

TIGER PROPOSAL 2015

Regional Truck Parking Information and Management System (TPIMS)

CONTACT INFORMATION

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A. PROJECT DESCRIPTION

To improve the efficiency, economic competitiveness and safety of the national freight network, the State of Kansas in partnership with Indiana, Iowa, Kentucky, Michigan, Minnesota, Ohio, Wisconsin and the Mid America Association of State Transportation Officials (MAASTO), has developed a proposal for a multi-state Truck Parking Information and Management System (TPIMS). This project, sponsored by the eight-state MAASTO TPIMS Partnership, provides an opportunity to create a new and collaborative way for the Midwest region to address truck parking information and availability needs along its busiest freight corridors. When deployed, this system will provide truck drivers with reliable, real-time information to make smarter, more efficient truck parking decisions. In addition, **the innovative application of existing, shovel-ready technologies assembled in this project will provide a benefit-cost ratio of over 4.27. Approximately \$37 million in deployment costs will generate over \$403 million in benefits for the motoring public over the life of the system.**

The cooperation exhibited by the partnership drives value further for freight customers through a commitment to develop a unified regional system. Over-the-road truck drivers typically travel at least 500 miles in a day, therefore the partner states are committed to developing common design criteria and standards for information dissemination to enable seamless system use across state lines. This lays the groundwork for this regional deployment to be expanded in the future to additional freight corridors and states, improving overall economic productivity and efficiency of the national freight network.

Deployment of a TPIMS is a critical need for the Mid-American region to improve truck safety, efficiency and way-finding, as well as to better align with the needs for truck drivers to meet Federal Motor Carrier Safety Administration's (FMCSA) Hours of Service (HOS) requirements. Trucks parked along a number of significant freight corridors throughout the MAASTO region often overflow onto the shoulders of rest area ramps, freeway ramps and adjacent roads, creating safety concerns for other motorists and for the commercial vehicle operators. This park-

ing behavior is often not due to a lack of available parking, but rather because there is no real-time information regarding parking availability for drivers to make informed decisions on where to park.

The MAASTO TPIMS Partnership believes that the existing spaces along these corridors can be utilized more efficiently through better communication of parking availability and way-finding to the trucking community. As a result, the primary needs to be addressed by this project include:

- Identifying available parking options using advanced parking technologies, and
- Communicating parking availability in real-time to commercial vehicle operators so that they can make informed parking decisions.



Lack of information about availability of safe truck parking is a significant issue for truckers and motorists

Truck parking, along a number of significant freight corridors throughout the MAASTO Region, overflow onto the shoulders of rest area ramps, freeway ramps and adjacent roads, creating safety concerns for commercial vehicle operators and motorists.

The MAASTO TPIMS Partnership proposes to deploy the system throughout the eight-state region on high volume freight corridors including: I-35, I-64, I-65, I-70, I-71, I-75, I-80, I-94, and I-135. The proposed project is a system that uses existing ITS infrastructure and capabilities, along with emerging vehicle detection and data collection technologies to address these needs. This project will monitor the availability of truck parking and will provide real-time information to commercial vehicle operators using multiple information dissemination methods, including dynamic truck parking signs, smart phone applications, and traveler information websites.

The Need for Action

Nationally, there is a large and growing problem with truck parking along the national highway system and other freight corridors of statewide and national significance. Access to safe and convenient parking areas for trucks is essential for a robust freight transportation network, yet truck drivers consistently have difficulty finding areas to safely rest. The FMCSA regulates Hours of Service for drivers and mandates rest periods for them – at least 10 hours per day after every 14 hour shift or risk fines and disciplinary action. However, drivers face two main issues when seeking safe and convenient resting options:

- **There are not enough safe and convenient parking options where needed, and**
- **There is no real-time information regarding parking availability and way-finding.**

The seriousness of this situation was addressed in Section 1401 of MAP-21; a section called “Jason’s Law”. In 2009, Jason Rivenburg, a commercial truck driver, sought a safe spot to rest before delivering a load of milk early the next morning. Tragically, Jason’s unfamiliarity to parking options nearby led him to park at an abandoned gas station, ultimately resulting in his murder. Jason left behind a young son and a wife pregnant with twins. As a result of this incident Hope Rivenburg, Jason’s wife, championed “Jason’s Law”; which takes solving the truck parking crisis from an industry issue to a national issue, expanding eligibility for states to use federal highway funds for truck parking projects.

In addition to driver security, a 2003 study by the National Cooperative Highway Research Program (NCHRP) estimated that driver fatigue contributed to 15% of fatal crashes involving trucks.¹ Truck drivers need access to safe parking to battle the fatigue of operating on a daily basis.



Graphic courtesy of PowerPoint by Desiree Wood, Andrew Warcaba Associates and Hope Rivenburg

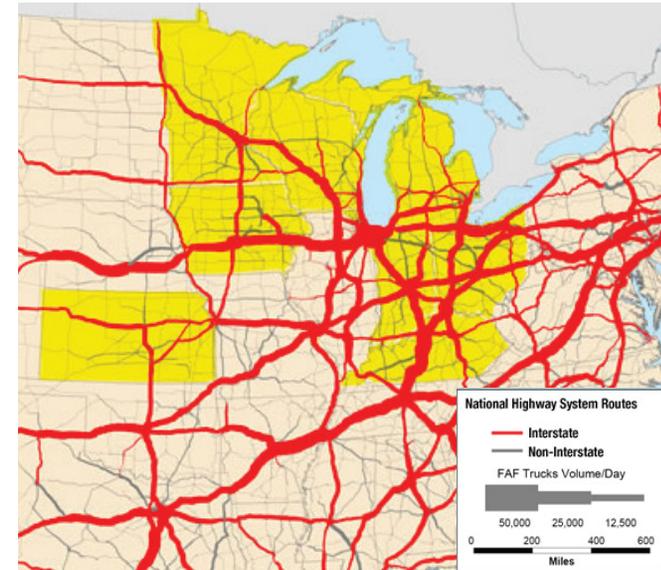
¹NCHRP Synthesis 317 – Dealing with Truck Parking Demands, Transportation Research Board, 2003

Without reliable, real-time information about parking availability, drivers often end their shift early and travel from lot to lot looking for available parking. In October 2013, a survey of nearly 4,000 truck drivers revealed that eighty-three percent (83%) of the respondents routinely took longer than 30 minutes to find parking; thirty-nine percent (39%) took longer than one hour. Drivers who have not located parking before reaching their hours of service limits are often forced to park illegally and/or unsafely, often on the shoulder of the highway, on an off-ramp or an abandoned facility, to avoid fines or discipline from their employer.² Taking the roughly \$120 per hour operational cost of a truck and applying it across the nearly 400,000 national parking events that occur on a daily basis, the economic cost of 83% of drivers spending 30 minutes or more each day to find parking is over \$7 billion annually.

As seen in Figure 1, there are many corridors in the Midwest with truck volumes exceeding 25,000 trucks per day. These high truck volumes create congestion at parking sites, making it difficult for truck traffic to locate parking during peak travel hours.

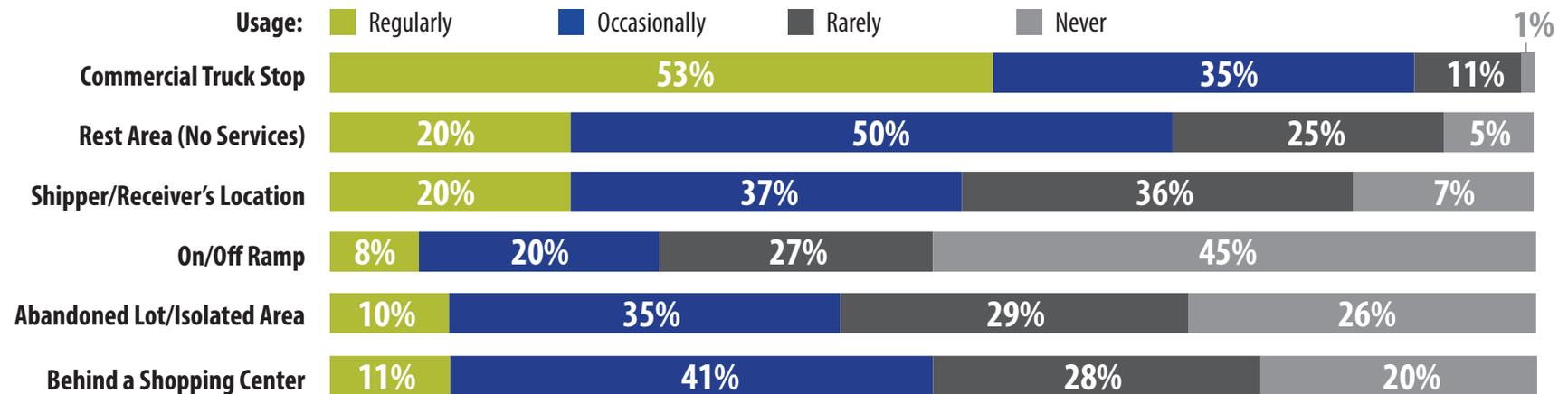
Figure 2 shows the survey results for locations where truck drivers generally park. A significant number of surveyed truckers park in areas that could be considered unsafe; including ramps, abandoned lots, and isolated locations like shopping center delivery areas.

Figure 1: Average Daily Long Haul Freight Truck Traffic on the National Highway System, 2011



Source: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, Freight Analysis Framework, version 3.4, 2013.

Figure 2: Survey results for locations where truckers normally park



Courtesy of PowerPoint by Desiree Wood, Andrew Warcaba Associates and Hope Rivenburg

²2013 Safe Truck Parking Survey PowerPoint by Desiree Wood, Hope Rivenburg, and Andrew Warcaba Associates

How Can TPIMS Address Regional Needs?

To improve safety and efficiency within the nation's truck transport network, drivers need real-time information regarding the location of available parking. In fact, recommendations in the first ever National Freight Advisory Committee report identify use of ITS as a solution for truck parking issues, while also citing fatigue prevention as a means to stem accidents in the transportation sector.³ This can be accomplished by launching a TPIMS. TPIMS is envisioned to be a network of safe, convenient parking areas with the ability to collect and broadcast real-time availability to drivers through a variety of media outlets. This will enable drivers to proactively plan their routes and make safer, smarter parking decisions. It will also enable parking facility owners (public and private) to understand the magnitude and timing of the demand on their facilities, thereby allowing for smart partnerships and investments to increase parking capacity in areas where demand exceeds supply. Commercial truck drivers will have new resources to use when looking for parking, increasing their overall productivity and efficiency. Therefore, instead of unsafely or illegally settling for parking at an overcrowded

parking facility, operators will have the ability to weigh the value of driving extra 5 to 20 miles to secure parking without fearing the unknown or lack of availability upon arrival.

Why the Midwest, and Why Now?

Three states in the MAASTO region are already implementing variations of TPIMS, paving the way for a progression to a regional system: Michigan, Wisconsin and Minnesota.

- TPIMS was deployed by the Michigan Department of Transportation (MDOT) in southwest Michigan, continuously operating since mid-2014. The I-94 international trade corridor often experiences overcrowding of rest areas, forcing drivers unfamiliar with the area to park along ramps, shoulders, and adjacent interchanges. The MDOT system helps truck drivers locate safe and convenient parking and plan their rest periods on a 130-mile stretch of I-94 from the Indiana state line to Parma, MI.



³ National Freight Advisory Committee, "Recommendations to U.S. Department of Transportation for the Development of the National Freight Strategic Plan", 2014.

- The Wisconsin Department of Transportation (WisDOT) is currently negotiating contracts to build a similar system along I-94 using a \$1 million grant from the Federal Highway Administration. This system will provide interstate truck parking continuity between Wisconsin and Minnesota. In Wisconsin, the system will provide dynamic message signs, integration with WI 511, and third party mobile applications to indicate availability of truck parking at four key rest areas.
- In Minnesota, truck parking availability at three rest areas is being calculated using an innovative stereoscopic camera system developed by the University of Minnesota. Information is provided via in-cab communications, the MN 511 website, and the University of Minnesota website.

The progress made in these three states has led to the initiation of this eight-state collaboration across the Midwest. This regional TPIMS approach is especially focused on the rest and parking needs of long-haul trucking operators who travel hundreds of miles, often across state lines, during a 14-hour shift. **With the Midwest serving as the Heartland of the U.S., this region offers a great opportunity to improve the national and global competitiveness of the nation's goods movement via truck, and sets the stage for the later expansion to both coasts and significant NAFTA corridors connecting to Canada and Mexico.**

Who Would Benefit from this System?

There are many benefactors of the MAASTO TPIMS Project. Commercial truck drivers will benefit from the system because, as shown through the success of MDOT's I-94 TPIMS Project, there will be better utilization of the parking assets along each corridor, reducing the illegal and informal parking at rest areas. As drivers will have the ability to use real-time truck parking availability information to find the next available parking location, their safety and the security of the goods that are being transported will also be increased. Maintaining agencies will benefit from the TPIMS investment because of the reduction in non-routine maintenance repairs on shoulders and ramps due to illegal or informal parking. Law enforcement agencies will be able to focus resources on higher value targets, rather than enforcing illegal parking. Manufacturers and shippers in the region will benefit from the more efficient movement of cargo, which enhances the global competitiveness of the Midwest economy. Residents of the partnership states will benefit from reduced emissions and a reduction in overall truck crashes, impacting fellow motorists safety and mobility. **The MAASTO TPIMS Project drives safety, economic benefits, and environmental benefits for the residents of the eight-state partnership at a very compelling benefit-cost ratio.**

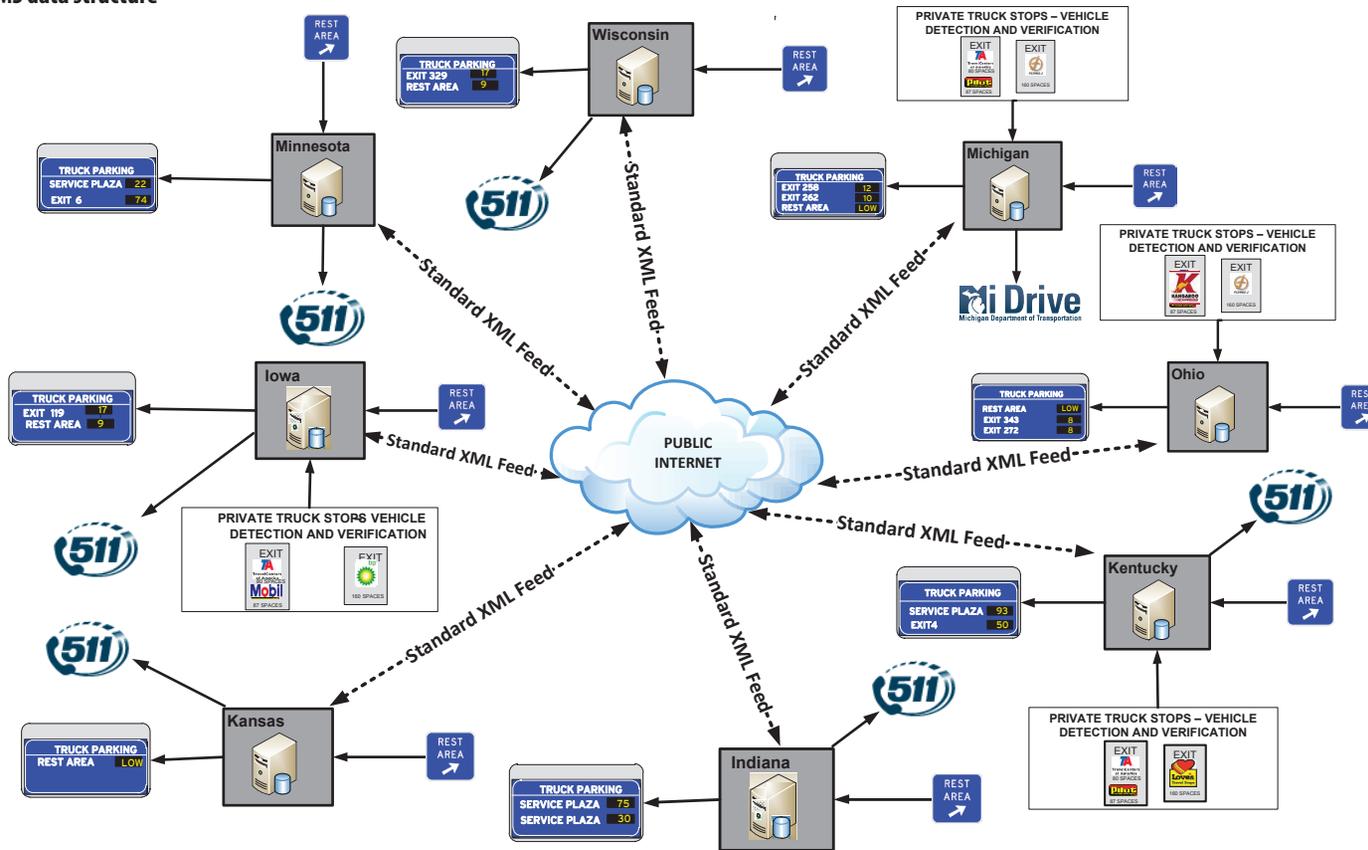


What is the Project Architecture?

The proposed architecture for TPIMS in the MAASTO region includes both the flexibility to allow each state to run their own parking system, and common standards to provide interoperability across state lines. This will allow for seamless integration while setting standards for future truck parking efforts nationwide. As shown in Figure 3, the technology deployed at parking facilities and roadside signs will integrate with each state’s existing ITS network and software platform.

Additionally, a common Application Programming Interface (API) will be developed to exchange parking availability information between all parties, both public and private. This approach builds off of the successes in Michigan with data being seamlessly exchanged between MDOT and private project partners. This architecture will allow for quick project startup while being scalable to include additional sites, states, and data service platforms in the future.

Figure 3: TPIMS data structure



How will Availability Information be Shared?

The MAASTO TPIMS Partnership is proposing to deploy a TPIMS on critical freight corridors in the Midwest. The system will collect truck parking availability information and disseminate it to users over a variety of media, including dynamic truck parking signs upstream of rest areas, State DOT traveler information web sites, and smart phone applications. Michigan is also currently disseminating truck parking info via Dedicated Short Range Communications (DSRC), and will continue in the future.

Dynamic Truck Parking Signage

The primary dissemination method for truck parking availability will be dynamic truck parking information signs upstream from project rest areas and weigh stations. Additionally, signs bring awareness to the system while showing alternate parking facilities near problem areas, and were ranked as the most preferred way to receive information in a 2012 survey of commercial operators in the Midwest. These signs will provide real-time information about the number of parking spaces available. **Figure 4** shows one of the five truck parking signs deployed in Michigan along I-94.

Smart Phones and In-Cab

Another potential approach for truck parking information dissemination is through the use of smart phone applications. In order to ensure safe operations, mobile applications will be FMCSA “one-touch” compliant by relying on hands-free voice interactive commands. Some of the State DOTs are considering the establishment of a mechanism to distribute data to drivers through existing subscription services such as third party dispatch platforms. Other DOTs may choose to limit information dissemination to dynamic truck parking information signs and/or traveler information web sites. The TPIMS allows flexibility for states to integrate new applications in the future as state budgets allow or new technologies become available.

Figure 4: Existing Truck Parking Sign in Michigan on I-94.

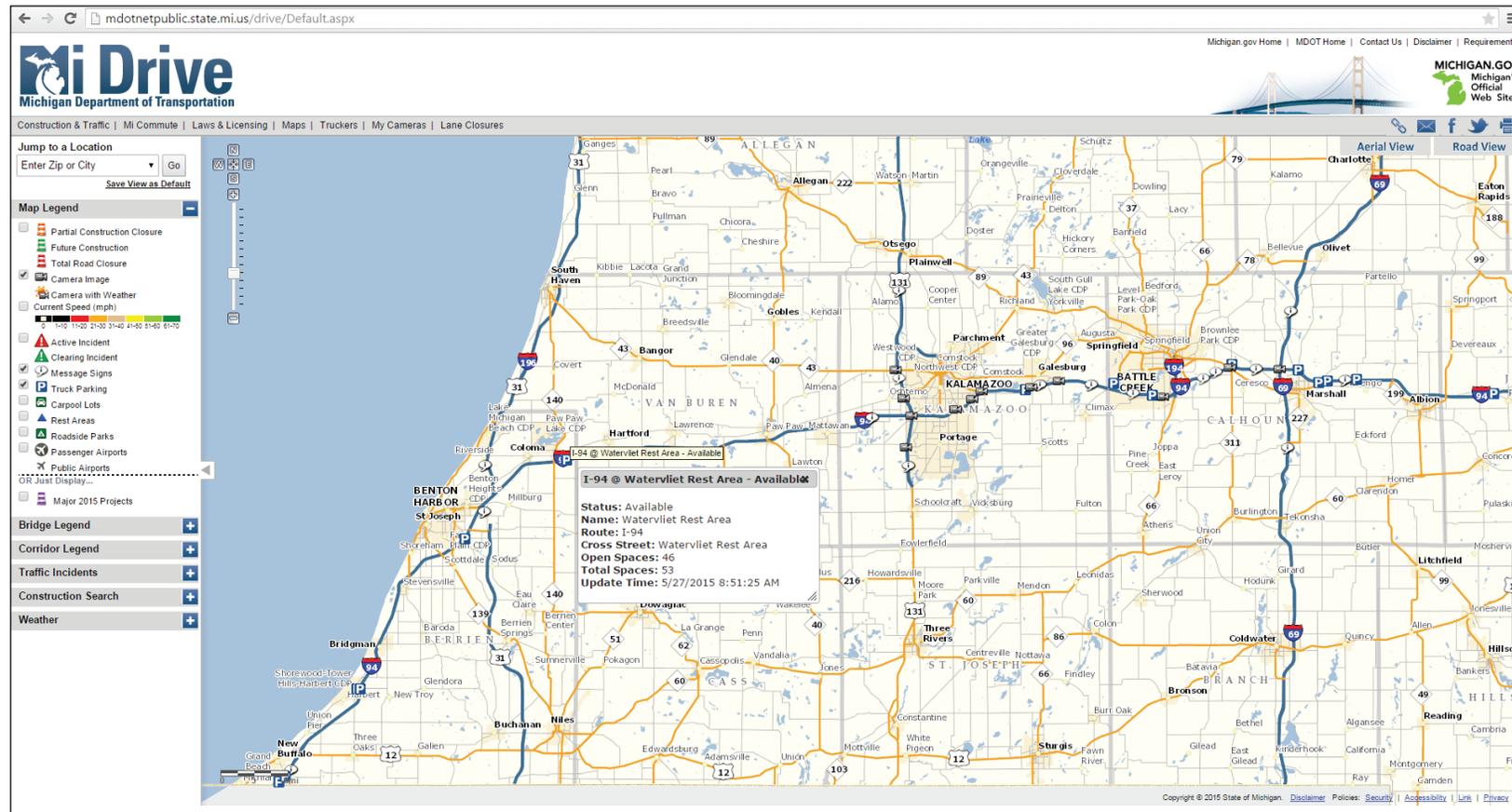


Traveler Information Web Sites

Parking availability information will be published on traveler information web-sites, such as KanDrive/511, Mi Drive, and MN 511 sites. Michigan, Minnesota, Wisconsin, Indiana, Iowa, and Kentucky will continue to maintain their respective websites while adding the new parking locations to their databases, while the

remaining states will determine if they will integrate data with their respective traveler information sites. These websites may include a page specifically for “Truckers”. Dispatchers can use this information to inform their drivers of parking availability in the corridor. As seen in **Figure 5** below, Mi Drive is already utilized to show parking information on existing TPIMS along I-94.

Figure 5: The Mi Drive website is another mechanism for disseminating parking availability information

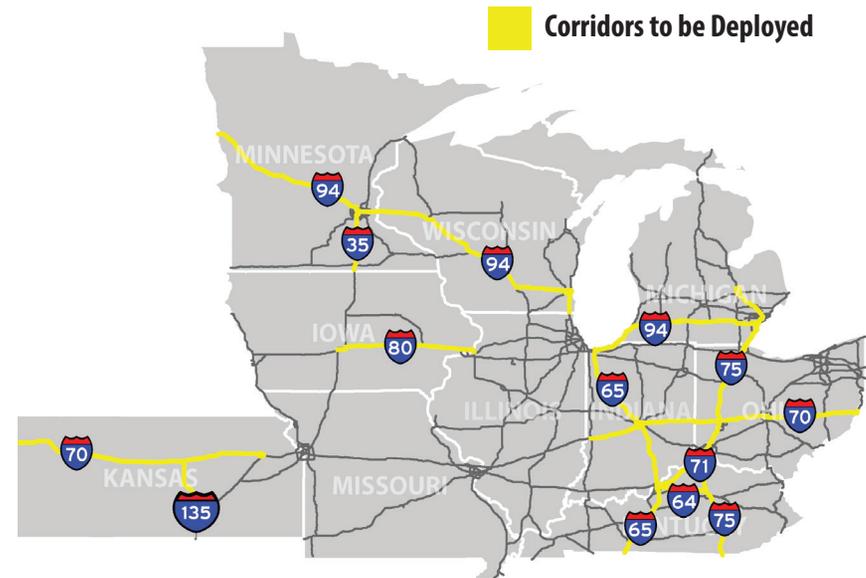


B. PROJECT LOCATION

The TPIMS project will be deployed across eight states which have each chosen specific corridors and locations to meet their particular needs. The Indiana, Kansas, Minnesota and Wisconsin DOTs will implement TPIMS at public facilities on their corridors. Michigan, Ohio, Kentucky and Iowa will implement at both public and private facilities to meet their truck parking availability needs. These facilities and corridors were selected for the following reasons:

- They carry high volumes of commercial vehicles, many of which are destined for large cities such as Kansas City, Des Moines, Indianapolis, Louisville, Chicago, Milwaukee, Detroit, Minneapolis, Cincinnati, Columbus, and Cleveland, among others. Commercial traffic uses the truck parking facilities along these corridors as staging and resting areas prior to delivering their loads to their destinations.
- State law enforcement agencies report that public rest areas and private truck parking facilities along these segments experience overcrowding that spills over onto rest area and interchange ramps and shoulders, creating safety and operational concerns. Enforcement of illegal parking is a growing challenge.
- Crash data compiled from the previous 10 years indicate that crashes involving trucks are common and many involve driver fatigue.

Figure 6: TPIMS Deployment Corridors



Corridor	State Deployed Across	Number of Deployed Rest Areas
I-35	Minnesota	3 DOT
I-64	Kentucky	2 DOT, 2 Private
I-65	Indiana, Kentucky	13 DOT, 5 Private
I-70	Ohio, Indiana, Kansas	32 DOT, 21 Private
I-71	Kentucky	1 DOT, 3 Private
I-75	Michigan, Ohio, Kentucky	14 DOT, 23 Private
I-80	Iowa	14 DOT, 10 Private
I-94	Michigan, Indiana, Wisconsin, Minnesota	16 DOT, 11 Private
I-135	Kansas	4 DOT

TPIMS Deployment Corridors

	<p>I-35 is a major north–south Interstate Highway in the central United States. I-35 stretches from Laredo, TX, on the American-Mexican border to Duluth, MN. I-35 serves as a main artery to the Midwest states by connecting Minneapolis, Des Moines, and Kansas City. The sections that will be covered by the TPIMS are from Minneapolis to Iowa.</p>		<p>In Kentucky, I-64 travels for 191 miles passing by Louisville, Frankfort, Lexington and Ashland. It has several major junctions within the state: I-65, I-71, I-264 and I-265 in Louisville, and I-75 in Lexington. TPIMS will cover the entire I-64 corridor in Kentucky.</p>
	<p>I-65 is a major Interstate Highway in the eastern United States. Its southern terminus is located in Mobile, AL, and its northern terminus is in Gary, IN, just southeast of Chicago. The TPIMS will be in place from Gary, IN south to the Kentucky/Tennessee border. I-65 serves as a main trucking route to Chicago, Indianapolis, and Louisville.</p>		<p>I-70 runs from Maryland to Utah, just over 2,150 miles, and is a major United States Interstate Highway running through many major cities including Denver, CO, Kansas City, KS, St. Louis, MO, Indianapolis, IN and Columbus, OH. TPIMS will be deployed on I-70 through Kansas, Indiana, and Ohio. The TPIMS deployment will cover over 800 miles of the highest truck volume sections of I-70.</p>
	<p>I-71 is an Interstate Highway in the Great Lakes/Midwestern and Southeastern region of the United States. Its southern terminus is in Louisville, KY and its northern terminus is in Cleveland, OH. While I-71 is designated a north–south highway, it is a major east–west route for cross-country traffic linking I-80 and I-90 to I-70 and ultimately (via I-65) to I-40. The section selected for TPIMS runs from Louisville, KY to Cincinnati, OH.</p>		<p>I-80 is a transcontinental limited-access highway in the United States that runs from downtown San Francisco, CA to Teaneck, NJ in the New York City Metropolitan Area. It is the second-longest Interstate Highway in the United States. I-80 runs through many major cities including Toledo, OH, Des Moines, IA, Omaha, NE, Salt Lake City, UT, Sacramento, CA and Oakland, CA, and passes within 10 miles of Chicago, IL and New York City, NY. TPIMS will be installed in Iowa along I-80 from the west side of Des Moines east to the Mississippi River.</p>
	<p>I-75 is a major north–south Interstate Highway in the Great Lakes and Southeastern regions of the United States and spans a total of 1,786 miles from Miami, FL to Sault Ste. Marie, MI. Due to high traffic levels on the Interstate, much of the route is six lanes - even in rural areas. The areas that will be installed with the TPIMS are high truck volume areas from Flint, MI to the Kentucky/Tennessee border.</p>		<p>I-94 is a main artery for the northern states. I-94 is the northernmost east–west Interstate Highway connecting the Great Lakes and inter-mountain regions of the United States. I-94 is notable for being the only east–west Interstate Highway to form a direct connection into Canada connecting points from Seattle via I-90 to Toronto via Ontario Highway 401. TPIMS will be deployed from Moorhead, MN (the North Dakota/Minnesota border) to Port Huron, MI (the Canada/Michigan border). I-94 is a main trucking route in which the TPIMS deployment will cover 928 miles of the most heavily trucked miles of the 1604 mile long corridor (57.9% of the total corridor).</p>
	<p>I-135 is a 95.7-mile-long Interstate Highway in central and south-central Kansas. I-135 runs between the cities of Salina and Wichita. The route also runs through the cities of McPherson, Newton, and Park City. The Interstate's northern terminus is at the junction of I-70 and its southern terminus is with I-35. TPIMS will cover the entire I-135 corridor in Kansas.</p>		



C. PROJECT PARTIES

The MAASTO TPIMS Project is proposed as a multi-state effort targeting major interstate and highway corridors to benefit the trucking community and safety of all motorists.

The Kansas Department of Transportation (KDOT) is the lead applicant for this project. KDOT will be coordinating and partnering with seven other State DOTs and MAASTO in order to construct, operate, and maintain this deployment. All participating parties in the proposed TPIMS Project are shown in the graphic on this page. All eight states committed matching funds and are ready to deploy TPIMS if selected for this grant.

The Michigan Department of Transportation (MDOT) has already deployed an initial TPIMS along the western half of the I-94 corridor from the Indiana border to Parma, MI. MDOT hopes to expand the project because of its ability to provide a safer, less congested I-94. In addition to deploying the system at public rest areas, MDOT has partnered and deployed the system with ten private truck stop locations to provide additional real time truck parking information to the truck drivers. The success of the project prompted MDOT to reach out to the MAASTO region to see if the system could be utilized along other corridors. MDOT has taken a lead role in organization and coordination of the project/application because of their positive experience with the TPIMS initial deployment.

The TIGER grant will also advance the efforts of several other states who have worked to provide information to their freight customers. Like MDOT, the Minnesota Department of Transportation (MnDOT) has deployed an information system related to truck parking. MnDOT recently completed a project with the University of Minnesota that developed and deployed video-based detection technologies at several rest areas along I-94 in the Twin Cities area. This information was then compiled and shared with truckers through portable-changeable message signs along I-94, and on a public website. In addition, the Kentucky Transportation Cabinet (KYTC) recently completed a study of truck parking.

Together, KDOT and the other partnering states are committed to deploying a consistent and innovative TPIMS as soon as the TIGER grant is successfully awarded.

 <p>Lead-Applicant</p>	 <p>Partner</p>
 <p>Partner</p>	 <p>Partner</p>
 <p>Partner</p>	 <p>Partner</p>
 <p>Partner</p>	 <p>Partner</p>

D. GRANT FUNDS

The TPIMS Project has a total estimated capital cost of \$36.6 million (in 2015 dollars). Deployment costs include design, construction, and integration. Construction costs were estimated based on the 2013 bid tabulations for the I-94 TPIMS project. Planning and design cost was estimated as 25% of construction, integration was estimated at 10% of the construction cost, and Construction, Engineering & Inspection (CEI) was estimated to be 12% of construction costs.

Local Funding Source

The local funding source for the lead applicant and all project partners are state DOT funds. This project was determined to be a rural TIGER grant application as a majority of deployed sites are within rural areas as determined by the 2010 US Census. Even though there is no required match for a rural application, the eight-state MAASTO TPIMS Partnership has assembled a 10% state match and has all local matching funds committed and ready to deploy as soon as the grant is successfully awarded. As stated earlier in this application, **the TPIMS is a package of shovel-ready technology solutions to improve truck parking way-finding and efficiency for the trucking community.**



Project Budget

MAASTO Breakdown by State	Public Sites	Public Spaces	Private Sites	Private Spaces	Signs	Deployment Total (2015 \$)	90% TIGER Request (2015 \$)	10% State Match (2015 \$)	Annual State O&M (2015 \$)
Indiana	20	1,044	0	0	20	\$6,085,800	\$5,477,220	\$608,580	\$235,775
Iowa	14	263	10	2,060	14	\$4,980,864	\$4,482,778	\$498,086	\$423,336
Kansas	16	160	0	0	16	\$4,868,640	\$4,381,776	\$486,864	\$188,620
Kentucky	9	375	14	1,560	12	\$4,077,383	\$3,669,645	\$407,738	\$478,922
Michigan	8	194	22	942	8	\$4,020,089	\$3,618,080	\$402,009	\$662,556
Minnesota	5	130	0	0	8	\$1,775,000	\$1,597,500	\$177,500	\$68,289
Ohio	18	515	33	2,592	18	\$7,855,873	\$7,070,286	\$785,587	\$1,064,566
Wisconsin	7	241	0	0	14	\$3,000,000	\$2,700,000	\$300,000	\$82,521
Total	97	2,922	79	7,154	110	\$36,663,649	\$32,997,285	\$3,666,364	\$3,204,585

E. SELECTION CRITERIA

State of Good Repair

The MAASTO TPIMS Project will not add or replace existing truck parking facilities; rather, it will deploy an innovative package of ITS technology applications at existing facilities to optimize truck parking facility utilization and performance. TPIMS uses a system of sensors and cameras to convey traveler information to eliminate overcrowding and spread trucks across many available facilities. Overcrowding at facilities often causes trucks to park on the entrance/exit ramps of rest areas or truck stop exits and the shoulders of roadways which leads to the degradation of the pavement in that area. Pavement on the shoulders and ramps was not designed to support parked vehicles for extended periods of time, especially at the loading requirements of commercial vehicles. The damage to the pavement has led to the need for expensive repairs over time.

In urban areas, truck drivers utilizing the TPIMS spend less time driving in urban settings looking for parking. Less time spent on urban streets decreases wear and tear on those roads. Reduced truck volume on urban streets also benefits motorists by decreasing congestion.

Economic Competitiveness

Truck parking improvements provide a number of strong economic benefits within the project corridors and helps strengthen the overall economic productivity and competitiveness of the entire Midwest.

- When deployed, a TPIMS is estimated to save the US economy billions of dollars each year, according to Traffic Technology International.⁴ It is estimated that the yearly cost of wasted fuel and lost working hours is \$7 billion and an average yearly cost of \$35 billion in damaged or stolen goods in transit in the US. The TPIMS Project would greatly decrease the time spent searching for parking and, in turn, decrease the amount of fuel used. Trucks would also no

longer be parking in low light locations such as the shoulders of freeways and exit/entrance ramps, which would deter theft. Assuming each driver saves 15 minutes while they seek parking, **annual driver time savings for the project corridors is estimated at over \$10 million.**

- A large-scale TPIMS will increase the ability of the U.S. to compete globally. The Midwest is known for its manufacturing industry and with explosive demand for just-in-time supply chains, an increase in efficient and reliable freight movement is needed to compete globally and increase both national and international trade. As shown in Figure 7 on the following page, truck traffic through the MAASTO TPIMS area is projected to greatly increase in the next 25 years. By proactively providing drivers with real-time parking information, the region will allow drivers to competitively move goods more efficiently, thereby supporting the region's manufacturing dominance and productivity.

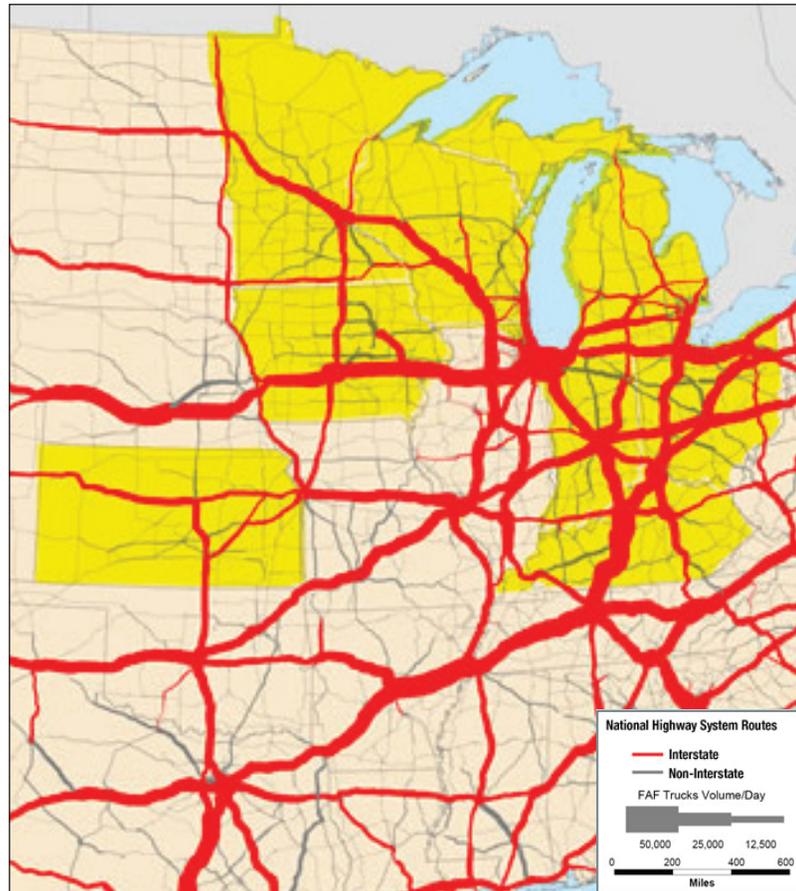
Quality of Life

This TPIMS project has the ability to improve the quality of life for all drivers on the roadway. Truck drivers utilizing the mobile traveler information web sites and dynamic truck parking signs will be able to locate a parking lot with available spaces instead of settling for an overcrowded lot or unsafe parking conditions. For those with sleeper cabs, a decrease in overcrowding and an increase in information about parking availability would allow for a much better night's sleep – essential for alert driving. Since commercial truck drivers have the greatest use for a TPIMS, their livability would be improved to the greatest extent, but the quality of life benefits extend to all highway users and nearby residents. Everyone benefits from fewer crashes caused by fatigued driving, adequate and appropriate rest area space for commercial vehicles, and reliable movement of goods.

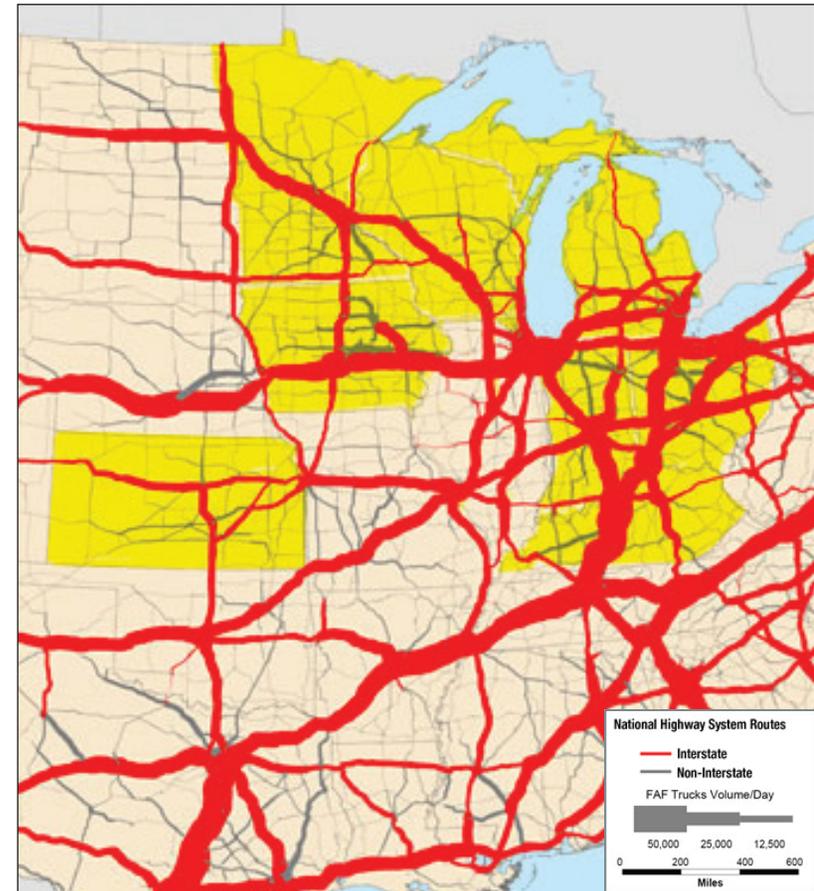
⁴“Smart Truck Parking System Set to Save the Economy Over US\$40bn.” Traffic Technology International n.d. Feb 2015. 64

Figure 7: Average Daily Long Haul Freight Truck Traffic on the National Highway System: 2011 and 2040

2011



2040



Source: U.S. Department of Transportation, Federal Highway Administration, Office of Freight Management and Operations, *Freight Analysis Framework*, version 3.4, 2013.
Notes: Long-haul freight trucks typically serve locations at least 50 miles apart, excluding trucks that are used in movements by multiple modes and mail. NHS mileage as of 2011, prior to Map-21 System Expansion.

Environmental Sustainability

The longer it takes for a driver to locate parking, the more fuel is expended. TPIMS will make it easier for an operator to find a safe and convenient parking spot, which reduces the total amount of time a truck spends idling in traffic, consuming fuel, and creating emissions. Commercial vehicles are a large contributor to air pollution and TPIMS will greatly reduce the amount of unnecessary air pollution that is released into the environment from circling and seeking parking. **With an average two gallons of diesel fuel used in 15 minutes of searching for parking, over 176 metric tons of CO₂ emissions will be reduced every day on the MAASTO TPIMS corridors.**

In addition, directing trucks to a safe resting area keeps them off shoulders and ramp areas. Keeping trucks that haul environmentally harmful materials (such as hazardous materials, like oil and gas) off the shoulders of busy highways is especially important. A crash involving hazardous materials will potentially have irreversible effects on the quality of water, wetlands, and air. Providing short term solutions for locating truck parking efficiently, including for trucks hauling hazardous materials, is critical in promoting environmental sustainability.

Safety

As has been demonstrated successfully with the I-94 TPIMS deployment in Michigan, readily available information about safe truck parking reduces the overcrowding at rest areas and truck stops, decreasing the amount of incidents involving commercial vehicles parked on the shoulders of the highway and ramps.

Additionally, several studies have linked parking shortages to increased crash rates. In Michigan, study results showed a positive relationship between rest area spacing and fatigue-related truck crashes with a significant increase in crashes, “when rest area spacing exceeded 50 mi.”⁵ A similar study in Minnesota showed that single truck crash densities increased at all times of the day with rest area distances greater than 30 miles.⁶ Both studies concluded that increased crash rates were related to overcrowded or insufficient available truck parking.

Moving off the road provides improved safety for drivers and security for the goods they are transporting. Jason Rivenburg, as previously mentioned, was a commercial vehicle operator whose tragic circumstance left his family without a husband and father. **Providing easier access to safe parking can help prevent future tragedies while generating more than \$100 million in safety benefits.**

Secondary Selection Criteria

Innovation

KDOT and their partner State DOTs are building off the innovative projects deployed by Michigan and Minnesota for this regional TPIMS deployment.

The TPIMS Project represents the assembly of existing technologies – such as video and magnetometer detection - in an innovative way to drive safety and economic benefits for the region’s freight network.

Each of the sensing technologies utilized by the project are proven, which provides a high degree of confidence. However, when marrying these individual technologies in new and innovative ways, the MAASTO TPIMS Partnership can drive new value for system users.

The application of these technologies for previous TPIMS in Minnesota and Michigan was a leap forward in the utilization of existing detection technologies to solve a unique problem. In Minnesota, the project partners utilized common video cameras with stereoscopic video analytics to create a presence based detection system. Michigan project team members noted that previous traffic detection efforts focused on advancing technologies and determining the most accurate

⁵Taylor, W.C., N. Sung, K. Kolody, A. Jawad. A Study of Highway Rest Areas Characteristics and Fatigue Related Truck Crashes. Michigan State University, Lansing. July 1999.

⁶SRF Consulting, Inc. Interstate Highway Safety Study. Analysis of Vehicle Crashes Related to Rest Area Safety Rest Area Spacing. Minnesota Department of Transportation, Saint Paul, July 2007

technology systems. With the I-94 TPIMS, the Michigan team elected to develop a more holistic approach where overall system reliability – not accuracy – was paramount for driver adoption and project success. By supplementing off-the-shelf devices with human error correction, the project team was able to increase the reliability of the data without intense research and development expended by other projects.

These approaches will be repeated for the entire MAASTO TPIMS project. For example, typical traffic sensors (video, magnetometers, radar) are intended to be used on tangent sections of roadway at consistent speeds above 30 mph. However, these conditions rarely exist at rest areas or truck stops. The MAASTO TPIMS project will deploy simple video cameras combined with analytics for object tracking and vehicle classification; applications that have existed in the defense market for years. This innovative combination of existing technologies will enable the TPIMS project to achieve a high reliability for the drivers. **Drivers can count on the system to provide accurate information in order to make a smart, safe, efficient decision.**

Partnership

While the partnership demonstrated by the collaboration of eight State DOTs and MAASTO is impressive, this project represents a larger collaboration between public and private sector partners striving to improve parking conditions for the nation's truck drivers. The MAASTO TPIMS Partnership has received letters of support from both private truck stop operators and national trucking companies. Because at least 70% of the region's truck parking spaces are privately owned, relationships like these will be critical to the overall parking solution. By encouraging parking to take place at designated public and private facilities, instead of along the highway, state and private partners will come together to

battle a significant safety, economic and environmental issue.

In addition to the partnership between public and private sectors, the collaboration between the MAASTO TPIMS partners presents opportunities to drive greater consistency in the national freight network. The partner states will develop standard design criteria and details to be used throughout the region, providing the uniformity that drivers demand. The project will also facilitate the adoption of a common software API, creating the ability to share availability data within the region, but also with private sector parties who may be able to integrate the information into existing truck traveler information services. The standardization of a truck parking API will also enable collaboration and partnership with other groups working on truck parking projects, such as the I-95 Coalition, Florida DOT, and Federal Motor Carrier Safety Administration. This initial deployment will set the stage for future expansion of TPIMS across the country bringing State DOTs, truck stop operators, fleets, and over-the-road drivers together to provide timely and reliable information to make smarter, safer and more efficient parking decisions.

F. RESULTS OF BENEFIT-COST ANALYSIS

The benefit-cost analysis for this proposal was completed using project performance data collected from the eight states that are participating in the region-wide TPIMS deployment. Inputs used to determine the benefits include:

- Benefit from reduction in crashes related to commercial driver fatigue;
- Benefit from travel time savings due to reduced number of crashes;
- Benefit from travel time savings for commercial drivers; and
- Benefit from reduced CO₂ and other emissions.

The analysis was conducted following the procedures set forth in the TIGER Benefit-Cost Analysis (BCA) Resource Guide from March 2015. **Safety, travel time, and environmental benefits total over \$403M in undiscounted dollars, leading to a Benefit-Cost ratio of 4.27.** With 3% and 7% discounts, the project Benefit-Cost ratio is 3.78 and 3.35, respectively. The full values and benefits are presented in the table on the right, and discussed in detail below.

Safety Benefits

To calculate the safety benefits of this proposal, safety data was collected from each of the eight participating states for the corridors involved in the deployment. A 10-year history of crashes involving commercial vehicles with driver fatigue as a contributing factor was available for analysis.

From the historical data, an annual average was derived for the number of crashes, injuries, fatalities, and incidents of property damage. Data on property damage was not available for all states, but based on those states where property damage data was provided, an average property damage cost was generated, then divided by the miles of deployment. That factor was then applied to the miles of deployment in the other states’ corridors. The injury data was converted to the Abbreviated Injury Scale (AIS) according to the BCA guidance. Injuries, fatalities and property damage were then valued according to the BCA guidance.

Measure	Undiscounted (2013 \$)	NPV Discounted at 3%	NPV Discounted at 7%
Safety Benefit	\$107,139,265	\$72,734,574	\$45,677,214
Travel Time Benefits	\$206,344,580	\$140,082,959	\$86,550,788
Environmental Benefits	\$89,574,770	\$60,466,668	\$46,927,508
Total Benefits	\$403,058,614	\$273,264,201	\$179,155,509
Deployment Costs	\$36,663,649	\$33,063,805	\$28,949,491
Maintenance Costs	\$57,682,548	\$39,159,458	\$24,592,087
Total Cost	\$94,346,197	\$72,223,263	\$53,541,577
Benefit-Cost Ratio	4.27	3.78	3.35

Some of the key findings of the analysis include the following:

- In rest area proximity studies done in Michigan⁷ and Minnesota⁸, the data demonstrates that unavailable or inconvenient parking is linked to increased crash rates.
- Estimates of the percent of crashes related to commercial driver fatigue vary widely, from just under 2% when most narrowly defined in the California research to a number closer to 20% based on research done in Australia.⁹
- In the “The Large Truck Crash Causation Study - Analysis Brief Federal Motor Carrier Safety Administration Office of Research and Analysis Publication No. FMCSA-RRR-07-017 July 2007,” approximately 12% of crashes were attributed to “driver non-performance,” which includes fatigue, as well as other possible causes such as a heart attack or failure of other causes to explain the crash.¹⁰

To analyze potential safety benefits, a projection of future truck traffic and an estimate of the percent of commercial driver fatigue-related crashes that could be avoided by deployment of this system is necessary. While there is a wide variety of research into the connection between access and availability of truck parking on truck operator fatigue, and the relationship of fatigue to performance and crashes, there is no readily available projection regarding the number of crashes that might be eliminated if the problem were more effectively addressed.

The assumption for the purposes of this analysis is that region-wide implementation of the TPIMS has the potential to reduce the number of driver-fatigue-related crashes by 10% annually. If that is the case, implementation of TPIMS throughout the region would generate safety savings of \$4,877,993 annually. These savings, when projected to 2035, amount to \$107,139,265. When the 20-year safety savings are discounted at 3% the total comes to \$72,734,574; at 7%, those 20-year savings are \$45,677,214.

Economic Competitiveness: Travel Time Benefits

Travel time benefits have two components:

- Benefit to the general public from reduced crashes and subsequent lane closures, and
- Benefit to commercial truck drivers from increased productivity as a result of easier access to available truck parking.

To generate an estimated cost of travel time delay due to driver fatigue crashes, the percentage of urban and rural miles of corridor were calculated, and the number of crashes per state were distributed accordingly, and then aggregated. The total number of urban and rural crashes were then multiplied by the estimated delay time cost for rural and urban interstate miles, according to values cited in the Federal Motor Carrier Safety Administration’s Report, Delay and Environmental Costs of Truck Crashes, released in March 2013.

The benefit to the public relies on the earlier estimate that deployment of TPIMS throughout the Midwest region has the potential to decrease the number of commercial driver fatigue-related crashes by 10%. Using that projection, the savings to be gained from reduced travel delay is an estimated \$649,219 per year. These savings, when projected to 2035, amount to \$11,685,933. When the 20-year savings are discounted at 3%, the total comes to \$7,993,332; at 7%, those 20-year savings are \$3,561,002. This represents significant travel time benefits and savings once the TPIMS Project is deployed.

⁷<http://www.tac.vic.gov.au/road-safety/statistics/summaries/fatigue-statistics>

⁸Taylor, W.C., N. Sung, K. Kolody, A. Jawad. A study of Highway Rest Areas Characteristics and Fatigues Related Truck crashes. Michigan State University, Lansing. July 1999.

⁹<http://www.fmcsa.dot.gov/safety/data-and-statistics/large-truck-and-bus-crash-facts-2012>

¹⁰Crashes; SRF Consulting, Inc. Interstate Highway Safety Study. Analysis of Vehicle Crashes Related to Related to Safety Rest Area Spacing. Minnesota Department of Transportation, Saint Paul, July 2007

	Number of Crashes per Year	Average Value of Delay by Road Type (2013 \$)	Average Annual Cost of Delay
Urban Crashes	92	\$58,888	\$5,669,369
Rural Crashes	223	\$3,694	\$822,816
Total	315	NA	\$6,492,185

The second component of travel time benefits relates to time saved for commercial drivers looking for a safe place to rest at the end of their hours of service. **A 2013 survey of 4,000 truck drivers suggests that 83% of drivers spend more than 30 minutes looking for parking; 39% stated that they take longer than an hour to find parking.**

To calculate the savings in driver time to locate parking, a conservative estimate of 15 minutes in driving time savings per driver was assumed, with 80% utilization of the parking spaces included in the deployment. The value of driver time savings was then calculated according to BCA guidance. **The result is an expected annual driver time savings of \$10,814,369 per year. These savings, when projected to 2035, amount to \$216,287,386.** When the 20-year savings are discounted at 3%, the total comes to \$151,654,734; at 7%, those 20-year savings are \$100,067,763. This represents significant driver time savings as a result of being able to more efficiently locate available parking.

There are other economic benefits that have not been quantified for this analysis. For example, shippers that use the corridors could see greater reliability in freight delivery. **There are 86 “Fortune 500” companies located in the eight Midwestern states participating in this proposal; even those that do not ship freight will benefit from safer, more reliable Interstate travel.** Finally, many of these routes serve international freight shipments from border crossings into Canada or to deep-water international ports on the east coast and in the south. This helps improve the overall global competitiveness of goods movement as a result of the TPIMS project.

Environmental Sustainability Benefits

Reducing the number of miles that commercial vehicles drive during their search for safe parking also offers significant environmental benefits through reduced CO₂ and other diesel emissions. If a truck driver saves an estimated 15 minutes in drive time that would otherwise be spent looking for a safe place to rest, and instead use the time more effectively and productively by getting closer to his or her destination, that saves an estimated two gallons of diesel fuel. Using the number of parking spaces to be included in the deployment, and assuming 80% utilization of those spaces through the TPIMS, the reduction in CO₂ and other emissions was calculated using information from a 2008 Environmental Protection Agency Report “Emission Facts – Average In-Use Emissions for Heavy Duty Trucks” based on the reduction in use of diesel fuel. Those tons of emissions reductions were then valued according to BCA guidance. The result is annual savings from reduced emissions of \$4,464,701.

Reducing CO₂ emissions adds greater value in the future as compared to other pollutants or monetary savings, which are discounted due to inflation. **The anticipated 20 year savings from reduced CO₂ and other emissions, according to BCA guidance, will be \$89,574,770. The 3% and 7% discounted 20 year savings will be \$60,446,668 and \$46,927,508, respectively.**

existing on-call contracts once project locations and requirements are finalized. Construction and integration of the system is anticipated to begin mid-2017, with the first sites coming online in October 2017. The project is anticipated to be completed and operational by the end of 1st quarter, federal FY 2018.

Assessment of Project Risks and Mitigation Strategies

The following section summarizes the most significant risk areas with the proposed TPIMS Project, and the project partnership's plan to address them:

Private Owner Engagement

- *Risk:* Some private truck stop owners are apprehensive about allowing the truck parking technology to be built on their lots for fear of government overreach, which may delay installation at some locations.
- *Mitigation:* Extra time has been built into the planning phase of the project to provide enough time for coordinating and scheduling for installation on private lots. Also, standardizing deployment agreements will allow all organizations to understand what has been agreed to in the past and what the requirements will be in the future, thus fostering cooperation instead of apprehension. Providing specifications and requirements in an easy to read format will allow owners to know what they are responsible for and what each state is responsible for within the deployment process. Finally, unified agreements with national truck stop operators will make it easier to install on independent truck stop chain operators, rather than approaching each operator as a separate entity. These mitigation measures are all best-practices from the successful I-94 TPIMS project in Michigan, where 10 private truck stops were integrated into the network.

Inter-State Communication and Data Sharing

- *Risk:* If each state acts as an independent entity, there is a risk of incompatible data and communication plans. This would not serve the purpose of acting as a regional cooperative to increase commercial vehicle safety and traveler information for truck drivers.



- *Mitigation:* Communication and cooperation are also keys to the success of the program. MAASTO will appoint a task force to develop compatible platforms across the MAASTO region. MAASTO's task force will use lessons learned from Michigan's I-94 project and Minnesota's University of Minnesota project to build standards for information dissemination (i.e. dynamic roadside signs) as well as data sharing (Application Programming Interface). MAASTO will also rely on the program management task force to set design criteria. This will allow the individual states to use preferred design and procurement methods in order to utilize processes that minimize risk profile while creating a unified regional deployment.

Technology Accuracy, Type and Integration

- *Risk:* The accuracy and reliability of the individual systems is dependent on the quality of the data collection. Accuracy and reliability are key to providing truck drivers with the best information available to plan their rest stops and parking needs.

- *Mitigation:* One way to increase accuracy is to perform manual counts and system resets during key time-frames for increased reliability. Additionally, path tracking and object recognition technologies could be used to track vehicles entering/exiting a parking facility and determine the classification of the vehicle (car v. truck). This simple, yet powerful, application could be economically deployed with a project the size of MAASTO TPIMS, leading to a more autonomous and robust system with less operational cost.

Ongoing Operations and Maintenance Budget

- Risk: MAASTO partners could become burdened with the ongoing operations and maintenance (O&M) costs associated with the truck parking systems. Therefore, system could become unsustainable in the long-term.
- Mitigation: MAASTO partners can enter into public-private ventures that result in O&M costs being mitigated as private companies operate the system for individual states. **The TPIMS Partnership will explore options with private entities that would reduce or eliminate the O&M burden from the states in the future.** Options include privatization of the traveler information services, sponsorships, and other arrangements.

Environmental Approvals

The proposed TPIMS Project will utilize existing state DOT ITS infrastructure as well as include the addition of new traffic sensors, cameras, and dynamic truck parking signs placed at or around the rest area locations and at interchanges. The placement and operation of the additional equipment is not expected to have any negative direct, indirect or cumulative environmental impacts. The project is fully expected to be environmentally classified as a Categorical Exclusion per each state's applicable environmental laws and regulations. The approximate locations of work will be determined and an environmental review will be completed prior to final design activities.

State and Local Planning

The Project is in conformance with state and local plans, including the statewide freight plans developed by Partnership states. The TPIMS Project also supports the charter adopted by the Mid-America Freight Coalition by "evaluating, implementing and operating technologies and other roadway appurtenances from a regional perspective and in a manner that supports the reliable, efficient and safe movement of freight."¹¹ If awarded funding, the project will be expeditiously included in each state's Transportation Improvement Program (TIP).



¹¹"MAFC Charter." MidAmerica Freight Coalition RSS., 2015.



H. CONCLUSION

The MAASTO TPIMS Partnership Value

Kansas, Indiana, Iowa, Kentucky, Michigan, Minnesota, Ohio, Wisconsin and MAASTO are all committed to improving the quality and efficiency of the Midwest region's freight network. By collaborating with private truck stops and freight carriers, the Partnership will deploy the TPIMS Project on key freight corridors to provide truck drivers with real-time information related to truck parking availability. This system, comprised of innovative combinations of shovel-ready technology and applications, will facilitate smarter, safer and more efficient parking decisions. The safety, economic, and environmental improvements made possible by the system will generate a staggering \$403 million in benefits. This \$36.6 million TIGER grant request, coupled with the identified local matching funds for capital deployment as well as ongoing O&M, generate an impressive total benefit-cost ratio of greater than 4:1.

The MAASTO TPIMS Project is a model for regional collaboration and is scalable to the entire national freight network. On behalf of the entire MAASTO TPIMS Partnership, the Kansas Department of Transportation respectfully requests full funding of the Project.



I. FEDERAL WAGE RATE CERTIFICATION

Signed certifications are available at www.maasto.net/TIGERgrant.html.

APPENDICES

Appendix A: Benefit Cost Analysis

Benefit Cost Analysis is available at www.maasto.net/TIGERgrant.html.

Appendix B: Letters of Support

Letters of Support are available at www.maasto.net/TIGERgrant.html.