North/West Passage Truck Parking Information Management System Assessment

Prepared for:

North/West Passage Freight Task Force

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North/West Passage

The North/West Passage (NWP) is a multi-state operations-focused partnership initiated in 2002 between the Departments of Transportation (DOTs) of Idaho, Minnesota, Montana, North Dakota, South Dakota, Washington, and Wyoming. With I-90 and 94 serving as their major passenger and commercial vehicle corridors, these states share similar operational challenges due in part to extreme weather conditions.

TPIMS Assessment

The objective of the NWP Truck Parking Information Management System (TPIMS) Assessment is to document the current state of TPIMS in the NWP, as well as identify truck parking information needs and consider the potential for NWP state coordination to advance a multi-state TPIMS in the region.

Acknowledgements

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Opinions and limitations

Unless otherwise indicated, the opinions herein are those of the authors and do not necessarily reflect the views of the North/West Passage.

Cover image: Commendatore, Cristina, Fleet Owner, "Michigan takes a look at truck parking availability," September 2015, https://www.fleetowner.com/for-the-driver/on-the-road/article/21184099/michigan-takes-a-look-at-truck-parking-availability.

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Acronyms / Abbreviations

API	Application Programming Interface
ATCMTD	Advanced Transportation and Congestion Management Technology Deployment
ATTIMD	Advanced Transportation Technologies and Innovative Mobility Deployment
ATRI	American Transportation Research Institute
BIL	Bipartisan Infrastructure Law
CMAQ	Congestion Mitigation and Air Quality Program
CMS	Changeable Message Sign
CMV	Commercial Motor Vehicle
CRP	Carbon Reduction Program
DMS	Dynamic Message Sign
DOT	Department of Transportation
EB	Eastbound
FASTLANE	Fostering Advancement in Shipping and Transportation for the Long-Term Achievement of National Efficiencies
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
FTF	Freight Task Force
HOS	Hours of Service
HP-ITD	High Priority Innovative Technology Deployment
INFRA	Nationally Significant Multimodal Freight & Highway Projects
ITD	Idaho Transportation Department *OR* Innovative Technology Deployment
ITS	Intelligent Transportation Systems
JTC	Joint Transportation Committee
MAASTO	Mid America Association of State Transportation Officials
MDT	Montana Department of Transportation
MNDOT	Minnesota Department of Transportation
NB	Northbound
NDDOT	North Dakota Department of Transportation
NHFP	National Highway Freight Program
NHPP	National Highway Performance Program
NHS	National Highway System
NOFO	Notice of Funding Opportunity
NWP	North/West Passage
OOIDA	Owner Operator Independent Drivers Association
OS/OW	Oversize/Overweight
RAISE	Rebuilding American Infrastructure with Sustainability and Equity
RFI	Request for Information
RFP	Request for Proposals

RURAL	Rural Surface Transportation Grants Program
SB	Southbound
SC	Smart Corridor
SDDOT	South Dakota Department of Transportation
STAR	Smart Transportation Applications & Research
STBG	Surface Transportation Block Grant Program
TETC	The Eastern Transportation Coalition
TIGER	Transportation Investment Generating Economic Recovery
TMC	Transportation Management Center
TPAS	Truck Parking Availability System
TPIMS	Truck Parking Information Management System
USDOT	United States Department of Transportation
VDOT	Virginia Department of Transportation
WB	Westbound
WSDOT	Washington State Department of Transportation
WYDOT	Wyoming Department of Transportation

1 Introduction

1.1 Truck Parking Information Management Systems

Truck parking is crucial to support the safe and efficient movement of goods across the country. However, truck drivers face challenges finding truck parking, including in North/West Passage (NWP) states. There exists a range of opportunities to address truck parking issues, including policies, capacity projects, and information projects.

A truck parking information management system (TPIMS) serves as one type of solution to improve access to truck parking by sharing real-time information about truck parking locations and availability with truck drivers. By connecting drivers to available truck parking supply, TPIMS seeks to improve the utilization of existing truck parking capacity. As a result, these systems reduce the time drivers search for parking, occurrences of driving while fatigued or over hours-of-service (HOS) limitations, and the need to park in undesignated locations to stay within HOS requirements.

1.2 Purpose of this Assessment

The NWP Freight Task Force (FTF) *Truck Parking Information Management System Assessment* summarizes the current state of truck parking information needs and solutions in the NWP. The Assessment spans all seven states in the NWP: Idaho, Minnesota, Montana, North Dakota, South Dakota, Washington, and Wyoming.

This Assessment seeks to identify how state DOTs share truck parking availability information and determine NWP stakeholder interest in pursuing a multi-state TPIMS in the region.

Through stakeholder engagement and literature review, this Assessment provides an overview of how TPIMS operates, documents the status of TPIMS efforts in each NWP state, and gauges regional interest – from both the public and private sectors – in the potential for a multi-state TPIMS in the NWP. This Assessment further profiles case studies and best practices for successful multi-state TPIMS projects. Finally, roundtable discussions with state DOT representatives informed the identification of opportunities, challenges, and next steps as the region considers advancing a multi-state TPIMS.

1.3 Methodology

The Project Team undertook the following activities to document TPIMS efforts in each NWP state and obtain feedback on interest in a regional TPIMS.

- **Desk Research:** The Project Team conducted a review of truck parking studies and other relevant plans completed by each NWP state's DOT to understand truck parking conditions, needs, and efforts in the region. The Project Team conducted additional research to document the status of TPIMS in the NWP region, as well as case studies of successful multi-state TPIMS projects.

- **Consultations with State DOTs:** The Project Team held individual consultations with six NWP state DOTs to validate findings from desk research and gain a deeper understanding of truck parking information issues, solutions, and next steps. The consultations included discussions

of the barriers to deploying, maintaining, and/or expanding TPIMS within each state, as well as each state's interest in pursuing a regional TPIMS.

- **Roundtable Meetings with State DOTs:** The Project Team hosted two roundtables with NWP member state representatives to share project updates and findings, as well as obtain feedback through Mentimeter live polling and discussion. The first roundtable (April 2023) served to introduce the project, facilitate information sharing on NWP state TPIMS efforts, and begin discussions related to a potential regional TPIMS. The second roundtable (May 2023) served to provide updates on industry feedback, present case studies of regional TPIMS, identify challenges and opportunities for the NWP, and discuss potential next steps for the region to advance a multi-state TPIMS.

- **Industry Engagement:** The Project Team distributed an online survey to truck drivers and conducted a consultation with the Owner Operator Independent Drivers Association (OOIDA) to obtain industry input on truck parking information needs and solutions.

- **Consultation with The Eastern Transportation Coalition (TETC):** The Project Team held a consultation with TETC, formerly known as the I-95 Corridor Coalition, to understand the truck parking information effort undertaken by the Coalition and inform the identification of best practices for other multi-state coalitions.

2 Overview of Truck Parking

2.1 Introduction

Behind the wheel of every truck is a driver who needs a safe place to park in order to meet federal HOS requirements, wait for pick-up and drop-off appointments (also referred to as staging), and access basic amenities, such as restrooms and food. Despite the need for truck parking to support the safe and efficient movement of goods across the country, there exists a national truck parking shortage. Truck drivers consistently cite truck parking as their top industry concern.[1] In the most recent Jason's Law Truck Parking Survey, 75 percent of drivers reported problems finding safe truck parking one or more times a week.[2]

A lack of safe and adequate truck parking leads to negative safety, economic, environmental, infrastructure, and quality of life impacts. Due to difficulties finding parking, truck drivers may stop driving early, drive while fatigued or over their HOS limits, or park in undesignated, or unmarked, areas – each of which negatively affects truck drivers, businesses, and communities.

2.2 Truck Parking Issues in the NWP

2.2.1 Identified by State DOTs

Truck parking issues, including a shortage of truck parking spaces and the occurrence of parking in unmarked areas (also referred to as undesignated parking), exist across the NWP. Figure 1 summarizes key truck parking needs among NWP states, informed by state DOT consultations and a review of freight and truck parking planning documents.

Throughout the region, truck drivers face challenges finding truck parking. As a result, truck drivers may be forced to spend significant time searching for parking or park in undesignated locations, such as corridor shoulders, on/off ramps, and last-mile roads. Interstates, including I-90 and I-94, are often hotspots of undesignated parking. In rural locations, truck parking locations may be spaced far apart. Meanwhile, truck drivers require parking for staging near pick-up and drop-off locations near urban areas. Extreme weather events can also cause surges in truck parking demand that exacerbate existing truck parking issues.

[1] ATRI, Critical Issues in the Trucking Industry, 2015-2022, https://truckingresearch.org/atri-research/top-industry-issues/
[2] USDOT FHWA Office of Freight Management and Operations, Jason's Law Commercial Motor Vehicle Parking Survey and Comparative Assessment, 2020, https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/workinggroups/2020/mtg/jasons_law_results.pdf.

Figure 1: Summary of Truck Parking Needs Among NWP States

State	Relevant Plans with Truck Parking	Top Truck Parking Needs
Idaho	• 2017 Idaho Transportation Department Statewide Freight Strategic Plan • Idaho Truck Parking Study currently under development	• Undesignated truck parking on highway on/off ramps. • Need for more parking to support staging. • Drivers spend significant time searching for parking to meet HOS requirements. • Driver concerns about costs at Interstate Oasis partner parking facilities. • Challenges with finding parking for Oversize/Overweight (OS/OW) loads.
Minnesota	• 2018 Minnesota Statewide Freight System and Investment Plan • 2019 Minnesota Statewide Truck Parking Study	• Statewide truck parking shortage, with acute issues in the core Twin Cities. • Need to integrate truck parking into local planning. • Private truck parking development focused on urban fringe, greenfields, and other low-cost areas. • Cost-related maintenance pressure has resulted in limited expansion of TPIMS. • Updated truck parking study (2019) identifies a series of priority areas that need investment if funding is available.
Montana	• 2022 Montana State Freight Plan	• I-90 is a top corridor of concern for truck parking. • Road closures due to weather events (e.g., winter storms, high winds) exacerbate truck parking issues. • Commodity-driven truck traffic (e.g., oil, wind components) impacts truck parking needs.
North Dakota	• 2023 North Dakota State Freight and Rail Plan	• Undesignated truck parking issues notably on Interstates (e.g., I-94, I-29) and near pick-up/drop-off locations. • Truck parking gaps, with long distances between truck parking facilities. • Some challenges finding parking for OS/OW loads.
South Dakota	• 2018 SDDOT Rest Area & Truck Pullout Truck Parking Analysis • 2021 SDDOT Truck Parking Assessment • 2022 Draft SDDOT Freight Plan	• Truck parking issues on Interstates, including HOS parking needs on I-90 WB for drivers from Chicago and gaps in truck parking supply along I-29. • Undesignated parking occurs on corridor ramps, city streets, and under rural bridges.
Washington	• 2022 Washington State Freight System Plan (including a Truck Parking Assessment) • 2021 Washington State Joint Transportation Committee (JTC) Truck Parking Action Plan	• Truck parking is a top priority in the state. • Updated analysis (2022) identified concentrations of undesignated parking in the Puget Sound Region, and along I-5, I-90, and I-82. • JTC Truck Parking Action Plan (2021) identified actions to increase truck parking capacity and better utilize existing capacity, including through truck parking information systems.
Wyoming	• 2018 Freight Resilience Plan • 2022 Wyoming Statewide Freight Assessment	• Need additional truck parking, especially along I-80. • Extreme weather events heighten demand for truck parking. • Rural landscape means truck parking locations are spaced far apart.

Source: Consultations with State DOTs, 2023. Note: Source information for listed plans and studies can be found in Appendix A.

2.3 Truck Parking Solutions

There exists a range of opportunities to address truck parking issues, including policies, capacity projects, and information projects.

- **Policies** aim to advance truck parking studies, communication, collaboration, and funding.
- Truck parking **capacity projects** involve the construction of new, expanded, or upgraded truck parking facilities to increase the number of truck parking spaces available to drivers. Capacity projects are most effective at addressing a shortage of truck parking supply within a high-demand areas.
- Truck parking **information projects** seek to provide information to truck drivers about the location and availability of truck parking spaces to more effectively utilize existing truck parking capacity. Information projects are most effective when drivers are unaware of available truck parking spaces; they can also help inform drivers' planning and decisions on when and where to stop for parking.

The remainder of this Assessment focuses on truck parking information projects – specifically TPIMS – which serve to improve the utilization of existing truck parking capacity by providing drivers with information to support truck parking decision-making. By connecting truck drivers to available truck parking, TPIMS aims to reduce the time drivers search for parking, occurrences of driving while fatigued or over hours-of-service (HOS) limitations, and the need to park in undesignated locations to stay within HOS requirements.

3 Overview of TPIMS

3.1 Introduction

A TPIMS serves as a truck parking information solution by collecting real-time truck parking availability and disseminating this information to truck drivers, dispatchers, and other interested users. By providing information to connect truck drivers with available parking, a TPIMS seeks to reduce the time drivers search for parking, occurrences of driving while fatigued or over HOS limitations, and the need to park in undesignated locations to stay within HOS requirements. Many states have advanced or considered TPIMS solutions. Currently, about a dozen states have TPIMS in operation on a pilot, corridor-wide, or statewide level, with many more evaluating TPIMS as a part of ongoing Truck Parking Studies or State Freight Plans.

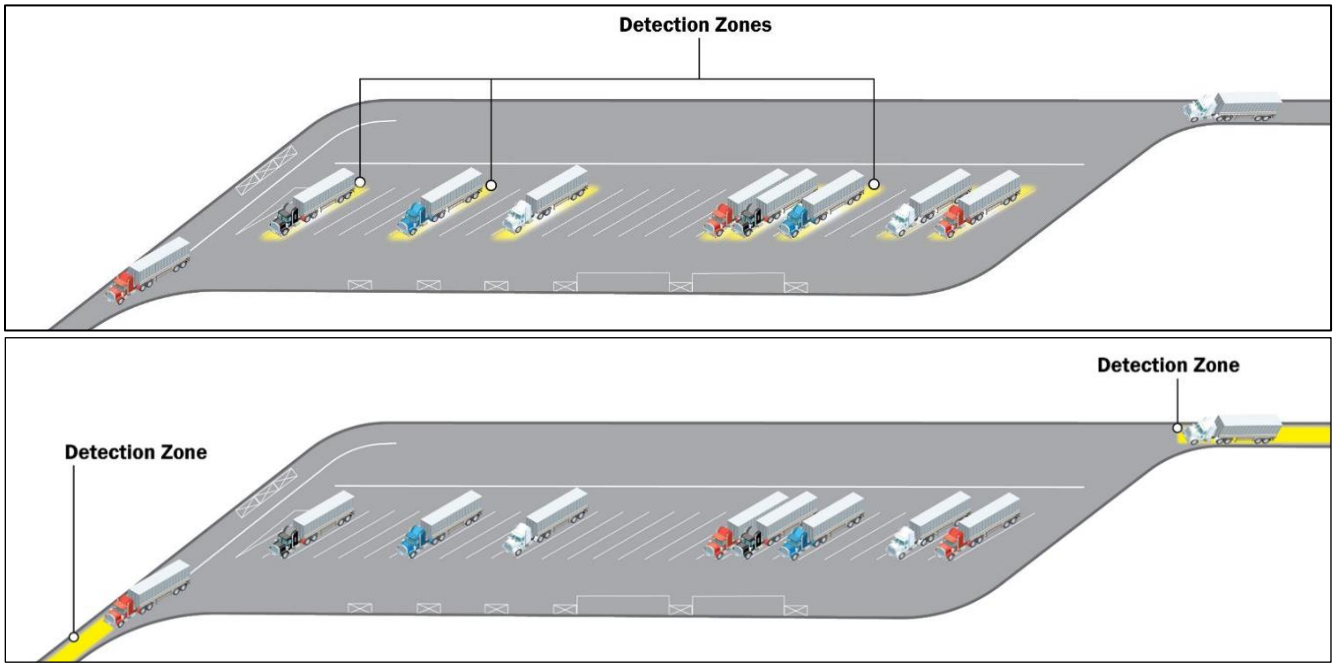
3.2 TPIMS Technology

TPIMS involves the collection, processing, and sharing of real-time truck parking information. There are two major categories of TPIMS technology: **sensing technology**, which senses the presence of trucks in parking spaces or facilities, and **information dissemination technology**, which distributes gathered parking data to truck drivers, dispatchers, and other interested parties.[3]

3.2.1 Sensing Technologies

Sensing technologies include **direct sensing technologies** that monitor the utilization of truck parking spaces themselves and **indirect sensing technologies** that monitor facility entry and exit to infer utilization. These differences are outlined in Figure 2.

Figure 2: Direct and Indirect Sensing Technologies



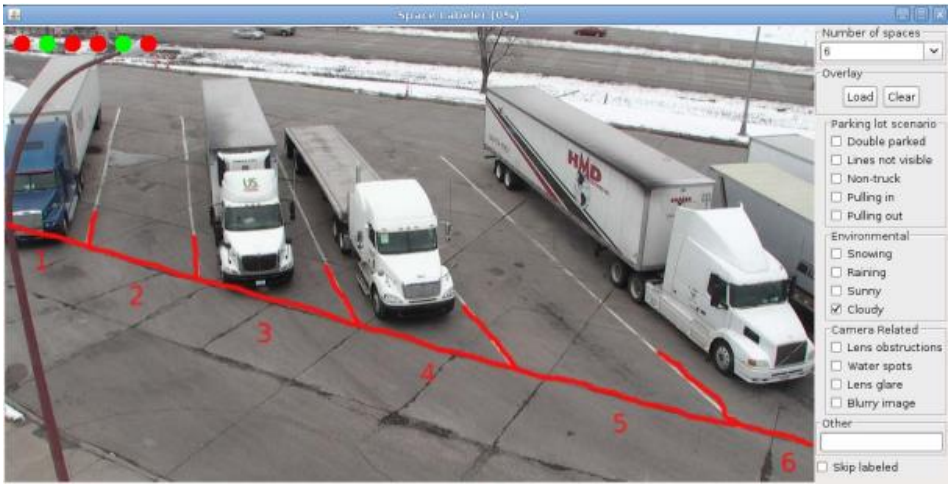
Source: I-10 Corridor Coalition, 2023.

[3] ATRI, Truck Parking Information Systems: Truck Drivers Use and Perspectives, 2021, https://truckingresearch.org/wp-content/uploads/2021/06/ATRI-Truck-Parking-Information-Systems-Driver-Use-and-Perceptions-06-2021.pdf.

Direct sensing technologies include in-pavement detection technologies (also known as pucks) (Figure 4) and camera and video monitoring technologies (Figure 3), while indirect sensing technologies include radar, cameras/video, laser/lidar (Figure 5), and magnetometers.

Each technology type provides its own trade-offs. Direct sensing technologies are often considered more accurate because they monitor marked truck parking spaces themselves, whereas indirect sensing systems cannot differentiate between trucks parked in designated (marked) and undesignated (unmarked) areas. Indirect sensing systems are further prone to in/out count errors that can compound over time. Weather conditions can also impact technology performance – for instance, freeze and thaw cycles can cause damage to in-pavement pucks, whereas fog, rain, and snow can inhibit the performance of camera and video systems. Other weather conditions, including high wind and ice or dust storms might also impact technology performance. Cost considerations are an additional factor when agencies evaluate sensing technologies.[4]

Figure 3: Camera Detection System



Source: University of Minnesota Center for Transportation Studies, A Comprehensive System for Assessing Truck Parking Availability, 2017, https://cts-d8resmod-prd.oit.umn.edu/pdf/cts-17-02.pdf

Figure 4: TPIMS Puck Sensor

Source: Sensys Networks.

Figure 5: Laser/Lidar Technology

Source: Illinois State Freight Advisory Council, IDOT TPIMS Project, 2019.

3.2.2 Information Dissemination Technologies

Information dissemination technologies share information with drivers, dispatchers, and other interested parties. Certain methods, such as websites (Figure 7 and Figure 8) and mobile applications that require more than one touch, can only be used by truck drivers while planning for parking. Dispatchers may also access this information to share with drivers while they are on the road. Other methods, such as roadside dynamic message signs (DMS) (Figure 6) and in-cab message systems, can be viewed by truck drivers while operating a vehicle. When asked about information dissemination preferences, drivers often prefer DMS and mobile applications, with the Trucker Path application and

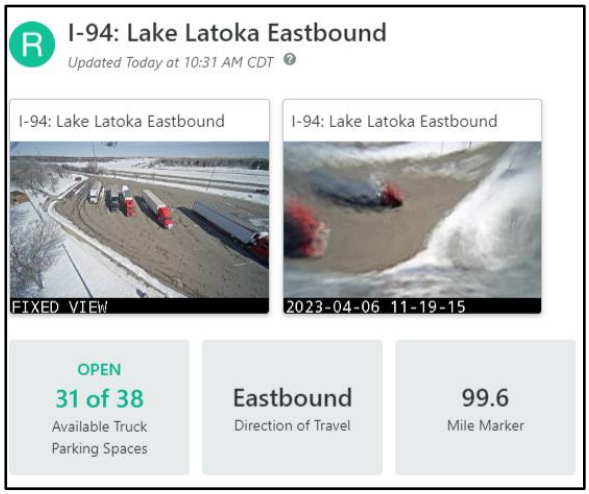
Figure 6: Minnesota Truck Parking DMS

Google Maps Streetview, 2023.

[4] ATRI, Truck Parking Information Systems: Truck Drivers Use and Perspectives, 2021, https://truckingresearch.org/wp-content/uploads/2021/06/ATRI-Truck-Parking-Information-Systems-Driver-Use-and-Perceptions-06-2021.pdf.

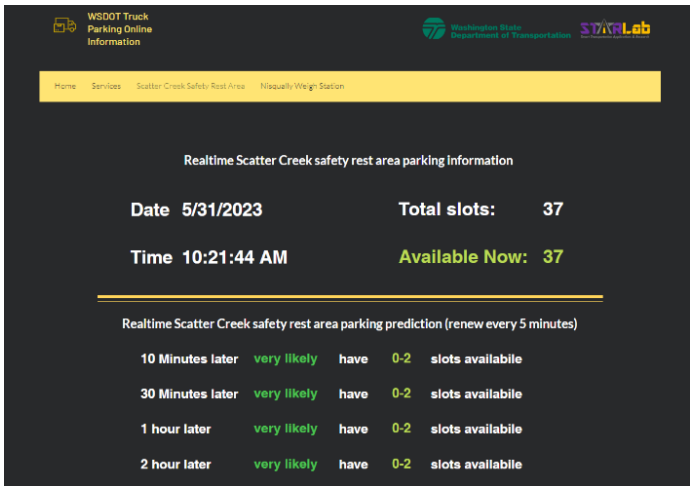
private truck stop applications identified as those most often used.[5]

Figure 7: Minnesota 511 Website



Source: Minnesota Department of Transportation, 511 Website, accessed 2023, https://511mn.org/.

Figure 8: Washington TPIMS Pilot Website



Source: Washington State Department of Transportation and University of Washington STAR Lab, WSDOT Truck Parking Online Information, accessed 2023, https://uwstarlab.wixsite.com/wsdotparking/scatter-creek-safety-rest-area.

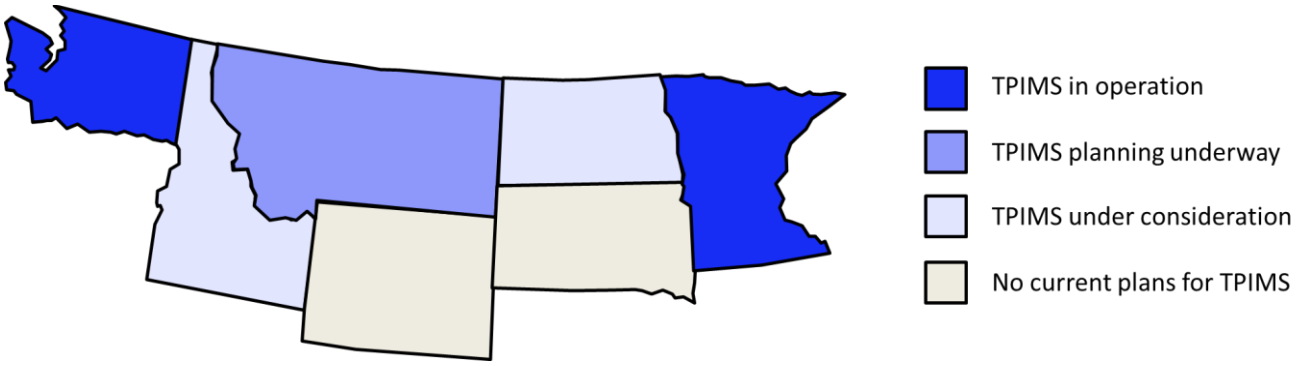
[5] ATRI, Truck Parking Information Systems: Truck Drivers Use and Perspectives, 2021, https://truckingresearch.org/wp-content/uploads/2021/06/ATRI-Truck-Parking-Information-Systems-Driver-Use-and-Perceptions-06-2021.pdf.

4 TPIMS Efforts in the NWP

4.1 Introduction

Across the NWP region, states are at various stages of advancing or considering the deployment of TPIMS. Figure 9 illustrates those states that have TPIMS in operation (Minnesota and Washington), are planning for TPIMS (Montana), or are considering TPIMS in ongoing studies (Idaho and North Dakota), and which states do not currently have plans for TPIMS beyond initial discussions (South Dakota and Wyoming).

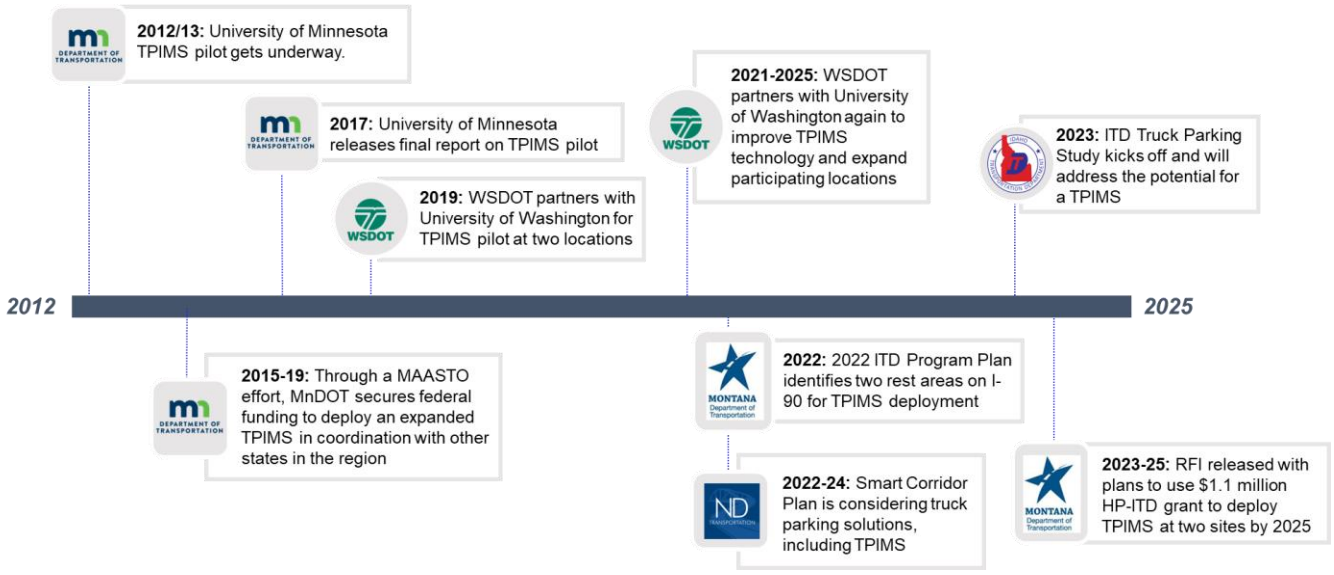
Figure 9: Current Status of TPIMS in NWP



Source: CPCS, 2023.

Figure 10 details a timeline of TPIMS planning and implementation across the NWP. As shown, Minnesota was the first NWP state to implement TPIMS, followed by a recent deployment in Washington. Montana has TPIMS planning underway, and evaluations are under consideration in Idaho and North Dakota.

Figure 10: Timeline of TPIMS in the NWP



Source: CPCS, 2023.

The following sections provide additional detail on the completed and ongoing TPIMS efforts among the NWP's seven member states.

4.2 Idaho

Idaho is currently evaluating TPIMS as part of its ongoing Truck Parking Research Project.

Planning Efforts

As part of the 2017 Idaho Transportation Department (ITD) Statewide Freight Strategic Plan, the freight project and program list proposes developing "ITS [Intelligent Technology Solution] capabilities to track truck parking availability at key locations and [providing] real-time data integrated with Idaho's trucker-specific 511 site."[6]

The ongoing Idaho Truck Parking Research Project, which began in early 2023, will research the need for near real-time information on the location of available parking and explore TPIMS software options to advance future monitoring of truck parking availability.[7] The state also noted that concurrent with the push for a truck parking study, ITD leadership has expressed renewed interest in exploring TPIMS.[8]

Future of TPIMS

ITD indicated an interest in participating in a regional TPIMS effort. However, Idaho will first assess the need for TPIMS within the state, through its ongoing truck parking study. Cost will be another crucial factor in determining whether TPIMS will be deployed within the state.

4.3 Minnesota

Minnesota currently operates a TPIMS at six public truck parking locations spanning 167 spaces along I-35 and I-94 in the state.[9]

Minnesota was one of the first states to deploy TPIMS, with its initial pilot beginning in 2012.[10] The system expanded through the Mid America Association of State Transportation Officials (MAASTO) regional TPIMS in 2015. Currently, TPIMS is in operation at five public truck parking locations on I-94 and one on I-35. The following sections provide an overview of the state's TPIMS efforts.

University of Minnesota Pilot Study (2012-2017)

TPIMS began in 2012 through a pilot study conducted by the University of Minnesota, supported by the American Transportation Research Institute (ATRI) and funded by the Minnesota Department of Transportation (MnDOT) and the Federal Highway Administration (FHWA).[11] Over the course of two years, the pilot successfully demonstrated the feasibility of TPIMS at a cost of just over $2 million.[12]

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[6] Idaho Transportation Department, Idaho Transportation Department Statewide Freight Strategic Plan: Final Report, February 2017, https://apps.itd.idaho.gov/apps/freight/FreightPlan.pdf.
[7] Idaho Transportation Department, Idaho Transportation Department – Division of Highways: State of Idaho Truck Parking Research Project Request for Proposal, 2022, accessed February 2023, https://itd.idaho.gov/wp-content/uploads/2022/08/TruckParking_RFP.pdf. | Consultation with ITD, 2023.
[8] Consultation with ITD, March 30, 2023.
[9] Minnesota Geospatial Commons, Rest Areas and MnDOT Facilities in Minnesota, accessed February 2023, https://gisdata.mn.gov/dataset/struc-mndot-facilities.
[10] Trucks Park Here, MAASTO TPIMS Project: National TPIMS Projects Fact Sheet, accessed February 2023, https://trucksparkhere.com/wp-content/uploads/2016/08/Fact-Sheet-3_TPIMS-MAASTO_Factsheet_NationalTPIMSProjects_2016-08-02-1.pdf.
[11] University of Minnesota: Center for Transportation Studies, Technology developed by U researchers helps truck drivers in Kansas and Wisconsin find safe parking, February 2019, https://www.cts.umn.edu/publications/catalyst/2019/february/truck.
[12] USDOT Federal Highway Administration: Freight Management and Operations, National Coalition on Truck Parking: Technology and Data Working Group – Truck Parking Availability Detection and Information Dissemination, modified February 2022, https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/workinggroups/technology_data/product/best_practices.htm.

The University of Minnesota's Center for Transportation Studies published "A Comprehensive System for Assessing Truck Parking Availability"[13] in 2017 to summarize results of the pilot study. The study involved a pre-implementation usability survey of drivers and carriers, the implementation of TPIMS at three rest areas, and a post-implementation survey, as described in Figure 11.

Figure 11: Results of University of Minnesota TPIMS Pilot

Step	Results
Step 1: Pre-Implementation Survey	• Drivers most interested in receiving truck parking information through Changeable Message Signs. Least interested in information via a dispatcher. • Almost half of drivers were interested in DMS notifications 20 miles away, followed by 5 miles. • System reliability needs to be at least 85 percent in order to be useful. • Largest share of drivers are not willing to pay for TPIMS.
Step 2: TPIMS Implementation	• Used direct methodology with a multi-camera system. This had multiple benefits: ability to generate 3D images, perform redundancy checks to ensure accuracy, and overcome lighting challenges. • System operated 24/7 and was able to self-calibrate. • Deployed at three rest areas: Elm Creek (early 2013), Big Spunk Lake (early 2014), and Enfield (mid 2014). • System proved to be 95 percent accurate with discrepancies of ±1-3 counts. Accuracy slightly lower at night. • Information disseminated using web parking information portal, in-cab application, and roadside electronic signs.
Step 3: Post-Implementation Survey and Assessment	• Drivers prefer receiving information via an onboard computer. • Most drivers preferred to receive availability information 20 miles in advance. • Half of respondents had no preference between specific number of spaces available and high-level space availability information (low, medium, high). • More than half of drivers and carriers reported that TPIMS positively or very positively affected their productivity.

Source: University of Minnesota Center for Transportation Studies, A Comprehensive System for Accessing Truck Parking Availability: Final Report, January 2017, https://cts-d8resmod-prd.oit.umn.edu/pdf/cts-17-02.pdf.

TPIMS Deployment with MAASTO TIGER Grant (2015-2019)

Minnesota was one of eight MAASTO states to advance a regional truck parking effort, with the support of a federal Transportation Investment Generating Economic Recovery (TIGER) grant. As part of this effort, Minnesota was awarded over $1.2 million, with a matching state contribution of $177,500.[14] MnDOT opted to advance this TPIMS using in-pavement puck sensors, which offered cost savings with strong accuracy, compared to the multi-camera system utilized for the pilot system.[15] The MAASTO project resulted in the deployment of TPIMS at seven public truck parking locations, six of which are currently active today. An additional three rest areas were considered for the MAASTO project but were not selected for TPIMS installation – Moorhead on I-94 EB, Straight River on I-35 NB, and Albert Lea on I-35 NB.[16]

[13] Morris, Ted, et al., A Comprehensive System for Assessing Truck Parking Availability: Final Report, University of Minnesota: Center for Transportation Studies, January 2017, https://cts-d8resmod-prd.oit.umn.edu/pdf/cts-17-02.pdf.
[14] Trucks Parks Here, MAASTO TPIMS Project: TIGER Factsheet, 2016, accessed February 2023, https://trucksparkhere.com/wp-content/uploads/2016/08/TPIMS-MAASTO_Factsheet_TIGERSheet_2016-06-29.pdf.
[15] Consultation with MnDOT, April 3, 2023.
[16] ArcGIS, MAASTO TPIMS Project: Field Data, accessed February 2023, https://www.arcgis.com/apps/webappviewer/index.html?id=5666e51247c34de088b74e0a42234160&extent=-12495005.0632,4038600.8609,-7798714.0454,6433220.083,102100.

Current TPIMS

As shown in Figure 12, there are six active TPIMS locations in Minnesota, five on I-94 and one on I-35.[17] A seventh on I-35 NB has been inactive since the rest area was reconstructed in 2020.[18] All TPIMS locations in Minnesota have been implemented at rest areas on corridors leading into the Twin Cities – intended to help truck drivers plan their breaks before entering the urban area.

Figure 12: Inventory of TPIMS Locations in Minnesota

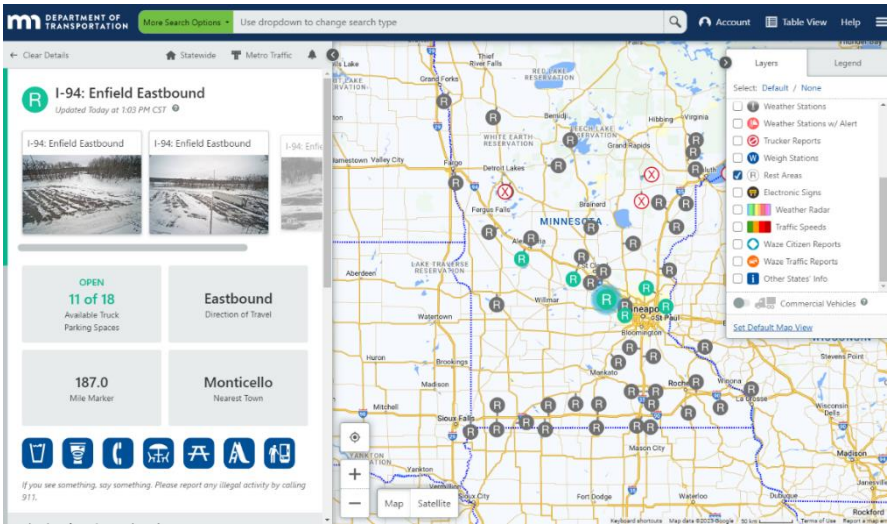
Name	Project	Truck Parking Spaces	DMS Sign Distance	Route	Status
Lake Latoka EB	MAASTO TPIMS	38	6 miles	I-94	Active
Big Spunk EB	MAASTO TPIMS	16	4 miles	I-94	Active
Enfield EB	U of MN TPIMS Pilot	18	5 miles	I-94	Active
Elm Creek EB	U of MN TPIMS Pilot	27	4 miles	I-94	Active
St. Croix WB	MAASTO TPIMS	53	4 miles	I-94	Active
Forest Lake SB	U of MN TPIMS Pilot	15	4 miles	I-35	Active
Heath Creek NB	MAASTO TPIMS	19	5 miles	I-35	Inactive

Source: MnDOT, Construction Plan for Traffic Management System: State Project Number 8816-2461, May 2017, https://www.dot.state.mn.us/its/projects/2016-2020/truckparking/constructionplan.pdf; MAASTO TPIMS Project: Field Data, https://www.arcgis.com/apps/webappviewer/index.html?id=5666e51247c34de088b74e0a42234160&extent=-12495005.0632,4038600.8609,-7798714.0454,6433220.083,102100; USDOT FHWA: Freight Management and Operations, National Coalition on Truck Parking: Technology and Data Working Group – Truck Parking Availability Detection and Information Dissemination, modified February 2022, https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/workinggroups/technology_data/product/best_practices.htm

MnDOT shares truck parking availability information with drivers through the Minnesota 511 website (Figure 13), state and third-party applications, and DMS[19] located in advance of each rest area (Figure 14). The data is also available in a static and dynamic public feed on the MAASTO TPIMS website for developers, enabling public access to the state's real-time truck parking availability information for incorporation into software or other applications.[20]

[17] Minnesota Department of Transportation, 511, accessed February 2023, https://511mn.org/@-95.61352,46.92432,6?show=metroTrafficMap,roadReports,winterDriving,weatherWarningsAreaEvents,stationsAlert,otherStateInfo.
[18] Consultation with MnDOT, April 3, 2023.
[19] MnDOT often uses the equivalent term "Changeable Message Sign (CMS)."
[20] Trucks Parks Here, Application/In-Cab Navigation Developers, accessed February 2023, https://trucksparkhere.com/developer-info/.

Figure 13: Minnesota 511 System Truck Parking Availability Information



Source: Minnesota Department of Transportation, 511, accessed February 2023.

Figure 14: Minnesota DMS in Albany for Big Spunk EB

Source: Google Maps Street View, 2023.

MnDOT has noted challenges with the longevity and performance of the puck technology used to detect truck parking availability. A combination of technology and operating condition challenges, including inclement weather like ice and freezing rain, have led to battery performance and puck failure issues. MnDOT is currently evaluating the potential to upgrade its sensing technologies.[21]

MnDOT has also noted the need for continued resources, including both funding and staffing, to operate and maintain existing TPIMS sites.

Future of TPIMS

Minnesota does not currently have plans to expand the state's TPIMS; rather, the state is focused on operating and maintaining its current sites. However, MnDOT expressed support for a regional TPIMS, with the ability to provide technical assistance to other NWP states implementing TPIMS.[22]

MnDOT also identified a range of factors to consider for the future of TPIMS, including:[23]

- Accommodating electric vehicles, connected vehicles, and autonomous vehicles as these are deployed.
- Integrating private truck stops into TPIMS requires consideration of their incentive to provide information about truck parking availability.
- Need for guidance at the federal level to standardize TPIMS moving forward, including ITS infrastructure and sign spacing and design.

[21] Consultation with MnDOT, April 3, 2023.
[22] Consultation with MnDOT, April 3, 2023.
[23] Consultation with MnDOT, April 3, 2023.

4.4 Montana

Montana has secured funding to deploy TPIMS at two pilot locations and is currently evaluating sensing technologies.

Planning Efforts

The 2022 Montana Freight Plan highlights that the state is aiming to implement a truck parking availability system in the near future.[24] The 2020 ITD Program Plan identifies Columbus EB, Homestake WB, Quartz Flats EB and WB, and Clinton EB and WB as additional potential locations for TPIMS implementation.[25] Since then, the Montana Department of Transportation (MDT) has expanded the top-level design to all 45 rest areas in the state.[26]

TPIMS Pilot with HP-ITD Grant (2022-ongoing)

In 2022, Montana secured a $1.1 million Federal Motor Carrier Safety Administration (FMCSA) High Priority Innovative Technology Deployment (HP-ITD) grant to deploy TPIMS at public truck parking locations – Columbus Rest Area on I-90 WB and Homestake Rest Area on I-90 EB. The grant will fully fund this pilot project, with funds available through 2025 for Montana to deploy a TPIMS.[27] MDT selected the pilot sites based on two factors: the locations cover travel in each direction on I-90, and they are located along a corridor that experiences high-profile weather events, including high winds, that frequently impact travel and cause road closures.

The state is currently in the process of evaluating sensing technologies for the system. MDT recently released a Request for Information (RFI) (opened March 2023 and closed April 2023) to inform the assessment and selection of TPIMS technologies and design. Montana also plans to share TPIMS information through dynamic signs, the 511 website, and an Application Programming Interface (API). Finally, the state is committed to implementing a resilient TPIMS that will remain accurate through inclement weather, such as snowstorms.[28]

Future of TPIMS

In the near future, Montana will be focused on implementing the TPIMS pilot. If the ongoing TPIMS pilot is successful, Montana may consider expanding the system to additional rest areas. MDT also indicated an interest in participating in a regional TPIMS effort.

[24] Montana Department of Transportation, 2022 Montana Freight Plan, accessed February 2023, https://mdt.mt.gov/freightplan/docs/2022-Montana-Freight-Plan.pdf.
[25] Montana Department of Transportation, Expanded Innovative Technology (ITD_ Program Plan and Top-Level Design (PP/TLD): For the State of Montana, January 31, 2020.
[26] Montana Department of Transportation input, NWP Freight Task Force TPIMS Assessment Roundtable #1, April 20, 2023.
[27] Montana Department of Transportation input, NWP Freight Task Force TPIMS Assessment Roundtable #1, April 20, 2023.
[28] Consultation with MDOT, March 29, 2023.

4.5 North Dakota

North Dakota is currently evaluating TPIMS as part of its ongoing Smart Corridor Planning Project.

Planning Efforts

The 2023 North Dakota Freight and Rail Plan highlights TPIMS as an opportunity to improve truck parking information and management.[29] Additionally, the state's ongoing Transportation Management Center (TMC) and Smart Corridor (SC) Planning Project will assess technology opportunities, including TPIMS and other truck parking solutions, to improve the I-29 corridor.[30] This $1.1 million project is supported by a $550,000 Rebuilding American Infrastructure with Sustainability and Equity (RAISE) planning grant.[31]

Future of TPIMS

The North Dakota Department of Transportation (NDDOT) may be interested in participating in a regional TPIMS effort but first needs to assess the value of a TPIMS within North Dakota. The current Smart Corridor Plan will conduct a high-level review of truck parking technology solutions but will not involve a detailed assessment of TPIMS.

4.6 South Dakota

South Dakota has yet to plan for, evaluate, or advance TPIMS beyond informal discussions.

Planning Efforts

Currently, TPIMS has only been discussed informally within the South Dakota Department of Transportation (SDDOT). Recent state freight, truck parking, and rest area planning efforts have not identified or evaluated TPIMS as a potential opportunity.[32] The 2018 SDDOT Rest Area & Truck Pullout Truck Parking Analysis did involve the installation of video cameras at each rest area in the state to measure truck parking utilization and availability, but this technology was only in place for 24 hours to inform the study.[33]

Future of TPIMS

The state identifies cost and competing priorities as barriers to advancing a TPIMS. SDDOT sees the value of regional coordination but needs to assess the value of a TPIMS within South Dakota before considering a regional effort.

[29] North Dakota Department of Transportation, State Freight & Rail Plan, January 2023, https://www.dot.nd.gov/projects/frp/assets/documents/NDDOT_FinalFRP_Jan2023.pdf (page 5-10).
[30] North Dakota Department of Transportation, Request for Proposal: North Dakota's Transportation Management Center and Smart Corridor Plan, March 2022, https://view.officeapps.live.com/op/view.aspx?src=https%3A%2F%2Fwww.dot.nd.gov%2Fdivisions%2Fets%2FRFPs%2Fdocs%2F1586%2FTMC-SMART%2520Corridor%2520RFP.docx&wdOrigin=BROWSELINK.
[31] USDOT, RAISE Grants: Planning Awards FY 2021, accessed 2023, https://www.transportation.gov/sites/dot.gov/files/2022-02/RaiseGrants%20Planning_Fact%20Sheets.pdf.
[32] South Dakota Department of Transportation, SDDOT Rest Area & Truck Pullout Truck Parking Analysis: Final Report, December 2018, https://dot.sd.gov/media/documents/Final_Truck%20Parking%20Report_December%202018.pdf; South Dakota Department of Transportation, Draft 2022 South Dakota Freight Plan, accessed February 2023, https://dot.sd.gov/media/documents/2022draft_PublicAll.pdf.
[33] South Dakota Department of Transportation, SDDOT Rest Area & Truck Pullout Truck Parking Analysis: Final Report, December 2018, https://dot.sd.gov/media/documents/Final_Truck%20Parking%20Report_December%202018.pdf.

4.7 Washington

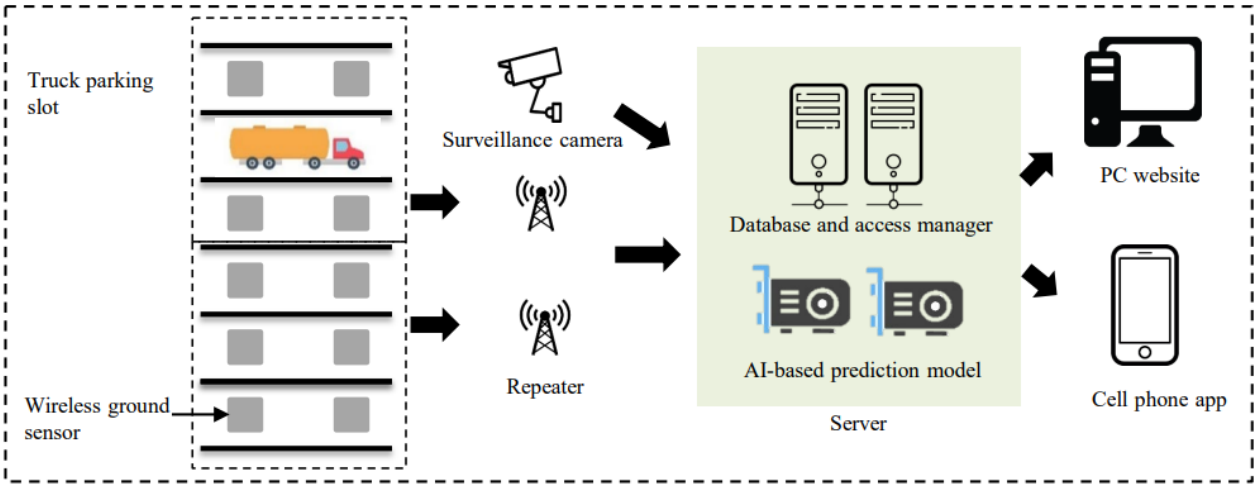
Washington currently operates a TPIMS at two public truck parking locations along I-5, with plans to expand TPIMS to the remaining 28 public truck parking locations along I-5 and I-90 in the state.

Washington currently has two pilot TPIMS locations, deployed through a pilot in 2019. The state is currently in the process of expanding the system to all locations on I-5 and I-90 through an FMCSA grant awarded in 2021. The following sections provide an overview of the state's TPIMS efforts.

TPIMS Pilot

In 2019, the Washington State Department of Transportation (WSDOT) partnered with the Smart Transportation Applications & Research (STAR) Lab at the University of Washington to pilot a TPIMS using in-pavement puck sensors at Fort Lewis/Nisqually Weigh Station and Scatter Creek Rest Area.[34] During this pilot study, the University of Washington also developed an algorithm to predict future truck parking availability up to four hours in advance with about a 12 percent error (Figure 15).[35] The resulting real-time truck parking availability and prediction information is shared on an application and website (Figure 16).[36] The TPIMS at Fort Lewis/Nisqually Weigh Station and Scatter Creek Rest Area are currently in operation, covering a total of 49 stalls. WSDOT funded the $200,000 pilot project.[37]

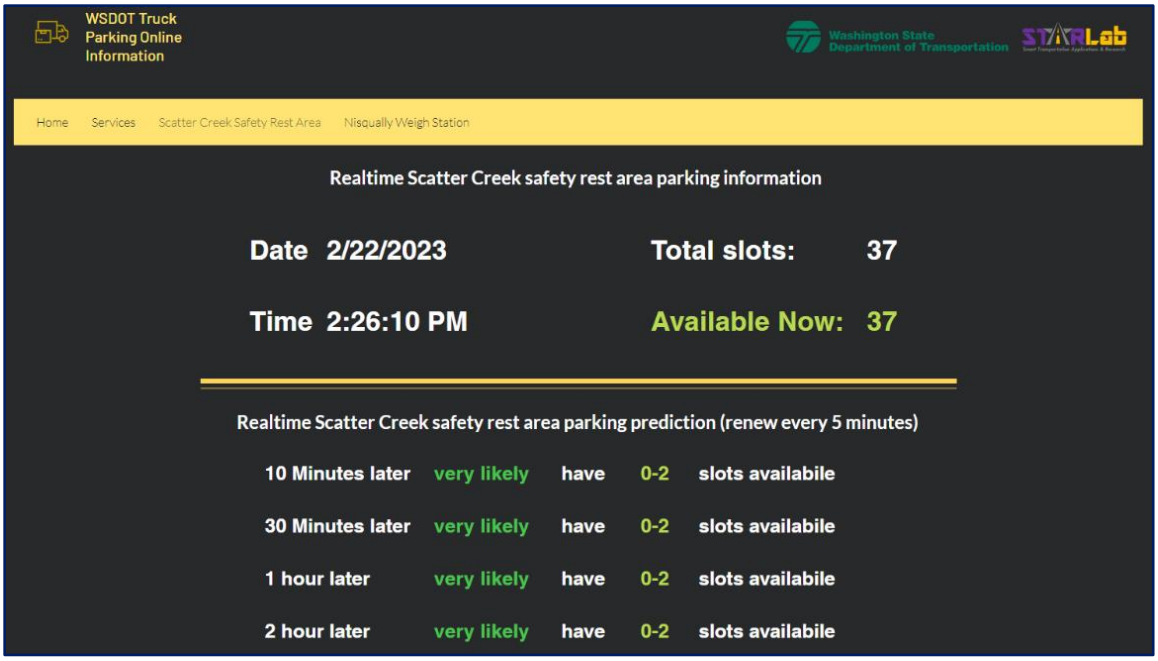
Figure 15: WSDOT and STAR Lab Pilot TPIMS Architecture



Source: Murthy, Karthik, and Hao (Frank) Yang, A Cost-Effective Solution for Truck Parking Based on Artificial Intelligence, Washington State Department of Transportation and STAR Lab, October 2021, http://www.westernstatesforum.org/Documents/2021/Presentations/WSDOT_UW_MurthyYang_Final_TruckParkingPrediction.pdf.

[34] Washington State Department of Transportation, 2022 WSDOT Freight Plan: Appendix H, accessed February 2023, https://wsdot.wa.gov/sites/default/files/2022-07/Freightsystemplan-Appendix-H.pdf.
[35] Consultation with WSDOT, March 30, 2023.
[36] Washington State Department of Transportation and STAR Lab, WSDOT Truck Parking Online Information, accessed February 2023, https://uwstarlab.wixsite.com/wsdotparking/scatter-creek-safety-rest-area.
[37] Consultation with WSDOT, March 30, 2023.

Figure 16: WSDOT Truck Parking Online Information Website



Source: Washington State Department of Transportation and STAR Lab, WSDOT Truck Parking Online Information, accessed February 2023, https://uwstarlab.wixsite.com/wsdotparking/scatter-creek-safety-rest-area.

TPIMS Expansion with FMCSA Grant (2021-ongoing)

WSDOT, in partnership with the University of Washington STAR Lab, is currently working to expand the state's existing TPIMS, with support from a 2021 FMCSA grant. Of the $2.3 million project cost, the FMCSA grant makes up 85 percent, with the remaining 15 percent funded by WSDOT. The state plans to deploy TPIMS to 28 truck parking locations (21 rest areas and 7 weigh stations) on I-5 and I-90 in the coming years.[38] WSDOT has noted challenges with the performance of the puck technology used to detect truck parking availability, and the state is currently considering a range of additional sensing technologies, including Omni Sight Radar, video detection using fixed cameras, and Wavetronix lidar, for the expansion. The state is open to combining one or more technologies or using a mix of technologies in a system-agnostic approach. Considerations related to costs and benefits, rural and urban needs, and facility features and design (e.g., power, communications). The state plans to disseminate TPIMS information on the online traveler information map, through an app, and an API. Signage is not part of this effort.[39]

FMCSA funding is available through 2025, and WSDOT plans to select TPIMS technologies by early fall 2023, with construction and deployment by the end of 2024 and evaluation occurring in 2025.[40] The University of Washington is also refining its existing truck parking availability prediction algorithm for more accurate forecasting.[41]

[38] Washington State Department of Transportation, 2022 WSDOT Freight Plan: Appendix H, accessed February 2023, https://wsdot.wa.gov/sites/default/files/2022-07/Freightsystemplan-Appendix-H.pdf.
[39] Consultation with WSDOT, March 30, 2023.
[40] Consultation with WSDOT, March 30, 2023.
[41] Washington State Transportation Center, Truck Parking Information and Management System (TPIMS), May 2022, https://depts.washington.edu/trac/current-projects/wsdot-fmcsa-truck-parking-information-and-management-system-tpims/ and STAR Lab, Truck Parking Information and Management System with Pattern Analysis and Availability Prediction, accessed February 2023, https://www.uwstarlab.org/content/projects/truck-parking.html.

WSDOT has also noted the need for continued resources, including both funding and staffing, to operate and maintain the state's planned TPIMS network.

Future of TPIMS

Upon completion of the TPIMS expansion to I-90 and I-5, WSDOT may consider expanding the system to the remaining 170 public truck parking stalls in the state. WSDOT is currently in discussions with California DOT and Oregon DOT to advance a regional TPIMS along the I-5 corridor. The agency has also expressed interest in participating in a regional TPIMS effort with the NWP.[42]

4.8 Wyoming

Wyoming has yet to advance TPIMS.

Wyoming Department of Transportation's (WYDOT) Risk and Resiliency Plan for Critical Freight Transportation Assets identified communicating truck parking availability as a common recommendation.[43] However, the most recent Wyoming Statewide Freight Assessment did not discuss TPIMS.[44]

[42] Consultation with WSDOT, March 30, 2023.
[43] Wyoming Department of Transportation, Risk and Resiliency Plan for Critical Freight Transportation Assets, 2018, accessed February 2023, https://www.whp.dot.state.wy.us/files/live/sites/wydot/files/shared/Planning/2018%20WYDOT%20Freight%20Resilience%20Plan.pdf.
[44] Wyoming Department of Transportation, 2022 Wyoming Statewide Freight Assessment, accessed February 2023, https://dot.state.wy.us/files/live/sites/wydot/files/shared/Planning/Freight%20Plan/210830_WY_Freight_Plan%20wAppendices_Final%20October%202022.pdf.

5 Industry Feedback on TPIMS

5.1 Introduction

The Project Team also engaged the private sector to obtain industry input on truck parking information needs and opportunities. This input is critical, as truck drivers are the ultimate end users and primary beneficiaries of truck parking information solutions. Their experiences and feedback on TPIMS support a comprehensive assessment of TPIMS in the NWP.

Outreach with truck drivers enables state DOTs to make truck parking investments with the greatest on-the-ground value.

To accommodate as many preferred outreach methods as possible in the trucking industry, the Project Team utilized two engagement methods:

1) Online Survey distributed to truck drivers by NWP state Trucking Associations

2) Consultation conducted with OOIDA

Overall, the trucking industry indicated real-time truck parking information systems provide useful information that can inform planning and decision-making for truck parking. However, trucking stakeholders highlighted the ongoing need to expand truck parking capacity to address the urgent truck parking shortage. Respondents encouraged state DOTs to consider using available resources, as able, to construct additional truck parking spaces.

5.2 Consultation with OOIDA

The Owner Operator Independent Driver Association (OOIDA) has represented the rights of its 150,000 members, including small business truckers and company drivers, for 50 years. A consultation[45] held with OOIDA included a discussion about how truck drivers access information about truck parking and how TPIMS can be most useful for truck drivers.

- **Truck drivers vary significantly in their use of and preferences for accessing information about truck parking locations and availability.** There is also variation in knowledge about truck parking availability, with those driving regular routes knowledgeable about truck parking along the route, while those driving new routes may be less familiar with where to find available truck parking. This highlights the importance of communicating information about truck parking to drivers – both in terms of advertising truck parking information systems as well as TPIMS dissemination methods themselves – through a range of methods.

- **Real-time availability information is most useful when shared on DMS directly ahead of parking locations.** DMS near rest areas is helpful to inform drivers as to whether or not they should exit to find truck parking. Information on signage located farther away from rest areas may be less useful because the status of this information could change in the time it takes truck drivers to reach the rest area. OOIDA also suggested states consider opportunities to simplify and streamline information being shared with drivers on signs.

- **The ideal TPIMS is a single, simple system that shares information with drivers in-cab.** As states and regions advance TPIMS forward, the ultimate goal should look toward one TPIMS for

[45] Consultation with OOIDA, May 24, 2023.

use by all truck drivers, rather than the variation of systems and applications that make up the current landscape of TPIMS. The future of TPIMS will also involve sharing information in-cab, similar to how safety and bypass information is currently shared with truck drivers.

- **Continued outreach with truck drivers is critical** to understand their experiences and needs. Integrating truck driver perspectives into scope development ensures a TPIMS investment that will be used by truck drivers and realizes safety, quality of life, environmental, and economic benefits.

- **There remains a need for more truck parking.** OOIDA stressed the importance of developing more truck parking. While TPIMS solutions are also helpful, more truck parking spaces remains the greatest need.

5.3 Truck Driver Survey

Several NWP state Trucking Associations distributed an online survey (through SurveyMonkey) to truck drivers to collect information about truck parking information needs and solutions in the NWP. Appendix B provides an overview of distributed survey questions and responses from truck drivers. The survey yielded 14 total responses, 11 of which proceeded beyond introductory questions and 9 of which were fully completed. Below is a summary of responses from the 11 truck drivers who provided substantive input on the survey.[46]

- **Respondents represented truck drivers with experience driving in all NWP states**. Drivers surveyed ranged in their average length of haul, with regional (100-499 miles per trip), inter-regional (500-999 miles per trip) and long (1,000+ miles per trip) hauls reported.

- **Truck drivers identified a lack of sufficient truck parking as the top truck parking issue in the NWP, followed by a lack of information about truck parking.** When asked to rank issues, truck drivers ranked a lack of information about truck parking locations slightly higher than a lack of information about truck parking availability. Within the NWP, the I-90 corridor was noted as having insufficient truck parking. Multiple respondents also shared that truck parking issues are getting increasingly worse.

- **Truck drivers who have seen or received real-time truck parking information do use this information to make truck parking decisions.** Only four respondents[47] reported having seen or received real-time truck parking information. These drivers accessed this information through mobile applications and roadside signs. However, three of these four noted using TPIMS information to make truck parking decisions to plan for parking. One respondent shared that Minnesota's "[up-to-the-minute] sign information is helpful."

- **Truck drivers are generally interested in a regional TPIMS in the NWP.** While truck drivers underscored the need for more available parking, the majority of respondents (seven[48]) also indicated that a coordinated regional TPIMS in the NWP would be useful. One respondent stated that such a system "would be useful in planning where to park for the evening."

[46] Two of the eleven respondents that advanced beyond introductory questions skipped select questions.
[47] Only ten respondents answered this question. One respondent skipped this question.
[48] Only ten respondents answered this question. One respondent skipped this question.

6 Regional TPIMS Opportunities

6.1 Introduction

Several multi-state groups have or are currently advancing regional TPIMS nationwide. Notable examples include projects in the Midwest, where eight MAASTO states implemented TPIMS, and along the I-10 corridor, with four southwest states deploying a truck parking information solution. The NWP may similarly consider advancing a coordinated TPIMS across multiple states in the region. Evaluating recently completed efforts offers important lessons learned and best practices to inform future regional TPIMS projects. Input from state DOTs, obtained through two roundtable meetings held as part of this Assessment, further identifies opportunities, challenges, and next steps for the NWP, as the group considers moving a regional TPIMS forward.

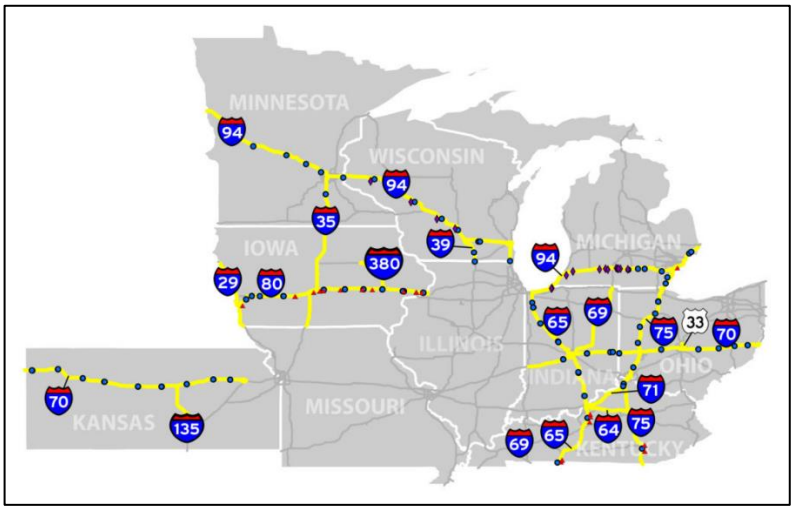
6.2 Case Studies

MAASTO TPIMS (2015-2019)

Project Overview

In 2015, eight MAASTO states – Minnesota, Wisconsin, Michigan, Kansas, Indiana, Iowa, Ohio, and Kentucky – came together to advance a novel regional TPIMS. The project's goals included improving safety, maximizing the usage of existing truck parking assets, and adding value to the trucking industry by providing timely, reliable, and accurate truck parking information harmoniously across multiple states.[49]

Figure 17: MAASTO TPIMS Project Area



Source: Trucks Park Here, Find Truck Parking, accessed February 2023, https://trucksparkhere.com/find-parking/.

In 2015, MAASTO secured a $25 million TIGER grant, supported by nearly $3.7 million in matching state contributions, to advance a regional TPIMS at approximately 150 locations across the Midwest.[50] MAASTO estimated the TPIMS project would offer over $400 million in benefits (in 2015 dollars) through more efficient driving, less fuel consumption, reduced emissions, and improved safety.[51]

Kansas DOT served as project champion, leading application development, coordinating state efforts, and managing funds for the federal grant award. MnDOT underscored the importance of KDOT's leadership efforts to the success of the MAASTO TPIMS project.[52]

[49] Minnesota Department of Transportation, MAASTO TPIMS Project: Concept of Operations, July 2016, https://www.dot.state.mn.us/its/projects/2016-2020/truckparking/conops.pdf.
[50] MAASTO TPIMS Project, TIGER Grant Fact Sheet, June 2016, accessed June 2023, https://trucksparkhere.com/wp-content/uploads/2016/08/TPIMS-MAASTO_Factsheet_TIGERSheet_2016-06-29.pdf
[51] Trucks Park Here, The MAASTO TPIMS Project: MAASTO 2016 Conference Handout, 2016, accessed February 2023, https://trucksparkhere.com/wp-content/uploads/2016/08/TPIMS_MAASTOConference_Handout_2016-08-05_Print.pdf.
[52] Consultation with MnDOT, April 3, 2023.

This project demonstrated the feasibility of a large-scale, multi-state TPIMS, while also serving as a model of regional collaboration.

The MAASTO TPIMS project included the deployment of sensing technology, a new integrated truck parking availability monitoring system, and communication of information through roadside signs, websites and applications, and a public API.[53] Construction began in 2017 and the system went live in 2019.[54]

States had the flexibility to select technologies and advance the project in line with their unique conditions, preferences, and requirements, as shown in Figure 18. Despite the patchwork of technologies and system architectures between states, the project coordinated a single data repository at the University of Wisconsin to house each state's real-time truck parking availability information. This data center makes TPIMS data publicly available through public feeds, meaning state systems can consume it to share truck parking availability on roadside signs or provide an API, but also third-party vendors like Waze could theoretically use it as well.[55]

Figure 18: TPIMS Across MAASTO States

Functions	Type	Iowa	Ohio	Michigan	Kentucky	Wisconsin	Indiana	Kansas	Minnesota
Procurement	Public	DBOM	DBOM	DBB	DBB	DBB	DBB	DBB	DBB
	Private		N/A	DBOM		N/A	N/A	N/A	N/A
Data Collection Method	Public	Functional Requirements	Functional Requirements	In/Out	In/Out	In/Out	In/Out	Space-by-Space	Space-by-Space
	Private		N/A			N/A	N/A	N/A	N/A
Data Collection Technology[6]	Public	Functional Requirements	Functional Requirements[1,2]	Video	Magnetometer	Magnetometer	Magnetometer	Video[2]	Magnetometer
	Private		N/A	Video		N/A	N/A	N/A	N/A
Operations & Maintenance	Public	Third Party	Third Party	Internal[3]	Third Party[4]	Third Party	Internal	Third Party	Internal
	Private		N/A	Third Party		N/A	N/A	N/A	N/A
	Sign Operations	N/A	Internal	Internal	Internal	Internal	Internal	Internal	Internal
Data Analytics & Sharing	Processing	Third Party	Third Party	In-House ATMS[7]	In-House ATMS	Third Party	In-House ATMS	In-House[8]	In-House ATMS
	Software	Not Developed	Not Developed	Current	Not Developed	Current	Not Developed	Not Developed	Needs Additional Development
	Sharing Format	XML Data Feed	XML Data Feed	XML Data Feed	XML Data Feed	XML Data Feed	XML Data Feed	XML Data Feed	XML Data Feed
Information Dissemination	Signs	No Signs	DTPS	DTPS	DTPS	DTPS	DTPS	DTPS	Full-Matrix Color DMS
	Website	State and Third Party[5]	State and Third Party[5]	State and Third Party[5]	State and Third Party[5]	State and Third Party[5]	State and Third Party[5]	State and Third Party[5]	State and Third Party[5]
	Mobile Website/ Mobile App	State and Third Party[5]	State and Third Party[5]	State and Third Party[5]	State and Third Party[5]	State and Third Party[5]	State and Third Party[5]	State and Third Party[5]	State and Third Party[5]

Source: Purdue University, MAASTO Regional Truck Parking Information Management System (TPIMS), 2018, accessed February 2023, https://docs.lib.purdue.edu/cgi/viewcontent.cgi?article=4218&context=roadschool.

[53] Trucks Park Here, MAASTO TPIMS Project Handout, 2017, accessed February 2023, https://trucksparkhere.com/wp-content/uploads/2017/02/TPIMS_Overview-2017_Handout_2017-02-01.pdf ; Kansas Department of Transportation, Mid America Association of State Transportation Officials, TIGER Proposal 2015: Regional Truck Parking Information Management System (TPIMS), 2015, https://trucksparkhere.com/wp-content/uploads/2016/06/MAASTO__TPIMS_TigerGrant2015.pdf.

[54] National Operations Center of Excellence, MAASTO Regional Truck Parking Information System, May 2020, https://transportationops.org/case-studies/maasto-regional-truck-parking-information-system.

[55] Minnesota Department of Transportation input, NWP Freight Task Force TPIMS Assessment Roundtables #1 and 2, April 20, 2023, and May 30, 2023.

Lessons Learned

As the first coordinated regional TPIMS, the MAASTO project provided many lessons for future efforts.[56]

- **Importance of a regional project champion:** Kansas served as project champion for the MAASTO project, leading federal grant application development and deployment.
- **Need for early buy-in and approval:** MAASTO received board approval, which helped give the project credibility and influence.
- **Balance between consistent regional approach and state flexibility:** The MAASTO project offered states the flexibility to adopt their own technologies and system architecture. Yet, the regional TPIMS balanced this with overall operational consistency to ensure interoperability across the region, such as through a cohesive data feed.
- **Consider ongoing operations and maintenance costs:** States should begin planning and programming for ongoing operations and maintenance costs, which are required after initial TPIMS deployment, and require funds beyond those awarded for capital activities.
- **Carefully evaluate different technologies and system designs:** There is a range of technologies, designs, and processes that may be used for a TPIMS. States should carefully research and evaluate these options while considering the benefits and drawbacks of approaches advanced by other states and regions.

I-10 Corridor Coalition Truck Parking Availability System (TPAS) (2019-2024)

Project Overview

The I-10 Corridor Coalition is a partnership between the states of California, Arizona, New Mexico, and Texas formed in 2016. The Coalition focuses on resource sharing, economies of scale, joint testing, and transportation best practices.[57] In 2019, the four I-10 Corridor Coalition states won a $6.85 million Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) grant to design and deploy a TPAS.[58] The TPAS seeks to improve mobility and safety, reduce infrastructure damage and emissions, and provide financial and time savings for drivers. State matching funds will further support the $13.7 million project.

Figure 19: I-10 Corridor Coalition TPAS System

Source: I-10 Corridor Coalition, Overview of TPAS, accessed 2023, https://i10connects.com/overview-tpas.

Texas DOT serves as project champion, leading application development, coordinating state efforts, and managing funds for the federal grant award. TxDOT also had available contracting capacity to support the state's grant application effort, and additional contracting capacity was secured across the corridor to support implementation.

[56] Minnesota Department of Transportation input, NWP Freight Task Force TPIMS Assessment Roundtables #1 and 2, April 20, 2023, and May 30, 2023; Consultation with MnDOT, April 3, 2023.
[57] I-10 Corridor Coalition, Overview of TPAS, accessed 2023, https://i10connects.com/overview-tpas; I-10 Corridor Coalition, Applying for Multi-State Grants Webinar, NWP Freight Task Force, March 14, 2023, https://www.nwpassage.info/projects/downloads/16-2-webinar-recording-2023-03.mp4.
[58] TPAS is another term for TPIMS.

States are currently in the process of system design and construction, with anticipated deployment in 2024. Once it goes live, the system will cover 550 truck parking spaces at 37 public rest areas (6 in California, 8 in Arizona, 5 in New Mexico, and 16 in Texas).[59]

States have the flexibility to select technologies and advance the project in line with their unique conditions, preferences, and requirements, while also working collectively to ensure system interoperability across the corridor. Arizona plans to implement a direct sensing technology system (space-by-space monitoring). The other three states – Texas, New Mexico, and California – intend to implement an indirect sensing technology system (entry and exit counting). The precise detection technologies have yet to be determined.[60] Meanwhile, across the corridor, information will be disseminated through DMS, smartphone apps, in-cab message systems, and traveler information websites. The Coalition also expects to integrate each state's truck parking availability data into a series of uniform dissemination platforms. These include consistent signage design and a single shared data feed. Data will also be shared on other platforms like the DriveTexas 511 system and third-party applications.[61]

To inform system design, the Coalition also conducted industry outreach, including a 2020 Truck Driver and Dispatcher Baseline Survey.[62] The results of this survey confirmed that drivers spend significant amounts of time searching for parking and a need for truck parking improvements. Respondents preferred roadside changeable signs over other information dissemination options.

Lessons Learned

While still ongoing, the I-10 Corridor Coalition has also identified lessons learned for advancing TPIMS.[63]

- **Importance of regional project champion and state champions:** The idea for this project began through initial discussions between personnel at Texas and California's DOTs. Texas served as project champion for the I-10 TPAS project, leading federal grant application development and deployment. TxDOT's available contracting capacity provided further support. Leads from Arizona and New Mexico also steered this effort forward, with champions from all states meeting regularly to coordinate efforts.
- **Ongoing communication keeps the project in motion:** Coordinating between different projects is one of the biggest challenges facing multi-state efforts. To ensure continued momentum, the I-10 Corridor Coalition coordinates frequent meetings among involved states and other public and private stakeholders. These include interactive coalition workshops, monthly coalition coordination meetings, technical working group meetings, and peer exchange meetings.
- **Balance between consistent regional approach and state flexibility:** Similar to the MAASTO project, the I-10 TPAS project offered states the flexibility to adopt their own technologies and system architecture while ensuring interoperability across the corridor, including through data integration and uniform dissemination systems.

[59] I-10 Corridor Coalition, Overview of TPAS, accessed 2023, https://i10connects.com/overview-tpas; I-10 Corridor Coalition, Applying for Multi-State Grants Webinar, NWP Freight Task Force, March 14, 2023, https://www.nwpassage.info/projects/downloads/16-2-webinar-recording-2023-03.mp4.
[60] I-10 Corridor Coalition, Applying for Multi-State Grants Webinar, NWP Freight Task Force, March 14, 2023, https://www.nwpassage.info/projects/downloads/16-2-webinar-recording-2023-03.mp4
[61] I-10 Corridor Coalition, Applying for Multi-State Grants Webinar, NWP Freight Task Force, March 14, 2023, https://www.nwpassage.info/projects/downloads/16-2-webinar-recording-2023-03.mp4
[62] I-10 Corridor Coalition, Truck Parking Availability System: Truck Driver and Dispatcher Baseline Survey Summary, 2020, https://i10connects.com/sites/default/files/2021/01/TPAS-survey-summary-20201223_0.pdf.
[63] I-10 Corridor Coalition, Applying for Multi-State Grants Webinar, NWP Freight Task Force, March 14, 2023, https://www.nwpassage.info/projects/downloads/16-2-webinar-recording-2023-03.mp4

The Eastern Transportation Coalition (formerly the I-95 Corridor Coalition) TPIMS (2008-2018)

Project Overview

The Eastern Transportation Coalition (TETC) is a group of 17 Eastern states and the District of Columbia. In 2008, the TETC (named the I-95 Corridor Coalition at the time) secured $5.5 million in funding through the FHWA Truck Parking Initiative to pilot and deploy a TPIMS. State and in-kind matches supplemented the federal grant.

TETC was one of the first regions in the country to consider and advance the implementation of TPIMS. As a result, the Coalition spent significant time and resources developing a concept of operations, and faced challenges related to technology limitations and high costs.[64] The Coalition ultimately developed an ITS system architecture and conducted initial testing of detection technologies at public rest areas in Maryland and Virginia. The system was ultimately deployed using pavement puck sensors at five sites in Virginia. The system was turned over to Virginia in 2018, with real-time truck parking information shared through the Virginia Department of Transportation's (VDOT) 511 system.[65] This information is currently not available on the 511 system as VDOT conducts a comprehensive truck parking assessment, which may include a reintroduction of TPIMS based on updated research and use of newer technologies.[66]

Lessons Learned

When TETC turned the TPIMS over to VDOT, the Coalition published a detailed summary of key lessons learned.[67] A selection of these lessons, supplemented with information from a consultation with TETC,[68] is documented below:

- **Need for stakeholder outreach and buy-in:** Conducting outreach with stakeholders and receiving the required approvals is important early in the project process. The successful demonstration of technologies is also paramount to inspire confidence from both states and drivers. In addition, continuous communication with relevant stakeholders is crucial to ensure ongoing system performance.
- **Interoperability of systems and technologies ensures flexibility:** At a high level, TPIMS should be modular, flexible, and adaptable. This allows reconfiguration of rest areas, replacement or upgrade of technologies, and data sharing.
- **Consider ongoing operations and maintenance costs:** States should plan for the full cost of TPIMS, which includes not only capital installation but also ongoing operation and maintenance. States are best able to consider ongoing costs if they have ownership of their own TPIMS. The Coalition noted developing a business model to help offset costs should be pursued.
- **Balance between consistent regional approach and state flexibility:** While a uniform data repository is important and requires some level of regional cooperation, it is also crucial for individual states to have ownership of their TPIMS. This autonomy allows states to scale the TPIMS design to their own needs and abilities. Otherwise, a state may end up with a system that it cannot maintain or that it is not familiar with, which may result in the system being turned off, leaving a gap in the regional TPIMS.
- **Private sector participation is desirable but hard to achieve:** A comprehensive TPIMS network would include real-time information sharing for both public and private truck parking

[64] Consultation with The Eastern Transportation Coalition, June 21, 2023.
[65] The Eastern Transportation Coalition, Truck Parking: Projects, accessed 2023, https://tetcoalition.org/projects/truck-parking/.
[66] Consultation with The Eastern Transportation Coalition, June 21, 2023.
[67] I-95 Corridor Coalition, I-95 Truck Parking Demonstration System: Summary of Key Lessons Learned, December 2018, https://tetcoalition.org/wp-content/uploads/2015/02/I-95_Truck_Parking_Systems-Lessons_Learned_Summary_Revised.pdf.
[68] Consultation with The Eastern Transportation Coalition, June 21, 2023

facilities. However, private sector participation may be hard to secure, and future work should identify strategies to encourage private sector participation.

- **Dissemination systems should be diverse and should prioritize safety:** The technologies used to disseminate truck parking availability information should offer a seamless user experience and be diverse enough to cater to various driver and carrier preferences. The ideal system would offer a one-stop shop to drivers seeking truck parking availability information. These systems should also minimize driver distraction and maximize safety. To reduce confusion, applications that incorporate TPIMS should provide fully comprehensive truck travel information (e.g., truck routing, infrastructure information), or else come with a disclaimer.
- **Sharing lessons learned helps achieve gradual improvements:** The completed and ongoing efforts nationwide to advance TPIMS serve as models to guide future deployments. Documenting and sharing lessons learned ensures the use of best practices, an understanding of common challenges, and mitigation of risks and errors to achieve gradual improvement of TPIMS.
- **Need to ensure that there is adequate truck parking capacity:** A TPIMS is most effective when it directs truck drivers to available truck parking. TPIMS may be integrated into capacity expansion solutions to simultaneously address capacity and information needs.

6.3 Best Practices for Regional TPIMS

The following outlines best practices for advancing a regional TPIMS, identified based on common practices advanced by successful regional truck parking information solutions.

1. Identify regional project champion and state project champions.

Coordinating stakeholders across multiple jurisdictions is a challenging but necessary element of advancing a regional TPIMS. Successful completed and ongoing efforts have been led by a regional champion with a strong interest in taking ownership of the project. The regional champion must dedicate time and leadership to coordinate across regional partners – for instance, Kansas DOT for the MAASTO states and Texas DOT for the I-10 corridor. The Eastern Transportation Coalition is unique in the fact that the Coalition has full-time staff to support regional efforts. Additionally, each participating state needs its own champion to lead state efforts, which involves coordinating within the DOT and with other state stakeholders.

2. Secure buy-in from state DOT leadership.

Each state will require approval from DOT leadership to advance a regional TPIMS. This includes support to deploy TPIMS within the states, as well as support to coordinate elements of the state TPIMS with neighboring states. State champions can prepare materials to communicate the importance of truck parking and the need for truck parking information to state DOT leadership. Demonstrating support from stakeholders within the state – such as other personnel within the DOT and the trucking industry – can also help communicate the value of TPIMS.

3. Seek and secure federal funding support.

Many complete and ongoing TPIMS efforts, including those deployed regionally, have advanced with the support of federal funding programs. For instance, the TIGER program (now known as RAISE) funded the MAASO TPIMS project and the ATCMTD program (now known as Advanced Transportation Technologies and Innovative Mobility Deployment (ATTIMD or ATTAIN)) funds the I-10 TPAS project. An HP-ITD grant is also currently funding Montana's TPIMS pilot within the NWP region. When considering how to fund TPIMS, states can similarly evaluate this range of federal funding programs to support the project and prepare an application to request funding. Often, federal discretionary grants also require applicants to provide local match funds, which state DOTs must

secure. In addition to seeking funding for capital costs, states should also plan for how to program ongoing maintenance and operating costs.

4. Conduct a peer exchange to learn from completed and ongoing TPIMS efforts.

Many TPIMS projects that have been advanced nationwide over the past decade should serve as models to guide future deployments. There is an opportunity for future TPIMS efforts to learn from similar completed and ongoing projects. For instance, the I-10 Corridor Coalition conducted a peer exchange with the MAASTO states ahead of project deployment. TETC similarly recommended working with MAASTO and other states when considering and scoping TPIMS. Ongoing and future TPIMS projects should also document project successes and challenges to contribute to the growing body of TPIMS best practices.

5. Secure support from key stakeholders early in the process.

Support from many stakeholders is needed for the successful implementation of TPIMS. This includes stakeholders from the public sector (e.g., state DOT personnel in transportation planning, facility management, information technology, and data management) and the private sector (e.g., state trucking associations). Early outreach with these stakeholders will ensure the development of a project scope that is useful for truck drivers and can be successfully deployed, operated, and maintained by the DOT. For a multi-state effort, this stakeholder outreach must be coordinated across jurisdictions as well.

6. Develop scope with a balance between regional consistency and state flexibility.

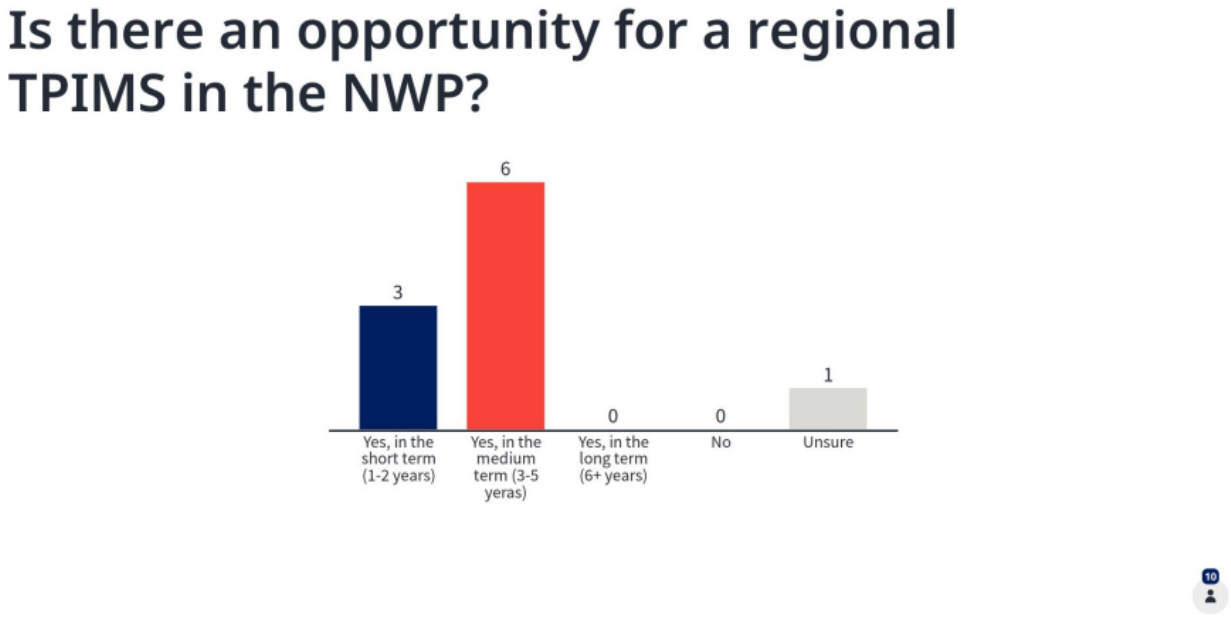
A regional TPIMS project must consider each state's individual needs, while also taking advance of a multi-state approach that offers consistency and increased value to its users. Flexibility for states to develop their own approaches, such as technology selection and system design, allows for the development of TPIMS that aligns with each state's unique requirements and processes. Current multi-state TPIMS efforts in the MAASTO states and along the I-10 corridor have taken this approach, while still planning for regional interoperability and consistency, such as through integrated data systems and feeds and coordinated signage.

6.4 Next Steps for the NWP

6.4.1 Opportunities

Representatives of many NWP states believe that there is an opportunity for the region to advance a multi-state TPIMS. When polled about this opportunity during a May 30 roundtable, the majority of respondents indicated there was an opportunity for a regional TPIMS. If planning begins shortly, a regional effort could be deployed across the states within 3-5 years.

Figure 20: NWP State DOT Interest in NWP TPIMS



The following conditions create a window of opportunity for the advancement of a multi-state TPIMS across the NWP region.

- **Truck parking is a federal priority:** The United States Department of Transportation (USDOT) recognizes the national importance of truck parking and the safety, economic, environmental, and quality of life concerns associated with truck parking issues. The agency has identified expanding access to truck parking as a key priority.[69]

- **Availability of an unprecedented amount of federal funds:** The Bipartisan Infrastructure Law (BIL), enacted in November 2021, has expanded existing and created new federal funding programs that offer an unprecedented amount of funding for states to advance transportation and infrastructure projects, including projects to address truck parking problems. Truck parking information projects are considered eligible under many formula and discretionary funding programs (see Appendix C for details about these funding programs), with multi-state groups identified as eligible applicants. Many of these programs have also previously funded similar truck parking information projects.[70] Additionally, the Truck Parking Safety Improvement Act is currently pending in Congress. If passed, the Act would provide over $750 million in new truck parking funding. As currently written, eligible projects for this funding will include projects that identify, promote, and manage the availability of truck parking, such as with ITS.[71]

- **The NWP Steering Committee has expressed support for advancing a regional project:** While the NWP Freight Task Force has typically advanced assessments to understand existing conditions, needs, and opportunities in the region, the NWP Steering Committee has recently indicated an interest in advancing a project beyond planning, toward implementation. TPIMS

[69] Landline, "Truck parking a 'national concern,' Buttigieg says," September 29, 2022, https://landline.media/truck-parking-a-national-concern-buttigieg-says/; Transport Topics, "Expanding Truck Parking High on USDOT Agenda, Buttigieg Says," May 9, 2023, https://www.ttnews.com/articles/truck-parking-buttigieg

[70] The White House, A Guidebook to the Bipartisan Infrastructure Law: Guidebook Data, accessed 2023, https://www.whitehouse.gov/build/guidebook/.

[71] Library of Congress, H.R. 2367 – Truck Parking Safety Improvement Act, accessed June 2023, https://www.congress.gov/bill/118th-congress/house-bill/2367/text.

could serve as this opportunity for regional implementation of a project, developed based on research and outreach conducted through this Assessment and additional efforts.

- **Minnesota and Washington can offer guidance to other states and regionally:** Two NWP states have experience not only deploying TPIMS within their state but also coordinating with other states on regional TPIMS projects. Minnesota currently operates TPIMS at six locations and was part of the MAASTO TPIMS effort. Meanwhile, Washington has deployed TPIMS at two pilot locations and is currently exploring the potential for a multi-state TPIMS along I-5 with Oregon and California. Based on these experiences, Minnesota and Washington can provide guidance to the other NWP states on best practices and risk mitigation at the state and regional levels.

- **The NWP has existing relationships with the trucking industry:** Through ongoing Freight Task Force work, the NWP has engaged the trucking industry to obtain feedback on a variety of freight topics – including truck parking information solutions. Building off these initial conversations, NWP states can conduct further outreach with state trucking associations, carriers, and drivers, to develop a TPIMS that effectively serves its users and fills truck parking information gaps. Initial outreach and national research suggest truck drivers find usefulness in a coordinated, regional TPIMS.[72]

6.4.2 Challenges

However, several challenges also pose barriers to a coordinated TPIMS effort across NWP states.

- **NWP states are at different stages in advancing or considering TPIMS:** Across the NWP region, three states have or are in the process of implementing TPIMS, two states are considering TPIMS as part of ongoing studies, and two states have not advanced TPIMS beyond informal discussions internally. As a result, NWP states have different needs for, and see varying value in, a regional TPIMS. Some states have also indicated that their participation in a regional TPIMS is dependent on individual state assessments, and there is still a need to secure buy-in from leadership on the value of truck parking solutions.

- **Need for a regional project champion, as well as individual champions for participating states:** As evidenced by other successful regional TPIMS, a multi-state project requires a regional champion to dedicate time and resources to the effort, which includes the difficult task of coordinating across and engaging multiple states. In addition to a regional champion, each participating state requires its own champion to lead coordination with the regional champion and communicate with state DOT, private, and other stakeholders. While many NWP states contributed to the development of this Assessment, including participation in roundtables, the group has yet to identify a champion to lead the region's effort.

- **Need for ongoing communication on this topic:** NWP states will need a forum to continue communicating potential regional TPIMS efforts beyond this Assessment. This is typically coordinated by a regional project champion, often with further support from contracting capacity.

- **Need for outreach with the trucking industry:** TPIMS may be met with hesitancy by the trucking industry, as building additional capacity is often identified as the top need when public resources are available for truck parking solutions. However, outreach with state trucking associations, drivers, and other stakeholders, can serve to provide background on the current opportunity and communicate the benefits of a regional TPIMS, while also conveying the state's recognition of the

[72] CPCS, North/West Passage: Truck Parking Info Management System (TPIMS) Assessment Survey, conducted via SurveyMonkey, 2023; ATRI, Truck Parking Information Systems: Truck Drivers Use and Perspectives, 2021, https://truckingresearch.org/wp-content/uploads/2021/06/ATRI-Truck-Parking-Information-Systems-Driver-Use-and-Perceptions-06-2021.pdf

importance of and attention to truck parking capacity opportunities. Securing buy-in from industry, as well as input on the scope, enables the successful implementation of a TPIMS.

When asked about the top barriers for each state to participate in a regional TPIMS, states highlighted the need for leadership buy-in and competing state priorities, followed by the need for upfront capital and ongoing operations and maintenance costs (Figure 21). Meanwhile, when asked about the top barriers for the region to collectively advance TPIMS, states noted the variation in TPIMS advancement across the region, funding, and the need for a project champion as top barriers (Figure 22).

Figure 21: NWP State DOT-Identified Barriers to State Participation in Regional TPIMS

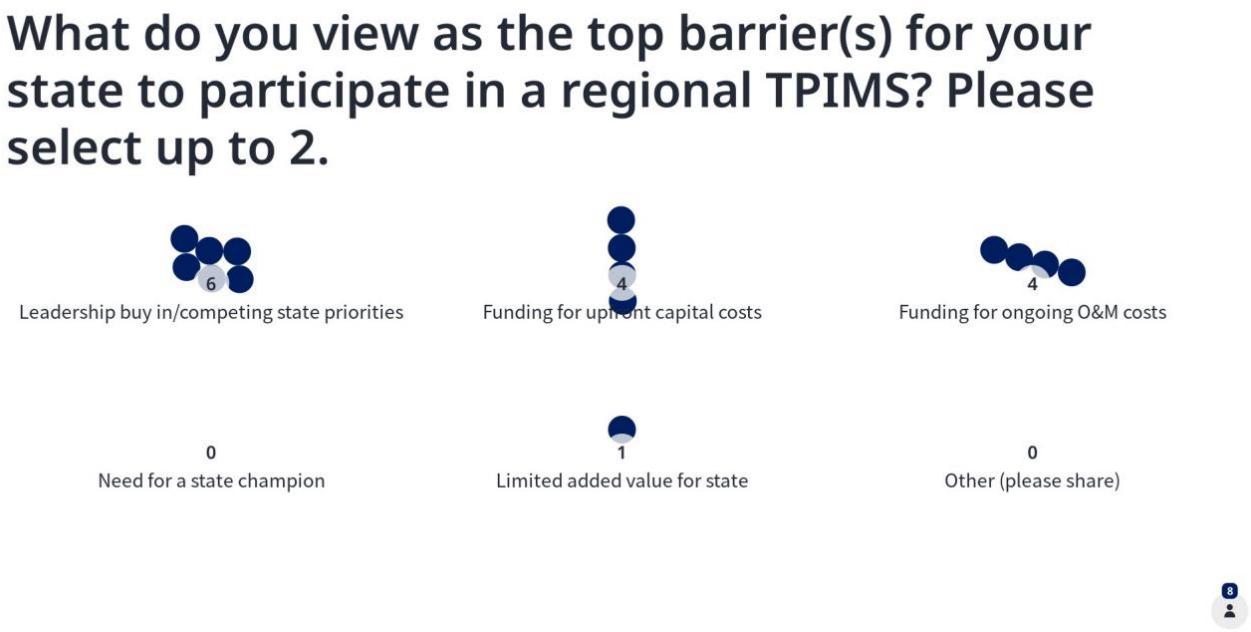
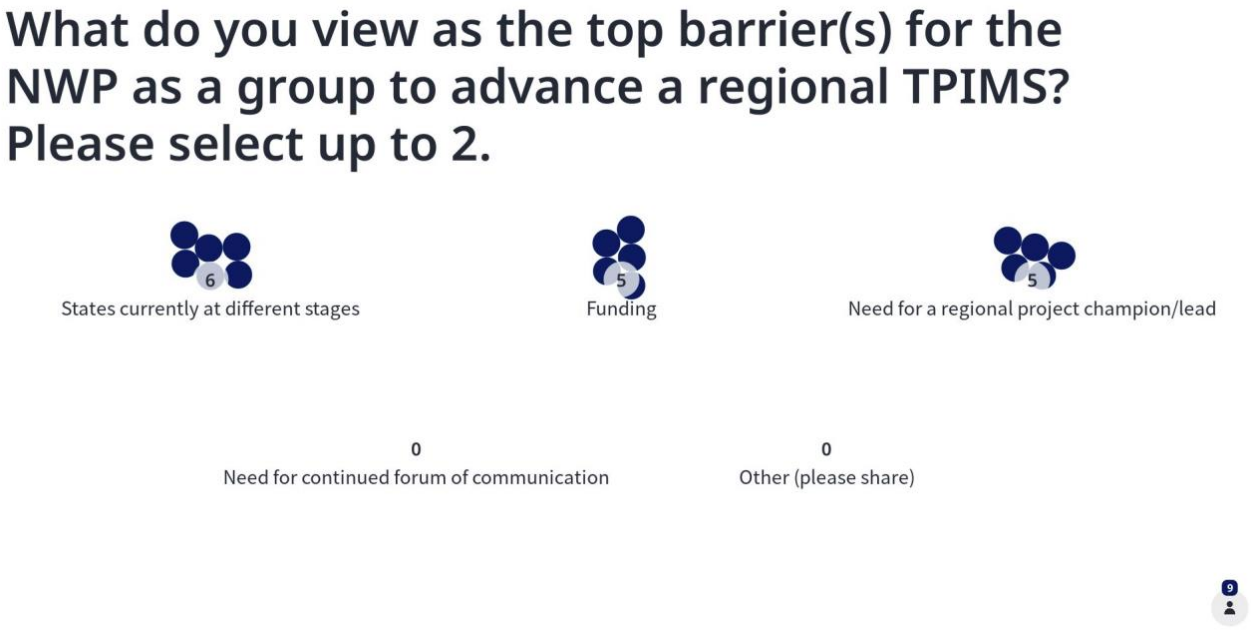


Figure 22: NWP State DOT-Identified Barriers to Regional TPIMS



6.4.3 Critical Next Steps

As the NWP and its member states consider the potential for a regional TPIMS, the following will serve as critical next steps to the successful advancement of this multi-state effort:

- **Present idea to NWP Steering Committee:** As the NWP Pooled Fund Study enters its 18th year, one of its goals is to implement a project across multiple states. At the NWP Steering Committee meeting in early April, the group discussed interest in seeking multi-state opportunities that provide value to the region – TPIMS could serve as one of those opportunities. Given this, the Freight Task Force should present the results of this Assessment to the Steering Committee to secure NWP leadership buy-in on pursuing a regional TPIMS. Additionally, as part of next year's work, the NWP Steering Committee has plans to prepare a concept for regional deployment. A topic has yet to be selected – again, the concept of TPIMS for regional deployment across the NWP could be further explored and scoped through this effort. States could further use the outputs of this regional effort to support a pitch to respective state DOT leadership.

- **Present idea to state DOT leadership:** State participation in a regional TPIMS requires buy-in and sign-off from state DOT leadership. As a first step, the idea and value proposition of advancing a regional TPIMS must be shared with state DOT leadership. This internal discussion within each state's DOT will differ across states, based on existing TPIMS efforts and interests. The results of this Assessment, in combination with the outputs of future efforts (e.g., additional meetings, preparation of concept), should be used to support these discussions.

- **Identify a regional champion:** Successful implementation of a multi-state project requires a strong interest in and drive from within the region. NWP states have yet to identify a regional champion to take ownership of a regional TPIMS, and the various steps and coordination required to advance the effort beyond this Assessment.

- **Develop a federal grant application:** Many state representatives expressed interest in developing a federal grant application to support the advancement of a regional TPIMS. As documented, successful multi-state TPIMS projects have been supported by federal grant funds. However, in order to move such an effort forward, NWP states will need to obtain approval from the NWP Steering Committee and state DOT leadership, as well as identify a regional champion to lead the necessary efforts (e.g., coordinating state meetings, developing application materials, and securing matching funds, etc.) involved with advancing a multi-state grant application.

Appendix A Relevant NWP State Plans with Truck Parking

Idaho Transportation Department, State of Idaho Truck Parking Research Project: Request for Proposal, 2022, https://itd.idaho.gov/wp-content/uploads/2022/08/TruckParking_RFP.pdf.

Minnesota Department of Transportation, Minnesota Statewide Freight System and Investment Plan, 2018, https://www.dot.state.mn.us/planning/freightplan/pdf/statewidefreightplanrevised2018.pdf.

Minnesota Department of Transportation, Minnesota Statewide Truck Parking Study, 2019, https://www.dot.state.mn.us/ofrw/freight/PDF/truckparking/final-report.pdf.

Montana Department of Transportation, Montana State Freight Plan, 2022, https://mdt.mt.gov/freightplan/docs/2022-Montana-Freight-Plan.pdf?v=1.

North Dakota Department of Transportation, State Freight & Rail Plan, 2023, https://www.dot.nd.gov/projects/frp/assets/documents/NDDOT_FinalFRP_Jan2023.pdf.

South Dakota Department of Transportation, Decennial Interchange Corridor Study – Phase One: Truck Parking Assessment, 2020, https://projects.srfconsulting.com/INFRA/I-90/truck-parking-assessment-final-watt.pdf.

South Dakota Department of Transportation, Draft Freight Plan, 2022, https://dot.sd.gov/media/documents/2022draft_PublicAll.pdf.

South Dakota Department of Transportation, SDDOT Rest Area & Truck Pullout Truck Parking Analysis: Final Report, 2018, https://dot.sd.gov/media/documents/Final_Truck%20Parking%20Report_December%202018.pdf.

Washington State Department of Transportation, Washington State Freight System Plan, 2022, https://wsdot.wa.gov/sites/default/files/2022-12/WA-State-Freight-System-Plan-2022_0.pdf.

Washington State Department of Transportation, Washington State Freight System Plan Update: Appendix H: Washington Truck Parking Assessment, 2022, https://wsdot.wa.gov/sites/default/files/2022-11/Appendix-H-FSP-Truck-Parking-Assessment_0.pdf.

Washington State Joint Transportation Committee (JTC), Truck Parking Action Plan, 2021, https://leg.wa.gov/JTC/Documents/Studies/Truck%20Parking/Final_TruckParkingActionPlan_2021.pdf.

Wyoming Department of Transportation, Risk and Resiliency Plan for Critical Freight Transportation Assets, 2018, https://dot.state.wy.us/files/live/sites/wydot/files/shared/Planning/2018%20WYDOT%20Freight%20Resilience%20Plan.pdf.

Wyoming Department of Transportation, Wyoming Statewide Freight Assessment, 2022, https://dot.state.wy.us/files/live/sites/wydot/files/shared/Planning/Freight%20Plan/210830_WY_Freight_Plan%20wAppendices_Final%20October%202022.pdf

Appendix B Industry Survey Results

The charts below summarize responses to the industry survey from the 11 respondents who provided substantive input beyond introductory questions. Certain questions have under 11 responses, as indicated in the notes below the relevant charts.

Figure 23: Survey Question 1 – States of Operation

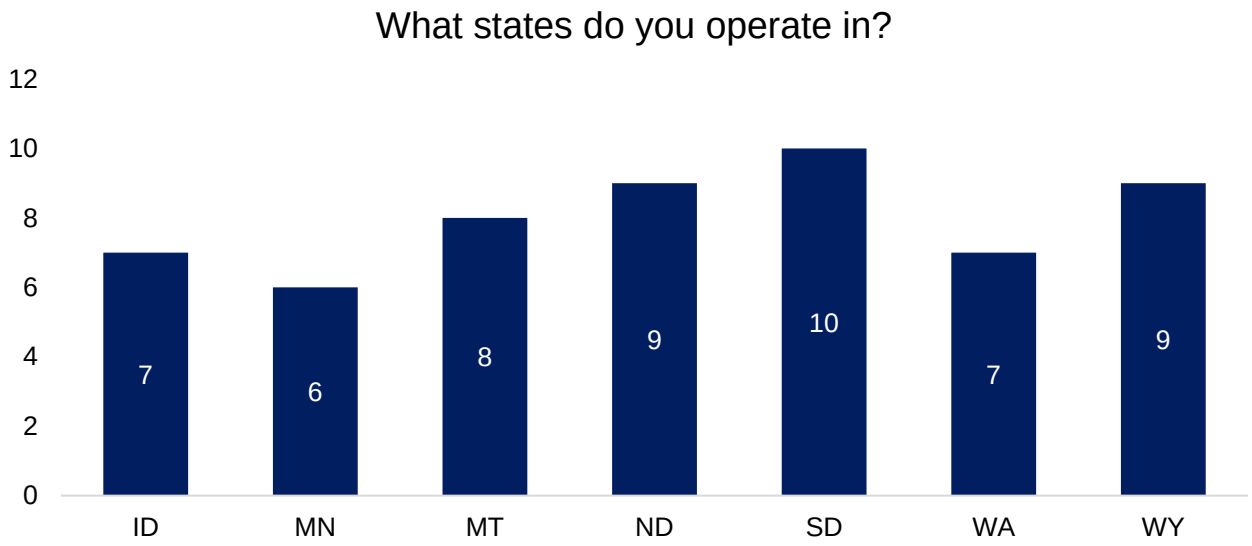


Figure 24: Survey Question 2 – Average Length of Haul

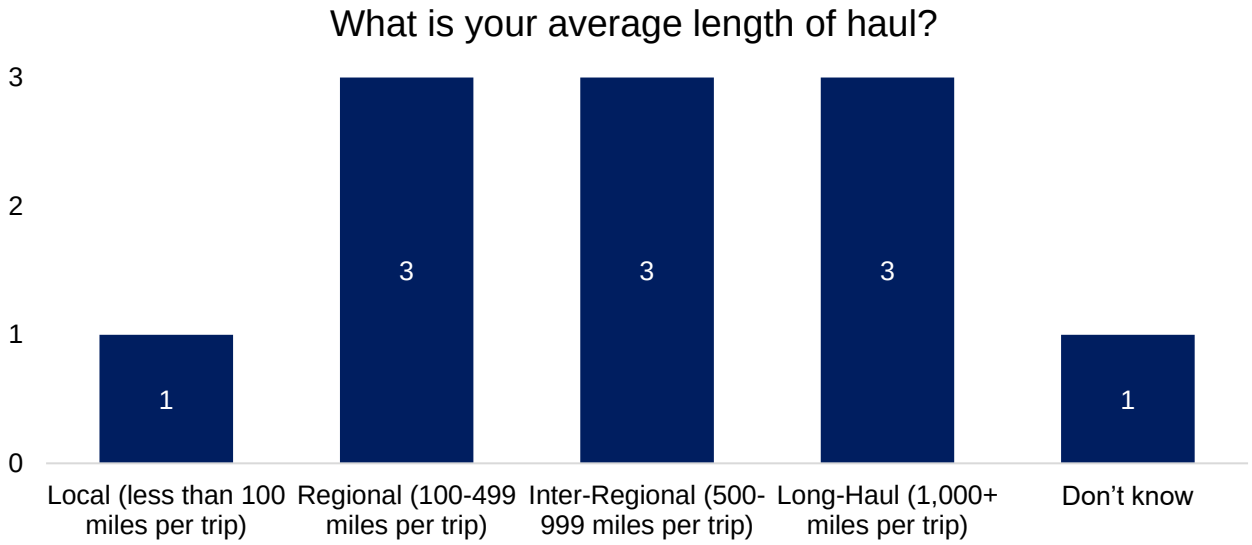
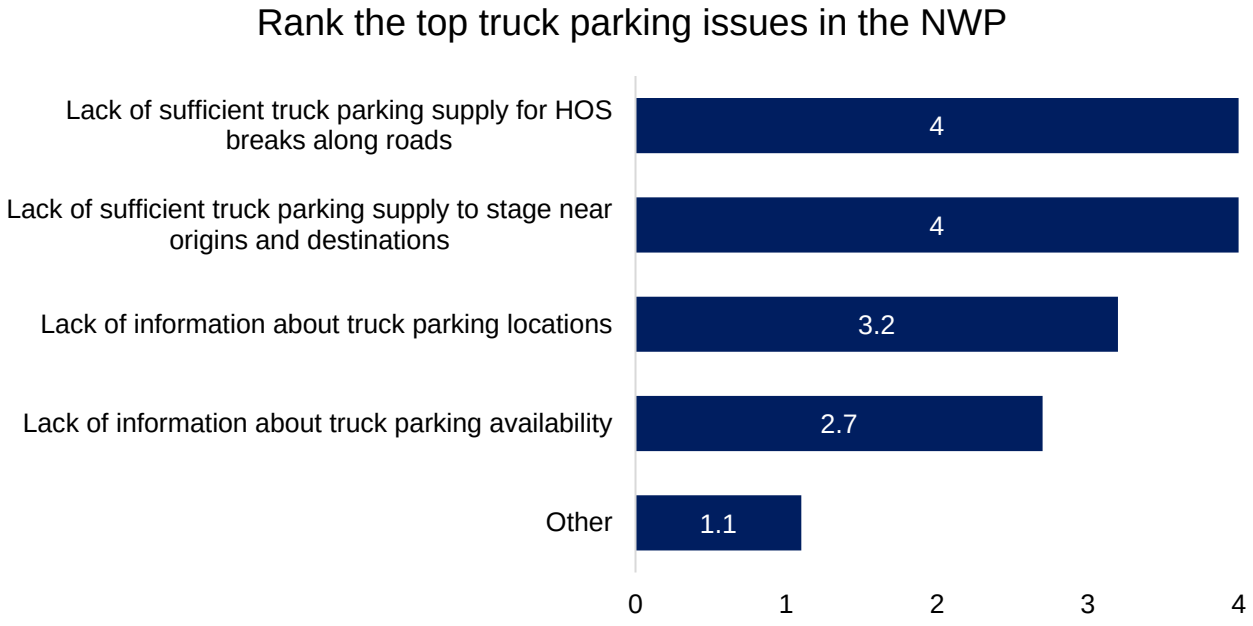
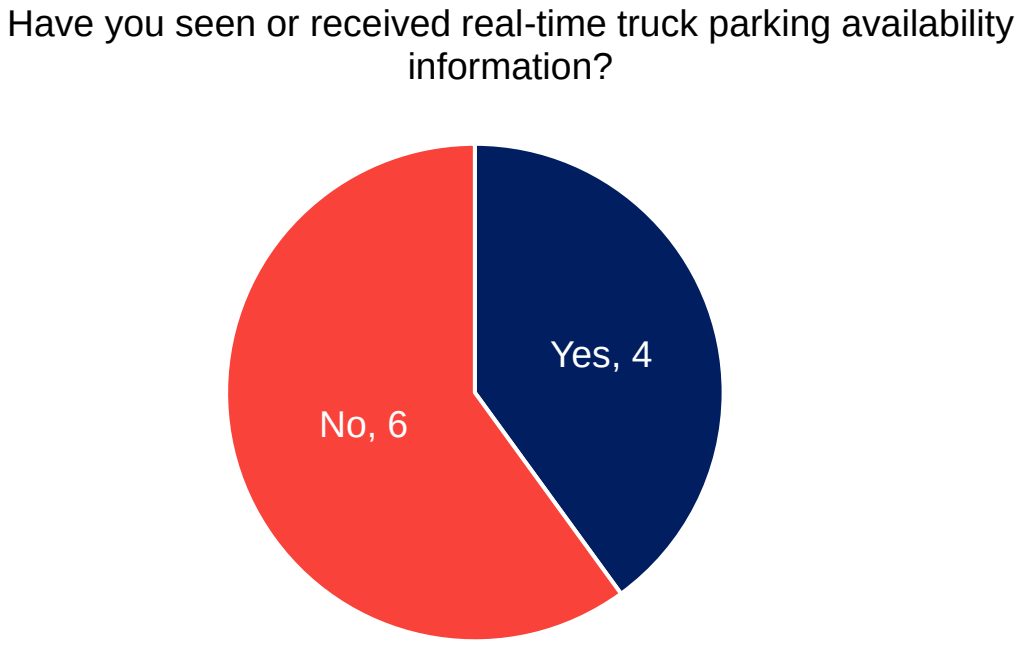


Figure 25: Survey Question 3 – Top Truck Parking Issues



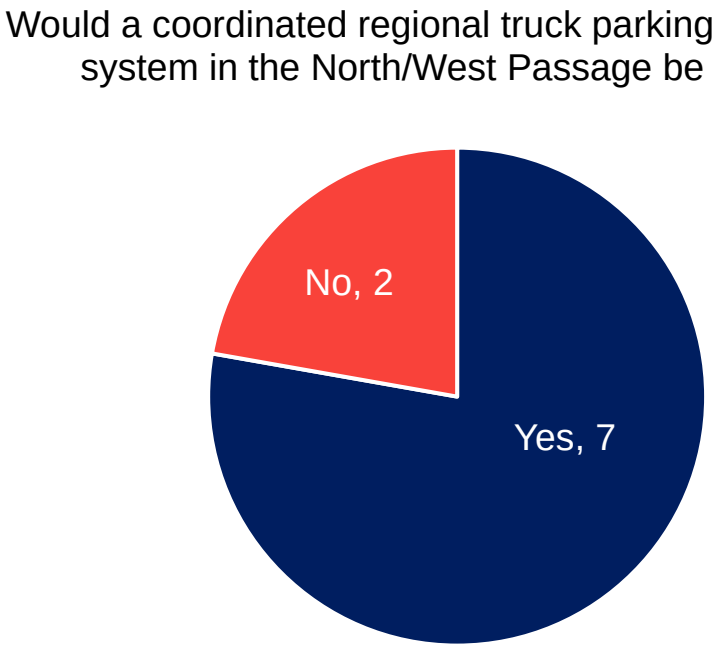
Note: Only ten respondents answered this question. One respondent skipped this question.

Figure 26: Survey Question 4 – Real-Time Truck Parking Information



Note: Only ten respondents answered this question. One respondent skipped this question.

Figure 27: Survey Question 5 – Interest in Regional TPIMS



Note: Only ten respondents answered this question. One respondent skipped this question.

Appendix C Federal Funding Opportunities for TPIMS

The following figures provide detail on the federal formula (Figure 28) and discretionary (Figure 29) funding opportunities to support TPIMS projects.

Figure 28: Federal Formula Funding Opportunities for TPIMS

Program Name	Leading Agency	BIL Funding Amount (4 Year Period)	Description	Eligible Uses	Maximum Program Share
Formula					
National Highway Freight Program (NHFP)	FHWA	$7.15 B	Program to fund eligible projects that will have significant local or regional impact and improve transportation infrastructure.	Projects that contribute to the efficient movement of freight on the National Highway Freight Network and are identified in a freight investment plan included in the State's freight plan.	Typically, 80% on non-Interstate and 90% on Interstate
National Highway Performance Program (NHPP)	FHWA	$148.0 B	Provides support for the condition and performance of the National Highway System (NHS), the construction of new facilities on the NHS, progress toward the achievement of performance targets established in a State's asset management plan for the NHS, and the resiliency of the NHS to mitigate the cost of climate change and disasters.	Highway and bridge projects, generally on the NHS, plus certain bridge projects on non-NHS Federal-aid highways	Typically, 80% on non-Interstate and 90% on Interstate
Surface Transportation Block Grant Program (STBG)	FHWA	$72.0 B	Improve and expand the surface transportation infrastructure in rural areas to increase connectivity, improve the safety and reliability of the movement of people and freight, and generate regional economic growth and improve quality of life.	the roughly one million miles of Federal-aid highways, for bridges on any public road, and for transit capital projects.	80%
Carbon Reduction Program (CRP)	FHWA	$6.42 B	Provides funds for projects designed to reduce transportation emissions, defined as carbon dioxide (CO2) emissions from on-road highways.	Projects that support the reduction of transportation emissions, including: the construction, planning, and design of trail facilities for pedestrians, bicyclists, and other nonmotorized forms of transportation; public transportation projects; and congestion management technologies.	Typically, 80% on non-Interstate and 90% on Interstate
Congestion Mitigation and Air Quality Improvement Program (CMAQ)	FHWA	$13.2 B	Reduce congestion and improve air quality for areas that do not meet the National Ambient Air Quality Standards for ozone, carbon monoxide, or particulate matter (nonattainment areas) and for former nonattainment areas that are now in compliance (maintenance areas).	Transportation projects that reduce congestion and reduce the mobile source emissions for which an area has been designated nonattainment or maintenance for ozone, carbon monoxide, and particulate matter by the Environmental Protection Agency.	Typically, 80% on non-Interstate and 90% on Interstate

Source: The White House, A Guidebook to the Bipartisan Infrastructure Law: Guidebook Data, accessed 2023, https://www.whitehouse.gov/build/guidebook/.

Figure 29: Federal Discretionary Funding Opportunities for TPIMS

Program Name	Leading Agency	BIL Funding Amount	Description	Eligible Uses	Maximum Program Share	Expected Timeline (FY2023)
Discretionary						
Advanced Transportation Technologies and Innovative Mobility Deployment (ATTIMD), also referred to as ATTAIN*	FHWA	$300 M (Available until expended)	Projects to deploy, install, and operate advanced transportation technologies.	Grants should improve safety, mobility, efficiency, system performance, intermodal connectivity, and infrastructure return on investment	Typically 80%	Notice of Funding Opportunity (NOFO) expected Fall 2023
High Priority Innovative Technology Deployment (HP-ITD)*	FMCSA	Total funding for the High Priority Program:[73] $432.5 M (four years). Recent funding for HP-ITD: $37.7 M (2022) $43 M (2023)	Advance the technological capability and promote the deployment of intelligent transportation system applications for Commercial Motor Vehicle (CMV) operations, including CMV, commercial driver, and carrier-specific information systems and networks, and to support/maintain CMV information systems/networks	Deployment and development of new and innovative advanced technology solutions that support CMV information systems and networks, for planning activities, including the development or updating of program or top-level design plans in order to become eligible or maintain eligibility for the HP-ITD awards; and for the operation and maintenance costs associated with innovative technology.	Typically 100%	NOFO closed in April 2023
Local and Regional Project Assistance, also referred to as Rebuilding American Infrastructure with Sustainability & Equity (RAISE)*	FHWA	$7.5 B (4 year)	Projects that will have significant local or regional impact, and improve transportation infrastructure	Highway or bridge projects eligible for assistance under title 23, United States Code are among eligible projects.	Typically 60%	NOFO closed February 2023, awards expected June 2023.
Nationally Significant Freight & Highway Projects (INFRA)*	FHWA	$7.25 B (4 year)	Multimodal freight and highway projects of national or regional significance to improve the safety, efficiency, and reliability of the movement of freight and people in and across rural and urban areas.	Projects that improve safety, generate economic benefits, reduce congestion, enhance resiliency, and hold the greatest promise to eliminate freight bottlenecks and improve critical freight movements.	Typically 60%	NOFO expected June 2023

[73] The High Priority (HP) grant program includes two major purposes: Innovative Technology Deployment (ITD) and CMV safety related activities and projects. Although ITD resides within HP, the ITD grant program purpose and program eligibility requirements are separate and distinct from CMV safety related activities and projects. From FMCSA, High Priority (HP) Grant – Overview, September 2021, accessed June 2023, https://www.fmcsa.dot.gov/grants/mcsap-high-priority-grant/motor-carrier-safety-assistance-program-mcsap-high-priority-grant

Program Name	Leading Agency	BIL Funding Amount	Description	Eligible Uses	Maximum Program Share	Expected Timeline (FY2023)
Rural Surface Transportation Grants (RURAL)	FHWA	$2.0 B (4 year)	Projects to improve and expand the surface transportation infrastructure in rural areas to increase connectivity, improve the safety and reliability of the movement of people and freight, and generate regional economic growth and improve quality of life.	Highway, bridge, or tunnel projects eligible under the National Highway Performance Program, Surface Transportation Block Grant Program, or the Tribal Transportation Program; highway freight project eligible under the National Highway Performance Program; highway safety improvement project; project on a publicly-owned highway or bridge improving access to certain facilities that support the economy of a rural area; integrated mobility management system, transportation demand management system, or on-demand mobility services.	Typically 80%	NOFO expected June 2023

Source: The White House, A Guidebook to the Bipartisan Infrastructure Law: Guidebook Data, accessed 2023, https://www.whitehouse.gov/build/guidebook/; USDOT, High Priority Innovative Technology Deployment Program (HP-ITD) Program, accessed June 2023, https://www.transportation.gov/rural/grant-toolkit/high-priority-innovative-technology-deployment-program-hp-itd-program. https://www.transportation.gov/rural/grant-toolkit/high-priority-innovative-technology-deployment-program-hp-itd-program; FY23 High Priority Program – Innovative Technology Deployment, (HP-ITD) Grant Announcement, accessed June 2023, https://www.grantsolutions.gov/gs/preaward/previewPublicAnnouncement.do?id=104872. Note: * Indicates programs that have previously funded truck parking information projects. ATCMTD (former name of ATTIMD) provides funds for the I-10 Corridor TPAS project; HP-ITD provides funds for the MTD TPIMS pilot; TIGER (former name of RAISE) provided funds for the MAASTO TPIMS project; FASTLANE (former name of INFRA) provided funds for the FDOT TPAS project.