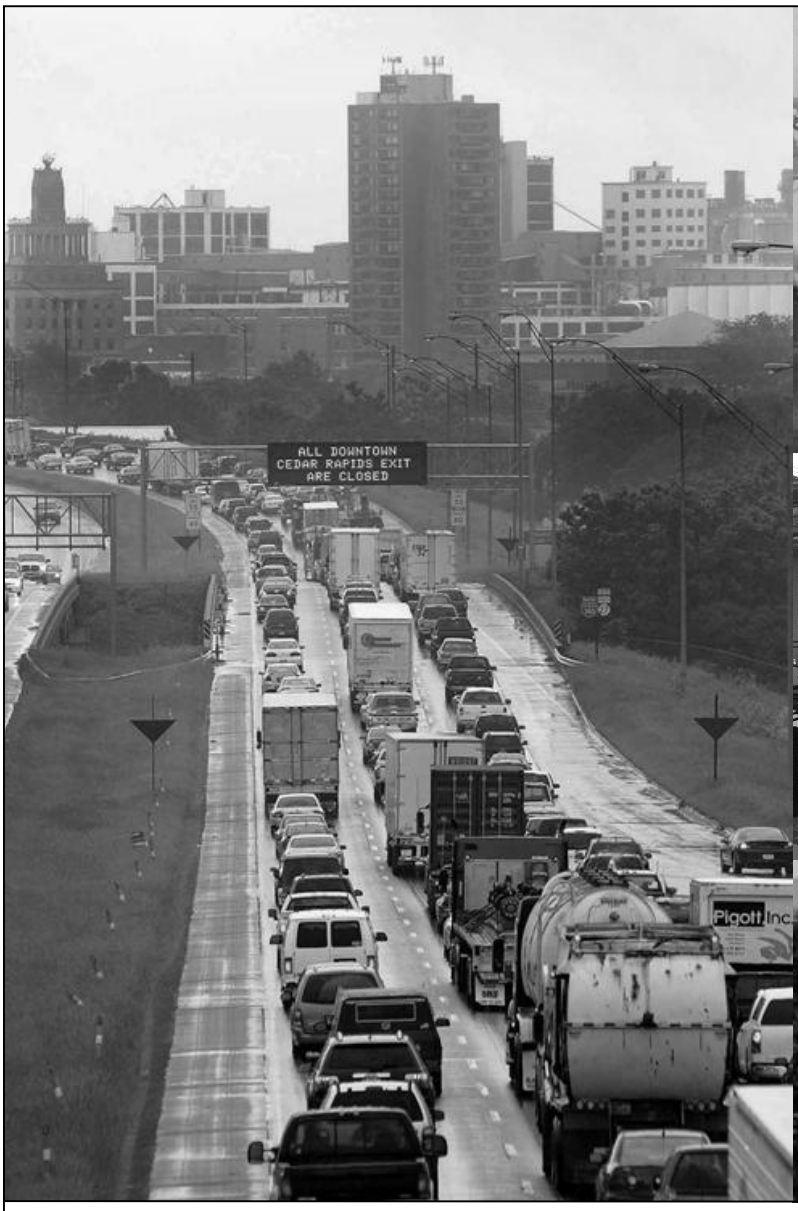

TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS (TSMO) STRATEGIC PLAN

February 2016

IOWA DOT

Iowa Transportation Systems Management and Operations (TSMO) Strategic Plan

Version 1.0

Prepared for:

Iowa Department of Transportation

Office of Traffic Operations

Prepared by:

Lakeside Engineers, LLC

Pat Noyes & Associates

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VERSION CONTROL

Date	Version	Description
02/11/16	1.0	Initial TSMO Strategic Plan

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IOWA'S CHALLENGE

Why Transportation Systems Management and Operations Matters

Transportation Systems Management and Operations (TSMO) is a cross-cutting approach meant to optimize existing infrastructure through better integration, coordination, and systematic implementation of key operational strategies. It offers resources and strategies to: realize the full capacity of the existing transportation system; increase reliability for freight and auto; improve safety and reliability through traffic incident management, traveler information, and work zone management; and, target safety and operational problem locations to deliver performance-driven improvements to the existing system.

Iowa's TSMO Program Plan provides strategic direction, program development, and specific steps for systems management and operations in Iowa. The performance-based plan focuses not only on the performance of the surface transportation system, but also on the strategies and business processes that will help improve overall system performance and safety.

Iowa faces challenges associated with the movement of people, goods and services that extend beyond traditional construction and maintenance functions. With projected traffic growth and system demand, advancements in technology, and limitations in funding, there is increasing recognition that Iowa's transportation system must be managed and operated in a manner responsive to constantly changing conditions. This document is intended to provide guidance and direction to Iowa DOT and public officials responsible for making strategic decisions about effectively managing and operating the transportation system with limited resources to meet the changing conditions and travel demand in Iowa.

Congestion Is a Problem

Congestion levels are increasing. According to the Texas Transportation Institute's 2015 Urban Mobility Scorecard, delays from congestion caused an extra 6.9 billion hours of travel and the purchase of an extra 3.1 billion gallons of fuel in 2014, totaling $160 billion in congestion costs nationwide (Shrank, Eisele, Lomax, Bak, & Inrix, Inc., 2015).

Transportation Systems Management and Operations (TSMO) optimizes the existing infrastructure through the implementation of multimodal, cross-jurisdictional systems, services, and projects designed to preserve capacity and improve the security, safety, and reliability of the transportation system.

Iowa Travel by the Numbers

- Population: 3.1 million (2013)
  - *11% increase since 1990*
- Licensed Drivers: 2.2 million
- Vehicle Miles Traveled (VMT): 31.6 billion (2013)
  - *Up from 23 Billion VMT in 1990*
  - *Projected to increase to nearly 38 Billion by 2030*
- Congestion Costs: $380 million annually in lost time and fuel
- Traffic Crash Fatalities: 321 (2014)

Congestion on the Iowa urban Interstate system is trending upwards measured as the percentage of congested urban Interstate or freeway lane miles. The percentage increased from 36 percent in 2009 to just over 40 percent in 2011, which ranked Iowa 32nd among the fifty states, and put it in the "Bad" category (Hartgen, Fields, & Feigenbaum, 2014). About 72% of the congestion experienced by the traveling public in Iowa is caused by temporary disruptions that take away part of the roadway from use, also known as "non-recurring" congestion. The four main causes of non-recurring congestion in Iowa are traffic incidents, work zones, bad weather, and special events (Figure 1). The remaining 28% of congestion in Iowa, referred to as "recurring" congestion, is caused by bottlenecks and poor signal timing typically during "peak hour" traffic periods where there are more vehicles than enough roadway capacity to meet the demand. Compared to the rest of the nation, Iowa has less congestion from bottlenecks and more congestion from bad weather (Figure 2).

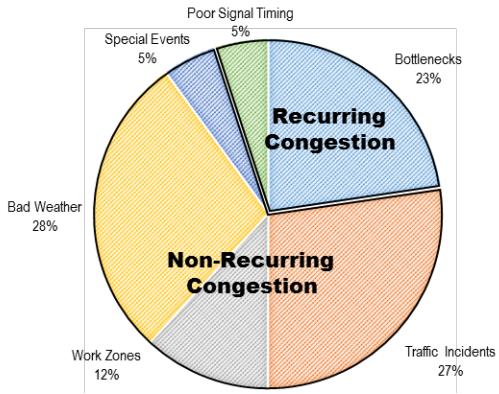

FIGURE 1. IOWA SOURCES OF CONGESTION, 2013-2015

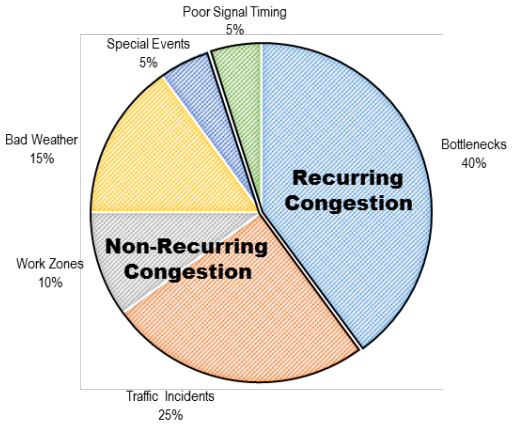

FIGURE 2. NATIONAL SOURCES OF TRAFFIC CONGESTION, 2005
(Cambridge Systematics, 2005)

The impact of congestion goes well beyond a traffic event itself. Every minute a lane is blocked during peak traffic leads to roughly four to five minutes of delay (National Traffic Incident Management Coalition, 2006). As an example, if a lane were blocked for 15 minutes, it would take approximately one hour for traffic conditions to return to normal. On average, the Iowa DOT Traffic Management Center in Ankeny responds to around 1,400 traffic incidents per month, all of which have the potential to block lanes. In addition, for each minute that a traffic incident continues, the likelihood of a secondary crash increases by 2.8% (Karlaftis, Latoski, Richards, & Kumares, 1999). Rapid decreases in speed, traffic backups, and rubbernecking all lead to dangerous conditions. The USDOT estimates secondary crashes represent more than 20% of all crashes and are often more deadly than the primary incident. Secondary crashes also represent 18% of all fatalities occurring in the Interstate highway system (SAIC & ATRI, 2010)

Because TSMO deals directly with the root causes of congestion and unreliable travel (incidents, weather, work zones, special events, bottlenecks and other supply and demand variations), it offers the potential to improve travel time reliability and help highway users travel to their destinations safely, efficiently, and conveniently.

Congestion Is Costly

Traffic congestion can mean different things to different users of the transportation system. In Iowa it may come in many forms:

- Spring flooding causes major long-term delays to commuters and the freight industry.
- A traffic crash causes a family to be late to a concert or other special event.
- A highway work zone causes back-ups because the traffic demand exceeds available capacity during peak travel times.
- Poor signal timing generates traffic delays during routine trips.
- The daily commute is routinely longer and unpredictable because locations on the highway do not have enough capacity.
- A trucking company misses their delivery window due to an unplanned lane closure and is required to pay liquidated damages because the factory did not have the parts needed to continue manufacturing.

In work zones on Interstate and State Highways from 2010-2014, there were a total of 1,633 crashes (involving all vehicles), including 25 fatalities and 45% (728 total) categorized as an injury crash (Iowa Department of Transportation, 2015).

In 2014, congestion cost Americans $160 billion (Shrank, Eisele, Lomax, Bak, & Inrix, Inc., 2015). In Iowa, an extra $2 billion is spent annually on unanticipated transportation costs, including:

- $935 million from accelerated vehicle depreciation, additional repair costs, and increased fuel consumption and tire wear;
- $380 million due to lost time and wasted fuel from traffic congestion; and
- $654 million for the financial cost of traffic crashes, including insurance costs and lost household productivity (The Road Information Program (TRIP), 2015).

Congestion wastes time, fuel, and money, and is a direct cost to the traveling public. In one example from Interstate 380 in Cedar Rapids, the cost of delay from traffic crashes in July 2015 totaled $536,000 and an average of $33,700 per crash. Considering that on average, the Iowa DOT Traffic Management Center in Ankeny responds to about 1,400 traffic incidents per month, the costs from congestion in Iowa are significant.

Companies are increasingly looking at levels of congestion when deciding to re-locate or expand. Annually, $207 billion in goods are shipped from sites in Iowa and another $199 billion in goods are shipped to sites in Iowa. Eighty-nine percent of the goods shipped annually through Iowa are carried by trucks (Federal Highway Administration, 2015). Truck volumes and freight flows in Iowa are predicted to grow by 43 percent from around 360 million tons of freight moved by truck in 2010 to around 514 million tons by 2040 (Iowa Department of Transportation, 2012). With very tight supply chains, effective management and operation of the highway system is critical to maintaining Iowa's economic engine.

Because TSMO provides cost-effective congestion and safety solutions, it offers the potential to maximize existing system capacity and increase traffic flow throughout the transportation system.

THE CASE FOR TSMO

Iowa's transportation system will be safer, more efficient, and more reliable as a result of coordinated and targeted Transportation Systems Management and Operations (TSMO) strategies and investments. TSMO complements the investment Iowa DOT has made in infrastructure by enhancing system management and traffic operations to gain the maximum return on investment.

- In 2005, Maryland DOT's CHART program averaged 22 minute incident durations, compared to 29 minutes by other agencies, reducing travel delay by 37 million vehicle hours and saving $578 million (National Traffic Incident Management Coalition, 2006).
- In the fourth quarter of 2012, Washington State DOT responded to more than 10,000 incidents, with costs savings of over $17 million (Washington Department of Transportation, 2012).

The State of Iowa has a responsibility to balance statewide needs and resources to serve Iowans in a cost effective, responsible and accountable way. Transportation is an important service that supports the state economy and day-to-day mobility needs of Iowans. TSMO strategies (such as traffic incident management, traveler information services, work zone management, safety service patrols and freight management) improve system efficiency, reduce traveler delays, and maximize the return on the State's investment in transportation infrastructure. TSMO also enhances the quality of life for Iowans through improved mobility.

From a public perspective, customer focus groups recently convened to discuss TSMO needs in Iowa identified safety as a transportation priority and cited the importance of the transportation system in supporting the economy and local businesses. TSMO is critical to providing safe and convenient mobility for Iowans and maintaining Iowa's economic engine through traffic incident management, traveler information services, work zone management, safety service patrols and freight management.

Iowa DOT, like other state transportation agencies, has historically focused on increasing capacity to improve level of service. As the ability to increase capacity on existing infrastructure has become constrained through limited funding and a push to increase the efficiency and safety of existing facilities, TSMO provides an opportunity to maximize current system efficiency and address delay and congestion through more operations-focused means.

The ability to increase transportation capacity through construction has not always kept pace with increases in vehicle miles traveled (VMT) and growing congestion on Iowa highways. With increased demand, the transportation system experiences congestion and decreased safety from temporary disruptions like traffic incidents, bad weather, and work zones. As public stewards of the State highway system, Iowa DOT must adapt to changing travel demands to meet the needs of businesses and the

traveling public. As demonstrated in the past, Iowa DOT's adaptive leadership and changes in DOT culture will respond to changing conditions to better meet customer demand with new resources. This includes prioritizing projects and operational strategies that target bottlenecks on the transportation system, and deploying technology and strategies to improve system mobility, enhance public safety, reduce traveler delay and improve information access. TSMO provides a performance-based approach to delivering cost effective investment and services to realize Iowa DOT's vision of *Smarter, Simpler, Customer-Driven.*

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, it 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. With increasing travel demand reflected in a growing population and VMT, and with funding constraints for construction of additional lanes, TSMO brings together Iowa DOT and its external partners to reduce traffic congestion and address nonrecurring traffic disruptions in a collaborative and cost effective program. These strategies can be implemented faster and more economically than new construction, and support environmental and sustainability objectives by reducing congestion and avoiding more impactful construction options.

TSMO STRATEGIC DIRECTION

The overall strategic direction for the TSMO Program aligns with and supports the vision, mission, goals and core values of Iowa DOT. The following reflects Iowa DOT's priorities and those articulated in focus group meetings with external partners and customers.

TSMO Vision

Iowa's transportation system is safe, efficient and reliable, supporting the state's environmental and economic health as a result of TSMO.

TSMO Mission

To get you there safely and reliably by proactively managing the transportation system.

TSMO Strategic Goals and Objectives

The TSMO strategic goals and objectives in Table 1 support the TSMO vision and mission, and provide specific direction for the TSMO Program.

TABLE 1. STRATEGIC GOALS AND OBJECTIVES

Strategic Goal		Strategic Objective
	1. Safety	Reduce crash frequency and severity
	2. Reliability	Improve transportation system reliability, increase system resiliency, and add highway capacity in critical corridors
	3. Efficiency	Minimize traffic delay and maximize transportation system efficiency to keep traffic moving
	4. Convenience	Provide ease of access and mobility choices to customers
	5. Coordination	Engage all DOT disciplines, and external agencies and jurisdictions to proactively manage and operate the transportation system
	6. Integration	Incorporate TSMO strategies throughout DOT's transportation planning, design, construction, maintenance, and operations activities

The Strategic Goals and Objectives set the overall direction for TSMO in Iowa and frame the priorities for developing a TSMO Program and for integrating TSMO throughout Iowa DOT. The TSMO Program is the primary mechanism for delivering these Goals, and the TSMO Program Plan articulates the specific organizational procedures and resources, activities, services and projects needed to realize the strategic TSMO Goals.

TSMO PROGRAM PLAN OVERVIEW

Figure 3 illustrates how the TSMO Plan is composed of three components:

- TSMO Strategic Plan
- TSMO Program Plan
- TSMO Service Layer Plans

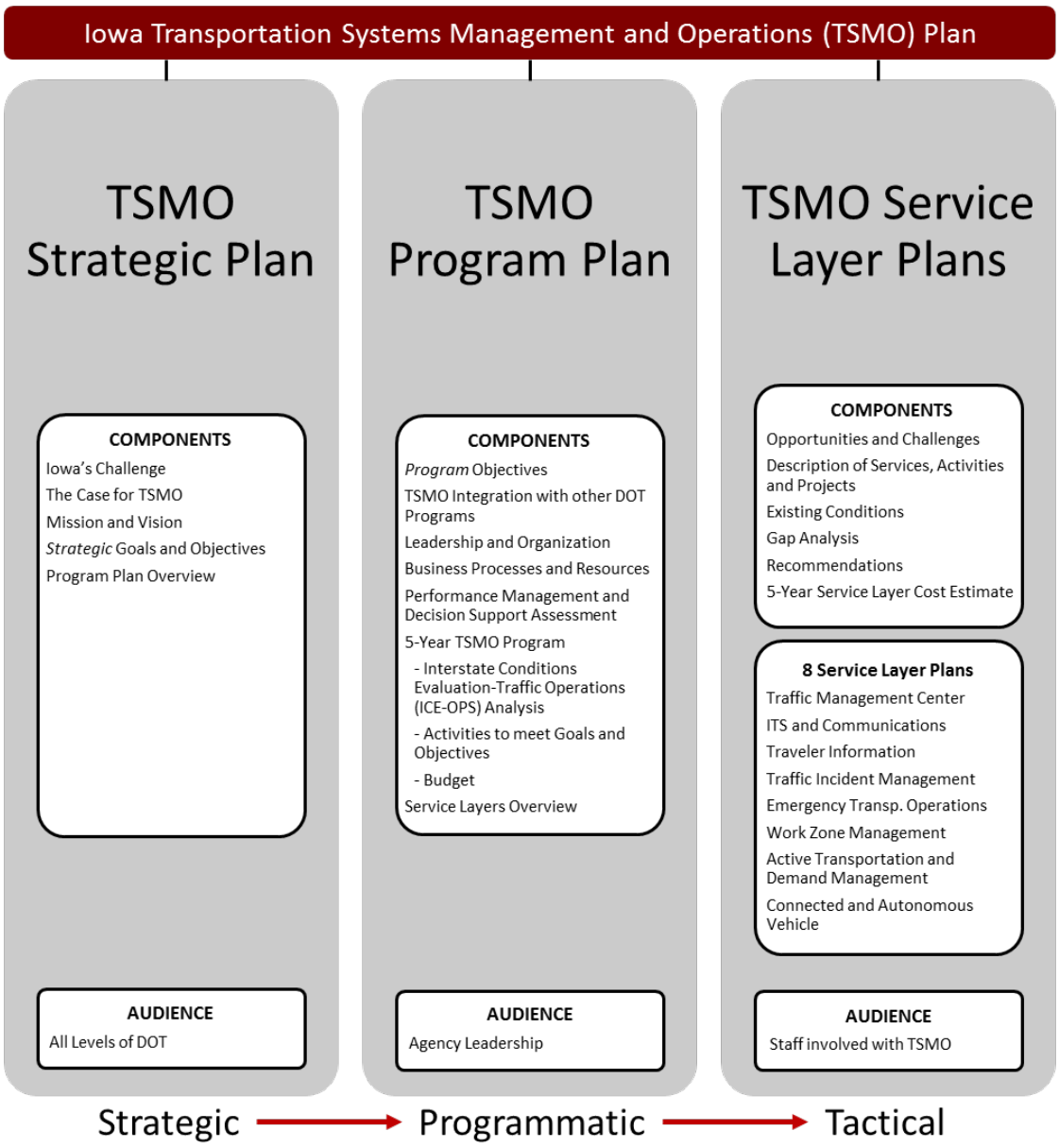

FIGURE 3. TSMO DOCUMENTS RELATIONSHIP

1) TSMO Strategic Plan – Highlights Iowa's challenges, makes the case for TSMO, and describes the Vision, Mission, Goals, and Strategic Objectives for TSMO. It focuses on the benefits of a comprehensive approach to TSMO to support Iowa DOT's vision of *Smarter, Simpler, Customer-Driven* and provides a strategic direction for Iowa DOT's TSMO Program and integration.

2) TSMO Program Plan – A companion to the Strategic Plan is the TSMO Program Plan, which provides the structure for a comprehensive TSMO Program. The Program Plan outlines the programmatic objectives, strategies, processes, procedures, and resources needed to deliver the Vision and Goals of the TSMO Strategic Plan. The TSMO Program Plan Includes:

- Program Objectives – Provides specific *programmatic* objectives that support the Strategic Goals and Objectives.
- TSMO Integration with Current Plans and Programs – Highlights how TSMO principles support current DOT plans and programs and how they can be integrated across the DOT, from the earliest stages of planning and project development.
- Leadership and Organization – Identifies how Iowa DOT can adopt effective practices to improve TSMO capabilities and inform future organizational culture.
- Business Processes and Resources – Provides a detailed investigation into a variety of departmental TSMO activities, including:

    - Staffing and Expertise
    - Budgeting, Accounting, Procurement and Contracting
    - Project Programming
    - Systems Engineering
    - Collaboration with External Partners
    - Programmatic and Administrative Support
    - Sustainability and Resiliency
    - Communications, Marketing, and Outreach
    - Data Management and Geographic Information Systems (GIS)
    - Continuous Improvement
    - Research and Development

- Performance Management and Decision Support Assessment - Provides a snapshot of ongoing performance measurement activities and highlights the need for improved decision support to make better TSMO-based decisions.
- 5-Year TSMO Program – includes three components:

    - A tool that extends the existing Interstate Condition Evaluation (ICE) methodology developed by the Office of Systems Planning to reflect additional traffic operations criteria called ICE-OPS
    - 5-year list of activities that deliver TSMO Strategic Goals and Objectives
    - 5-year budget plan

3) TSMO Service Layer Plans – Based on the Program Plan Objectives, the Service Layer Plans are intended to provide more detailed recommendations and actions for each of eight service areas. The Service Layer Plans include discussion and analysis of opportunities and challenges, existing conditions assessment, gap analysis, recommendations, and a more detailed 5-Year Service Layer Plan cost estimate for each Service Layer.

Eight Service Layer Plans are expected to be completed over the next two years. Table 2 provides a definition of each Service Layer.

TABLE 2. SERVICE LAYER DEFINITIONS

Service Layer	Definition
Traffic Management Center	The around-the-clock hub of DOT traffic coordination activities throughout the state. The Traffic Management Center recently relocated from Ames to a newly remodeled facility in the Iowa Motor Vehicle Division Building in Ankeny.
ITS and Communications	Fixed and mobile traffic detectors, non-enforcement traffic cameras, dynamic message signs, highway advisory radio, and supporting communications infrastructure.
Traveler Information	Traveler Information tools that help publicly broadcast planned and prevailing traffic conditions, such as Iowa 511 and various social media.
Traffic Incident Management	The coordination of how Iowa DOT and its partners respond to routine highway traffic incidents.
Emergency Transportation Operations	The coordination of how Iowa DOT and its partners respond to large scale incidents (not necessarily highway related), such as flooding, tornado, epidemics, etc.
Work Zone Management	The planning and deployment of various strategies to maintain traffic flow and safety through highway work zones.
Active Transportation and Demand Management	Innovative strategies to maximize available capacity of roadways, such as ramp metering, variable speed limits, lane control signing, and time-of-day shoulder use.
Connected and Autonomous Vehicle	An emerging technology that considers the challenges and opportunities of vehicle-to-vehicle, vehicle-to-infrastructure, and autonomous vehicles to improve vehicle safety and efficiency. Iowa DOT's primary role is an information service provider.

BIBLIOGRAPHY

Cambridge Systematics. (2005). *Traffic Congestion and Reliability, Trends and Advanced Strategies for Congestion Mitigation.* Washington, DC: Federal Highway Administration.

Federal Highway Administration. (2015). *Freight Analysis Framework*. Retrieved from http://ops.fhwa.dot.gov/FREIGHT/freight_analysis/faf/index.htm

Hartgen, D., Fields, M., & Feigenbaum, B. (2014). *21st Annual Report on the Performance of State Highway Systems (1984-2012).* Washington, DC: Reason Foundation.

Iowa Department of Transportation. (2012). *Iowa Freight Facts*. Retrieved from Iowa Department of Transportation: http://www.iowadot.gov/systems_planning/freight/Iowa%20Freight%20Facts%20and%20Figures.pdf

Iowa Department of Transportation. (2015, May 22). Iowa Work Zone Crashes. Ames, IA: Iowa Department of Transpostation.

Karlaftis, M. G., Latoski, S. P., Richards, N. J., & Kumares, S. C. (1999). ITS Impacts on Safety and Traffic Management: An Investigation of Secondary Crash Causes. *Intelligent Transportation Systems Journal*, 39-52.

National Traffic Incident Management Coalition. (2006). Benefits of Traffic Incident Management. Washington, DC: National Traffic Incident Managament Coalition.

SAIC, & ATRI. (2010). *Traffic Incident Management Handbook.* Washington, DC: Federal Highway Administration. Retrieved from http://ops.fhwa.dot.gov/eto_tim_pse/publications/timhandbook/tim_handbook.pdf

Shrank, D., Eisele, B., Lomax, T., Bak, J., & Inrix, Inc. (2015). *2015 Urban Mobility Report.* College Station, TX: Texas A&M Transportation Institute, Inrix, Inc. Retrieved from http://d2dtl5nnlpfr0r.cloudfront.net/tti.tamu.edu/documents/mobility-scorecard-2015.pdf

The Road Information Program (TRIP). (2015). *Iowa's Top Transportation Challenges.* Washington, DC: TRIP, a National Research Group.

Washington Department of Transportation. (2012). *The Gray Notebook, Edition 48.* Seattle, WA: Washington Department of Transportation. Retrieved from http://wsdot.wa.gov/publications/fulltext/graynotebook/Dec12.pdf