TRUCK PARKING AVAILABILITY DETECTION AND INFORMATION DISSEMINATION

A number of States have been implementing Truck Parking Information Management System (TPIMS). These systems are intended to convey real-time information to truck drivers about available parking, thereby maximizing utilization of existing truck parking capacity. TPIMS uses differing kinds of technology. In general, these systems collect real-time parking information using sensors in the parking facility. This data is then sent to an information processing center to be converted into parking availability information, which is then disseminated via different media to drivers to inform them of parking availability.

There are two main technological approaches to determine parking space availability:

- Sensing a vehicle parked in an assigned location.
- Counting vehicles as they come in and as they leave a facility.

The methods for counting vehicles include closed-circuit television, camera vision systems that use software to identify and analyze objects in a video image at high speeds, in-ground sensors (these include wireless fluxgate magnetometers, in-ground radar devices, and inductive loop detectors), infrared sensors, above-ground radar, and side laser scanners, among others.

After the data is sent for processing, the information can be disseminated to truckers via in-cab systems, via mobile apps or websites, and on the road via dynamic message signs (DMS).

This document provides examples of just some of the technology being deployed by States today. It is not an exhaustive list of types of technology or States using truck parking information systems. Truck parking availability and information dissemination technology is developing rapidly, and States are conducting additional research and deployment often. This document seeks to highlight just a few best practices at this time.
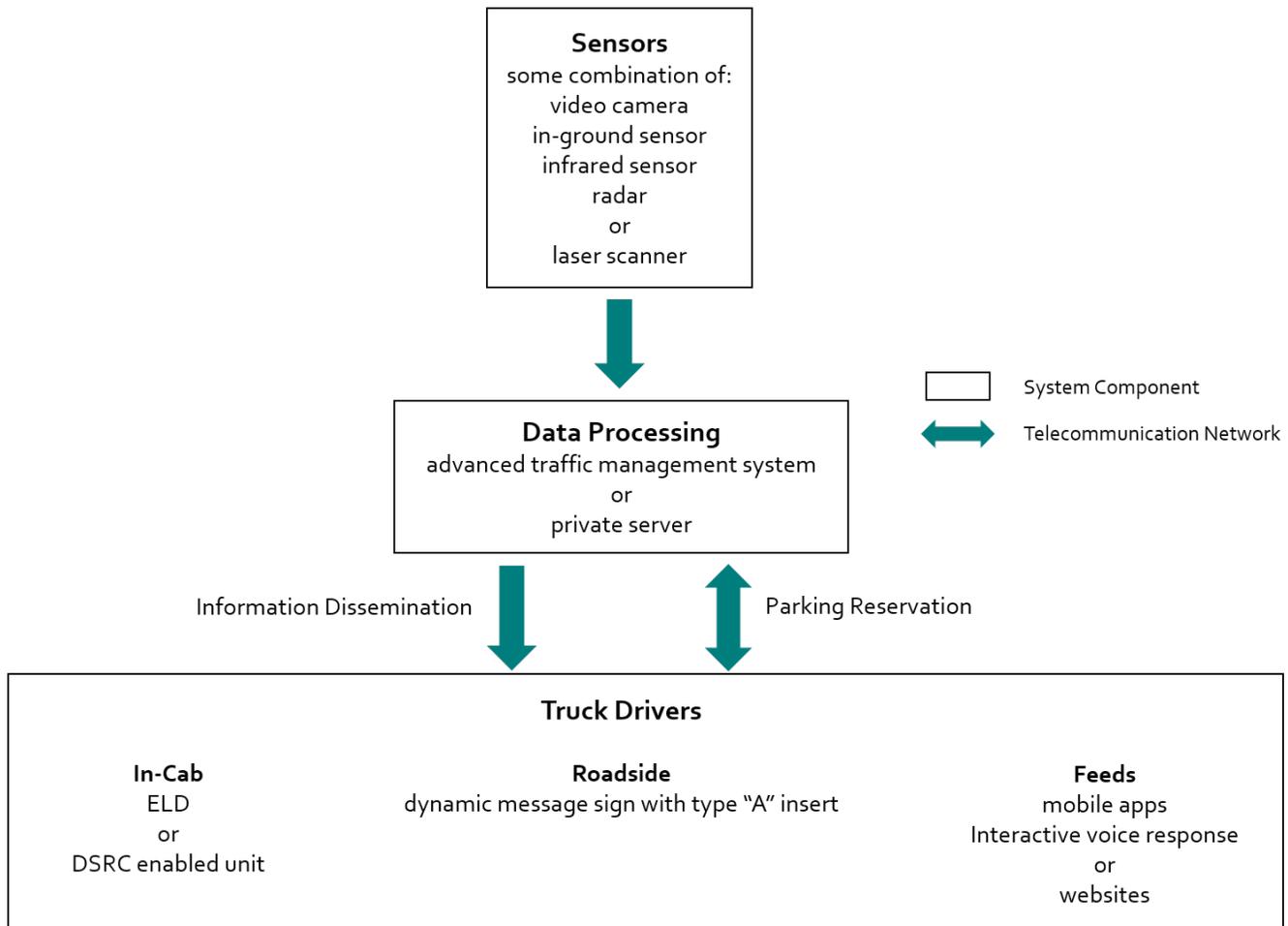
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Sensors
some combination of:
video camera
in-ground sensor
infrared sensor
radar
or
laser scanner

☐ System Component

⟷ Telecommunication Network

Data Processing
advanced traffic management system
or
private server

Information Dissemination

Parking Reservation

Truck Drivers

In-Cab
ELD
or
DSRC enabled unit

Roadside
dynamic message sign with type "A" insert

Feeds
mobile apps
Interactive voice response
or
websites

Figure 1: Components of a smart parking system. Source: Battelle

MID-AMERICA ASSOCIATION OF STATE TRANSPORTATION OFFICIALS (MAASTO) TPIMS PROJECT

MAASTO, which represents Iowa, Indiana, Kansas, Kentucky, Michigan, Minnesota, Ohio and Wisconsin, received a $25 million Transportation Investment Generating Economic Recovery (TIGER) grant from the Federal Highway Administration (FHWA) to develop and implement a regional TPIMS. The overall project cost is $29 million, with the remainder coming from participating States. The project is being led by the Kansas Department of Transportation (KDOT). The TPIMS involves the development of a coordinated truck parking management solution in the Midwest region.

Means of detection and notification are uniquely defined within each State, but the information from each State will be collected through standard extensible markup language (XML) feeds and shared through a common application programming interface (API) via dynamic message signs (DMS), traveler information websites, and a smart phone app.

National Coalition on Truck Parking

TPIMS will be installed at areas on Interstate-35, Interstate-64, Interstate-65, Interstate-70, Interstate-71, Interstate-75, Interstate-80, Interstate-94, and Interstate-135. The system is expected to be fully operational by January 2019.

	Indiana	Iowa	Kansas	Kentucky	Michigan	Minnesota	Ohio	Wisconsin
Site Type	Public	Both	Public	Both	Both	Public	Public	Public
Detection Technology at Site	In/Out	In/Out and Space-by-Space	Space-by-Space	In/Out	In/Out	Space-by-Space	In/Out	
Notification Technology	DMS, 3rd Party 511 or similar	3rd Party 511 or Similar	DMS, 3rd Party 511 or similar	DMS, 3rd Party 511 or similar	DMS, 3rd Party 511 or similar	Full Color DMS 3rd Party 511 or similar	DMS, 3rd Party 511 or similar	DMS, 3rd Party 511 or similar
Public Sites	20	14	16	9	8	5	18	7
Public Spaces	1,044	263	160	375	194	130	515	241
Private Sites	0	10	0	14	22	0	33	0
Private Spaces	0	2,060	0	1,560	942	0	2,592	0

Figure 2: MAASTO Approach to TPIMS - Adapted from MAASTO Annual Report http://www.maasto.net/documents/MAASTO2017-annual-report.pdf **and** http://www.maasto.net/documents/TPIMS-Grant.pdf

For more information on the MAASTO project, please visit http://www.maasto.net/TPIMS.html. For the latest MAASTO annual report, please visit http://www.maasto.net/documents/MAASTO2017-annual-report.pdf.

MAASTO State Departments of Transportation (DOTs) build off of innovative truck parking detection projects that have previously been implemented to conduct additional truck parking information improvements. Some of the improvements are as follows:

INDIANA

Indiana DOT (INDOT) will be using In/Out sensors at 19 sites to track where open truck parking spaces exist in real time. The sensors will be calibrated according to how many spaces exist in each lot, and then they will count the number of trucks that enter to park and exit. The number of open spaces will be automatically calculated and displayed on DMS along the interstate, overseen by INDOT's Traffic Management Center (TMC). The sensor equipment features magnetometers, which are in-ground, wireless pucks at the entrances and exits of the parking lot. The system will be recalibrated once a day, and the information will be automatically updated to the system every 15 minutes to appear on DMS. DMS would be installed approximately 15 miles before the truck parking area and would include not only the amount of parking spaces for the closest parking area, but also for the one or two parking areas after that. The confirmed Indiana sites include 19 rest areas on I-65, I-69, and I-70. Indiana received about $5.32 million from the TIGER Grant and had a State 12.7 percent match of $608,580 for the original federal funds of $4.15 million.

Indiana is installing cameras that oversee the parking areas to aid the TMC as a backup confirmation on the number of trucks in the parking lot. Indiana hopes to eventually expand the project to include all of INDOT's welcome centers, rest areas and weigh stations. At that time, private truck stops could be invited to join the system by their investments into the sign additions and construction expansion.[1]

IOWA

In December 2017, the Iowa Department of Transportation announced that it has partnered with a contractor to collect truck parking availability data from parking areas along Interstate-80 using a variety of in-pavement and entrance/exit ramp sensors. Information will be available through Iowa's 511 Traveler Information System, as well as made available as a data feed that can be used in routing systems, on the Trucker section of the Iowa 511 website, and a Federal Motor Carrier Safety Administration (FMCSA)-compliant mobile app. The system is scheduled to go live in January of 2019. Iowa DOT awarded a $3.9 million contract to implement and test the TPIMS, as well as maintain it for three years following final deployment. Iowa DOT received $3.4 million from the TIGER Grant and contributed a match of $498,086.

KANSAS

Kansas DOT (KDOT) began installing their TPIMS in December 2017. DMS will provide the number of available truck parking spaces at 18 rest areas along I-70. Each sign updates every five minutes and shows parking spaces available for two-to-three rest areas to give trucks an idea how full parking areas are ahead. KDOT is using a "computer vision" system that uses cameras to build a 3D image of the parking area so available spaces can be automatically detected. Most rest areas will have two camera poles installed near the truck parking area and each pole will have three cameras mounted on it to produce the 3D image.[2] Kansas

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[1] https://www.in.gov/indot/files/November%202016%20Trucks.pdf
[2] http://www.publicnow.com/view/878998D72E990E7FAC63E47D701138A573943DCB?2017-12-19-19:00:10+00:00-xxx5663

received approximately $5 million from the TIGER Grant and contributed 10 percent, approximately $487,000.

KENTUCKY

Kentucky Transportation Cabinet will deploy TPIMS along Interstates 65, 71 and 75. The TPIMS will disseminate parking information through a variety of means including DMS and traveler information websites. Kentucky will use an In/Out data collection method in the entrance and exit driveways to the truck parking areas. Kentucky received $2.7 million from the TIGER Grant and contributed approximately $407,000 in matching funds.

MICHIGAN

In 2014, prior to the receiving the TIGER grant, Michigan DOT (MDOT) installed TPIMS in 15 public and private truck parking locations on Interstate-94, funded by a $4.5 million grant from FHWA's Truck Parking Facilities Discretionary Grants Program. MDOT used wireless magnetometers for entry and exit detection for public rest areas and per-space detection using video cameras for private facilities. The deployment focused primarily on overall system reliability and supplemented off-the shelf devices with human error correction. MDOT now displays real-time parking availability at these locations to drivers via DMS, smartphone apps, in-cab displays and multiple websites. The DMS are placed a maximum of 30 minutes or 30 miles upstream from the farthest destination on the sign. This spacing standard is used to minimize the likelihood that the number of available spaces would change significantly prior to a trucker's arrival at the parking facility. The data on the signs updates approximately every 3 to 5 minutes. Private truck parking locations are displayed on the sign only by their exit number to remove perception of advertising.
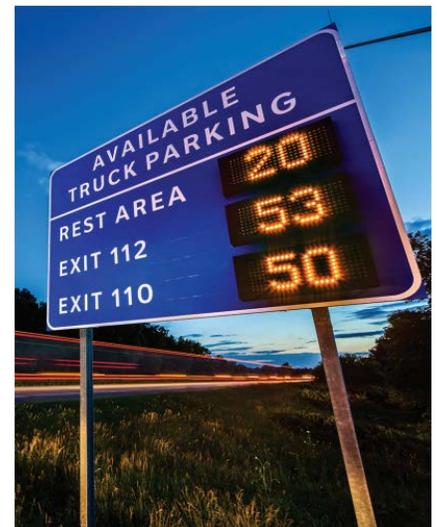

Figure 3: DMS used to display the number of available parking spaces at rest areas in Michigan. Source: http://www.maasto.net/documents/TPIMS-Grant.pdf

The University of Michigan Transportation Research Institute (UMTRI) conducted a review of the system to learn more about the effectiveness of the technology and drivers' opinions on the usability of the system. Approximately one third of respondents used DMS to decide where to park and drivers indicated that dynamic signage was their preferred method of communication for parking availability. UMTRI was not able to establish whether or not TPIMS technology improved safety along Interstate-94 during the trial period, but previous MDOT studies have found a correlation between the number of parking related crashes and distance between rest areas.[3]

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[3] https://www.michigan.gov/documents/mdot/MDOT_Truck_Parking_Project_Report_528340_7.pdf

With the TIGER funding of $2.7 million and a State match of $402,000, Michigan is expanding their TPIMS along I-94 and into other corridors. Michigan may expand their in-ground sensors with camera-based detection at the TPIMS sites.

MINNESOTA

Prior to the MAASTO TPIMS project, Minnesota DOT (MnDOT) used State funds and FHWA's Section 1305 Truck Parking Grant Program to implement truck-parking detection. MnDOT used video cameras with stereoscopic video analytics to gather data, which was disseminated in three ways: roadside DMS, an internet/website information portal, and an onboard geolocation application that informs drivers of parking availability downstream from their current direction of travel.

The University of Minnesota and FHWA's Office of Freight Management and Operations conducted a study, published in January 2017, to test the effectiveness this deployment. The researchers sought feedback from drivers and operators to better understand their perceptions of parking shortages and the utility of the parking information delivery mechanisms. Overall, the system tested provided accurate 24/7 information about truck parking availability to drivers. The overall project cost was $2,040,940. This TPIMS served as a starting point for the MAASTO project, which will build off the lessons learned by Minnesota's effort.

Upon receiving the $1.2 million TIGER grant and contributing approximately $177,000, MnDOT installed TPIMS at seven rest areas on Interstate 94 and Interstate 35 that use in-ground sensors to detect the presence of trucks. MnDOT also plans to retrofit the pilot sites with this technology. The information from the sensors is sent to MnDOT's Regional Transportation Management Center, where it is relayed to DMS along the highway that displays the number of spaces available at a rest area. The information is also displayed on MnDOT's trucker 511-highway information page and forwarded to trucking company dispatch centers.

OHIO

The Ohio DOT (ODOT) is deploying TPIMS at four rest areas on I-70, all rest areas on I-75, and one set of rest area along the US 33 Smart Corridor between Dublin and Marysville, Ohio. ODOT is utilizing a performance based contract which allows the contractor flexibility in regard to the method of parking space detection the contractor utilizes. Ohio received $6.4 million from the TIGER grant and matched approximately $785,000. ODOT awarded a 3-year design, operate, maintain contract. The contractor will deploy a series of signs, denoting spaces available as trucks approach each rest area. The construction portion of the contract is expected to be completed by January 2019.

WISCONSIN

Wisconsin DOT (WisDOT) deployed TPIMS in 2016 on I-94 eastbound for 157 truck stalls. The 2016 deployment used video pattern recognition (developed by the University of Minnesota and utilized at one site) and magnetometer detection (utilized at three sites). The magnetometer counts vehicles entering and

exiting the truck parking areas, and the video system analyzes how many parking spaces are occupied in real-time. The data was deployed to Wisconsin 511, five roadside DMS, and is available through the WisDOT traffic data feed for third party apps, such as Truck Specialized Parking Service (TSPS).

The 2017 deployment of TPIMS as part of the MAASTO project concentrated on completing I-94 eastbound and expanding to I-94 westbound and consisted of 241 truck stalls using the same technology. WisDOT received approximately $2 million and contributed a State match of $300,000.

OTHER STATE INITIATIVES

CALIFORNIA

The Smart Truck Parking (STP) project is a collaborative implementation and research effort among the FHWA, California Department of Transportation (Caltrans), the University of California at Berkeley, and other partners. The project, supported by an FHWA Section 1305 grant, is designed to demonstrate real-time parking availability at truck stops on Interstate-5.

The project is currently testing video detection and in-ground sensors (including induction, magnetic, infrared, radio-frequency identification (RFID), and optical) at truck parking facilities in the cities of Sacramento and Stockton. [4] Stakeholder outreach efforts are ongoing to discuss design options, recruit early adopters, and facilitate accelerated deployment.

Information collected from these areas is not only broadcast on DMS, but also on americantruckparking.com. The site has information on both private and public rest areas, and truck fueling locations. Dynamic truck parking availability for certain sites in California is updated at least every five minutes. [5] The site also has a broader truck parking availability demonstration effort, where users can submit truck parking spot locations.

COLORADO

The Colorado DOT (CDOT) plans to implement TPIMS to communicate real-time parking availability to drivers. Part of the project is being funded through a Fostering Advancements in Shipping and Transportation for the Long-Term Achievement of National Efficiencies (FASTLANE) grant. The remainder is being funded by CDOT and other federal funding. CDOT will collect information from public rest areas, private truck stops, and new parking facilities along each of the three National Highway Freight Network corridors that traverse the State: Interstate-25, Interstate-70, and Interstate-76. A combination of static cameras and sensors will be implemented to monitor parking availability. The intelligent transportation system (ITS) components to be designed and constructed include all of the detection equipment, necessary communications connections, static and DMS signs, application development, and the computer infrastructure at the CDOT Transportation Management Center. CDOT will communicate real-time parking information to drivers via DMS, the CDOT

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[4] http://www.itscalifornia.org/Content/AnnualMeetings/2014/Presentations/TechSession7/4_-_ITSCA2014_TS7_Completes_the_Street_Martin.pdf
[5] http://www.americantruckparking.com/

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website, smartphone apps, and the 511 travel information system. CDOT also developed a Truck Parking Guide to assist drivers in locating long-term, emergency, and chain-up parking. The State will align the project to be a compatible and complimentary extension of the MAASTO TPIMS approach.

FLORIDA

The Florida DOT (FDOT) commissioned the University of Florida's Transportation Institute to conduct an evaluation of commercial truck parking detection technology, focusing on two rest areas in Columbia County– one on Interstate-75 northbound and the other one Interstate-75 southbound. FDOT's system is called Truck Parking Availability Systems (TPAS). The study evaluated three commercially-available wireless in-pavement sensors and judged their accuracy by comparing their results to video of the rest areas. The study found that each sensor technology performed with 95% accuracy (occupancy) and 90% accuracy (turnover) or greater which established the parameters included in the specification for the technology. An additional technology vendor was subsequently tested, but found to not meet the required parameters established during the initial evaluation.

Figure 4: Map of the Regional Traffic Management Centers (RTMC) that will receive the electronic data from the sensors, process and then distribute the information to the roadside signs as well as the FL 511 and third party data feeds. (Map courtesy of FDOT via http://www.fleetowner.com/driver-management-resource-center/tackling-truck-parking-sunshine-state-s-solution)

Based on the study, TPAS will use in-ground sensors in the truck spaces at interstate rest areas and welcome centers to monitor the number of available truck parking spaces, and CCTV cameras will be periodically monitored to validate the systems. The weigh stations will utilize microwave vehicle detection and CCTV cameras to monitor the number of available truck parking spaces. The information will then be displayed on the State's FL511 website and app for drivers or dispatchers to access; displayed on DMS along the roadside prior to rest areas, welcome centers, and weigh stations; and made available for third-party apps. FDOT hopes to eventually expand to predictive analyses from the real-time data. Since the study was completed, FDOT has installed or begun installing TPAS along Interstate-4, Interstate-10, Interstate-75, and Interstate-95, with a total of 68 locations State-wide by Fall 2019.[6] The remaining rest areas that were not instrumented as part of the initial TPAS deployment will be incorporated during subsequent construction projects, including locations along I-10 (Suwannee and Columbia Counties), I-75 (Hillsborough County) and I-4 (Seminole County).

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[6] Staff at Florida Department of Transportation

MARYLAND

The Maryland State Highway Administration (MDSHA) commissioned the University of Maryland at College Park to develop and test an automated low-cost and real-time truck parking information system. The final report on the project was delivered in November 2013. The parking detection system was piloted at MDSHA's truck parking facility located on Interstate-95 northbound, near the intersection with Maryland Route 32. The research team used wireless magnetic in-ground sensors to detect vehicles parked at the test site. The team noted that an advantage of in-ground sensors, unlike video detection, is that the truck and driver remain completely anonymous in the parking availability detection process. The research team found that its method for vehicle detection had an average overall detection error rate of 3.75%.

MARYLAND AND VIRGINIA – I-95 CORRIDOR COALITION

FHWA Awarded the I-95 Corridor Coalition a grant to pilot a truck parking system deployment called TruckNPark that uses space by space availability monitoring using in-ground sensors comprised of both radar and magnetometer units. Initial testing of this technology was conducted at I-95 Northbound at Ladysmith, Virginia and I-95 Northbound Welcome Center in Maryland. Final deployment of the TruckNPark system is at five public rest areas in Virginia: Three are located on I-95 Northbound at Ladysmith, Carson, Dale City and two sites located on I-66 at New Kent Eastbound and New Kent Westbound.

In March 2018, the I-95 Corridor Coalition transitioned full operation and maintenance of the TruckNPark system to Virginia DOT (VDOT), where it is being integrated into VDOT's Statewide Advanced Traffic Management System. Parking availability information is disseminated via the TruckNPark website and interactive voice response system with an automatic call-back feature, on VDOT-operated DMS in advance of the rest areas, on the VDOT 511 system and on the VDOT SmarterRoads Data Portal. The SmarterRoads cloud-based portal allows access to TruckNPark data to third party enterprises (including for developer incorporation into Apps) and the general public.

TENNESSEE

The FMCSA initiated the SmartPark program to implement a National Transportation Safety Board recommendation that the agency provide information on truck parking availability. The project consisted of two phases. Phase I was to demonstrate a technology sufficiently accurate to determine truck parking occupancy count. After determining that magnetometers and video detection did not suffice, FMCSA tested Doppler radar combined with either laser scanning or light curtain. Closed circuit television cameras, a network video recorder, and a project website were used to verify accuracy of the truck parking occupancy count. A study determined that different combinations of Doppler radar combined with either laser scanning or light curtain were all at least 93% accurate in performing truck counts and classifications. After determining that the optimum technology was Doppler radar combined with side-fire laser scanning, FMCSA

used this technology in Phase II to demonstrate (i) how two truck parking areas could be linked so that trucks can be diverted from a full area to one with availability, (ii) how a truck parking reservation system could work, and (iii) how truck parking availability information could be disseminated. Methods of dissemination that were demonstrated included: (i) dynamic message signs, (ii) interactive voice recognition, (iii) web site, and (iv) mobile application (smartphone).

Phase II of the study was conducted using the truck parking areas at mile markers 23 and 45 northbound on Interstate-75 in Tennessee, located about 20 miles north of Chattanooga and halfway between Chattanooga and Knoxville, respectively. The field test ended in September 2016. Tennessee DOT is not currently using truck parking availability because the system was cumbersome to keep calibrated. The final FMCSA report on Phase II of the study was published in May 2018.

Figure 5: SmartPark detector configuration. Source: https://www.tn.gov/content/dam/tn/tdot/documents/RES2016-08.pdf.

INTERSTATE-10 WESTERN CONNECTED CORRIDOR FREIGHT PROJECT

The I-10 Corridor Coalition was formed in 2016 and is made up of four DOTs in Arizona, California, New Mexico, and Texas. The goal of the Coalition is to create safer, more efficient commercial and personal travel along this corridor. The Coalition adopted a memorandum of understanding (MOA) in September 2017 at AASHTO's annual meeting, building on a charter executed in 2016.

The Coalition's first collective pooled-fund project involves the development of a Concept of Operations for technologies and strategies to improve freight movement in the Corridor. After preparing a detailed corridor database and synthesis of freight technologies and strategies, the Coalition's project contract team conducted stakeholder workshops in all four states in the summer of 2016. The group held a workshop in Phoenix in April 2018 to decide which functional steps or applications to include in the Concepts of Operations. One of the functional use cases to be documented is truck parking information systems. Many of the States are in the process of building statewide truck parking needs assessments independent of this Concept of Operations study. The Coalition is modeling its truck parking-related work on MAASTO's TPIMS project, focusing on public parking facilities. The group has applied for federal grants under the Advanced

Transportation and Congestion Management Technologies deployment program to fund the truck parking information systems project.[7]

**Figure 6: Aerial view of a SmartPark test site in Athens and Cleveland, Tennessee.
Source: Map data ©2018 Google, DigitalGlobe.**

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[7] Members of the I-10 Western Connected Freight Corridor Project

SUMMARY OF SIGNIFICANT TRUCK PARKING PROJECTS

Adapted from Accelerating SmartPark Deployment, Task 2: Identification and Assessment of ITS Technology, FMCSA

Please note, this chart is not an exhaustive list of truck parking availability technology and represents a snapshot in time.

Project	Caltrans	Minnesota DOT	Colorado DOT	Florida DOT	Michigan DOT	I-95 Corridor Coalition	MAASTO	Wisconsin DOT	Tennessee
Funding Agency	FHWA and Caltrans	MNDOT and FHWA	Federal Funding and Colorado DOT	FHWA and FDOT	FHWA and MDOT	FHWA, MDOT, and VDOT	USDOT through TIGER grants.	Initially funded by FHWA. It is now part of the MAASTO TIGER grant.	FMCSA and TDOT
Partners	California DOT, UC Berkeley Transportation Sustainability Research Center, ParkingCarma, and NAVTEQ.	Minnesota DOT, University of Minnesota's Center for Transportation Studies, ATRI.	Colorado DOT	Florida DOT	Michigan DOT	I-95 Corridor Coalition is a partnership of transportation agencies, toll authorities, public safety, and related organizations from Maine to Florida.	Eight MAASTO states: Indiana, Iowa, Kansas, Kentucky, Michigan, Minnesota, Ohio, and Wisconsin.	Wisconsin DOT and TAPCO.	FMCSA and the State of Tennessee.
Location	One privately owned site on I-5.	Three public rest areas along I-94. It will also integrate with the Wisconsin I-94 system.	Six locations during the first phase, with a final goal of deploying across the state on I-25, I-70 and I-76.	Seven rest areas and weigh stations along I-4 and I-95 are scheduled for phase 1. A total of 68 locations will be active by April 2019.	Seven private truck stops and five public rest areas.	Testing was done at rest areas on I-95. Currently, the system is active at two rest areas in I-95 and two more on I-64 Virginia.	The system will be deployed in major corridors in member states.	Four rest areas along the I-94 corridor. It will integrate with the Minnesota I-94 system.	Two rest areas.

Project	Caltrans	Minnesota DOT	Colorado DOT	Florida DOT	Michigan DOT	I-95 Corridor Coalition	MAASTO	Wisconsin DOT	Tennessee
Sensing Technology	Multi-camera system, inductive loops and GPS-based system (Information from the ConOps. Implementation might differ).	Multi-camera system.	Combination of static cameras and sensors. Information is not available.	In-pavement sensors and CCTV cameras will be used for rest areas and welcome centers. Microwave systems will be used for weigh stations.	For public rest stops, a combination of CCTV and in-ground magnetometers. For private truck stops, elevated camera sensors.	In-ground sensors incorporating both radar and magnetometers in a single casing.	Each state will select the technology that best fits its needs.	Multi-camera system in one rest area and a count in/out microwave system, along with CCTV cameras for error correction in three rest areas.	Doppler radar and side laser scanner.
Information Dissemination	Website, mobile apps, and IVR.	DMS, website, in-cab geolocation application device integrated with existing ELD and XML feeds for third-party use.	DMS with type "A" Inserts, website, mobile apps, and XML feeds for third-party use.	DMS, website, mobile apps, DSRC-enabled in-cab devices, and XML feeds for third-party use.	DMS with type "A" inserts, DSRC-enabled in-cab devices, websites, and mobile apps.	Website, IVR and XML feeds for third-party use.	Website, DMS with type "A" inserts, mobile apps, and in-cab devices.	Website, DMS with type "A" inserts, in-cab devices, mobile apps, and XML feeds for third-party use.	DMS, website, IVR, and mobile apps.
Other features	Reservations are part of the plan, but not implemented yet.	(none)	Parking reservations and parking forecasting service will be implemented in the future.	Reservations are part of the plan, but not implemented yet. Parking forecasting will be a feature added in the future.	(none)	(none)	(none)	(none)	Parking reservations are implemented.
Project cost	(not available)	$2,040,940	$9,000,000	(not available)	Estimated $115,000 per rest area and $65,000 per private site.	$10,251,688	$94,000,000	(not available)	(not available)

Project	Caltrans	Minnesota DOT	Colorado DOT	Florida DOT	Michigan DOT	I-95 Corridor Coalition	MAASTO	Wisconsin DOT	Tennessee
Difficulties encountered and lessons learned	Difficulty with sensing and disseminating parking information, challenges implementing a reservation system and limitations to the performance and cost of sensing technologies.	Need for better night time sensitivity. Reduce costs by using existing infrastructure. Using high speed broadband could increase reliability. Other sensors were tested and not considered and discarded.	(none published)	(none published)	Integrating public and private parking locations was achieved. mobile app needs to be moving to detect heading and distinguish parking locations ahead and behind. It will not start to collect information until it has traveled 800 meters.	Several video analytics products were evaluated. None of the products were considered viable to be used.	(none published)	(none published)	(none published)
Project status	Project is ongoing. Website is up and running.	Project has ended. Website is not active.	System launch is scheduled for 4th quarter of 2019.	Project is ongoing.	Project ended on 2014. Website is still up and running.	Project ended. Website is still up and running.	The system is expected to be in operation by the first quarter of FY 2018.	Incorporated with MAASTO.	Field test ended August 2016.

The examples in this report show innovative solutions for truck parking applied in a range of situations. Suitability in other locations will depend on applicable Federal laws, State standards, and site-specific considerations. This document is disseminated under the sponsorship of the U.S. Department of Transportation in the interest of information exchange. The U.S. Government assumes no liability for the use of the information contained in this document. This report does not constitute a standard, specification, or regulation. It does not create any requirements other than those stipulated in statute or regulation. The U.S. Government does not endorse products or manufacturers. Trademarks or manufacturers' names appear in this report only because they are considered essential to the objective of the document. They are included for informational purposes only and are not intended to reflect a preference, approval, or endorsement of any one product or entity.