Time System Management Information Program, Subpart C, Section 511.303, https://www.gpo.gov/fdsys/pkg/CFR-2011-title23-vol1/xml/CFR-2011-title23-vol1-part511.xml, accessed December 1, 2016.

SERVICE LAYER PLAN DEVELOPMENT PROCESS

Developing the Service Layer Plan began with identifying the challenges and needs of Iowa travelers, Iowa transportation professionals, and specifically the needs of other Iowa TSMO Service Layers. As Figure 4 illustrates, a process of document reviews and customer outreach was used to gather information that serves as the basis for this Service Layer Plan. Customer groups were identified based on their use of data and information generated by Iowa DOT. Their input was desired to understand how they currently use data and information and to understand how they might use it in the future. Their input informed the challenges and needs identified for traveler information.

Figure 4 Illustration of the Service Layer Development Process



†Information gathered through meetings and interviews.
*Information gathered from DOT staff survey responses in 2015 Iowa 511 Traveler Information System User Analysis.

DOCUMENT CONTENT AND INTENDED USE

This document is intended to serve as a tactical plan for managing the Traveler Information Service Layer in a way that is consistent with, and supportive of, the Iowa DOT TSMO Strategic and Program Plans. The content will be used by Iowa DOT to manage operations, procurements, partnerships, developments and deployments to accomplish the objectives defined.

Following this introduction, the remaining sections are organized as follows:

- ***Opportunities and Challenges*** – Includes a description of traveler information challenges, as well as a series of objectives and tactics that support TSMO strategic goals while addressing challenges.

- ***Description of Existing Services and Systems*** – Provides a detailed description of existing traveler information services and systems.
- ***Existing Conditions*** – Presents an overview of related existing conditions impacting traveler information.
- ***Gap Analysis*** – Describes the analysis and criteria used to identify where services and other needs are unmet.
- ***Traveler Information Summary of Services*** – Describes the agreed upon services to be delivered and the overall vision for traveler information in Iowa that will address gaps identified in previous sections.
- ***Action Recommendations*** – Provides a list of actionable recommendations by fiscal year, categorized by Services, Policies and Procedures, ITS Deployment Projects and Highway Improvement Projects.
- ***Performance Management*** – Includes specific measures for each Service Layer Objective and a process for evaluating and correcting actions to meet the objectives.
- ***5-Year Service Layer Cost Estimate*** – A summary of current costs and cost estimate by fiscal year that will be used to refine the TSMO Program Plan budget estimates.

OPPORTUNITIES AND CHALLENGES

Iowa DOT has historically developed and operated its traveler information services by understanding trends, strengths and weaknesses, and then capitalizing on opportunities to enhance service. This section provides a summary of the challenges encountered by Iowa DOT in achieving its vision of ***Smarter. Simpler. Customer Driven.*** relative to traveler information, and the opportunities presented by Traveler Information to mitigate those challenges. A brief discussion of typical challenges is followed by tactical strategies that represent opportunities to directly resolve the challenges.

CHALLENGES FACING IOWA TRANSPORTATION

The state of Iowa experiences an average of 32 snow events each year, resulting in annual average snowfall amounts of 30 inches. Iowa travelers face an average of 52 days with at least a minimal amount of winter precipitation, roughly half of all the winter days.[2] Winter weather creates hazardous driving conditions in rural areas and can also create significant delays in and around metropolitan areas. It is not surprising that travelers throughout Iowa seek information during the winter season to help understand current conditions. In a survey conducted in May 2015, 69 percent of the respondents indicated that they sought traveler information in the six months prior to the survey.[3]

Citizens traveling for personal reasons are not the only group impacted by winter weather. Emergency responders (e.g. police, fire, ambulance) must respond to emergencies, perform long distance patient transfers to other medical facilities, and perform various other activities involving the Iowa road network. Motor carriers also rely on predictable travel times to transport goods on Iowa roads. These activities are impacted if winter road conditions reduce the safety of travel or create delays.

Winter is not the only season that impacts travelers throughout Iowa. Flooding is another challenge, particularly in areas near major rivers. Portions of Eastern Iowa are also routinely at risk of spring season floods that can result in closed roadways. From 2000-2010 there were 16 flood events in Iowa.[4] This included historic flooding in central Iowa from late May 2008 through June 2008 which resulted in 86 of 99 Iowa counties declared as state disaster areas.[5]

Flooding and winter weather, combined with incidents, special events and road work comprise most of the congestion experienced by travelers in Iowa. As shown in Figure 5, these non-recurring events account

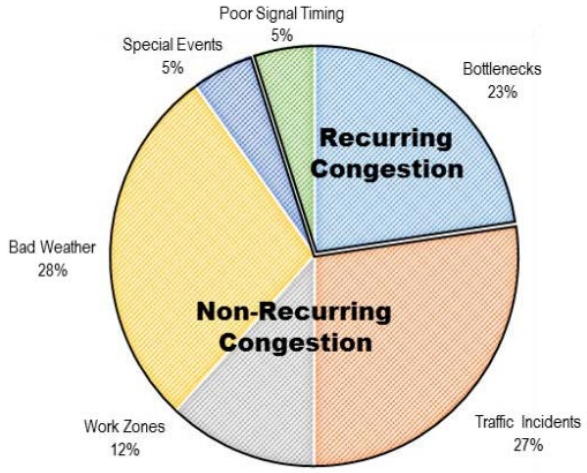
[2] Iowa DOT Winter Quick Facts, http://www.iowadot.gov/maintenance/winterquickfacts.html, accessed December 20, 2016.

[3] Iowa 511 Traveler Information System User Analysis – Final Report, July 2015; Iowa State University, CTRE, http://www.iowadot.gov/511/Iowa_DOT_Traveler_Information_Usage_Report.pdf.

[4] Eash, D.A., 2014, Summary of U.S. Geological Survey reports documenting flood profiles of streams in Iowa, 1963–2012: U.S. Geological Survey Scientific Investigations Report 2014–5085, p. 20, http://dx.doi.org/10.3133/sir20145085.

[5] Local Office Service Assessment, Central Iowa Floods of 2008, May 2009; US Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service, Weather and Forecast Office – Des Moines, Iowa, http://www.weather.gov/media/dmx/SigEvents/2008_Central_Iowa_Floods.pdf.

Figure 5 Iowa Sources of Congestion, 2013-2015



for 72 percent of the congestion that travelers encounter. In calendar year 2016, there was an average of 2,078 traffic incidents per month statewide, with an average time to clear lane-blocking incident of 52.6 minutes.[6] These are situations that travelers may not anticipate in advance and often must respond to in real-time. The remaining 18 percent of congestion that Iowa travelers experience is recurring in the form of bottlenecks and poor signal timing.

In summary, Iowa travelers' needs for traveler information are not going away, and the following challenges have been identified by the Traveler Information Service Layer:

- The climatic range in Iowa weather conditions from extreme winter weather to flooding conditions creates hazards and delays for travelers;
- Road work, incidents, and special events create additional delays and potential hazards;
- As travelers become increasingly connected through mobile phones, in-vehicle navigation systems, and eventually connected and automated vehicles, the demand for real-time traveler information will only increase.

TRAVELER INFORMATION OBJECTIVES AND TACTICAL APPROACH

In order to address the challenges defined above, Iowa DOT is formalizing a Traveler Information Service Layer that will work together with the other TSMO Service Layers to collectively manage and operate the Iowa transportation system. Based on the challenges described above, a series of objectives and tactics have been defined for the Traveler Information Service Layer. Table 1 presents the Traveler Information objectives that support the Iowa DOT TSMO strategic goals and objectives. Tactics for achieving the objectives are then described.

Table 1 Traveler Information Objectives Supporting TSMO

TSMO Strategic Goals	TSMO Strategic Objectives	Traveler Information Supporting Objectives
Safety	Reduce crash frequency and severity	***Objective 1:*** Gather data and assemble information describing traffic and travel conditions impacting Iowa travelers on a continuous basis in order to serve as the authoritative source of traveler
Reliability	Improve transportation system reliability, increase system resiliency, and add highway capacity in critical corridors	

[6] Iowa DOT, Traffic Management Center Performance Report, December 2016, Kapsch.

TSMO Strategic Goals	TSMO Strategic Objectives	Traveler Information Supporting Objectives
Efficiency	Minimize traffic delay and maximize transportation system efficiency to keep traffic moving	information on state highways throughout Iowa.
Convenience	Provide ease of access and mobility choices to customers	***Objective 2:*** Deliver traveler information directly to Iowa travelers and transportation professionals using travelers' preferred communications mediums in order to reach as wide an audience as possible.
Coordination	Engage all DOT disciplines, and external agencies and jurisdictions to proactively manage and operate the transportation system	***Objective 3:*** Optimize Iowa DOT traveler information by supporting but not duplicating efforts of other TSMO Service Layers and by maximizing the benefits of third-party information service providers and data sources.
Integration	Incorporate TSMO strategies throughout DOT's transportation planning, design, construction, maintenance, and operations activities	

To accomplish these objectives, the Traveler Information Service Layer will define and implement actions based on seven tactics, described as follows.

Tactic 1: Gather data and information from other Iowa TSMO Service Layers, serving as the primary focal point for fusing all traveler information together for dissemination (e.g. incident information from the Traffic Management Center Service Layer). (Objective 1, Objective 3)

Tactic 2: Fuse together data and information from all sources (DOT and non-DOT) in order to assemble a comprehensive information set (converting data into information as needed) for all state roadways in Iowa in accordance with the provisions for traffic and travel conditions reporting outlined in the Real-Time System Management Information Program.[7] (Objective 1)

Tactic 3: Create information needed by travelers but not available from other TSMO Service Layers by identifying feasible sources externally, or implementing new reporting processes internally. (Objective 1)

Tactic 4: Develop automated processes for data gathering and information creation that is labor intensive and therefore resource constraining. For example, the manual entry of winter

[7] Code of Federal Regulations, Title23 – Highways, Part 511 – Real-Time System Management Information Program, Subpart C, Sec. 511.309, https://www.gpo.gov/fdsys/pkg/CFR-2011-title23-vol1/xml/CFR-2011-title23-vol1-part511.xml#seqnum511.309.

driving conditions is a time-consuming activity, and one possible solution could be to expand existing systems such as Trackaplow and Weatherview to accomplish automated reporting of winter driving conditions. (Objective 1)

Tactic 5: Operate a suite of information dissemination services to reach as many travelers as possible in the safest and most efficient way, both pre-trip and en-route. (Objective 2)

Tactic 6: Respect the limited resources available to Iowa DOT by regularly assessing the information dissemination services used to ensure as many travelers are supported as possible, while considering the reduction or elimination of services that are underutilized or redundant. (Objective 2)

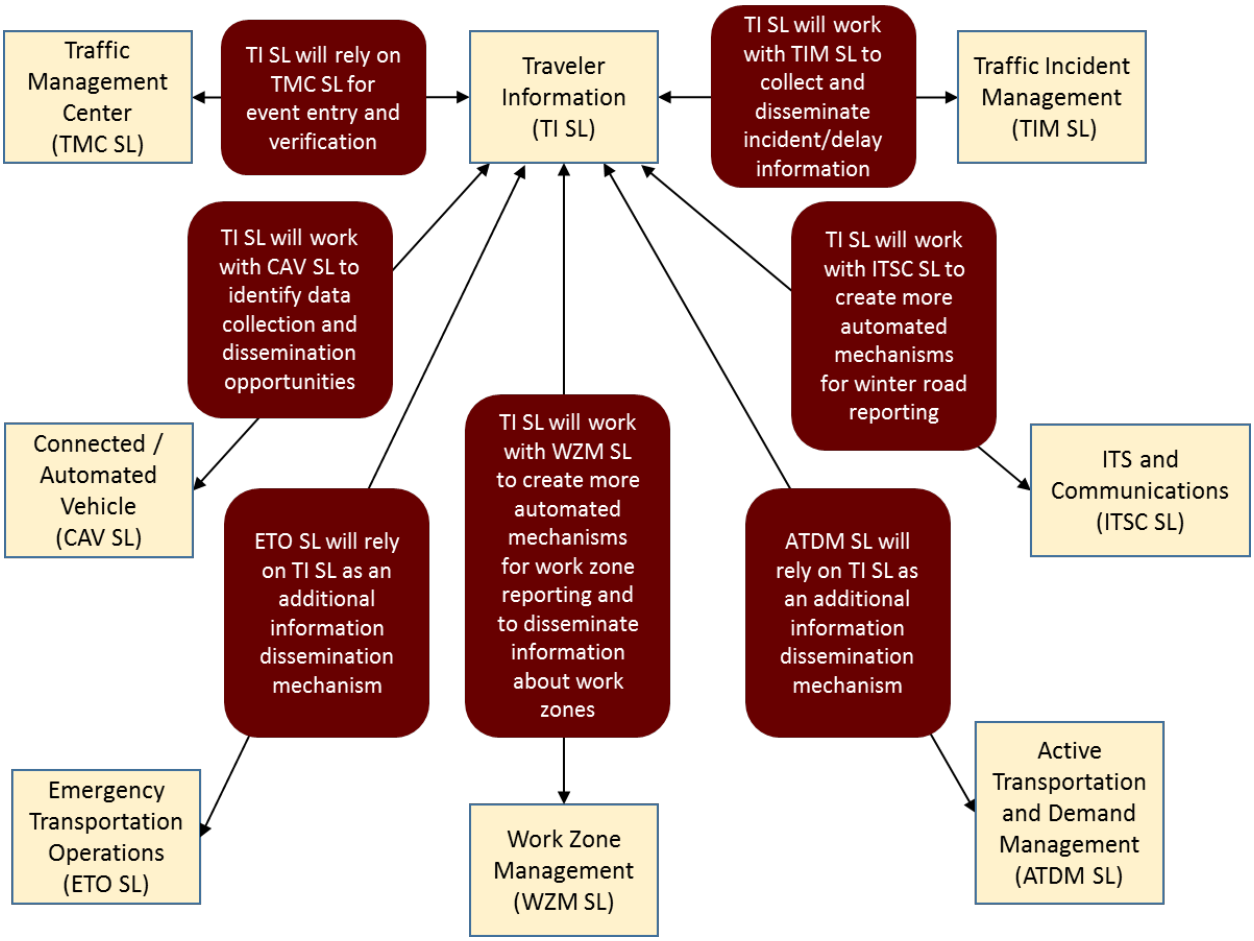
Tactic 7: To encourage the most prolific and highest quality traveler information possible in Iowa by openly sharing information third-party information service providers and encouraging their success, recognizing that it can increase public knowledge while reducing public sector funds required for dissemination. (Objective 3)

OPPORTUNITIES CREATED BY A TSMO BASED APPPROACH

Iowa DOT has been disseminating information to travelers for decades. Early efforts involved printed materials and press releases enabling the news media to relay messages to travelers. As technology progressed, Iowa DOT eventually provided roadside message signs, telephone systems, and Internet information dissemination, initially through labor intensive processes that were later replaced by automated systems. As with any evolution of a service provision, the traveler information functions were and continue to be performed by various groups within Iowa DOT.

Several of the tactics described above identify interactions with other TSMO Service Layers required to accomplish the Traveler Information Service Layer objectives. This illustrates that one anticipated outcome of the transition to a TSMO based approach is clarification of roles for management and operations activities among the eight service layers. This creates the opportunity for the Traveler Information Service Layer to address traveler challenges together as part of the overall TSMO structure. As illustrated in Figure 6, clarification of the objectives and actions of the Traveler Information Service Layer will define the services performed by Traveler Information and the services performed by other TSMO Service Layers.

Figure 6 Example of Traveler Information Interaction among TSMO Service Layers



DESCRIPTION OF EXISTING SERVICES AND SYSTEMS

Defining future actions for the Traveler Information Service Layer requires an understanding of the existing services and systems operated by the Iowa DOT. This section describes both to set the stage for identifying the conditions that most impact them, analyzing gaps and eventually recommending actions to address the gaps.

TRAVELER INFORMATION SERVICES

Iowa DOT currently offers a variety of services to disseminate information to the traveling public, local governments, emergency service providers, and commercial vehicle operators. Most services provide real-time information, while others share planned and longer-term information. Real-time systems are primarily managed by the Office of Traffic Operations and branded at Iowa 511. The other services are managed by several different groups within Iowa DOT. Table 2 describes each of the current services according to their primary purpose and intended audiences.

Table 2 Current Traveler Information Services

Service	Primary Purpose	Intended Audiences
511 Telephone	• Information dissemination • Pre-trip and en-route • Real-time travel impacts on state roadways • Audio only • Lowest common medium available to all travelers with telephone service	• Travelers - Non-Computer Users - Rural Commuter - Leisure
511ia.org (Webpage)	• Information dissemination • Pre-trip and en-route • Real-time travel impacts on state roadways • Visual only • Personalization available • Available to anyone with Internet and computer	• Travelers - Computer Users - Urban Commuter - Rural Commuter - Leisure • Motor Carriers • Media
Iowa 511 (Mobile App)	• Information dissemination • Pre-trip and en-route • Real-time travel impacts on state roadways • Visual and audio • Allows hands-free use • Displays nearby impacts based on user location	• Travelers - Computer Users - Urban Commuter - Rural Commuter • Motor Carriers
Social Media (Twitter, Facebook)	• Information dissemination • Pre-trip • Real-time travel impacts on state roadways • Text and visual • Announcement style alerts inserted within other information streams	• Travelers - Computer Users - Urban Commuter - Rural Commuter • Motor Carriers • Media
XML Data Feed	• Data feed only • Information dissemination • Pre-trip and en-route • Real-time travel impacts on state roadways • Available to third-parties that subscribe to the feed	• Third-party information service providers (e.g. Google, INRIX) • Third-party data analyzers • Third-party data archivers

Service	Primary Purpose	Intended Audiences
Dynamic Message Signs (DMS)	• Information dissemination • En-route • Text only • Real-time travel impacts on state roadways • Travel times on select state roadways • Roadside announcement of alerts • Available to all passing travelers	• Travelers - Urban Commuter - Rural Commuter - Leisure • Motor Carriers
Multiyear Construction Project Webpages (e.g. Council Bluffs, I-29 Sioux City)	• Information dissemination • Pre-trip • Planned travel impacts on select state roadways under construction • Visual only • Detailed information about project purpose, start/end, impacts, outcomes, costs, etc. • Available to anyone with Internet and computer	• Travelers - Computer Users - Urban Commuter - Rural Commuter - Leisure • Motor Carriers • Community Residents and Businesses • Media
Trackaplow (Webpage)	• Information dissemination • Pre-trip • Real-time information on plow operations and camera views of state roadways • Visual only • Allows public to observe plow operations • Available to anyone with Internet and computer or mobile device	• Travelers - Computer Users - Urban Commuter - Rural Commuter • Motor Carriers • Media
Weatherview (Webpage)	• Information dissemination • Real-time information about road weather conditions on state roadways • Real-time information about weather conditions at local airports • Flight planning • Visual only • Available to anyone with Internet and computer	• Travelers - Computer Users - Urban Commuter - Rural Commuter • Motor Carriers • Local Transportation Agencies • Pilots • DOT Staff • Media
Press Releases	• Information dissemination • Planned impacts on state roadways • Advance announcement style alerts inserted within other information streams	• Travelers - Computer Users - Non-Computer Users - Urban Commuter - Rural Commuter - Leisure • Motor Carriers • Local Transportation Agencies • Emergency Responders • DOT Staff • Media

TRAVELER INFORMATION SYSTEMS

The current services that Iowa DOT provides directly to travelers, together with the publishing of traveler information to third-party information service providers, are supported by a combination of the systems described below.

- **Road Condition Reporting System.** The Condition Acquisition and Reporting System (CARS) is currently used by Iowa DOT. It is a web-based software system that allows manual entry and automated ingest of road condition reports such as construction/maintenance activities, incidents, winter driving conditions and other events that impact traffic. All reports are stored in one common database and shared through various dissemination services including 511 telephone, 511ia.org, Iowa 511 and social media. CARS was developed and is operated by Castle Rock Associates through a multistate partnership that allows agencies like Iowa DOT to share in development and operational costs.
- **Advanced Traffic Management System (ATMS).** The Iowa DOT currently uses the TransSuite software by TransCore to manage a statewide network of devices, include DMS, and actively manage traffic on the Iowa DOT system. TMC Operators use TransSuite to post traveler information message to DMS located throughout Iowa.
- **Snowplow Automatic Vehicle Location (AVL).** SkyHawk AVL is the system currently used by Iowa DOT to manage its plow fleet. Skyhawk also publishes a data stream that is ingested by the Iowa DOT and placed on a GIS base map, along with other data, to deliver the Trackaplow service.
- **Road Weather Information System (RWIS).** This system includes a network of 90 sites throughout the state of Iowa that are designed to provide atmospheric and pavement specific weather information, such as pavement surface temperatures. RWIS data is gathered in a central database that feeds the Weatherview service to share surface and subsurface temperature data and atmospheric weather data.
- **Geospatial Technologies and Information.** This system encompasses many disciplines, from linear referencing to remote sensing to vehicle resource tracking. The department leverages a service central, software neutral approach to data access which gives flexibility in development of systems and opens data to as many as possible.[8]

[8] Iowa DOT Geospatial Technologies, http://www.iowadot.gov/gis/default.htm, accessed January 31, 2017.

EXISTING CONDITIONS

Iowa DOT is recognized as a national leader in traveler information delivery. Since 1997, Iowa DOT has led a consortium of states that pool resources to collectively research, develop, and operate traveler information systems that include interactive telephone (511 phone), website (511ia.org), mobile applications, social media delivery, and a back-end condition acquisition and reporting system (CARS). Originally, a large benefit of the multistate consortium was to share commitments to long distance phone service in order to reduce the per-minute costs. Nonetheless, many other benefits were recognized through the partnership as Iowa DOT shared the development, hosting, operations, and maintenance costs of the software systems with other states.

Iowa DOT is now at a crossroads, where the need to establish a new contract for traveler information systems delivery presents the question of whether to continue with the multistate consortium approach or to embark on an independent contract with a selected vendor.

In addition to the traveling public, Iowa DOT disseminates information to emergency responders, local transportation related agencies, commercial vehicle operators, and finally provides direct access to the real-time information to enable third party information service providers to acquire and disseminate the information. This section presents a summary of existing conditions surrounding traveler information delivery in Iowa.

USE OF TRAVELER INFORMATION SERVICES

The following conditions were identified from the 2015 Iowa 511 Traveler Information System User Analysis[9] prepared by Iowa State University, stakeholder focus groups and surveys conducted as part of the Service Layer development, and usage statistics gathered from Iowa DOT staff. These conditions were identified to illustrate current levels of use and conditions that are influencing the use of traveler information services.

- Calls to **511** reached a peak in 2008 at just over 700,000 that year. Calls declined significantly in 2010 and have steadily declined to about 130,000 calls in 2016. This decline, combined with a general increase in mobile phone use, particularly smartphones with Internet access, could indicate a shift in user preference to obtain information via other means.
- Visits to **511ia.org** peaked in 2010 to just over 6,000,000 and have averaged approximately 4,000,000 visits per year from 2011-2016. Peaks in visits can be correlated to severe winter weather and flooding conditions. For example, a two-day storm in December 2015 alone generated 383,378 visits.
- Downloads of **Iowa 511** (mobile app) reached its highest point in 2015 at nearly 80,000. Usage of the app after it has been downloaded is difficult to calculate but declines in 511 calls and 511ia.org visits in 2015 could be loosely correlated with the increase in app downloads. This could reflect a shift in preference for how information is received.

[9] Iowa 511 Traveler Information System User Analysis – Final Report, July 2015; Iowa State University, CTRE, http://www.iowadot.gov/511/Iowa_DOT_Traveler_Information_Usage_Report.pdf.

- Of the 850 **travelers** who responded to the 2015 Motor Vehicle Division survey conducted by Iowa State University, only 24 percent (204/850) had used Iowa 511. Iowa 511 dissemination services were identified in the study as phone, websites, social networks and mobile apps. Websites were the most commonly used service with 51 percent (105/204) of respondents having visited one.
- There is strong use of Iowa DOT's traveler information services among **emergency responders**. Of those responding to an online survey (2016) issued during the Service Layer development, 52 percent (105/203) use Iowa DOT's traveler information services. Winter road conditions, construction and incidents are the top three categories of information used. The Iowa DOT website, 511ia.org, and mobile app are the top three traveler information services used by emergency responders.
- **Local transportation agencies** (cities, counties and metropolitan planning organizations) also use Iowa DOT traveler information services. Of the agency responding to the online survey issued during the Service Layer development, 70 percent (41/59) said they use traveler information; with more counties and metropolitan planning organizations than cities indicating use. Winter road conditions, construction and incidents are the top three categories of information used. The traveler information services most used by these agencies are 511ia.org and the Iowa DOT website (iowadot.gov).

OPERATION OF TRAVELER INFORMATION SERVICES AND SYSTEMS

To provide context for how Iowa DOT operates current traveler information services and systems, the following conditions were identified through discussions with Iowa DOT staff who are directly involved with operation of the services and systems.

- CARS is an effective and efficient system for assembling multiple types of data and information into **one source** that can then automatically disseminate consistent information through **multiple services**.
- Some Traveler Information services do not directly interface with CARS, including DMS, Trackaplow, Weatherview, and the multi-year construction websites. This creates the **potential for inconsistencies** in information.
- Traveler information services are **marketed** to the public on a conservative basis. Routine references are included in key sources such as the department website and social media, brochures at rest areas and press releases. More specific announcements are also made when new features or services are released.
- The **brand** for Iowa DOT traveler information services is heavily rooted in the 511 identity that was prompted by the national designation of 511 for traveler information by phone. As use of the 511 phone service continues to decline, Iowa DOT will need to evaluate the 511 identity as a comprehensive brand.
- **Construction information** is challenging to maintain – especially with contractors in charge of lane closures. A definitive source of active construction information is needed for traffic safety, planning and permitting purposes. Such information includes project start and end dates, lane closures and openings, and restrictions. This also creates a need for archiving information for historical reference.

- **Winter road condition reporting** is especially labor intensive and challenging to maintain. There is also public frustration with the lack of immediacy with updates that sometimes occurs when storms are large, active and fast-moving.

OBSERVED TRENDS AND FORECASTS FOR THE FUTURE

In addition to understanding use and operational conditions, there are many external conditions that influence traveler information services offered by Iowa DOT. The following conditions were selected as those most likely impacting traveler information.

- Traveler information services offer **customer relationship management opportunities**. Providing information as a service to the travelling public (customers) offers transportation agencies an opportunity to engage with their customers in a routine, positive fashion that establishes a relationship and foundation for future transportation related interactions.
- **Urban areas** are experiencing a continuous increase in the amount of available information and rural areas are not increasing in a similar fashion. This is largely due to the availability of data. In urban areas, it is still easier for transportation agencies to install and maintain infrastructure for gathering data and information about the transportation network. This is similar for third-party data services where urban markets offer more customer base.
- **Rural areas** are often underrepresented by third-party information service providers because the most lucrative business models tend to focus on large urban areas. Rural travel needs are also different than urban because of longer trips, more remote locations and less available information about weather.
- There are numerous **third-party sources** that provide traveler information, and the public are increasingly comfortable with the quality of the traveler information they provide. Approximately half of the respondents to the Motor Vehicle Division survey conducted by Iowa State University sought information about road construction, road weather conditions or travel times in the six months prior to May 2015. In most cases, this information was sought from third-party sources such as Google Maps and local media. Iowa DOT provides data to over 100 third-party sources as a partnership that broadens the availability of traveler information.
- Traveler information is similar in many ways to the **National Weather Service model** for gathering and disseminating information. The National Weather Service is an authoritative source for weather data and information that many third-party services use to provide weather services to others. Although the National Weather Service disseminates a modest amount of weather information directly, the service focuses on weather forecast models and outputs used by third-parties (e.g. media, app developers) that interpret, package and deliver weather information to much broader audiences.
- **Data** for traveler information is expected to change significantly in the next decade. As automobile manufacturers develop increasingly connected and automated vehicles the amount of data available from vehicles could also increase dramatically. Such data could improve information about travel speeds and road surface conditions.

- Options for **disseminating information** will also change significantly as vehicles become more connected to one another and roadway infrastructure. This could provide opportunities for Iowa DOT to broadcast messages from the roadside regarding roadwork, incidents and other unplanned events that travelers could encounter.

GAP ANALYSIS

Information about the existing services and systems, along with conditions that are influencing them, were reviewed in conjunction with the objectives for traveler information. The gaps resulting from that analysis are presented in this section.

GAPS, ISSUES, AND OTHER CHANGES NEEDED

The information gathered from surveys, focus groups, and in-person meetings has confirmed that the traveler information services currently offered by Iowa DOT are meeting the needs of travelers and transportation professionals. To this extent, no new services were desired, but enhancements and improvements to the existing services were identified. Each Traveler Information Service Layer objective was reviewed to determine if there are any gaps, issues or changes needed. The Summary of Services presented later in the next section also presents the vision for Iowa traveler information over the next 5-10 year period, and it is based on the gaps, issues, or changes outlined in Table 3.

Table 3 Traveler Information Gaps, Issues and Changes

Traveler Information Service Layer Objective	Gaps
Objective 1: Gather data and assemble information describing traffic and travel conditions impacting Iowa travelers on a continuous basis in order to serve as the authoritative source of traveler information on state highways throughout Iowa.	Gap 1.1: The CARS system and related dissemination services are critical components of the current Iowa DOT traveler information system. The contract period cannot be extended and therefore Iowa DOT must procure a replacement system to perform current functions plus or minus any changes identified in the Service Layer.
	Gap 1.2: Manual entry of winter driving conditions is labor intensive and not conducive to detailed reporting with frequent updates.
	Gap 1.3: Manual entry of road work impacting traffic makes it challenging to maintain accurate descriptions of lane closures, start and end dates, and other impacts.
	Gap 1.4: Archived traveler information is used by various groups within Iowa DOT. The current structure of the traveler information systems does not directly support archiving and as a result workaround solutions are utilized.
Objective 2: Deliver traveler information directly to Iowa travelers using various communications mediums in order to reach as wide an audience as possible.	Gap 2.1: The 511 phone service demands a high amount of funding in relation to a continuously declining volume of use.
	Gap 2.2: Technology advances (e.g. browser updates, social media platform changes, mobile application hosting requirements) have created a situation where portions of the traveler information dissemination services require nearly continuous upgrades to remain compatible and relevant.

Traveler Information Service Layer Objective	Gaps
	Gap 2.3: Delivering traveler information provides Iowa DOT an opportunity to actively manage broader department relationships with customers.
Objective 3: Optimize Iowa DOT traveler information by supporting but not duplicating efforts of other TSMO Service Layers and by maximizing the benefits of third-party information service providers and data sources.	Gap 3.1: There is some duplication in the entry of traveler information as traveler information related roles and responsibilities are not clearly defined among the TSMO Service Layers. A TSMO-based approach presents the opportunity to define roles and responsibilities of other TSMO Service Layers and define what the Traveler Information Service Layer can expect from and offer them in return.
	Gap 3.2: Third-party information service providers are increasing the traveler information services they offer and Iowa DOT has limited knowledge of these parties and the potential for partnering to disseminated traveler information.
	Gap 3.3: There is limited understanding of how connected and automated vehicles could impact traveler information in terms of both data/information gathering and information dissemination.

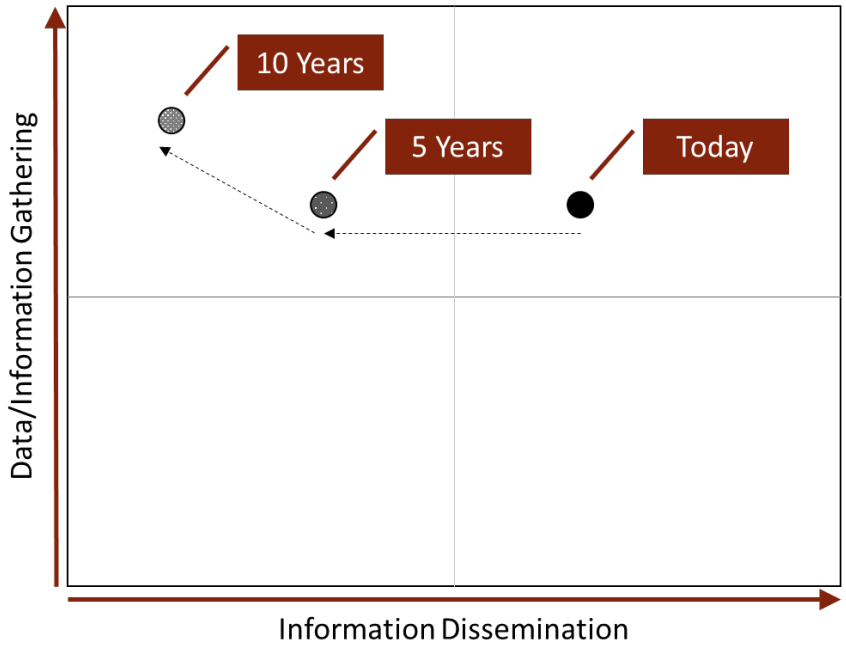
TRAVELER INFORMATION SUMMARY OF SERVICES

Iowa DOT is likely to continue providing the existing services and systems described earlier in this document for the near-term. This section describes a high-level vision for the direction that Iowa DOT chooses to move in relation to future services over the next several years.

VISION FOR TRAVELER INFORMATION IN IOWA

In the next 10 years, Iowa travelers and other users of traveler information will continue to have access to a diverse set of information dissemination mechanisms, operated by a combination of Iowa DOT, local media, and third-party information service providers. They will progressively receive additional and more accurate information than they are now able to receive, and they will receive information from various public and private sources. To accomplish this, Iowa DOT's vision for the initial five years will be to migrate towards performing less information dissemination directly. Movement in this direction will be influenced by users of Iowa DOT services and observations of the information disseminated by third-party information service providers. For example, if usage of the 511 phone service continues to decline, the service may be significantly altered or discontinued altogether. Also during the initial five years, the number of data and information types collected is not likely to increase but the accuracy and reliability of key elements will improve. This could include the automation of winter road condition reporting and further enhancement of road construction reporting. Beyond the next five years, Iowa DOT expects to continue to decrease the information dissemination performed, while the types of information collected will increase. Of significant note, data from connected and automated vehicles is expected to begin appearing within the next several years. Iowa DOT and other transportation agencies will need to prepare for the potential these new data sources may offer traveler information. Figure 7 illustrates this vision for Iowa DOT traveler information in terms of data collection and information dissemination.

Figure 7 Vision for Iowa DOT Traveler Information



ACTION RECOMMENDATIONS

This section defines action recommendations for Iowa DOT to bridge the gaps identified and accomplish the Traveler Information Service Layer vision according to the specified objectives and tactics. Table 4 presents each action recommendation, mapped to the relevant gap, tactic and objective to validate its applicability. Also included is an indication to whether the action recommendation is a service, policy/procedure, ITS deployment, or highway improvement. Each recommendation also includes a suggested fiscal year for the action to begin. It is also important to note that the staggered development of initial TSMO service layer plans has limited coordination of action recommendations across the service layers. To address this, action recommendations for traveler information that are likely related to other TSMO service layers have been noted as such in their description.

Table 4 Action Recommendations

Action Recommendation	Service	Policy/ Procedure	ITS Deployment	Highway Improvement	Suggested Fiscal Year
1. Procure a data/information gathering system with modular dissemination services that: • Allows Iowa DOT to periodically assess each dissemination service by tracking key usage statistics; (Objective 2, Tactic 6, Gap 2.1) • Allows Iowa DOT to terminate or significantly modify any one of the dissemination services, while keeping the overall contract in place; (Objective 2, Tactic 6, Gap 2.2) • Enables Iowa DOT to offer the current dissemination services on day one of operation (phone, web, mobile application, social media, data feed); (Objective 2, Tactic 5, Gap 2.2) and • Incorporates other Iowa DOT data/information or dissemination services into the newly procured system (e.g. AVL data, Trackaplow) to the extent possible. (Objective 1, Tactic 1, Gap 1.1)	✓				FY2018
2. Ensure the process to procure the new traveler information system results in a contractual relationship that enables Iowa DOT to move quickly on technical advances in order to benefit from new technologies or trends in user preferences. (Objective 2, Tactic 5, Gap 2.2)		✓			FY2018
3. Ensure the new system procured will include seamless integration with systems operated by other TSMO Service Layers (e.g. TMC, ITS and Communications). (Objective 1, Tactic 1, Gap 1.1)		✓			FY2018

Action Recommendation	Service	Policy/ Procedure	ITS Deployment	Highway Improvement	Suggested Fiscal Year
4. Coordinate with Connected/Automated Vehicle Service Layer to actively monitor and participate where reasonable in national activities (e.g. USDOT ITS JPO Data Program) associated with connected and automated vehicles to understand the potential implications on traveler information data gathering and information dissemination. (Objective 3, Tactic 7, Gap 3.3)		✓			FY2018 - FY2022
5. Cooperate with other TSMO Service Layers to advance a new system for reporting lane closures during roadwork and other events, automating the reporting to the extent possible. (Objective 1, Tactic 4, Gap 1.3)	✓				FY2019
6. Formalize processes with other TSMO Service Layers to minimize duplication of entry and redundant systems performing similar functions. (Objective 3, Tactic 1, Gap 3.1)		✓			FY2019
7. Ensure traveler information is archived and easily accessible to external systems. (Objective 1, Tactic 1, Gap 1.4)		✓			FY2019
8. Building off the 2015 Iowa 511 Traveler Information System User Analysis, establish a process for periodically assessing the extent to which Iowa DOT traveler information services are meeting customer needs. This will enable the department to assess how it can more actively manage department relationships with customers. (Objective 2, Tactic 6, Gap 2.3)		✓			FY2019
9. Cooperate with other TSMO Service Layers to advance a new system for automated winter driving condition reporting, automating the reporting to the extent possible. Further explore options for automated reporting through Iowa's involvement in the ENTERPRISE Pooled Fund. (Objective 1, Tactic 4, Gap 1.2)	✓				FY2020
10. Establish a process for regularly assessing the extent to which third-party information service providers are meeting customer needs in order to ensure that Iowa travelers have the core information they need for safe, efficient travel and to understand when Iowa DOT can potentially save resources by deferring to third-parties to provide information. (Objective 3, Tactic 7, Gap 3.2)		✓			FY2020

PERFORMANCE MANAGEMENT

This section defines performance measures for each of the Traveler Information Service Layer objectives. The measures are primarily focused on data/information gathering and dissemination regarding completeness, consistency, accuracy and timeliness. These attributes define the quality of information disseminated by Iowa DOT which ultimately influences the credibility of information for travelers. Several measures are directly based off the provisions for traffic and travel conditions reporting in the Federal final rule on the real-time system management and information program.[10]

The measures are also consistent with the Federal final rule regarding national performance management measures which specifically addresses system, freight and air quality performance targets for the National Highway Performance Program.[11] Specifically, the Traveler Information Service Layer performance measures can be traced to the following national goals for system performance:

- Congestion reduction—To achieve a significant reduction in congestion on the NHS.
- System reliability—To improve the efficiency of the surface transportation system.
- Freight movement and economic vitality—To improve the national freight network, strengthen the ability of rural communities to access national and international trade markets, and support regional economic development.

Table 5 summarizes the measures as mapped to each of the Traveler Information Service Layer objectives. This summary describes each measure and the intent of the measure as an explanation of the philosophy behind performance management for traveler information.

Table 5 Summary of Traveler Information Performance Measures

Traveler Information Service Layers Objective	Performance Measures	Intent of Measures
Objective 1: Gather data and assemble information describing traffic and travel conditions impacting Iowa travelers on a continuous basis in order to serve as the authoritative source of traveler information on state highways throughout Iowa.	1.1 Timeliness of traveler information dissemination as defined by 23 CFR 511, which states the timeliness for the availability of traveler information will be: - For construction activities: 20 minutes or less outside metropolitan areas and 10	*Measure the timeliness of information disseminated according to requirements of 23 CFR 511 in metropolitan and rural areas. It is assumed that timeliness is critical to traveler information being authoritative.*

[10] Code of Federal Regulations, Title 23-Highways, Chapter I, Subchapter F, Part 511-Real-Time System Management Information Program, Subpart C, Section 511.309, https://www.gpo.gov/fdsys/pkg/CFR-2011-title23-vol1/xml/CFR-2011-title23-vol1-part511.xml, accessed December 1, 2016.

[11] Code of Federal Regulations, Title 23-Highways, Chapter I, Subchapter E, Part 490-National Performance Management Measures, Subparts E-G, Sections 490.501-490.713, http://www.ecfr.gov/cgi-bin/text-idx?SID=a4c85bb14b3ae00cef651e140d8b44eb&mc=true&node=pt23.1.490&rgn=div5#sp23.1.490.c, accessed January 31, 2017.

Traveler Information Service Layers Objective	Performance Measures	Intent of Measures
	minutes or less in metropolitan areas. - For roadway or lane blocking incidents: 20 minutes or less outside metropolitan areas and 10 minutes or less in metropolitan areas. - For roadway weather observations: 20 minutes or less from the time of observation. - For travel time information: 10 minutes or less from the time travel time is calculated.	
	1.2 Accuracy of the traveler information types as defined by 23 CFR 511, which states the designed accuracy information shall be 85 percent accurate at a minimum.	*Measure the accuracy of information disseminated according to requirements of 23 CFR 511. It is assumed that accuracy is critical to traveler information being authoritative.*
Objective 2: Deliver traveler information directly to Iowa travelers using various communication mediums in order to reach as wide an audience as possible.	2.1 Availability of traveler information services as defined by 23 CFR 511, which states information shall be 90 percent available at a minimum.	*Measure the availability of traveler information according to requirements of 23 CFR 511 as traveler information service "up-time."*
	2.2 Trend over time in usage of each traveler information service provided by Iowa DOT.	*Measure usage of traveler information services as an indication of travelers' preferences and service performance.*
	2.3 Traveler perception of traveler information quality.	*Measure travelers' satisfaction with the quality and availability of traveler information.*
Objective 3: Optimize Iowa DOT traveler information by supporting but not duplicating efforts of other TSMO Service Layers and by maximizing the benefits of third-party information service providers and data sources.	3.1 Availability of reliable and quality information from third-party information service providers that is similar to information provided by Iowa DOT.	*Measure the availability of traveler information from third parties to determine redundancy and best practices.*

In contrast, Tables 6-11 provides further detail regarding the data, sources, analysis and application to decision-making that will be necessary for Iowa DOT to administer the process of managing traveler information performance in relation to these measures.

Table 6 Measuring Timeliness of Traveler Information

1.1 Timeliness of traveler information dissemination as defined by 23 CFR 511, which states the timeliness for the availability of traveler information will be: - **For construction activities: From the time of the closure, 20 minutes or less outside metropolitan areas and 10 minutes or less in metropolitan areas.** - **For roadway or lane blocking incidents: From the time that the incident is verified, 20 minutes or less outside metropolitan areas and 10 minutes or less in metropolitan areas.** - **For road weather observations: from the time the hazardous conditions, blockage, or closure is observed, 20 minutes or less from the time of observation.** - **For travel time information: From the time that the travel time calculation is completed, 10 minutes or less from the time travel time is calculated.**		
Data and Sources	**Analysis**	**Decision Application**
Data: Time difference between when events are reported and when the events are available in the traveler information system. Sources: - Sample, informal event reports gathered from staff in the field and relevant offices. - Timestamped records from the Iowa DOT traveler information system.	Iowa DOT may periodically collect a sample set of event reports from the field, offices and other systems. Using the parameters described above for each type of event, the TMC Manager or Traffic Management Systems Engineer will work with staff reporting events to the TMC Operations Staff to note when parameters are addressed. The sample reports may be correlated to corresponding records in the traveler information system. The timestamps will be compared and the time difference between calculated. The percentage of events that were reported within the allowed time limits will then be calculated as a measure of timeliness.	Timeliness is important for satisfying the federal rule and for satisfying the needs of the traveling public. Iowa DOT may work with FHWA or internally to establish a minimum acceptable percentage of timely event reports (e.g. 90 percent are within the required time limit). If the actual percentage is lower than what is acceptable, Iowa DOT can further investigate the causes and develop strategies to improve timeliness.

Table 7 Measuring Accuracy of Traveler Information

1.2 Accuracy of the traveler information types as defined by 23 CFR 511, which states the designed accuracy information shall be 85 percent accurate at a minimum.		
Data and Sources	**Analysis**	**Decision Application**
Data: Accuracy of traveler information can be ascertained through the correctness of event: - Location - Type - Impact on travel - Duration Sources: - Sample, informal event reports from staff in the field that include event characteristics. - Event reports from the Iowa DOT traveler information system.	Iowa DOT may periodically collect a sample set of informal event reports from the field. The TMC Manager or Traffic Management Systems Engineer will work with staff reporting events to the TMC Operations Staff to note event characteristics reported. These sample reports may be the same as the reports used for assessing timeliness, and the analysis may be performed concurrently. The sample reports may be correlated to their corresponding records in the traveler information system. Each event characteristic (location, type, impact and duration) from the initial reports may be compared to the event record within the traveler information system and differences noted. Note that Initial reports may contain a different level of detail than the condition reporting system. Discrepancies due to level of detail would not be considered as inaccuracies. Differences in event information between the sample reports and the traveler information records will be identified. The percentage of events that have one or more characteristic reported incorrectly will be calculated as a measure of accuracy.	Accuracy is important for satisfying the federal rule and for satisfying the needs of the traveling public. To satisfy federal rule, no more than 15 percent of the traveler information can be inaccurate, or at least 85 percent must be accurate. Iowa DOT may establish its own threshold that is higher than the federal rule. If traveler information reports are accurate at a lower rate than is acceptable by federal rule or Iowa DOT, the department can further investigate the causes and develop strategies to improve accuracy. Strategies may be dependent upon the event characteristics that are inaccurate. For example, if inaccuracies are mostly resulting from misreporting event locations, the DOT may focus on techniques to improve capturing locations and reporting them to the traveler information system.

Table 8 Measuring Availability of Traveler Information

2.1. Availability of traveler information services as defined by 23 CFR 511, which states information shall be 90 percent available at a minimum.		
Data and Sources	**Analysis**	**Decision Application**
Data: Up-time of information services as defined by: - The system is processing and reporting up-to-date traveler information. - The communication mediums by which the public reach the services are operational. Sources: - Data and error logs for the traveler information services that track up-time, system errors that halt the services, and the cause and duration of any down-time. - Service records for the communication mediums identifying up-time and the cause and duration of any outages.	The federal rule of 90 percent availability requires that both the traveler information service and the medium for delivering it to be operational. Availability should be measured over long periods of time, such as twelve months, in order to accurately understand overall availability. Iowa DOT may collect and review data and error logs for the traveler information services. The availability of the services can be calculated as the percentage of total possible hours that the services were operational and collecting current data from other systems upon which they rely. Iowa DOT may collect and review data and error logs for the mediums used to deliver traveler information, such as websites and Interactive Voice Response systems. The availability for the mediums can be calculated as the percentage of total possible hours that the services were operational and collecting current data from other systems upon which they rely. Note that the analysis of availability should not consider periods of time when services or mediums are unavailable due to circumstances beyond their control, such as widespread power and telecom outages.	Availability is important for satisfying the federal rule and for satisfying the needs of the traveling public. To satisfy federal rule, traveler information services must be available at least 90 percent of the time. Iowa DOT may establish its own threshold that is higher than the federal rule. The analysis of timeliness may be used to determine that traveler information is adequately available. If the analysis shows that information is not as available as federally required, or desired by Iowa DOT, the analysis can reveal the causes for down-time. That analysis may be used to focus improvements. For example, if a website is down due to Denial of Service attacks, Iowa may consider security upgrades. Or, the analysis may reveal if a service provider is not meeting its performance requirements, and a strategy can be developed to improve that service's up-time.

Table 9 Measuring Trends in Usage of Traveler Information

2.2. Trend over time in usage of each traveler information medium provided by Iowa DOT.		
Data and Sources	**Analysis**	**Decision Application**
Data: Measured and reported volume of users of various traveler information services and mediums. Sources: - Volume of calls to phone systems. - Number of subscribers to social media. - Number of page views to web sites. - Number of subscribers to condition reporting XML feed. - Number of mobile app downloads - Number of users of other mediums as they are identified, e.g. data feeds to connected and automated vehicles. - Periodic surveys such as that performed by Iowa State University for the 2015 Iowa 511 Traveler Information System User report.	There is no direct federal rule for measuring usage by traveler information medium, however, this measure is important for Iowa to understand how to best reach its customers. Usage should be measured over long periods of time, such as twelve months, in order to understand trends in usage. Shorter periods of time may misrepresent trends as specific events, such as severe weather, impact usage of particular mediums. Analysis can be performed by measuring changes in the usage of each medium and determining whether usage of a particular medium is increasing or decreasing. Additional analysis can be performed by surveying and reviewing responses to questions about traveler preferences for various mediums. Mitigating factors should be taken into considerations, such as a marketing activity for a particular medium, or major events such as long-term construction projects or a winter that had multiple severe events.	The analysis of usage by medium will provide insight that allows Iowa DOT to determine where to focus future efforts in expanding or contracting its funding and efforts. For example, if phone usage decreases and web traffic consistently increases, Iowa DOT may reevaluate the amount of funding and time spent providing each service. Survey results may reveal to Iowa mediums that they are currently not using, or that are gaining in popularity and may offer a solution for future traveler information dissemination. In addition, by analyzing the number of subscribers to its condition reporting XML feed, Iowa DOT can begin to understand the demand for such information. An increasing number of subscribers may imply an increase in the number of third-party information service providers. In coordination with Measure 3.1 analysis, Iowa DOT may examine how the information it shares is being used.

Table 10 Measuring Perception of Traveler Information

2.3. Traveler perception of traveler information quality.		
Data and Sources	**Analysis**	**Decision Application**
Data: Travelers' responses to surveys and polls regarding the traveler information available in Iowa. Sources: - Periodic surveys such as that performed by Iowa State University for the 2015 Iowa 511 Traveler Information System User report.	Analysis of travelers' perceptions of traveler information will require a series of surveys, perhaps a survey asking similar questions once every two to three years, in order to gauge changes in their perception, and to gauge shifting preferences for how traveler information is disseminated. The surveys should focus on traveler levels of satisfaction for each service, as well as purpose and intended audience, such as pre-trip and en-route, or leisure, freight and commuter. By conducting the survey at regular intervals, such as once every two to three years, Iowa DOT can compare results to similar questions over time to analyze trends in satisfaction and usage.	Survey results will largely help reinforce the findings of the quantitative measures described in 1.1, 1.2, 2.1, 2.2 and 3.1. Analysis of survey results can help Iowa DOT determine that it is meeting its objectives, or pinpoint areas where travelers are not as satisfied as Iowa DOT would like. The analysis can help Iowa DOT to determine where to focus existing traveler information resources as well as the issues that planning and future development can address.

Table 11 Measuring Availability of Third-Party Traveler Information

2.4. Availability of reliable and quality information from third-party information service providers that is similar to information provided by Iowa DOT.		
Data and Sources	**Analysis**	**Decision Application**
Data: Known third-party traveler information sources Sources: - Third-party traveler information services such as websites, mobile applications and data feeds. - Other third-party traveler information services as they are identified. - Third-party traveler information usage statistics as they are available. - Periodic surveys such as that performed by Iowa State University for the 2015 Iowa 511 Traveler Information System User report.	Analysis of this measure will involve periodically reviewing the known available third-party information service providers and noting the services they provide. Analysis will include a review of the types of information provided by third-parties and a real-time comparison of their accuracy and timeliness when compared to similar data provided by Iowa DOT. A sample set of events reported by both third-parties and Iowa DOT may be reviewed to determine their similarities, differences and which information was higher quality. Analysis of third-party information service providers may also include the long-term stability of the providers. This may be determined by the usage of their service and the maturity of the service's underlying technologies. This subjective assessment will be important when determining which third-party providers could be long-term partners and complement Iowa DOT traveler information.	The results of the analysis of third-party information may be used in several ways to help Iowa DOT determine how to proceed in developing traveler information systems. The analysis will identify third-party services that are redundant with Iowa DOT services such that a reliable, stable provider may reduce the need for Iowa DOT to provide a service. By reviewing third-party providers, Iowa DOT may also find services that offer promising solutions that are not fully implemented or are not reliable. This information may help Iowa DOT identify functionality that it can more effectively offer. The analysis may also identify potential partners for developing traveler information systems that share the cost between the public and private sectors.

FIVE-YEAR SERVICE LAYER COST ESTIMATE

The industry-wide trends that were presented earlier in this document were considered when projecting the five-year estimate of costs that Iowa DOT will spend on traveler information. Several key points are summarized below and highlighted in Figure 8.

Information Dissemination Cost Reduction. Over the next ten years, Iowa DOT will likely be able to reduce operational costs associated with the direct dissemination of information to travelers. These cost reductions could result from a combination of travelers' responses to other available options and Iowa DOT goals for reducing costs while maintaining similar levels of service. The reasons for this projection are as follows:

- The 511 phone service is a portion of the system for which operational costs are most directly tied to use (e.g. per minute costs are typically incurred for each call and monthly charges vary by volume). As mobile app and web-enabled mobile devices continue to increase in use and popularity, it is likely that travelers will use the 511 phone service even less. Similarly, Iowa DOT could set a goal to reduce per minute costs by adjusting the call menu tree, or targeting 511 phone to areas of the state less served by other information such as DMS, media and mobile services.
- There will likely be at least one time period where Iowa DOT experiences a sudden reduction in costs as one or more of their traveler information services are no longer operated. For example, it is expected that the 511 phone service could be significantly modified or eliminated as use declines. The timing of when this occurs cannot be specified and is generically referenced in Figure 8 as "Year X."
- The operational costs for traveler information websites, mobile apps, and information push systems are typically not tied directly to customer use, with the exception that extensive use can require server balancing and network management. However, if Iowa DOT continues to observe third-party information service providers offering sophisticated information delivery, there might be a decision to focus DOT-funded information delivery on the basics and to allow third parties to develop enhanced systems and services.
- The benefits of customer relationship management achieved by Iowa DOT operating traveler information systems, and the need to ensure that all travelers are represented with at least a base level of information dissemination, will likely cause Iowa DOT to incur information dissemination costs well beyond the next 10 years. At some point the cost reductions observed will level out as minimum costs of operation are reached.

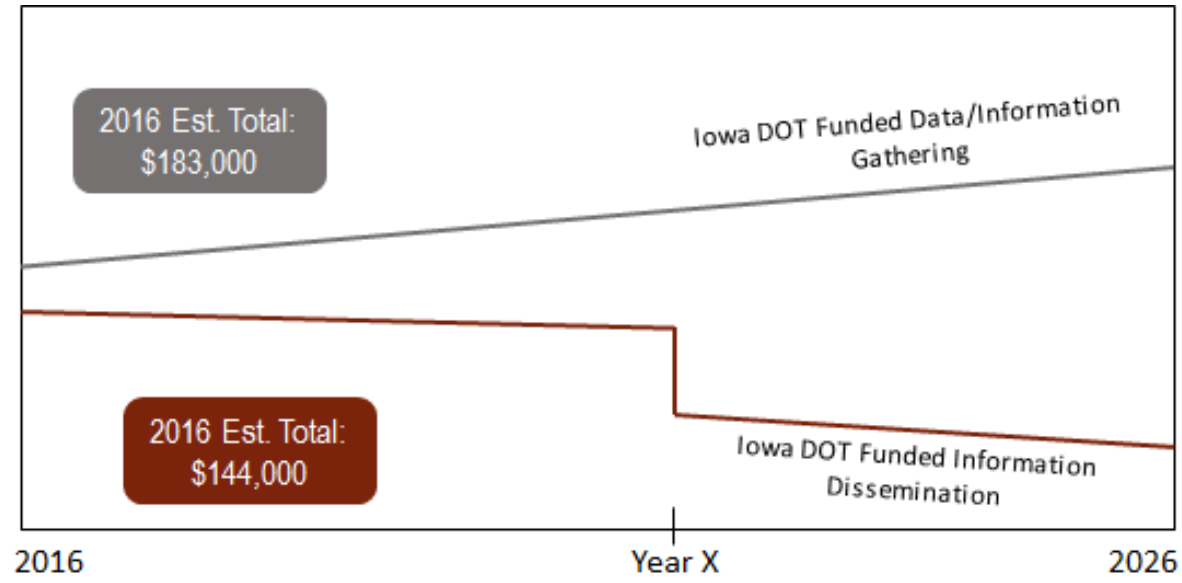
Data and Information Gathering Cost Increases. Travelers already demand that the coverage, accuracy, and precision of information be as high as possible, and their expectations for what is possible increase. As such, Iowa DOT will likely see an increase in the costs of data and information collection and assembly over the coming 10 years, projected as follows:

- While the third-party data providers will continue to generate new data and information, there will always be a portion of data collection that will be done by the DOT to maintain a common

level of data statewide and to avoid underrepresentation in selected markets. Technology advances in the areas such as video processing, probe data, on-board sensors, and connected and automated vehicles (both passenger and fleet vehicles) will create increased opportunities for Iowa DOT to generate more and better data. This will also allow the department to rely less on staff manually entering information and more upon automated data collection.

- Gathering data from new sources may also require increased security, data management or information filtering to maintain quality standards. These additional measures may also cause increased costs for the department. Iowa DOT will also be able to improve their own data and systems as other catalysts, such as connected and automated vehicles become available.

Figure 8 Estimated 10-Year Trends in Traveler Information Costs



While the trends are not understood to a level of detail where 2026 numbers can be estimated, these long-term trends are factored into five-year cost estimates for traveler information. Figure 9 presents estimated costs categorized as:

- New System Procurement
- Enhancements / Expansions
- Operations

Figure 9 Estimated Traveler Information Costs by Fiscal Year