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Working Paper 1

Arizona Truck Parking Supply, Demand, Needs Analysis

Working Paper 1: Truck Parking Literature Review and Best Practices

Prepared for:

Arizona Department of Transportation

Prepared by:

CPCS

Solutions for growing economies

CPCS Ref: 14325-P1
October 23, 2017

Acknowledgments

The CPCS Team would like to thank the Arizona Department of Transportation, the Arizona Truck Parking Advisory Group, and other stakeholders consulted in the development of this report.

Opinions

Unless otherwise indicated, the opinions herein are those of the author and do not necessarily reflect the views of ADOT or the State of Arizona.

Contact

Questions and comments on this working paper can be directed to:

Donald Ludlow
Project Director
T: +1.202.772.3368
E: dludlow@cpcstrans.com

Alex Marach
Project Manager
T: +1.920.737.2980
E: amarach@cpcstrans.com

Table of Contents

Acronyms / Abbreviations

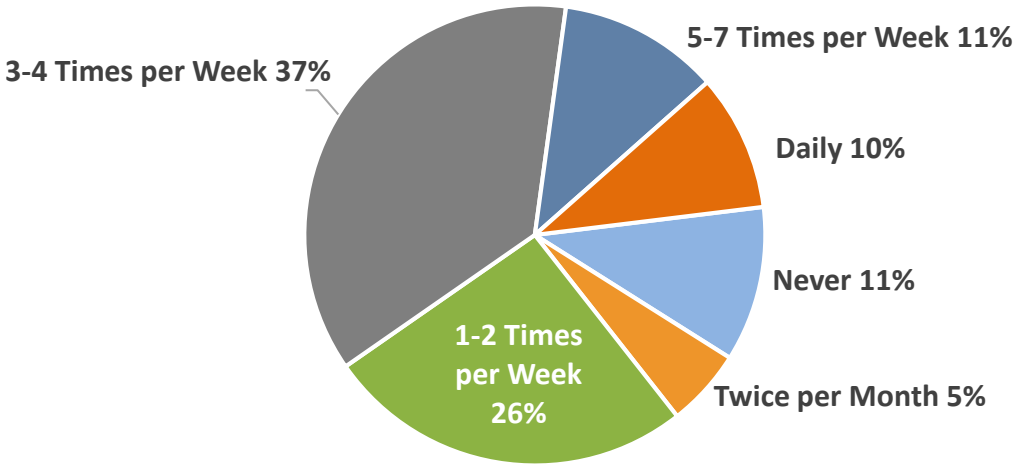
FMCSA	FEDERAL MOTOR CARRIER SAFETY ADMINISTRATION
HOS	HOURS OF SERVICE
ADOT	ARIZONA DEPARTMENT OF TRANSPORTATION
ATRI	AMERICAN TRANSPORTATION RESEARCH INSTITUTE
FAC	FREIGHT ADVISORY COMMITTEE
AASHTO	AMERICAN ASSOCIATION OF STATE HIGHWAY AND TRANSPORTATION OFFICIALS
ELD	ELECTRONIC LOGGING DEVICE
DPS	DEPARTMENT OF PUBLIC SAFETY
TPIMS	TRUCK PARKING INFORMATION AND MANAGEMENT SYSTEM
P3	PUBLIC-PRIVATE PARTNERSHIPS

Executive Summary

Truck parking facilities provide a location where drivers can take short breaks, wait for scheduled arrival times at nearby freight facilities, and long-term space for drivers who have reached the end of their driving day. Truck parking locations are critical to driver compliance with the Federal Motor Carrier Safety Administration's (FMCSA) Hours of Service (HOS) regulations.

A lack of adequate truck parking often results in drivers stopping early, driving beyond their allowed HOS, or negative truck parking behavior such as trucks parking on highway shoulders, ramps, or on local surface streets. These parking behaviors can negatively impact highway safety, infrastructure condition, public safety, and quality of life. As shown in ES 1, truck drivers often park in unauthorized/undesignated parking spaces multiple times per week.

ES 1: Unauthorized/Undesignated Parking Frequency



Source: ATRI, *Managing Critical Truck Parking Case Study –Real World Insights from Truck Parking Diaries* 2016

83 percent of truck drivers park in inappropriate parking spaces at least one to two times per week.[1]

Truck drivers may choose to stop early due to uncertainty or a known shortage of truck parking, reducing income for drivers and overall productivity for carriers. One estimate by the American Transportation Research Institute (ATRI) estimates that stopping early to find parking reduces the average driver's productivity by 9,300 miles each year, at cost of $4,600 per driver.[2]

[1] *Managing Critical Truck Parking Tech Memo #1: Commercial Driver Perspectives on Truck Parking,* September 2015. American Transportation Research Institute.

[2] *Managing Critical Truck Parking Case Study –Real World Insights from Truck Parking Diaries,* December 2016. American Transportation Research Institute.

Inadequate truck parking has been the topic of many studies at both state and national levels. Findings from existing literature provide insights into the issues encountered by and preferences of truck drivers when searching for truck parking. National surveys of truck drivers indicate the vast majority of truck drivers are responsible for finding truck parking. The two most common tools used to find truck parking were websites/smartphone applications and GPS.[3]

Truck parking demand is highest from 7pm to 5am, with drivers looking for truck parking most frequently from 4pm to midnight.[4] Additionally, while many drivers have used parking reservation systems, about 39 to 48 percent (depending on the study) of truck drivers were unwilling to pay to reserve a space. For those willing to pay for truck parking, the most frequent response was a willingness to pay between $1 and $5.[5],[6] Lastly, truck drivers most preferred way to receive truck parking information is through changeable messaging signs.[7]

The Arizona State Freight Plan identified inadequate truck parking facilities as an issue affecting the safety and efficiency of freight movement in Arizona, particularly on I-17 between Phoenix and Flagstaff, and on I-10 between Tucson and the California border. Similarly, trucking companies in Arizona and previous studies suggest there are shortages throughout the state, particularly on interstate corridors. Previous studies also suggest that Arizona's parking shortages are forecasted to more than double in the next 15 years.

While the majority of the existing sources are not specific to Arizona, these studies provide insights into the issues that truck drivers encounter while trying to find parking, as well as the process and tools used. These insights will be validated and built upon through consultation with truck drivers in Arizona.

This working paper also identifies the solutions identified in the literature. As shown in ES 2, solutions to truck parking issues come in two categories, information and capacity. Information solutions focus on ensuring truck drivers are effectively using existing truck parking facilities. If drivers believe all nearby parking areas are full, or if they run out of driving time, they may either choose or be forced to park in unauthorized areas. However, greater knowledge of nearby parking facilities and parking availability may help drivers utilize available spaces, reducing incidences of inappropriate parking. Information solutions improve the quality and timeliness of information available to truck drivers. While truck parking shortages are caused by a lack of parking supply relative to demand, symptoms of shortages, such as trucks parked on shoulders and ramps can be found in areas where demand approaches supply, but does not exceed it.

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[3] *Managing Critical Truck Parking Case Study –Real World Insights from Truck Parking Diaries,* December 2016. American Transportation Research Institute.

[4] Ibid

[5] *Managing Critical Truck Parking Tech Memo #1: Commercial Driver Perspectives on Truck Parking,* September 2015. American Transportation Research Institute.

[6] Morris, T., D. Murray, K. Fender, A. Weber, V. Morellas, D. Cook, N. Papanikolopoulos. *A comprehensive System for Assessing Truck Parking Availability,* January 2017. CTS 17-02. Center for Transportation Studies.

[7] Ibid

While improving information can help truck drivers "fill in the gaps" of available parking, information systems will be inadequate for areas where truck parking demand routinely exceeds supply. In these areas, often metropolitan areas with high densities of freight establishments, additional truck parking spaces are often needed. The major downside of capacity solutions is their higher cost of creation and maintenance relative to most information solutions.

The solutions presented in ES 2 provide a menu of options for subsequent phases of the Arizona Truck Parking Supply, Demand, Needs Analysis. The project team will add to the solutions shown in ES 2 as additional solutions are identified and explored. The second phase of this project will identify where information and capacity solutions are needed.

ES 2: Truck Parking Solution Continuum

Information Problems		
Where are parking locations?	What are parking amenities?	Are spaces available?

Information Solutions			
Stand – Alone Solutions		IT Information System Required	
Maps	Fixed Signs	Websites and Apps	Variable Signs
			

Lower Cost
Less Complex
Short-Term Implementation

Long-Term Implementation
More Complex
Higher Cost

Capacity Problems
How do we provide additional parking?

Capacity Solutions			
Collaboration Required		Stand-Alone Solutions	
P3s	Adapting Existing	Re-Opening Areas	Building New Areas
			

Lower Cost
Uncertain Complexity

Higher Cost
More Complex

1 Introduction

Key Messages

Truck parking shortages identified during the Arizona State Freight Plan resulted in the Arizona Department of Transportation (ADOT) commissioning a study of truck parking in Arizona. This study assesses current truck parking conditions and identifies gaps between truck parking supply and demand, defines infrastructure and policy needs, and proposes potential capacity and technology solutions to address needs and issues. This Working Paper is the first deliverable of this study and provides a review of existing truck parking literature, solutions, and best practices to inform subsequent steps in the study.

1.1 Background and Objectives

The Arizona State Freight Plan identified inadequate truck parking facilities as a major issue affecting the safety and efficiency of freight movement in Arizona, particularly on I-17 between Phoenix and Flagstaff, and on I-10 between Tucson and the California border. This finding was identified through consultations with truck drivers and trucking companies, as well as a growing body of state and national research on nationwide and Arizona specific truck parking issues.

A lack of adequate truck parking often prompts truck drivers to park on highway shoulders, entrance or exit ramps, vacant property, or on local surface streets. These parking behaviors can negatively impact highway safety, infrastructure condition, public safety, and quality of life. Existing truck parking shortages may be exacerbated by current trends and future changes to freight policies. For example, trucking industry executives in Arizonaexpect the difficulty finding parking to increase in the future as Electronic Logging Devices (ELD) are implemented, and as the volume of truck traffic increases faster than the development of dedicated truck parking spaces.

The objective of this project is to provide an in-depth analysis of the truck parking issues identified in the Arizona State Freight Plan. The plan will provide the groundwork to enable the Arizona Department of Transportation (ADOT) and its stakeholders to develop strategies to address inadequate truck parking.

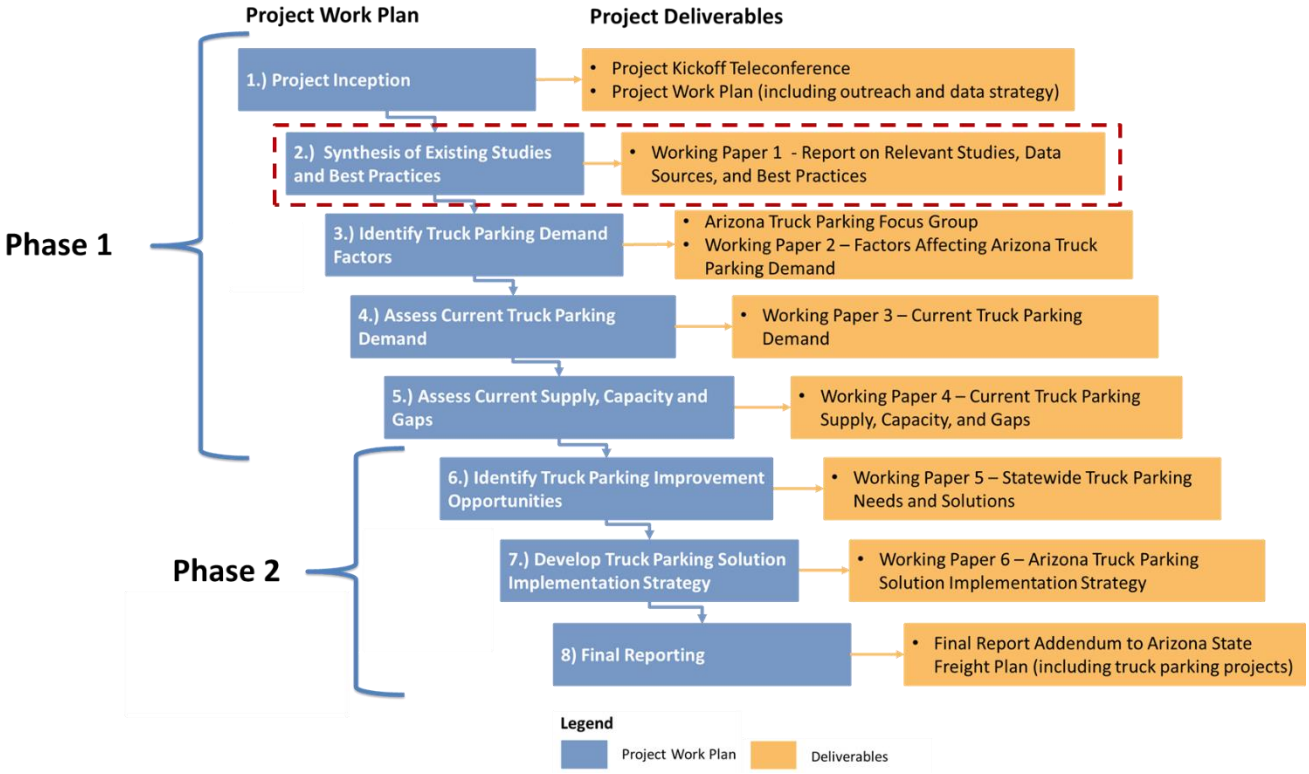
This study assesses current truck parking conditions and identifies gaps between truck parking supply and demand, defines infrastructure and policy needs, and proposes potential capacity and technology solutions.

Through the use of real time truck parking data and consultations with the trucking industry, law enforcement, and truck stop operators, CPCS will identify where trucks are parking in Arizona and how the new ELD requirement may impact Arizona starting on December 18, 2017. Ultimately, the study will identify the gap between the supply and demand for safe truck parking spaces, associated infrastructure and policy needs, and potential capacity and technology solutions to resolving them.

1.2 Project Structure

The Arizona Truck Parking Supply, Demand, Needs Analysis will be developed in two broad phases, with a total of eight work tasks, as set out in Figure 1-1. The present Working Paper is part of Phase 1 and is the output of Task 2 – Synthesis of Existing Studies and Best Practices.

Figure 1-1: Project Work Plan



1.3 Purpose of this Working Paper

The purpose of this Working Paper is to provide an overview of previous research on truck parking issues both nationally and in Arizona, and a synthesis of truck parking solutions being employed or proposed. Specifically, this Working Paper will define:

Which studies and national best practices, including recent ADOT studies and fieldwork, are relevant to understanding Arizona's truck parking needs?

This Working Paper also explores how existing studies and literature could be relevant to Arizona and can inform subsequent tasks as well as identifies best practices by answering the following key questions:

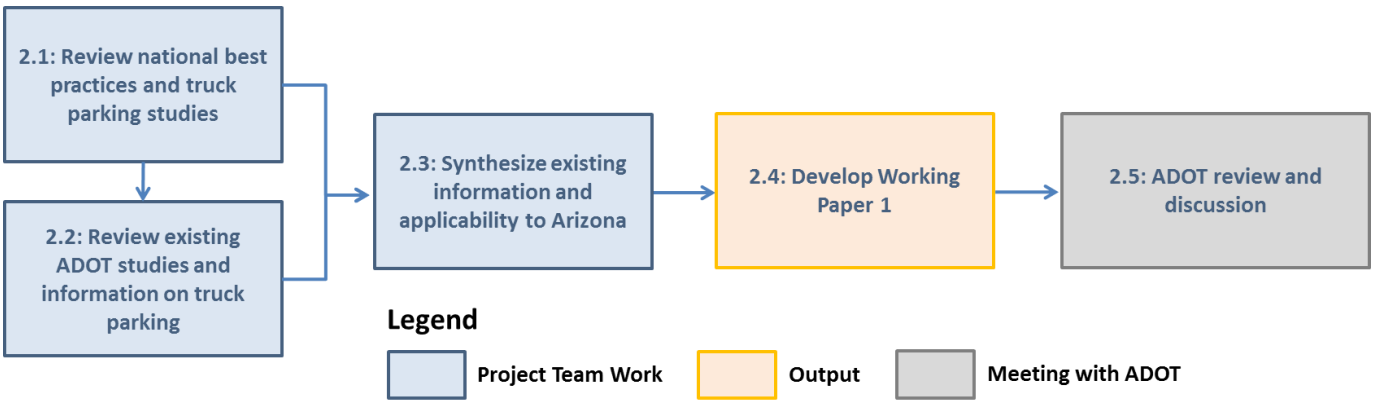
- What information from existing and ongoing studies, including analytical and fieldwork conducted by ADOT or its consultants, will inform this study and how?
- What are the best practices nationally on truck parking, including identifying locations of concern, engaging the trucking industry, environmental impacts, safety, and communications approaches/technologies?

This Working Paper is also intended to provide ADOT with an overview of progress to date and to solicit comments and other feedback on the structure and content of this component part of what will become the final report.

1.4 Methodology

This working paper was prepared using a literature review and synthesis approach. Key sources of information include the *Jason's Law Survey and Comparative Analysis*, the *Arizona Statewide Rest Area Study*, state DOT truck pilot projects in Minnesota, Wisconsin, and Michigan, recent state DOT truck parking studies in other states, and ADOT reconnaissance and inventories of truck parking needs at rest areas, among others. Figure 1-2 provides an overview of Task 2's workflow.

Figure 1-2: Task 2 Work Plan



1.5 Limitations

Some of the findings in this report are based on the analysis of third-party data. While CPCS makes efforts to validate data, CPCS cannot warrant the accuracy of third-party data.

2 Background on Truck Parking

Key Messages

Truck parking is a necessity for most truck drivers, and a lack of parking often results in trucks parked in inappropriate areas. In turn, inappropriate parking has negative impacts on highway safety, infrastructure condition, quality of life, and public safety. The need for parking is strongly influenced by federal Hours of Service (HOS) limits on the number of hours a truck driver is allowed to be on-duty and drive, and the implementation of the ELD mandate. The upcoming ELD mandate, due to take effect on December 18, 2017, is expected to exacerbate truck parking needs throughout the United States and in Arizona as ELDs compel drivers to more strictly adhere to required rest periods.

2.1 Role of Truck Parking Facilities in Trucking Operations

Truck parking facilities provide a location where drivers can take short and long-term breaks or wait for scheduled arrival times at nearby freight facilities. Truck parking facilities are key to providing a place where drivers can take longer breaks—including overnight rest—for drivers who have reached the end of their driving day. Truck parking for long-term rest is perhaps the most important use of parking facilities, as long-term parking is necessary for drivers to comply with the Federal Motor Carrier Safety Administration's (FMCSA), Hours of Service (HOS) regulations. Truck parking also provides drivers with a location to take their legally-required 30-minute break.

Hours of Service Regulations

The FMCSA sets limits on how long truck drivers may drive each day. These regulations are intended to improve highway safety by reducing the incidence of fatigued driving. Drivers must take a break of a minimum of 10 consecutive hours after:

- 11 hours of driving, or
- 14 consecutive hours on duty. On duty work includes driving, as well as inspections, paperwork, fueling, and other work tasks

Additionally, drivers may not drive for more than eight hours without a 30-minute break.

Many states and metropolitan regions, particularly those with high concentrations of freight-dependent industry, or those with major trucking corridors do not have adequate parking to support demand for overnight and long-term breaks. In these areas, parking shortages are common.

Evidence of truck parking shortages are trucks parked on highway shoulders and ramps. Areas with trucks parking on shoulders or ramps may have real parking shortages (demand exceeds supply) or perceived truck parking shortages (parking may be available, but truck drivers are unable to find it or believe no parking is available).

The real or perceived shortage of truck parking presents drivers with the difficult decision presented in Figure 2-1. Drivers can decide to "stop early" to find a parking location, but stopping early means that drivers give up potential mileage and income for the day. Alternately, drivers can "take a chance" and try to find parking closer to the time when their hours run out. However, if they are unable to find parking before their hours end, drivers may be forced to park on highway ramps and shoulders or in unsecured commercial areas. Alternatively, as drivers reach the end of the HOS, they may continue to search for parking while illegally driving beyond their allowed hours. Exceeding the HOS limit places drivers at greater risk of driving fatigued, potentially increasing the chance of accidents.

Figure 2-1: Decision Tree for Truck Drivers Trying to Find Parking

Figure 2-2 displays two examples of inappropriate parking, one of the most visible symptoms of parking shortages. Inappropriate parking practices pose an increased collision risk on roadways, which negatively impacts public safety. Additionally, trucks parked on shoulders and ramps damage unreinforced pavement, which is not intended to regularly support a parked truck for 10 hours or more. On the other hand, parking in unmonitored commercial or industrial areas may expose truck drivers to theft and other crime, and may be a nuisance to local businesses or residents.

Figure 2-2: Inappropriate Parking at Arizona Rest Area Ramps

Source: Arizona Department of Transportation

Truck parking has been a concern raised by the trucking industry in all of the American Transportation Research Institute's (ATRI) annual *Critical Issues in the Trucking Industry* publication since 2012 and has risen in importance from eighth out of ten in 2012 to fourth in 2016.[8] The trucking industry in Arizona has highlighted truck parking as an issue during both the Arizona Freight Advisory Committee (FAC) and through the Arizona Truck Association. Concerns about the upcoming ELD mandate and its impact on the demand for truck parking have prompted concern from the trucking industry in Arizona.

Electronic Logging Device

Electronic Logging Devices, or ELDs, are interface with a truck's onboard computers to automatically record driving hours. ELDs are intended to replace paper logbooks used to keep records of the driving time. The Moving Ahead for Progress in the 21st Century Act (MAP-21) mandated that commercial vehicles used in interstate commerce be equipped with ELDs. Since ELD records are tied to the truck's onboard computers, they are more resistant to falsification than paper logbooks.

2.2 Types of Truck Parking Facilities

Truck parking can be classified into two categories: established and inappropriate. The difference between "established" and "inappropriate" is whether the location is intended for truck parking. For example parking on the shoulder of an entrance or exit ramp or highway would be classified as inappropriate. Conversely, established truck parking locations are locations whose primary function is truck parking. Established truck parking takes many different forms. For this study established truck parking is differentiated as follows:

- **Publicly-owned –** Truck parking locations owned by the government that have designated truck parking. Examples of publicly-owned truck parking locations are rest areas owned by ADOT.

[8] *Critical Issues in the Trucking Industry – 2016,* October 2016. American Transportation Research Institute.

- **Privately-owned and publicly-open –** Truck parking locations owned by private companies expressly for truck parking or locations that allow truck parking. Examples of privately-owned and publicly open facilities include truck stops that provide fee-based parking and free parking, as well as businesses such as retailers or casinos that allow trucks to park at their facility even though providing truck parking is not their primary function.[9]
- **Private-only –** Truck parking locations that are privately owned and not available to the public. For example, some trucking companies provide space to park their trucks. In addition to parking, private-only locations may be used for maintenance or other purposes.

The focus of this study is publically-owned and privately-owned and publically-open truck parking facilities. Private companies may decide to invest in private-only truck parking to provide a better experience for their drivers, ensure safety and security of assets, or to complete maintenance on vehicles. While private-only truck parking facilities are a portion of Arizona's total statewide truck parking spaces, the exclusive nature of private-only truck parking facilities limits their use as a publically available resource. Therefore, these facilities are beyond the scope of this study.

[9] Locations classified as privately-owned and publicly-open must allow trucks to park at their location, without this permission these locations would be classified as an inappropriate location and not an established location.

3 Review of Existing Truck Parking Studies

Key Messages

Arizona's truck parking availability and capacity may compare favorably to neighboring states and the nation as a whole, but parking shortages and inappropriate parking have been observed throughout the state, particularly on interstate corridors. Additionally, Arizona's parking shortages are forecasted to more than double in the next 15 years.

3.1 National Studies of Truck Parking

By the early 2000s, truck parking shortages and their associated problems were emerging as an increasingly important issue for the trucking industry as well as state DOTs and the federal government. One of the first major efforts to understand truck parking needs and issues was the FHWA's *Study of Commercial Truck Parking Facilities*, which was completed in 2002. This report laid the groundwork for future studies by all levels of government and industry.

In the past five years, the federal government has conducted national-level studies, which have contributed to an overall understanding of truck parking problems in the United States. Additionally, industry groups, interest groups, and private companies have contributed to and funded studies of truck parking needs and issues in response to growing concerns about the availability of truck parking. These studies present industry perspectives and concerns, which will inform industry outreach conducted in subsequent tasks of this study. Similarly, recently completed studies of truck parking have been developed in response to industry need, changing HOS, and safety concerns.

3.1.1 American Transportation Research Institute

ATRI's Research Advisory Committee selected truck parking as the highest priority topic of research in 2015. Over the past five years, truck parking has increased in importance, as evidenced by its rise from eighth place to fourth place in ATRI's annual survey, *Critical Issues in the Trucking Industry.*[10] As a result, ATRI conducted its own research into truck parking issues and solutions. To date, ATRI has published four papers on truck parking. The remainder of this section outlines key findings from recent ATRI studies of truck parking.

[10] American Transportation Research Institute. *Critical Issues in the Trucking Industry – 2016,* October 2016. American Trucking Associations.

Commercial Driver Perspectives on Truck Parking

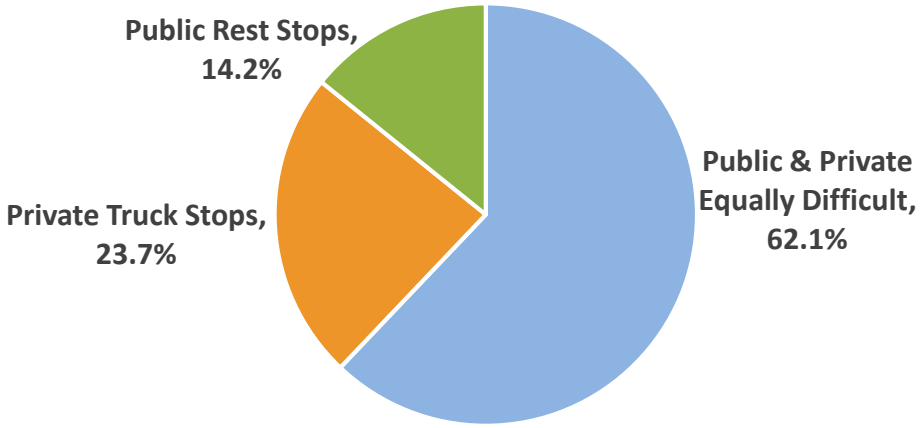
ATRI conducted a 2015 survey of truck drivers to understand driver issues, with a focus on collecting driver insights into parking reservation systems and their willingness to pay a fee for parking. Over 1,400 drivers completed ATRI's 2015 survey.

The ATRI study found that drivers use private truck stops 56 percent of the time and public rest areas 44 percent of the time.[11] The higher frequency of usage of private truck stops may be due to the fact that most states, including Arizona, have many more private parking spaces than public parking spaces, and private stops often offer additional amenities such as restaurants, shops, and repair services.

Survey respondents used private rest stops about 27 percent more often than public rest areas.

As shown in Figure 3-1, when asked about the difficulty finding parking at different types of parking facilities, 62.1 percent of responses felt that it was equally difficult to find parking at public and private facilities, 23.7 percent felt that finding parking at private truck stops was more difficult, and 14.2 percent said it was more difficult to find parking at public rest areas.[12]

Figure 3-1: Difficulty Finding Parking at Public Rest Areas and Private Truck Stops

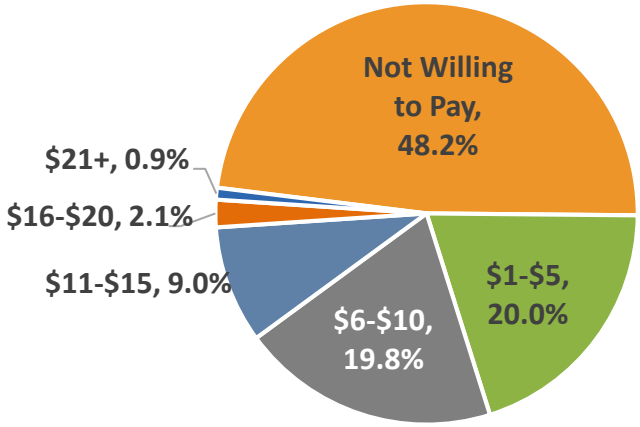


Source: ATRI, *Managing Critical Truck Parking Tech Memo #1: Commercial Driver Perspectives on Truck Parking*

In addition to studying the relative difficulty of finding spaces at private and public facilities, ATRI also measured driver's interest in, and willingness to pay for reserved parking spaces. As shown in Figure 3-2, almost half of drivers indicated that they were unwilling to pay for reserved parking spaces.

[11] *Managing Critical Truck Parking Tech Memo #1: Commercial Driver Perspectives on Truck Parking*. American Transportation Research Institute. September 2015.
[12] Ibid

Figure 3-2: Drivers' Willingness to Pay for Reserved Parking Spaces



Source: ATRI, *Managing Critical Truck Parking Tech Memo #1: Commercial Driver Perspectives on Truck Parking*

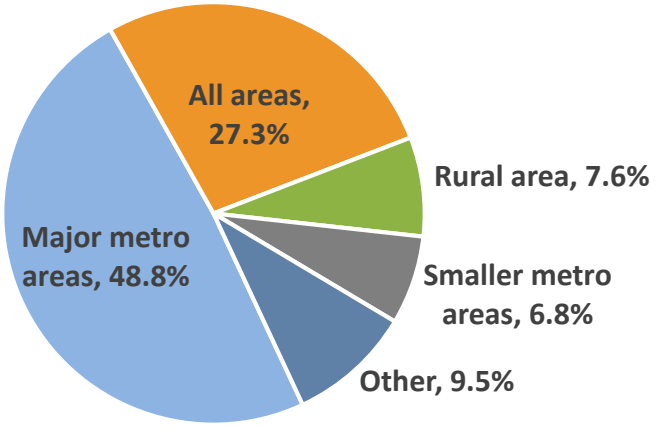
Almost half of drivers are unwilling to pay for reserved parking. Of the drivers who are willing to pay, 77 percent are willing to pay less than $10 per night.[13]

When asked who should pay for the reservation fee, 46.8 percent said the carrier, 20.7 percent said both the carrier and the driver, 15.3 percent said the driver and the remaining responses were evenly split between government, no fees, and other.

ATRI's 2015 survey also asked about the locations where drivers would be most likely to reserve parking space, a major metropolitan area, smaller metropolitan area, rural area, or all areas. Figure 3-3 indicates that drivers would be most likely to use a reservation system in major metropolitan areas, suggesting that it is more difficult to find a parking space in those areas. The second highest response was using reservations in all areas, followed by "other" which was often selected when there was no willingness to reserve a parking space.

[13] *ibid*

Figure 3-3: Location where Drivers would most likely to Reserve Truck Parking



Source: ATRI, *Managing Critical Truck Parking Tech Memo #1: Commercial Driver Perspectives on Truck Parking*

One potential approach to address the difficulty in finding truck parking would be a reservation system, but the majority of drivers are unwilling to pay anything or a relatively small amount for a reservation. Additionally, almost half of respondents said carriers should pay the reservation fee. Lastly, the survey suggests that a reservation system would have the highest impact in major metropolitan areas.[14]

Real World Insights from Truck Parking Diaries 2016

ATRI developed *Real World Insights from Truck Parking Diaries 2016* using 14 day diaries of truck drivers looking for truck parking. Diaries were collected to provide qualitative and quantitative data to better understanding the day-to-day experience of truck drivers searching for truck parking. The research study collected 148 detailed "parking diaries" completed by truck drivers, which helped illustrate the process and difficulty of finding parking. Drivers were offered the option to participate based on industry, employment status (employee drivers, independent contractors, and owner operators), and region where the driver operates. The truck parking diaries provide an overview of the tools and processes that truck drivers use to find truck parking, as well as an account of the time spent searching for parking.[15]

Beginning with the process for finding truck parking and the tools used, the vast majority of drivers surveyed (93.8 percent) find truck parking locations themselves. When asked to indicated all tools they use to find truck parking (allowing drivers to select all that apply), drivers indicated that websites or smartphone applications were used most often (55.5 percent), followed by GPS (53.4 percent), books (37.7 percent), other which mostly consisted of past experience and/or Google Earth (23.3 percent), none (8.2 percent), and no response (0.7 percent).[16]

[14] *Ibid*

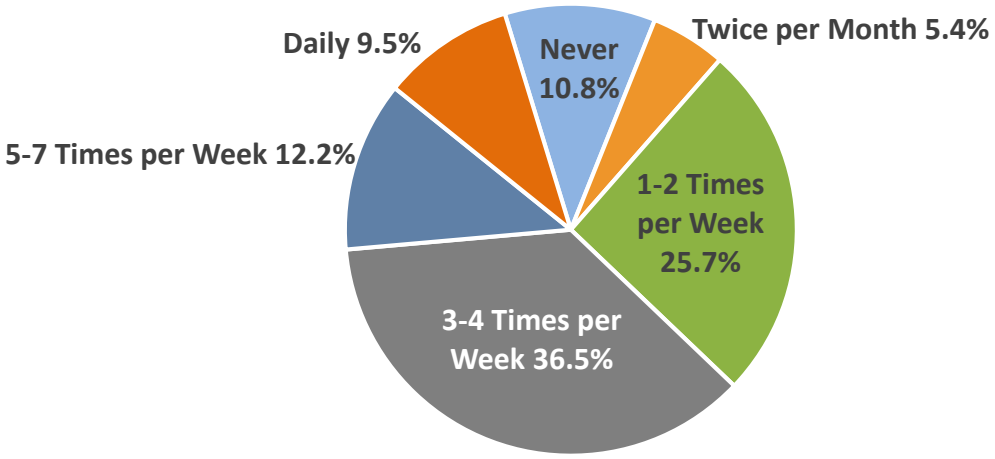
[15] *Managing Critical Truck Parking Case Study –Real World Insights from Truck Parking Diaries*, December 2016. American Transportation Research Institute.

[16] Ibid

Drivers are most often responsible for finding truck parking themselves and the two most common tools used to find truck parking were websites/smartphone applications and GPS.

About 46 percent of drivers had experience using reservation systems to hold a parking space. Some drivers viewed reserved spaces negatively, because they were often not in use at times when free parking is full. Other drivers liked the option to reserve parking spaces when they thought parking could be difficult to find. The trucker diaries confirmed concerns that drivers had difficulty finding proper parking. As shown in Figure 3-4, 83 percent of diary participants parked in unauthorized or undesignated locations at least one to two times per week.[17]

Figure 3-4: Unauthorized/Undesignated Parking Frequency



Source: ATRI, *Managing Critical Truck Parking Case Study –Real World Insights from Truck Parking Diaries* 2016

Parking shortages affect a large number of truck drivers: 83 percent of truck drivers park in unauthorized or undesignated parking spaces at least one to two times per week.

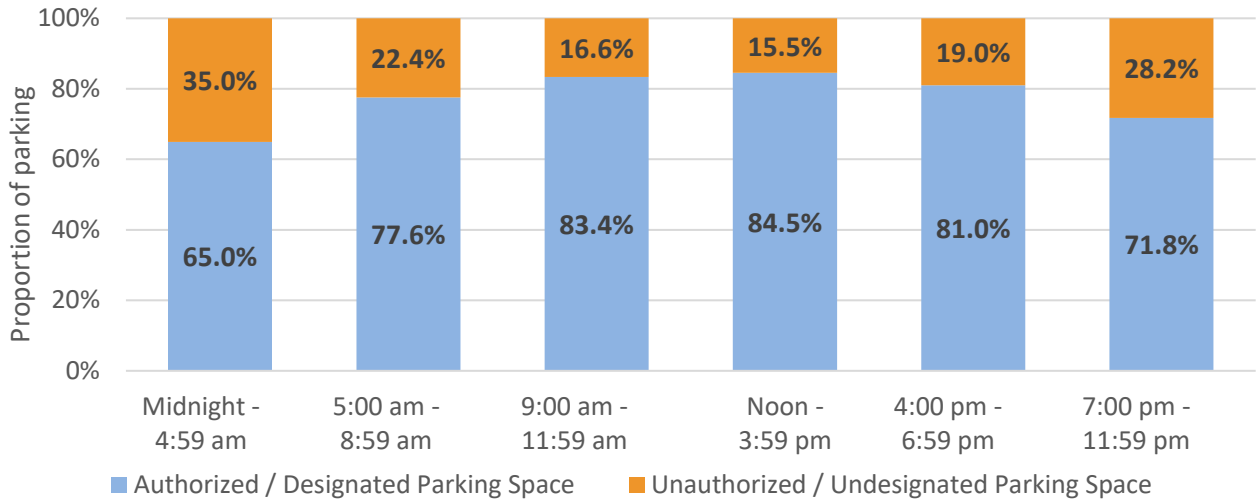
The study also asked drivers to identify the timing of unauthorized/undesignated parking. Figure 3-5 displays the timing of both authorized and unauthorized truck parking events. Overall, the late evening and early morning have the highest proportion of unauthorized or undesignated parking (inappropriate parking locations).[18]

[17] Ibid
[18] Ibid

Inappropriate truck parking is most likely to occur in the evening and early morning, specifically from 7pm to 5am.

The survey found similar proportions of authorized and unauthorized parking during the week compared to the weekend. The proportion of the time a truck parks in an unauthorized parking space relative to an authorized space were highest in urban areas (26.5 percent), followed by suburban (21.3 percent), and then rural areas (16.5 percent).[19]

Figure 3-5: Timing of Authorized and Unauthorized/Undesignated Parking Events

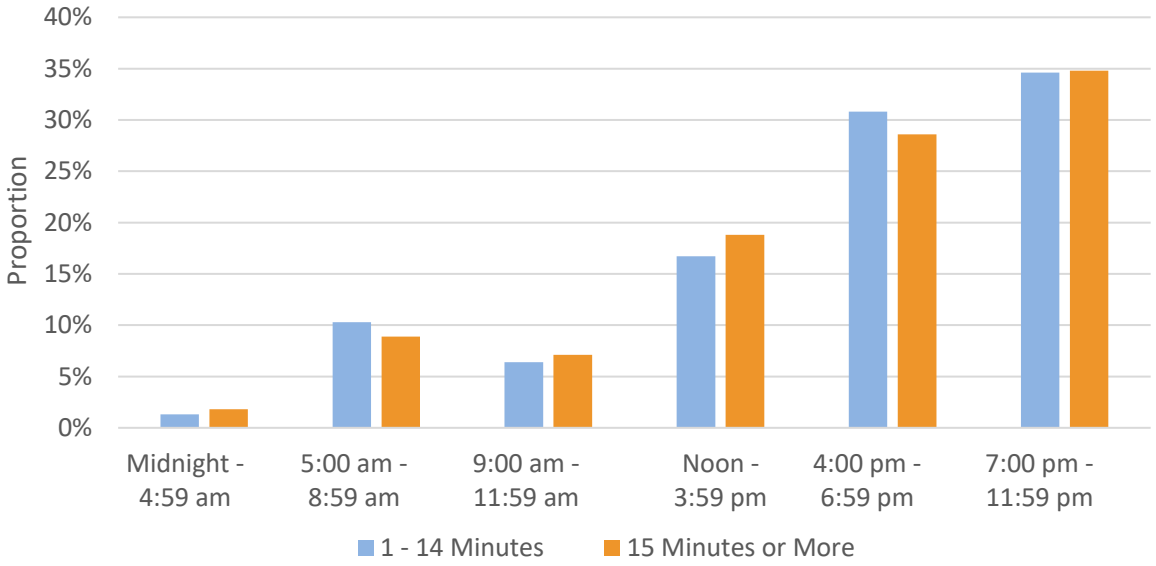


Source: ATRI, *Managing Critical Truck Parking Case Study –Real World Insights from Truck Parking Diaries*

Figure 3-6 displays the amount of time truck drivers spent searching for truck parking each time they needed to stop. The data are separated into two categories, 1 to 14 minutes and over 15 minutes of search time, each totaling 100 percent. The amount of time spent searching for truck parking is similar for each part of the day, meaning some trucks find parking quickly and others take longer. This suggests that some drivers know where to park and others do not or the locations where drivers are looking have different truck parking availability. Additionally, truck drivers were looking for truck parking between 4pm and midnight 60 percent of the time. Taken together, Figure 3-5 and Figure 3-6 show that trucks are most frequently looking for parking in the early and late evening, which coincides with higher frequencies of inappropriate parking. After midnight, most drivers have found parking, but many are parked inappropriately.[20]

[19] Ibid
[20] Ibid

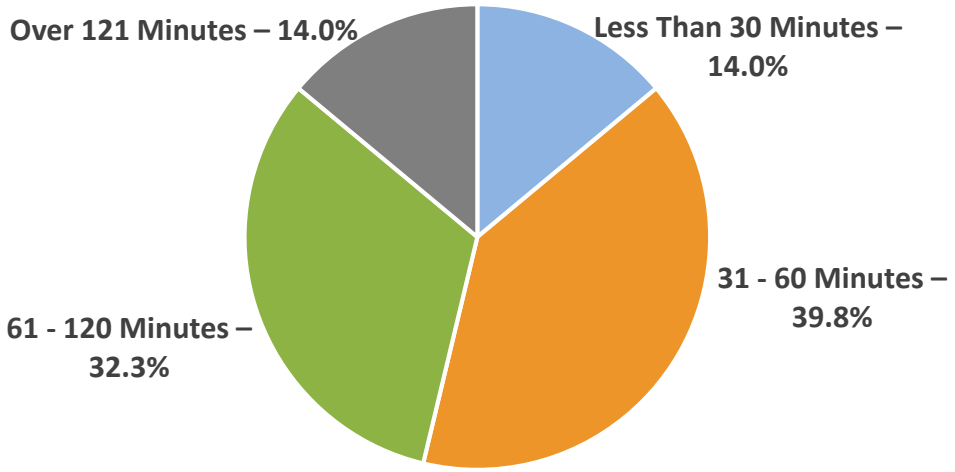
Figure 3-6: Amount of Time Searching for Truck Parking by Time of Day



Source: ATRI, *Managing Critical Truck Parking Case Study –Real World Insights from Truck Parking Diaries*

ATRI's work also illustrated the high economic cost of stopping early to find parking, which gave trucking companies and transportation policymakers some of the first insights into economic impacts of truck parking shortages. Figure 3-7 provides a breakdown of average driving time that drivers had remaining when they parked. Using these responses, and a median of 56 minutes of remaining drive time, ATRI calculated that the average driver could be forgoing over 9,300 additional revenue-earning miles each year, at a cost of $4,600 per driver.[21]

Figure 3-7: 14-Day Average of Daily Remaining Drive Time (minutes)



Source: ATRI , *Managing Critical Truck Parking Case Study –Real World Insights from Truck Parking Diaries*

[21] Ibid

ATRI estimates that stopping early to find parking reduces the average driver's productivity by 9,300 miles each year, at a cost of $4,600 per driver.

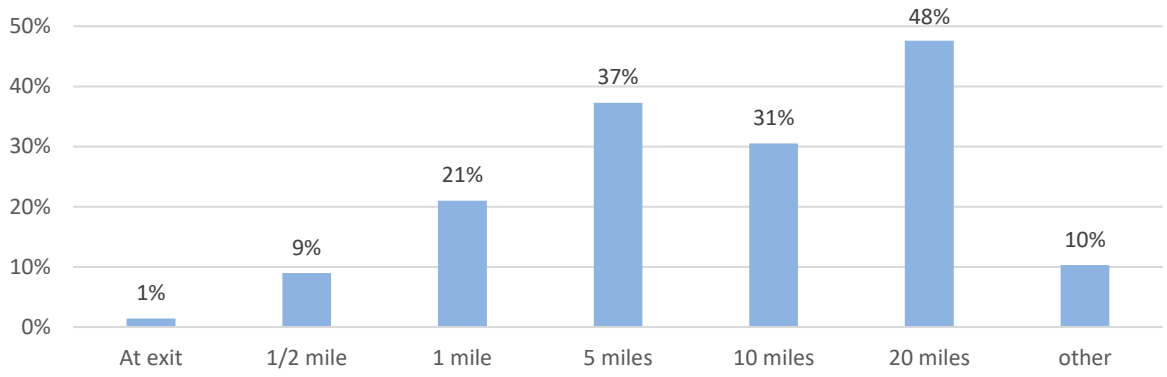
The truck driver diaries found that drivers with an ELD were more likely to search longer for truck parking relative to those that did not have an ELD. This finding from the ATRI study suggests a decrease in productivity from implementing an ELD.[22]

When asked what factors influence the selection of a parking space, the most often cited reason was the proximity of the location to the route (96.5 percent), followed by restrooms/showers (79.8 percent), and expected parking availability (75.5 percent). Other factors such as the width of parking spaces/ease of access or restaurants were cited less than 32 percent of the time.[23]

A Comprehensive System for Assessing Truck Parking Availability

A 2012 survey of 242 drivers and 93 non-drivers in the trucking industry covering a variety of topics found that truck drivers were most interested in receiving truck parking notifications through a changeable message sign or through a smartphone application. When asked to rank their preferences one through six, changeable message signs and smartphones were, on average, ranked 2.3 and 2.8 respectively. Less preferred options were the internet/website (3.5), onboard devices (3.6), 511 (3.8) and dispatcher (5). Drivers were also asked whether or not it would be helpful to receive information at a variety of distances from parking areas. As shown in Figure 3-8, most drivers want information on truck parking availability from 10 to 20 miles ahead. Additionally, 64.2 percent of drivers felt that accuracy needed to reach 85 percent or higher and another 25 percent felt accuracy needed to always be 100 percent.[24]

Figure 3-8: Truck Drivers' Preferred Distances for Truck Parking Information



Source: A Comprehensive System for Assessing Truck Parking Availability

[22] Ibid
[23] Ibid
[24] Morris, T., D. Murray, K. Fender, A. Weber, V. Morellas, D. Cook, N. Papanikolopoulos. *A Comprehensive System for Assessing Truck Parking Availability*, January 2017. CTS 17-02. Center for Transportation Studies.

The study also showed a slightly higher of willingness to pay compared to the 2015 study, with 36.9 percent not willing to pay for parking, 32.1 percent willing to pay $1-5, 25 percent willing to pay $6-10, and 6 percent willing to pay $11-20. The study also asked carriers what they would be willing to pay for truck parking reservations. Over 48 percent of carriers said nothing, 22.2 percent said $1-5, 22.2 percent said $6-10, and 7.4 percent said $11-20. [25]

3.1.2 National Coalition on Truck Parking Report

In 2015, the United States Department of Transportation and stakeholders from trucking industry, safety officials, state DOT staff, and truck stop owners established the National Coalition on Truck Parking. The National Coalition on Truck Parking was intended to respond to needs identified by the *Jason's Law Truck Parking Survey and Report*. To respond to identified needs, the Coalition conducted four meetings across the United States to get input on potential solutions to parking problems. The meetings were conducted in 2016, and the Coalition released a report on potential solutions in 2017.

At each meeting, participants provided feedback on four discussion areas: 1) Parking Capacity, 2) Technology and Data, 3) Funding, Finance, and Regulations, and 4) State, Regional, and Local Government Coordination. Major results for each topic are presented below:[26]

- Common solutions for Parking Capacity included the use of public land to develop additional parking, an overhaul of outdated national standards for parking facility design, addressing parking needs at industrial sites where there may be available paved surfaces, and examining how parking shortages may affect supply chain operations.
- The main suggestion for Technology and Data was that states should provide real-time information about parking availability.
- Funding, Finance, and Regulation recommendations included providing a dedicated funding source for public rest areas such as a tax or fee, promoting pooled parking cooperatives in areas with high concentrations of industrial sites, establishing public-private partnerships (P3) to provide parking, and implementing parking fees to fund the creation of additional truck parking.
- Government Coordination suggestions included education about the importance of truck parking, including truck stop operators in state FACs, and incorporating parking considerations into state and MPO freight plans.

3.1.3 Jason's Law Truck Parking Survey and Report

The *Jason's Law Truck Parking Survey and Report* provided an inventory of each state's parking capacity, assessed truck volumes, and set forth performance measures for parking. Survey

[25] Ibid

[26] Phelan, T., V. Mantero, J. Purdy, T. Kearney. *National Coalition on Truck Parking: Activity Report, 2015-2016*, June 2017. FHWA-HOP-17-026. Federal Highway Administration.

results are available state-by-state, making the study useful for comparing parking availability and problems between different states.

Jason's Law Background

Jason's Law is named after truck driver Jason Rivenburg, who was murdered while parked overnight at an abandoned gas station. Following Rivenburg's death in 2009, truck parking legislation was introduced and named in his honor, and integrated into MAP-21. This legislation directed the FHWA to study the availability of truck parking in all states, and provided resources for the development of additional truck parking in the future.

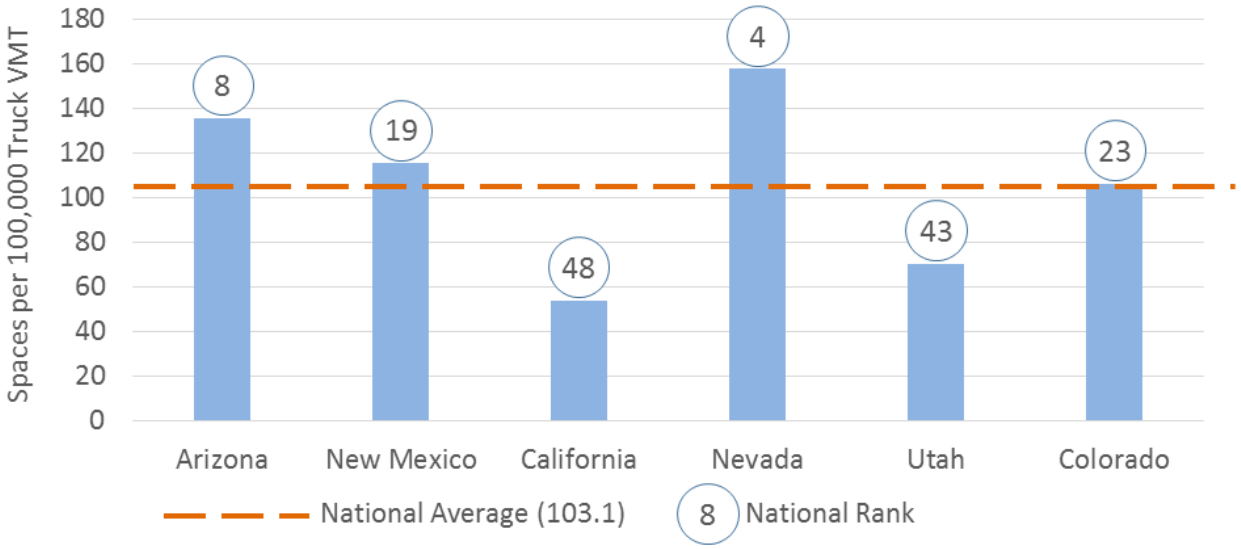
The Jason's Law Survey collected parking space inventories from state DOTs, and feedback on trucking problems and solutions from a survey of all 50 state DOTs, 391 truck stops, 249 dispatchers, 820 company truck drivers, and 7,333 independent truck drivers. Responses about parking problems, in general, were similar to the later ATRI survey: between 75 and 80 percent of drivers indicated that they experienced problems finding parking at least once a week.[27]

Nationally, over 75 percent of drivers report problems finding parking at least once each week.

The survey also provides state-specific insight relevant to Arizona. It identified 18 public facilities in Arizona with 495 truck spaces in total. It also identified an additional 73 private truck stops, which provided 6,635 truck spaces. As a whole, the state had an estimated 7,130 truck spaces at the time the Jason's Law Survey was completed. Compared with neighboring states in the Southwest, Arizona had a favorable number of truck spaces per 100,000 miles of VMT and per 100 miles of national highway (including interstates). Arizona's parking availability is compared with neighboring states in Figure 3-9 and Figure 3-10.[28]

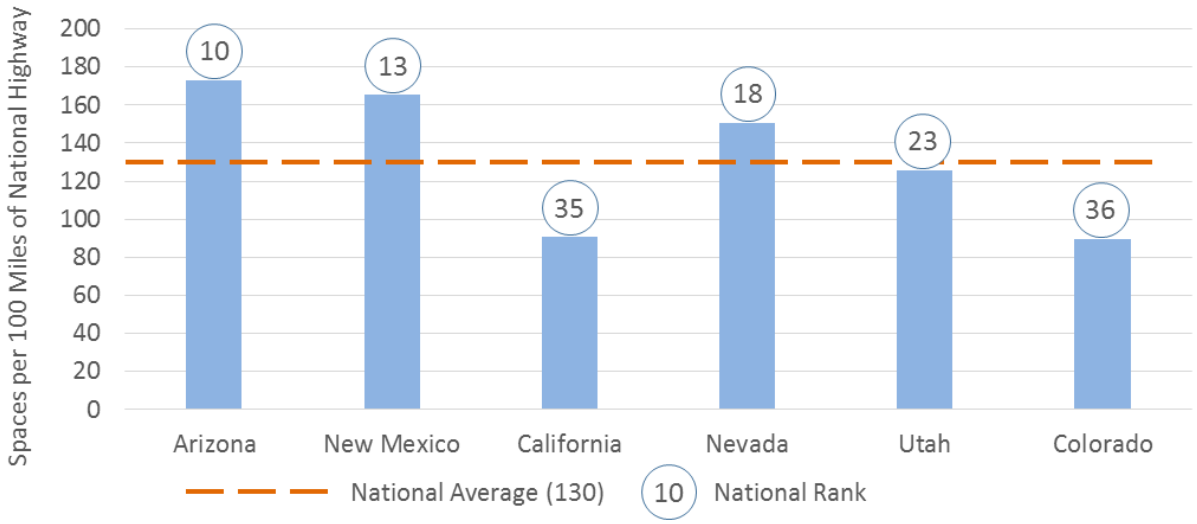
[27] *Jason's Law Truck Parking Survey Results and Comparative Analysis, September 2015. American Transportation*, August 2015. Federal Highway Administration.
[28] Ibid

Figure 3-9: Number of Truck Parking Spaces per 100,000 Truck Vehicle Miles Traveled (VMT)



Source: FHWA, *Jason's Law Truck Parking Survey Results and Comparative Analysis*

Figure 3-10: Number of Truck Parking Spaces per 100 Miles of National Highways



Source: FHWA, *Jason's Law Truck Parking Survey Results and Comparative Analysis*

While Arizona ranked favorably compared to its neighbors, feedback on parking problems from private industry presented a mixed outlook. About 18 percent of the responses from all trucking groups surveyed indicated that Arizona had a parking shortage. At the same time between 13 and 14 percent of responses from drivers indicated that Arizona had sufficient parking. Figure 3-11 shows what percentage of each survey group indicated that Arizona had a parking shortage, or sufficient parking.[29]

[29] Ibid

Figure 3-11: Jason's Law Arizona Parking Responses

	Parking Shortage	Sufficient Parking
Independent Drivers (OOIDA)	18%	14%
Company Drivers (ATA)	18%	13%
Company Dispatchers (ATA)	17%	24%

Source: FHWA, *Jason's Law Truck Parking Survey Results and Comparative Analysis*

In a national context, each of these response rates indicated that Arizona had favorable parking relative to the rest of the United States. For example, "sufficient" response rate from independent drivers ranked Arizona 12th in the nation for sufficient parking. The "sufficient" response rate of 13% from company drivers also placed Arizona 12th in the nation for sufficient parking among company drivers. Twenty-four percent of dispatchers said Arizona had sufficient parking, making the state ranked first for sufficient parking perception among dispatchers.[30]

Arizona's parking problems are less severe than other states, but are still worthy of attention, especially as truck traffic volumes grow in the future.

Overall, a greater share of truck drivers felt that Arizona had parking shortages or problems rather than sufficient parking. However, Arizona did rank favorably relative to other states when it came to sufficient parking ratings. These two findings suggest that Arizona has parking problems, but they may not be as severe or as widely recognized as problems in other states. Research conducted by ADOT on parking problems provides greater insight on parking needs and issues that are unique to the state.

3.2 Arizona-Specific Research

Since 2011, Arizona DOT has undertaken a number of research efforts intended to improve the understanding of parking in the state. These efforts include the 2011 *Arizona Statewide Rest Area Study*, field observations of inappropriate truck parking at state rest areas, and consultations with operators of private truck stops. This section provides a brief inventory of parking assets in Arizona, and high-level conclusions from previous ADOT research work.

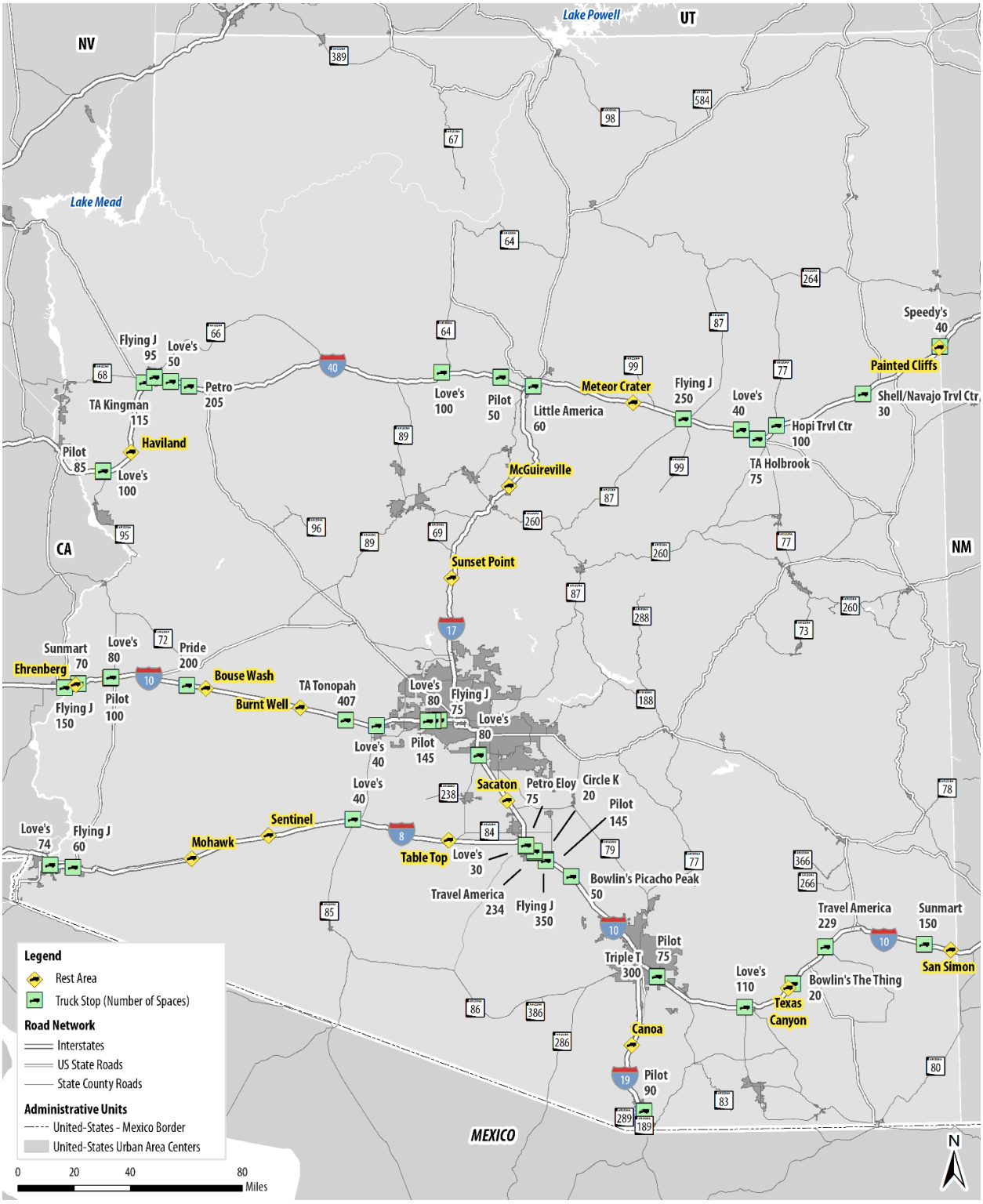
3.2.1 Arizona's Parking Assets

In order to understand Arizona's unique parking context, it is important to understand what highway infrastructure and parking assets are available in the state. As of October 2017, Arizona has about 515 public spaces at 19 rest areas, and 6,635 spaces at 73 truck stops.[31] The majority of these parking spaces, 452 public[32], and 4,874 private[33], are located adjacent to Arizona's

[30] Ibid
[31] Ibid
[32] Jacobs Engineering Group. *Arizona Statewide Rest Area Study*, 2011. Arizona Department of Transportation.
[33] Arizona Department of Transportation GIS files. 2017.

interstate highways. Figure 3-12 show's Arizona's major roadways, and parking facilities that are close to interstate highways.

Figure 3-12: Arizona's Interstate Highway Truck Parking Assets



Source: Arizona Department of Transportation

3.2.2 Arizona Statewide Rest Area Study

The 2011 *Arizona Statewide Rest Area Study* is a strategic plan intended to guide management of the state's rest areas through 2031. Among other issues, the study assessed current demand for truck parking and forecasted demand into the future. Additionally, the study set forth recommendations for areas that may need new rest area facilities in the future. Both the assessment and forecast of demand, and exploration of alternate rest area sites are helpful for understanding Arizona's parking situation.

Current and Forecasted Demand

The study estimated demand for truck parking at each rest area using a formula provided by the American Association of State Highway and Transportation Officials (AASHTO) *Guide for Development of Rest Areas*. The formula calculates parking demand as a function of factors such as daily traffic volume, the percentage of vehicles that stop at the rest area, and average stay at a rest area. Demand calculations were performed for 2011, 2016, 2021, and 2031 using traffic forecasts provided by ADOT.

Arizona's public truck parking space deficit is forecasted to more than double in the next 15 years.[34]

In 2011, there was an estimated deficit of parking spaces at 12 rest areas, 11 of which had nearby unauthorized truck parking problems noted by the Department of Public Safety (DPS). DPS also noted parking problems at eight other rest areas that did not have calculated deficits. Figure 3-13 shows how Arizona's rest area parking deficit was forecasted to grow by 170 percent over 20 years.[35]

Figure 3-13: Arizona's Increasing Parking Deficit (Rest Areas)

	2011	2016	2021	2031
Facilities with Parking Deficits	12	13	14	17
Total Parking Deficit	86	112	142	233

Source: Jacobs Engineering Group. *Arizona Statewide Rest Area Study,* 2011. Arizona Department of Transportation.

This calculation of parking deficits was supplemented by DPS observations of inappropriate truck parking, which were included in the report in both map and narrative format. An updated version of that map is presented in Figure 3-15 later in this chapter.

Corridors for New Rest Areas

Since the need for new truck parking was readily apparent, authors of the 2011 study used inappropriate truck parking as one of the criteria for evaluating corridors for new rest areas.

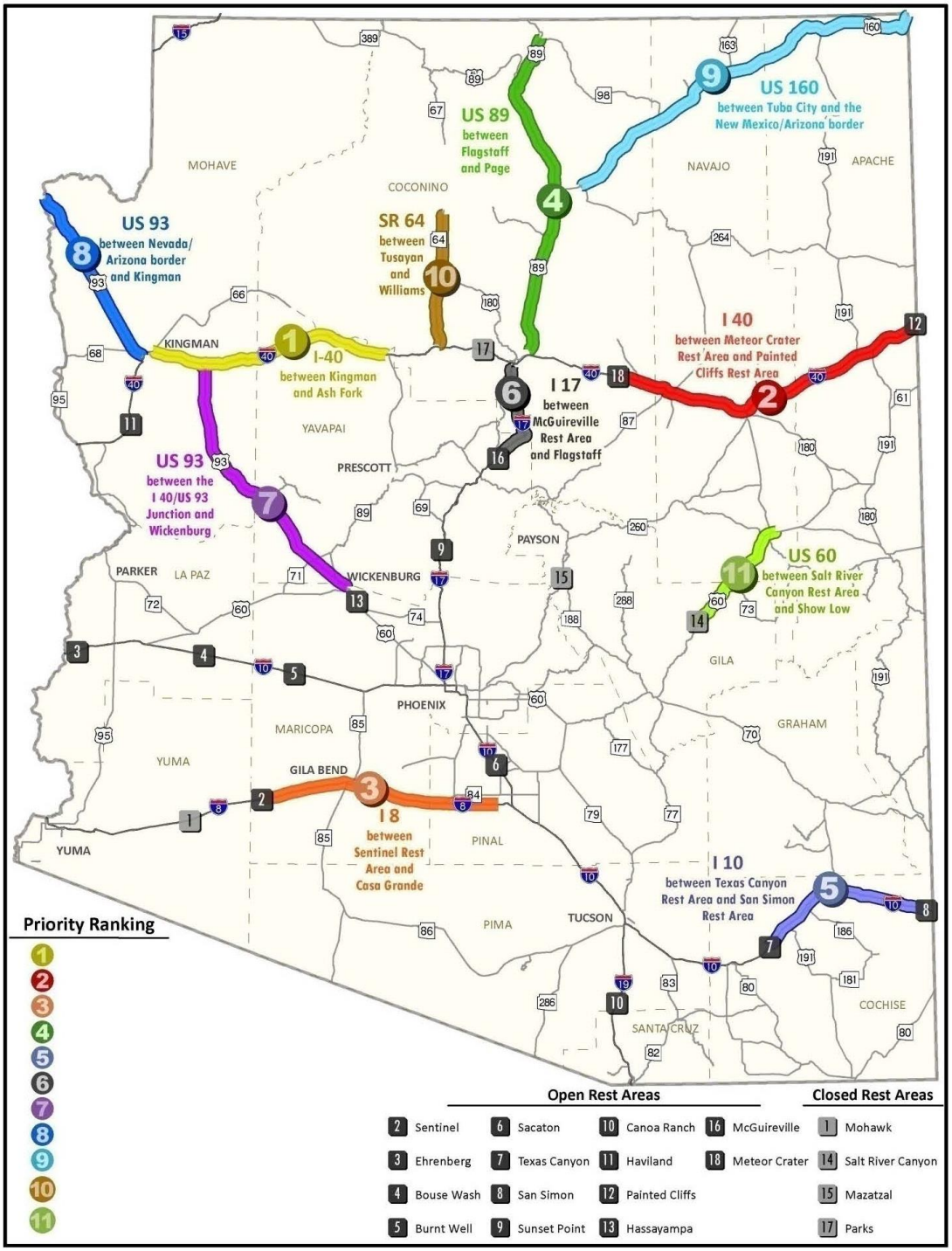
[34] Jacobs Engineering Group. *Arizona Statewide Rest Area Study*, 2011. Arizona Department of Transportation.
[35] Ibid

Four of the five highest-priority corridors were located on interstates, and the original map of the priority corridors is provided in Figure 3-14. Corridors 1 (I-10 between Texas Canyon and San Simon) and 6 (I-17 between McGuireville Rest Area and Flagstaff) were noted as areas with particularly high concentrations of parking problems, and a need for additional truck parking.[36]

I-10 between Texas Canyon and San Simon and I-17 between McGuireville and Flagstaff had particularly high concentrations of parking problems in 2011.

[36] Ibid

Figure 3-14: Priority Corridors for New Rest Areas (2011)



Source: Jacobs Engineering Group. *Arizona Statewide Rest Area Study*, 2011. Arizona Department of Transportation.

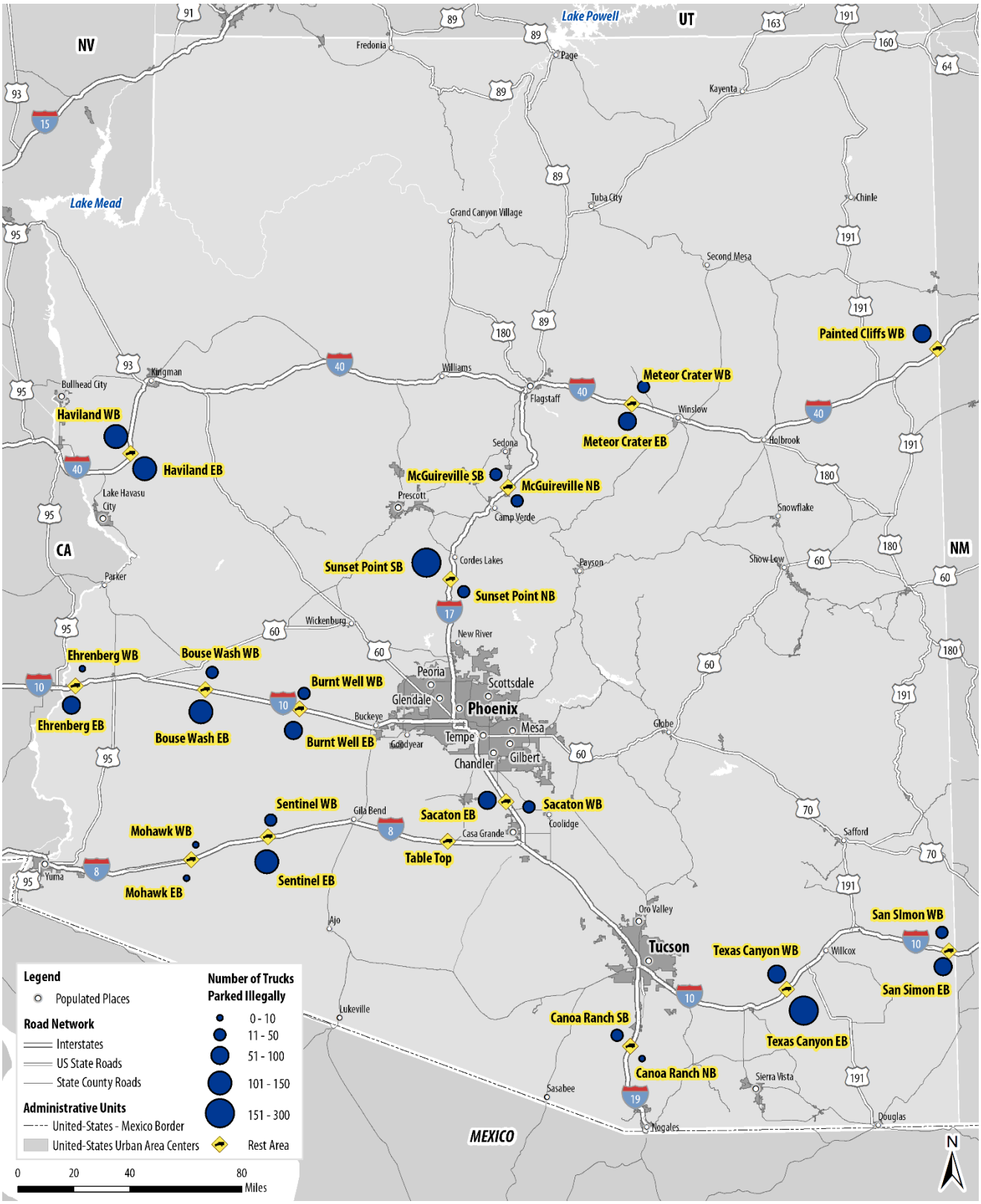
Ultimately, the Statewide Rest Area Study demonstrated Arizona's current and future need for additional truck parking, and laid some of the groundwork for future studies by providing a baseline understanding of parking issues (for public areas) in 2011.

3.3 Observations of Truck Parking Problems at Rest Areas

In 2017, ADOT and DPS studied parking problems at rest areas once again. The study counted the number of trucks parked inappropriately at rest areas located along the interstate over a two week period in May. The study was limited to rest areas, meaning it is only a portion of the trucks using inappropriate locations for parking. The results of this study are shown in Figure 3-15. This work shed light on new areas of truck parking problems not covered in the *Statewide Rest Area Study.* For example, inappropriate truck parking was observed and measured at new locations like Painted Cliffs, Ehrenburg, Bouse Wash, Mohawk, Sentinel, Texas Canyon, and San Simon. Established problem areas such as Haviland and Sunset Point also showed increased inappropriate parking activity. Overall, the results of this work compared against previous field observations from the *Statewide Rest Area Study*, suggests that the general trend of increasing parking problems established in the *Statewide Rest Area Study* is correct.

Updated research on Arizona's rest areas found inappropriate parking at all of Arizona's interstate rest areas, seven more areas than the 2011 Rest Area Study

Figure 3-15: Observations of Inappropriate Parking at Interstate Rest Areas



Source: Arizona Department of Transportation

3.4 Consultations with Truck Stop Operators

In order to gain a more complete understanding of parking problems outside of public rest areas, ADOT staff conducted outreach with private truck stop operators across the state. In spring 2017, outreach to 10 Love's and 4 Pilot truck stops revealed some additional trends not found by previous work. These findings suggest that truck stops on I-40 are busier on weekends, relative to the Arizona's other stops, and truck stops near urban areas such as Phoenix and Casa Grande are busier on weekdays. This work also supported ATRI and Jason's Law findings about frequency of unauthorized parking, as many consulted truck stops reported that trucks would park on nearby shoulders if parking stalls were full.

3.5 Conclusions and Remaining Questions

Previous research at both a national and state levels has demonstrated that Arizona has a truck parking shortage. The research also describes the parking problems associated with shortages. These problems can be observed across the state, with varying severity based on geographic and time factors. However, in order to fully understand Arizona's trucking "environment" and specific causes of parking problems, additional questions must be answered:

- What are the demand factors affecting truck parking in Arizona?
- Where are trucks currently parking in Arizona and are they parking legally or illegally (e.g. rest area on-ramp and off-ramp shoulder parking)?

To answer these questions, additional data will be collected and analyzed as part of this study.

4 Solutions and Best Practices

Key Messages

The potential solutions to truck parking issues will vary based on geography, available assets, and whether parking shortages are perceived or real. Solutions target a lack of information on the location and availability of truck parking or a lack of truck parking capacity. A variety of solutions address gaps in truck parking availability information and capacity. This chapter provides an overview of solutions to inform subsequent steps in this study.

4.1 Two Problems, and Two Types of Solutions

While truck parking shortages are caused by a lack of parking supply relative to demand, symptoms of shortages, such as trucks parked on shoulders and ramps can be found in areas where demand approaches supply, but does not exceed it. Parking problems occurring in areas where parking is available may be due to a lack of information for truck drivers. Therefore, states looking to improve parking availability and behavior must consider providing information about parking, as well as providing additional spaces. This section explores the advantages and disadvantages of different approaches to improving parking information and capacity.

Parking problems and shortages vary over time and geography; Phoenix's parking context and needs are likely to be different than the parking context and needs along rural I-40. It is important to keep in mind that no single solution is one-size fits all, and improving parking with limited resources will require a suite of solutions tailored to Arizona's unique human and physical geography.

Potential solutions to Arizona's parking issues will vary based on geography, available assets, and whether parking shortages are perceived or real.

Figure 4-1 provides an overview of the solutions presented in this section, organized from low-cost, short-term information solutions, to higher-cost longer-term capacity solutions.

Figure 4-1: Truck Parking Solution Continuum

Source: CPCS

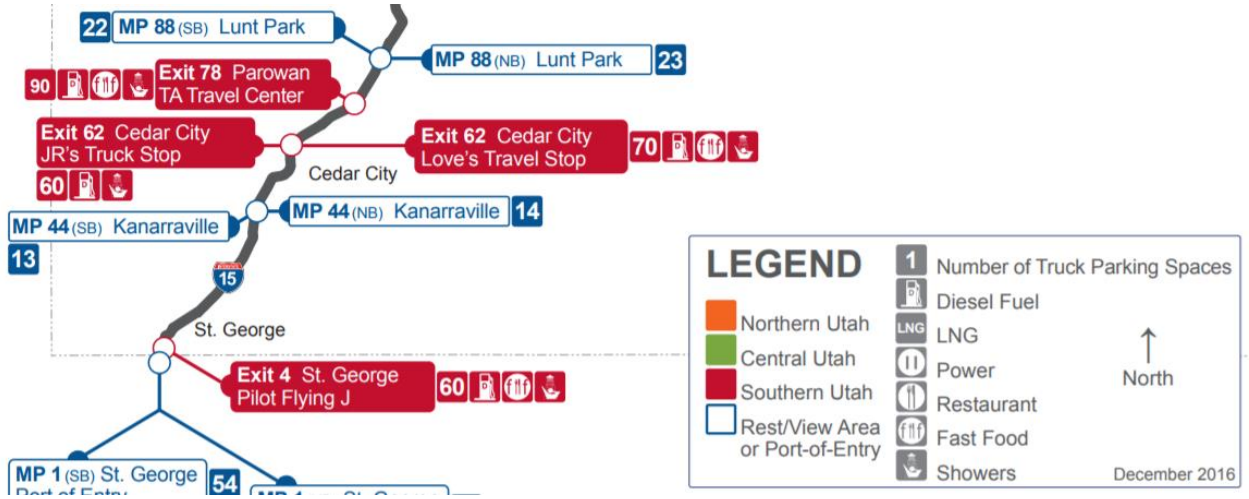
4.2 Information Solutions

The emergence of inappropriate parking prior to actual shortages is a product of truck driver's decision making processes, described in Figure 2-1. Truck drivers cannot afford to spend too much time and fuel searching for parking. If drivers believe all nearby parking areas are full, or if they run out of driving time, they may either choose or be forced to park in unauthorized areas. However, greater knowledge of nearby parking facilities and parking availability may help drivers utilize available spaces, reducing incidences of inappropriate parking. The information solutions presented here seek to improve the quality and timeliness of information available to truck drivers with the goal of routing them to available parking.

4.2.1 Parking Maps

Previous research from the late 2000's found that truck drivers are often unaware of the parking options along highways, especially if they are traveling a new route.[37] A cost-effective method of improving information about trucking facilities is the creation of online and printed truck parking maps listing parking locations and amenities. Three other western states, Utah, Wyoming, and Washington have created simple maps that can be distributed to drivers. Similar work could be done in Arizona using pre-existing data on parking capacity at rest areas and truck stops. Figure 4-2 shows an example of some of Utah's truck parking map, which was designed to fit within the storage pockets of a truck's sun visor.

Figure 4-2: Southern Utah Truck Parking Map



Source: Utah Department of Transportation. 2016.

The advantages of truck parking maps are their low cost and easy to create. However, the information may become outdated after printed (although electronic versions and parking websites can be easily updated). Also, the maps do not relay information about the availability of parking at a given facility. Therefore, these maps are best suited to rural areas with adequate parking, where drivers may not want to exit the highway to see what amenities are available.

[37] Adams, Teresa, et al. *Low Cost Strategies for Short Term Parking on Interstate Highways of the MVFC*. 2009.

4.2.2 Static Parking Signs

Static roadside signs like the example in Figure 4-3 are another low-cost option to provide drivers with information on parking amenities. Like maps, static sign options are best-suited for rural areas with adequate parking, but where truck drivers may have insufficient information about parking locations and amenities. Signs have the additional downside of potentially being more expensive than maps, and they cannot aid truck drivers in advance planning in the same way a map can.

Figure 4-3: Truck Sign

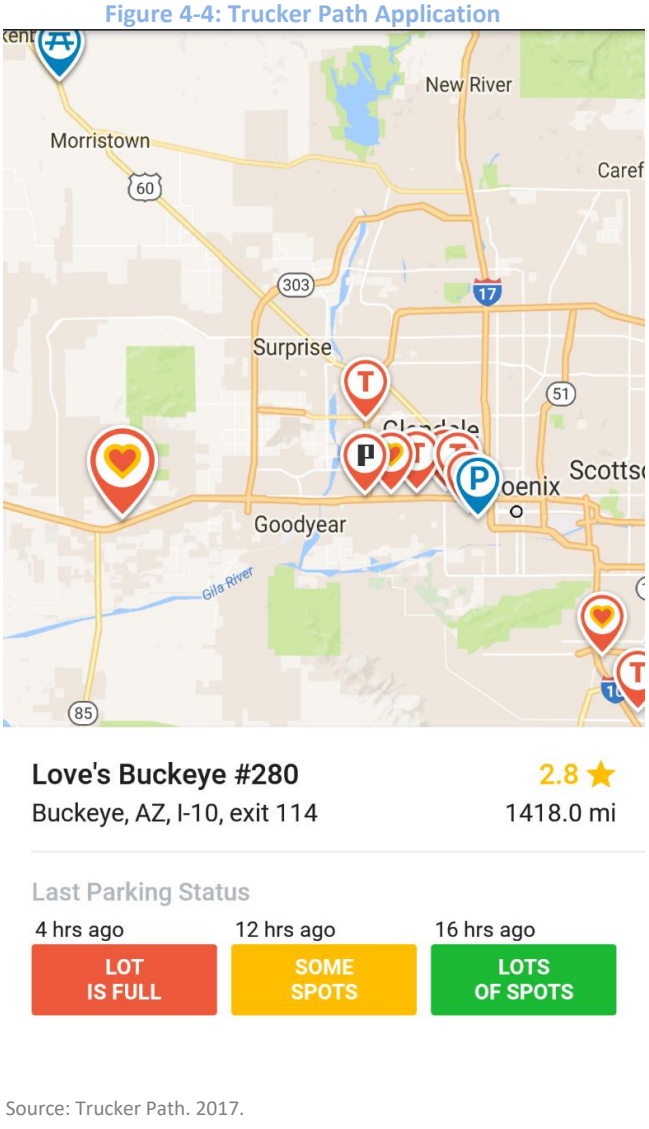
Source: Florida DOT. 2016.

4.2.3 Mobile Applications and Websites

The static nature of signs and maps makes them less useful in areas where parking demand approaches supply, and drivers may think that parking spaces are unavailable. In these circumstances, drivers need information about the real-time availability of parking. One means of providing this information is through mobile device applications or websites that are updated in close to real time.

The widespread acceptance of mobile devices, such as smartphones, has created an ideal platform for collection and/or communication of parking availability information. A good example is the Trucker Path mobile application, which enables truck drivers to rate the availability of parking at a rest area. This availability information is available to other drivers in real time. A screenshot of Trucker Path's map and information is provided in Figure 4-4.

Figure 4-4: Trucker Path Application



Source: Trucker Path. 2017.

Mobile applications and websites have the advantage of providing truck drivers with near real-time information on the availability of parking. They also have the benefit of being easily updated to reflect new or closed parking options. Additionally, the data collected by these systems may be stored for later analysis, making such systems potentially valuable for analysis of problems or solutions over time.

The biggest disadvantage of mobile applications and websites is that they may contribute to distracted driving if truck drivers use them while driving. Additionally, some applications, like Trucker Path listed above, rely on crowd-sourced responses from truck drivers to generate information on parking availability. Depending on adoption of the application and availability, updates may be infrequent, or inaccurate.

In addition to crowdsourced data, some websites and apps rely on truck stops to update information. Some applications are specific to one chain of truck stops, such as TravelCenters of America. Other approaches include information collected from specially-built roadside and parking lot infrastructure, which is discussed below.

4.2.4 Truck Parking Information and Management Systems

An emerging solution to information problems are systems designed to automatically collect and communicate parking availability information to truck drivers. Using ITS infrastructure such as cameras or in-pavement sensors, parking availability at individual facilities can be calculated, and availability information can then be communicated to truck drivers via a variety of means, including mobile applications, websites, and roadside variable message signs. These information systems are intended to be deployed across a long corridor, with the intention of maximizing parking utilization, and therefore minimizing parking problems across a wide area. Currently, at least thirteen states have some form of automated parking system in use or in development.[38] These information systems rely on two separate sets of technology: detection and communication equipment.

Parking Availability Data Collection

Existing truck parking information systems may use sensors in each parking space, entrance/exit sensors, or computer-analyzed video camera feeds to calculate the number of spaces available at a parking facility. Figure 4-5 shows one system, which uses in-ground magnetic sensors to detect trucks in parking spaces. The value of specific detector types varies based on parking facility layout, climate, and on-site internet connections. For example, automated video cameras can determine parking counts for a large area, but may require a fast internet connection, and may malfunction in low-visibility conditions like snow or dust storms. Other technology, like truck detectors placed within the pavement of individual parking spaces work well in a variety of conditions, but cannot be easily moved to accommodate new parking patterns.

Figure 4-5: Parking Space Occupancy Sensors at a Public Rest Area

Source: Florida DOT. 2016.

[38] *National TPIMS Projects*, 2017. Truckparkhere.com.

Therefore, application of specific detection technology has often been determined state-by-state, or even site-by-site basis.

Communicating Parking Availability

Once parking information is collected, it must be transmitted to drivers. Two commonly-used methods are virtual message signs that display parking availability at upcoming exits, or parking websites. One ongoing project, the Midwestern Truck Parking Information and Management System (TPIMS), will also use a real-time data feed to provide availability data to 3rd parties, including privately-developed mobile applications.

Truck parking information systems have the benefits of providing real-time information, and the ability to archive information about parking utilization over time. However, these systems come with the downside of high costs associated with the installation and maintenance of parking detection infrastructure, as well as the cost of maintaining internet connections and back-end data storage equipment. Furthermore, these systems are a relatively new technology, and there is not yet evidence that implementation actually improves parking utilization and decreases parking problems across a corridor. The Midwestern system mentioned above will undergo an extended period of performance measurement, which may shed light on the true efficacy of these systems.

4.3 Capacity Solutions

While improving information can help truck drivers "fill in the gaps" of available parking, information systems will be inadequate for areas where truck parking demand routinely exceeds supply. In these areas, often metropolitan areas with high densities of freight establishments, additional truck parking spaces are often needed. The major downside of capacity solutions is their higher cost of creation and maintenance relative to most information solutions.

4.3.1 Public-Private Partnerships and Public-Public Partnerships

P3s offer governments an opportunity to defray the cost of increasing parking capacity. The 2011 *Statewide Rest Area Study* provided insight into potential forms of P3s for truck parking.

First was the Federal Interstate Oasis Program, which allowed states to partner with private truck stop operators who would expand available parking at their facilities. In exchange for the additional parking, the state would provide limited advertising signage for the facility on nearby interstate highway corridors. A second option would be leasing state land to a private partner who would construct and operate truck parking facilities, as well as other commercial services. Under this model, private operators would save on land costs, while states would not have to pay for development of facilities. A third option was rest area sponsorship, where private partners could fund services at public rest areas in exchange for advertising rights.

Public-private or public-public partnerships could also help states tap into underutilized parking assets for large venues like sports stadiums, which may sit empty many nights of the year, and

Figure 4-6: Unused Stadium Parking in Phoenix

Source: Visit Phoenix. 2017.

could accommodate large numbers of trucks on days when parking for special events is not needed. These facilities may also have the added benefit of previously-established on-site lighting, security fencing, bathrooms, and trash collection. In Phoenix, a unique option for the creation of additional truck parking could be the adaptation of unused rental car lots adjacent to Sky Harbor, or use of vacant parking at the University of Phoenix Stadium or Arizona State Fairgrounds. Solutions that leverage unused spaces have a unique downside: truck parking will not be available every night, and truck drivers must be informed of when parking is and is not open.

Another form of partnership could be joint construction and operations of rest areas with other state agencies. For example, the Minnesota DOT and Department of Natural Resources have partnered to jointly construct and operate two state park visitor centers and highway rest area facilities adjacent to a major regional truck route. Combining visitor center and rest area functions in one building and parking area helps both agencies save on construction, staff, and maintenance costs. However, this option may be highly location-dependent, and limited to specific geographies where parking needs and other agencies' work overlap.

4.3.2 Re-Opening Closed Rest Areas

Figure 4-7: Truck-Only Rest Area

Source: Missouri DOT. 2016.

Re-opening closed rest areas with either full or partial amenities can help states save money on upfront construction costs, although this option will require the state to pay maintenance in the future. Arizona has already taken this step in one area, with the full-reopening of the Mohawk rest area in 2017. Another option is re-opening closed rest areas or weigh stations as "truck parking only" facilities with minimal amenities. The Missouri DOT has used this approach to provide additional truck parking at a lower cost. The re-opened truck parking areas, like the one shown in Figure 4-7, are only equipped with a vault toilet, picnic tables, and a garbage can, so maintenance requirements are much lower. In Arizona, this option might be feasible for the closed rest areas.

4.3.3 Constructing New Rest Areas

Construction of new rest areas for parking may be a less favorable option at a time when many states are closing rest areas as a cost saving measure. The *Statewide Rest Area Study* noted that

I-10 between Texas Canyon and San Simon, and I-17 between the McGuireville Rest Area and Flagstaff are areas with a particularly high incidence of truck parking issues, and potential areas for new rest stop development. However, given the high time and cost investment associated with constructing an entirely new rest area, other options, such as P3s, and re-opening limited facilities may be more favorable choices for a resource-constrained DOT.

4.4 Summary of Best Practices

4.4.1 Solution Best Practices

Determining best practices for parking solutions is difficult for two reasons: 1) solutions must be tailored to unique geographic areas, and 2) states are only just beginning to implement and evaluate the efficacy of different solutions. However, initial work on information systems like the Midwest TPIMS project suggests that parking issues should be approached from a corridor-wide perspective, instead of focused on specific locations. Taking a "wider" perspective at either a state or multi-state level will help decision makers understand how truck drivers are making parking decisions, and how those decisions are impacted by either a lack of information or geographic considerations. Once parking phenomena along a corridor is understood, DOTs can tailor the placement and type of solutions to maximize parking benefits.

A regional or corridor-wide approach to truck parking can help researchers determine efficient information and capacity solutions.

Arizona's work with the I-10 Western Connected Freight Corridor could serve as a starting point for understanding parking issues along a long corridor. An example of this corridor approach is shown in Figure 4-8, which was created as part of truck parking research for seven states along I-90 and I-94.

Figure 4-8: Map of Corridor Parking Problems

Source: Northwest Passage Freight Task Force. 2017.

4.4.2 Outreach Best Practices

Outreach requires time and consideration from stakeholders who may often be busy or reluctant to speak with the government. One of the first steps of successful outreach is developing a clear and concise goal for what a parking project will accomplish, and a specific description or vision of how that project will benefit each stakeholder group, truck drivers in particular. Having a clear set of benefits will help make stakeholders feel that their time and feedback is valued and that they may receive some return on the investment of their time.

A clear and concise goal and vision for the project can help incentivize and improve stakeholder engagement.

A state trucking association, like the Arizona Trucking Association, can be a key partner for outreach, as trucking staff can help can help research staff connect with truck drivers and companies to distribute surveys or solicit consultations. Not only does this relationship open doors for DOT or consultant staff to gather information, it also gives truck drivers a channel to provide feedback on ongoing research efforts.

In terms of methodology, surveys, and consultations have enabled successful outreach at both the state and national level. Surveys are beneficial because they can be distributed, collected, and analyzed in a relatively time-effective manner. However, they may provide limited insight into the nature of specific parking problems in specific locations, and surveys long enough to capture such detail may be too time consuming. Therefore, in-person or phone consultations are a good compliment to surveys, as they can capture greater depth, and allow researchers to more efficiently direct their line of questions. However, consultations have the downside of

being very time consuming relative to surveys, and therefore they cannot be used to collect information from as many people as would be possible with surveys.

5 Next Steps

Key Messages

The project team will use the insights from existing studies and define the factors affecting truck parking demand in Arizona. These factors include the primary concerns of the trucking industry, impact of the ELD mandate, truck parking needs, and future issues affecting truck parking in Arizona.

5.1 Next Steps

The next step of this research project will be an identification of truck parking demand factors. The key questions assessed in this phase include:

- What are the primary truck parking concerns of the trucking industry in Arizona?
- What demand factors, including freight activity, traffic volume, hours of service regulations and other issues affect truck parking demand statewide?
- What is the expected impact of the ELD mandate on truck parking in Arizona?
- What are the truck driver's parking needs and how do these needs differ by long-haul and short-haul (urban) operations?
- What other factors are expected to affect truck parking availability in the future?

The approach and answers to these key questions will culminate in Working Paper 2 – Factors Affecting Arizona Truck Parking Demand.