Truck Parking Inventory and Utilization Memo

WA 3: Truck Parking Study, Task 2.3/2.4/2.7
Final 1: February 28, 2020
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### Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Full Form</th>
</tr>
</thead>
<tbody>
<tr>
<td>AADTT</td>
<td>Annual Average Daily Truck Traffic</td>
</tr>
<tr>
<td>ADS</td>
<td>Automated Driving Systems</td>
</tr>
<tr>
<td>ATCMTD</td>
<td>Advanced Transportation and Congestion Management Technologies Deployment</td>
</tr>
<tr>
<td>ATM</td>
<td>Automated teller machine</td>
</tr>
<tr>
<td>ATRI</td>
<td>American Transportation Research Institute</td>
</tr>
<tr>
<td>CMV</td>
<td>Commercial Motor Vehicle</td>
</tr>
<tr>
<td>DFW</td>
<td>Dallas-Fort Worth</td>
</tr>
<tr>
<td>ELD</td>
<td>Electronic logging device</td>
</tr>
<tr>
<td>TxDPS</td>
<td>(Texas) Department of Public Safety</td>
</tr>
<tr>
<td>FHWA</td>
<td>Federal Highway Administration</td>
</tr>
<tr>
<td>FMCSA</td>
<td>Federal Motor Carrier Safety Administration</td>
</tr>
<tr>
<td>GPS</td>
<td>Global Positioning System</td>
</tr>
<tr>
<td>H-GAC</td>
<td>Houston-Galveston Area Council</td>
</tr>
<tr>
<td>HOS</td>
<td>Hours of Service</td>
</tr>
<tr>
<td>MAP-21</td>
<td>Moving Ahead for Progress in the 21st Century Act</td>
</tr>
<tr>
<td>MPO</td>
<td>Metropolitan Planning Organization</td>
</tr>
<tr>
<td>NAFTA</td>
<td>North American Free Trade Agreement</td>
</tr>
<tr>
<td>NCTCOG</td>
<td>North Central Texas Council of Governments</td>
</tr>
<tr>
<td>ODD</td>
<td>Operational Design Domain</td>
</tr>
<tr>
<td>ROW</td>
<td>Right of Way</td>
</tr>
<tr>
<td>SAE</td>
<td>Society of Automotive Engineers</td>
</tr>
<tr>
<td>SH</td>
<td>State Highway</td>
</tr>
<tr>
<td>STAC</td>
<td>State Transportation Advisory Committee (Pennsylvania)</td>
</tr>
<tr>
<td>TA</td>
<td>Travel Centers of America</td>
</tr>
<tr>
<td>TFMP</td>
<td>Texas Freight Mobility Plan</td>
</tr>
<tr>
<td>THFN</td>
<td>Texas Highway Freight Network</td>
</tr>
<tr>
<td>THT</td>
<td>Truck-hours traveled</td>
</tr>
<tr>
<td>TTI</td>
<td>Texas Travel Institute</td>
</tr>
<tr>
<td>TxDOT</td>
<td>Texas Department of Transportation</td>
</tr>
<tr>
<td>US DOT</td>
<td>United States Department of Transportation</td>
</tr>
<tr>
<td>WiFi</td>
<td>Wireless Fidelity</td>
</tr>
</tbody>
</table>
1.0 Introduction
The safe and efficient movement of freight depends on adequate and strategically located truck parking. Hours-of-service (HOS) regulations require drivers to rest at defined intervals, causing them to search for truck parking before their allowable drive time expires or while staging for their pick-up and delivery slots. The more scarce truck parking is, the sooner drivers must begin searching for parking, resulting in lost productivity and higher shipping costs. Truck parking shortages can also lead to parking in unauthorized locations and result in a safety hazard for both the driver and the motoring public. Assessing the current condition of truck parking was identified in the 2018 Texas Freight Mobility Plan (TFMP) as an immediate need and a comprehensive examination and plan for truck parking was one of the short-term policy recommendations.

1.1 Study Purpose and Tasks
The purpose of this study is to conduct a statewide truck parking evaluation that will assess the current supply and demand for truck parking in Texas, identify truck parking needs, recommend solutions, and develop solutions to address existing and future parking gaps and needs. The study will develop actionable strategies to meet truck parking needs across the state, promote partnerships with the private sector, enhance safety, reduce congestion, and improve efficiency on the Texas Highway Freight Network (THFN) shown in Exhibit 1.

The various tasks within this study are shown in Exhibit 2. This memo contains information for Tasks 2.3 and 2.4 (Truck Parking Inventory and Utilization) and portions of Task 2.7 (Conditions: Truck Parking Demand).

Parked trucks at a rest area outside of San Antonio, Texas
Source: Cambridge Systematics (2019).
Exhibit 1: Texas Highway Freight Network

Source: TxDOT.
This inventory and utilization of authorized truck parking locations is the foundation on which the analysis and technical reports will be built. To frame where this report fits in to the final report, the technical assessments and reports included in this effort are summarized below.

- **Truck Parking Inventory and Utilization of Authorized Locations (Tasks 2.3 & 2.4, and the subject of this report)** – An inventory and the attributes of all known and authorized truck parking locations across the state will be collected from a variety of sources. The utilization of authorized sites by time of day, day of week, and for what purpose will also be analyzed.

- **Truck Parking Demand in Dedicated and Unauthorized Locations: the Impacts of Truck Parking Deficiencies (Task 2.5)** – Building on the utilization analysis in the prior step, a more in-depth assessment of demand for truck parking will be conducted to identify common areas, patterns, and reasons for unauthorized parking.

- **Crash Data Analysis Related to Trucks on Highways and Ramps (Task 2.6)** – Truck involved crash statistics for the latest 5-year history will be analyzed to document and map the highest crash locations and overlay those crash statistics with the truck parking inventory and demand analysis.
- **Truck Parking Demand (Task 2.7, partially included in this report)** – Using the FHWA truck parking model and established improvements upon it, demand for truck parking in interstate corridors will be estimated. Additional considerations such as American Transportation Research Institute (ATRI) Global Positioning System (GPS) data, identified parking patterns, closures, and freight origins and destinations will be used to characterize demand for truck parking.

- **Freight Forecast and Impact on Truck Parking (Task 2.8)** – Future freight volumes will be forecasted to estimate future truck parking demand.

- **Truck Parking Impacts on Safety (Task 2.9)** – Building on the Crash Data Analysis (Task 2.6) an assessment will be conducted of how strategic truck parking improvements—such as increased capacity, improved technology, or physical changes to existing truck parking facilities—can provide safer operations for truck drivers, passenger vehicles, and local communities.

- **Summarize Truck Parking Needs (Task 2.10)** – Utilizing the information gathered in previous tasks, truck parking needs and issues will be summarized by type of concern (e.g., staging, short-term, long-term, or overnight truck parking).

- **Recommendations (Task 2.12)** – A range of short, medium, and long term policies, programs, and projects to address Texas’ current and future truck parking needs will be presented, along with an assessment of estimated costs, potential funding sources, and an analysis of key factors influencing, and affected by completing the recommendations.

- **Actionable Steps for Recommended Solutions (Task 2.13)** – A set of actionable steps for each recommended solution will be developed, describing the sequence of activities which must occur for the concept to be fully realized.

### 1.2 Definitions

There are a number of terms used when discussing truck parking, often describing very similar concepts and sometimes used interchangeably. For purposes of this study, the following terms and definitions apply:

- **Location** – specific site with authorized truck parking.
- **Inventory** – number of truck parking spaces at a location.
- **Capacity** – number of truck parking spaces in a given geographic area (TxDOT District, statewide, corridor, etc.).
- **Demand** – how many trucks would park at a location or geographic area if there were sufficient space.
- **Utilization** – how many trucks are parked at a location or in a geographic area at a given time.
Percent Utilization – the number of trucks parked at a location or in a geographic area at a given time compared to the inventory or capacity. This number, expressed as a ratio or percent shows if a location or area has an excess or gap of truck parking spaces.

1.3 Organization of the Report
The remainder of this report is organized into the following sections:

- Section 2 provides information on truck parking supply (inventory and capacity).
- Section 3 explores two approaches to analyzing demand.
- Section 4 examines raw utilization at TxDOT-owned truck parking locations.
- Section 5 examines raw utilization at the district and corridor levels.
- Section 6 discusses a number of issues that are currently or may in the future impact the demand for truck parking.
- Section 7 provides a summary and discussion of next steps.
- Appendix A includes details for the Federal Highway Administration (FHWA) demand methodology.
- Appendix B includes information on the ATRI GPS data set.
2.0 Calculating Truck Parking Supply (Capacity and Inventory)

Accurately identifying authorized truck parking capacity—an inventory of the number of spaces at both public and private truck parking locations—is a critical first step to understanding the scope of truck parking challenges in Texas. When compared against the demand for truck parking and utilization of this inventory (Sections 3 and 4), the gap or need for parking can be determined. Some considerations for developing this inventory include:

- What data sources are most accurate? What happens when data sources contradict actual truck parking attributes (number of spaces, amenities, etc.)?
- What is the definition of a truck parking space? Is the definition different for the public sector and the private sector?
- What is the minimal information to include a site on a list published by a public agency?
- What makes a space authorized or unauthorized?

Calculating an accurate inventory at authorized truck parking locations in Texas requires developing consistent answers to these questions. That task is the subject of this section.

Note that the inventory used in this and following memos is based on locations open as of February 2018. Locations opened after February 2018 (the last dates for data from the American Transportation Research Institute) would not have a full set of utilization data available and would skew utilization in the locations and districts where collected. Additional inventory opened between February 2018 and June 18, 2019 (the date that truck parking inventory data from the American Truck Parking website was received) is noted in the District Profiles included in Appendix A of the “Truck Parking Demand in Dedicated and Unauthorized Locations” Memo is current as of June 18, 2019. This is the date that New locations opened after this date will be noted when possible but not included in the analysis.

2.1 Key Findings and Observations

Below are some key findings and observations that will be presented in the remainder of this section.

- There are approximately 482 privately owned truck stops in Texas with fuel available for purchase and 10 or more spaces, with a combined total of nearly 25,000 spaces. The largest one is located in Laredo and offers 336 truck parking spaces.¹
- Out of the 177 publicly owned truck parking lots in Texas, the largest one in terms of truck parking spaces is the Hill County Rest Area with 60 spaces in each direction of travel.

¹ Note that two locations with a total of 420 spaces offer truck parking space for rent but do not include fuel are included in the inventory. One is located in Ft. Worth (Park My Truck 24/7 – 400 spaces) and one in Hutto (Hutto Truck Parking & Storage – 20 spaces). Section 2.3.2.3 offers further information about these facilities.
There are approximately 2,324 truck parking spaces at publicly owned location, accounting for approximately 8.5 percent of the statewide capacity. This small percentage of all locations is to be expected since public truck parking locations are typically smaller and in rural areas where private truck stops are less likely to be located and services are unavailable. These types of lots allow drivers to maximize their hours of service by providing truck parking between private truck stops at safe, quiet locations with minimal amenities.

The TxDOT districts with the highest capacity of publicly and privately owned spaces, all in excess of 2,000 spaces, are Houston, Dallas, and San Antonio. Eight additional districts have between 1,000 and 1,999 total spaces. Districts with the lowest total capacity include Austin (362), Lufkin (352), and Brownwood (306).

Across most of the Interstate Highway network in Texas, a driver will be able to find an authorized truck parking location within a 30 minute drive. On the less traveled, but still important, US Highway network drivers may have to drive an hour or more to find an authorized truck parking location. Note that this is based on inventory only—a specific truck parking space may be occupied at any given time and therefore not available. Additionally, congestion and time of day may influence travel times.

This truck parking capacity is serving approximately 746,000 truck trips per day, a number that is expected to grow to more than one million trips per day by 2045.2

2.2 The Attributes of a Truck Parking Location
In order to be of use to truck drivers, state and federal agencies, and the general public, key information must be available for each truck parking location. This information is used for both technical analysis and for reporting purposes. Additional attributes about truck parking locations are desirable to track for categorization and reporting, but information is not consistently reported by truck parking location owners or the aggregators of such information. The inventory will capture these optional attributes when they are provided, but they will not be consistently known for analysis or reporting purposes. Exhibit 3 presents the attributes that are relevant to a truck parking location.

2.2.1 Key Attributes
The following attributes are required for every truck parking location added to the TxDOT inventory database. Without these attributes, the location was not included.

- **Brand/Agency** - The brand associated with a private sector location or the agency associated with the public sector location is necessary for labeling purposes. For example, the brand on the signage, such as “Road Ranger” or “Flying J” is sufficient. For locations operated by a public sector agency, the agency name should be listed.

---

- **Private/Publicly Owned** - A simple flag denoting the type of ownership (private- or public-sector) is needed for reporting and categorization.

- **Inventory** - An accurate representation of the number of spaces available is needed. In many cases, this estimate will still be an approximation provided by either the location owner or the data source used to capture the information. Reasonable efforts must be made to identify an appropriate inventory.

- **Location – Street Address** - Street addresses are useful to maintain for reporting purposes, even though latitude and longitude will be utilized for all technical analyses. For publicly owned properties on limited access highways, the highway number and nearest mile marker may be utilized.

- **Location – Latitude / Longitude** - Geocoding is needed for all of the technical analyses. If the information provider only provides a street address, publicly available mapping programs are able to generate the latitude and longitude.

- **Facility Type** - Categorization for reporting and analysis purposes such as “Safety Rest Area,” “Parking Lot,” “Long Term Storage,” “Diesel Fuel,” “Restaurant,” “Retail,” etc. is needed to classify inventory. Certain facility types were not included in this analysis (e.g. “Restaurant”) so without this information, the location cannot be properly identified.

- **Duration Allowed** - Limitations on parking hours or duration are important to understand. For dedicated truck stops, both short term and overnight truck parking are generally allowed. For retail and food service establishments, however, there may be limitations on truck parking hours or duration.

- **Data Source** - Tracking the data source is important for understanding accuracy of information. For example, was it from the lot owners, or information provided by one or more drivers?

**Exhibit 3: Key and Desirable Attributes to Track Regarding Specific Truck Parking Locations**

<table>
<thead>
<tr>
<th>Attribute</th>
<th>Key</th>
<th>Desirable</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brand/Agency</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Optional Title</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Private/Public</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Inventory</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Street Address</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Latitude/Longitude</td>
<td>Yes, but can be derived if only street address is known</td>
<td></td>
</tr>
<tr>
<td>Data Source</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Attribute</td>
<td>Key</td>
<td>Desirable</td>
</tr>
<tr>
<td>----------------------------</td>
<td>-----------</td>
<td>-----------</td>
</tr>
<tr>
<td>Facility Type</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Duration Allowed</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Parking Surface</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Fee or Purchase Required</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Reserved Spaces</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Restrooms</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Private Showers</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Fuel for Purchase</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Food for Purchase</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Retail</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>ATM/Cash Facilities</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Repair Facilities</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Pet Facilities</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Transit Stop</td>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>Telephone Number</td>
<td></td>
<td>Yes</td>
</tr>
</tbody>
</table>

Source: Cambridge Systematics (2019).

2.2.2 Desirable Attributes to Track

Many providers of truck parking have additional services beyond the parking itself. Not all of these attributes will be tracked by every information provider, but it is reasonable to expect that the information provided is accurate.

- **Optional Title** - Location title can be useful to distinguish specific locations of a similar chain. For example, the Love’s truck stop in Fort Worth near Exit 40 of I-35W is known as “Love’s #281,” and placing that text string into Google Maps will yield driving directions to that specific location.

- **Parking Surface** - Inventory estimates for paved and striped lots are more accurate and consistent than for unpaved or unstriped lots.

- **Telephone Number** - A phone number allows a researcher to call the facility if needed.

- **Amenities Available** - While the key facility type attributes provide a general impression of the lot’s likely amenities, the specific amenities available to drivers are indicators of how desirable the location may be.
  - **Reserved Spaces** - This attribute contains information regarding whether reserved spaces are available for a fee.
- **Purchase/Fee Required** - This attribute contains information regarding whether a driver must pay a fee or make a food or retail purchase in order to use the parking facility.

- **Fuel for Purchase** - This attribute contains information on whether fuel is available for purchase, and if known, the number of fuel bays.

- **Restrooms** - This attribute contains information regarding whether fixed, portable, or no restrooms are available.

- **Private Showers** - This attribute contains information regarding whether private showers are available for drivers.

- **Repair Facilities** - This attribute contains information regarding whether truck repair facilities are provided. Many larger truck stops have both tire repair and light maintenance facilities on site.

- **Automated Teller Machine (ATM)/Cash Advance** - This attribute contains information regarding whether an automated teller machine or a cash card system such as Comchek or Western Union are available.

- **Retail** - This attribute contains information regarding whether retail items are available for purchase beyond a convenience store attached to a diesel gas station.

- **Food for Purchase** - This attribute contains information regarding whether food is available for purchase.

- **Pet Facilities** - This attribute contains information regarding whether comfort facilities are available for a driver’s pets. Pet ownership by drivers and the availability of relevant facilities were a frequent theme in stakeholder outreach sessions.

- **Transit Stop** - This attribute details to the facility visitor whether a posted mass transit stop is available either at the parking location or within 1/5th of a mile.

### 2.2.3 Authoritative vs. Secondary Sources of Information

An important item to consider when compiling information about truck parking locations is the level of authority of the information. An example of an authoritative source is the website of a major truck stop that informs the public of the number of truck parking spaces and amenities available at that location. Ideally, TxDOT would be able to receive information directly from each provider in a format where all of the attributes from Exhibit 2 are tracked accurately and precisely, and providers would proactively update information as needed.

Truck parking information is widely distributed to the public but opinions vary among stakeholders even on fundamental questions such as “what constitutes an authorized truck parking space?” Meanwhile, not all owners of authorized truck parking make their information easily obtainable or include details such as if food or restrooms are available. As a result, multiple secondary sources of information have arisen in the industry, the most common are apps such as Park My Truck, American Truck Parking, and Trucker Path. These
Secondary sources are generally useful to a truck driver but are more challenging when it comes to using their information for analysis and setting public policy.

Secondary sources have been used during inventory development but with caution. Exhibit 4 describes some of the challenges found with secondary sources. Section 2.3.2 describes the decisions made on what sources were chosen and how they were filtered to maintain an acceptable level of accuracy and precision.

**Exhibit 4: Characteristics of Authoritative vs. Secondary Sources of Truck Parking Inventory Data**

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Authoritative Sources</th>
<th>Secondary Sources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location Information</td>
<td>Precise and accurate</td>
<td>Generally precise, but sometimes street address is approximate</td>
</tr>
<tr>
<td>Owner Information</td>
<td>Precise and accurate</td>
<td>Generally accurate</td>
</tr>
<tr>
<td>Inventory Information</td>
<td>Generally but not always accurate</td>
<td>Will frequently be an approximation</td>
</tr>
<tr>
<td>Amenities</td>
<td>Accurate if provided, but not always provided</td>
<td>Unknown level of accuracy</td>
</tr>
<tr>
<td>Example</td>
<td>TxDOT Jason’s Law submission</td>
<td>Park My Truck application</td>
</tr>
</tbody>
</table>

Source: Cambridge Systematics (2019).

**2.2.4 Crowdsourcing: Strengths and Limitations**

Part of the challenge with secondary sources is that the number and quality of the inputs varies. Some secondary sources focus on “crowdsourcing,” providing a platform where truck parking owners, drivers, and other stakeholders can add information about specific locations—making them popular with drivers. Much of the information in crowdsourced data sites is both accurate and precise. There are enough situations with potentially inaccurate crowdsourced data, however, that care must be taken in what to include and what needs to be discarded.

Much of the disconnect comes back to the definition of what constitutes an authorized truck parking space, versus a location where a driver can park their truck and likely not be cited by police or towed by the property owner. As a result, crowdsourced data sites typically overstate the inventory of authorized truck parking, especially when representing retail, food service, and municipal street parking locations. Several frequent examples include:

- A restaurant is stated to have 5 truck parking spaces. Visually inspecting the site using a tool such as Google Maps, it is clear that the truck parking is in a vacant lot near the restaurant, possibly not owned by the same owner as the restaurant property. There is no way of knowing for certain if the vacant lot owner authorized the trucks to park there.
- A location in a small town is identified, and the comment is that “the town does not tow parked trucks.” Once again, this is not enough information to determine if the municipal ordinance allows truck parking or the municipality does not have the resources to conduct enforcement.

- A truck parking location is listed, but no inventory is given. As a result of a key attribute not being available, the information cannot be utilized. A location is listed, but the address is listed in a format similar to “Interstate xxx, Exit yyy.” Without sufficient detail to allow automated geocoding, the information cannot be utilized.

These challenges do not mean that crowdsourced information should be discarded. For example, for county or MPO-level truck parking studies, crowdsourced information can be used as a starting point for organizing field observations and surveys. But using crowdsourced data as a whole without filtering will cause challenges in analyses and recommendations. Crowdsourced information has been carefully evaluated and considered for use in this statewide study, and Exhibit 5 presents recommendations for this study. The data sources are further described in Section 2.3.2.

**Exhibit 5: Recommendations on Using Crowdsourced Data Regarding Truck Parking Inventory**

<table>
<thead>
<tr>
<th>Situation</th>
<th>Decision with Crowdsourced Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Authoritative Data Exists Elsewhere</td>
<td>Discard the crowdsourced data.</td>
</tr>
<tr>
<td>Information Regarding Fuel Providers</td>
<td>Use.</td>
</tr>
<tr>
<td>Information Regarding Retail/Food Providers</td>
<td>Discard, as the authorization to utilize the truck parking cannot be verified or assumed to be consistent over time.</td>
</tr>
<tr>
<td>Inventory Differences Across Data Providers</td>
<td>Spot-check a sample and prioritize which provider’s estimate to utilize when available.</td>
</tr>
<tr>
<td>Providers Refuse to Provide Exportable Data Formats</td>
<td>Discard. Some providers expressly refuse to provide data in a usable format, and these sources were not used in this study.</td>
</tr>
</tbody>
</table>

Source: Cambridge Systematics (2019).

### 2.2.5 Aggregating Inventory by Geography

One characteristic of truck parking is that many private sector facilities tend to be clustered along specific exits off of limited access facilities. Each individual facility is independently tracked, allowing reporting on topics such as the largest sites and the sites with the most parked trucks from the sample. In addition, it is important to be able to aggregate hundreds of sites into a smaller number of zones suitable for reporting, prioritization, and regional gap analyses. Based on consultation with TxDOT staff, the following decisions have been made regarding aggregation:

- In general, sites will be aggregated to the TxDOT district level, comprised of 25 districts as shown in Exhibit 6.
Exhibit 6: TxDOT Districts

2.3 Inventory Sources
The following section identifies known sources of truck parking inventory data and discusses the challenges inherent in creating a comprehensive and accurate supply inventory. An initial analysis of that inventory is provided in the following section.

2.3.1 Truck Parking Inventory Owned by the Public Sector
Truck parking inventory owned and published by public sector agencies such as TxDOT, counties, and municipalities are considered authoritative for the purpose of this study. Although the information updates may lag, in general they are a dependable source of accurate data.

2.3.1.1 Inventory Owned by TxDOT
The project team obtained two sources of information from TxDOT regarding publicly owned, authorized truck parking inventory. One source is the 2019 submission made by TxDOT to the Federal Highway Administration regarding authorized government-owned inventory. This information is being collected as part of Section 1401 of the Moving Ahead for Progress in the 21st Century Act, commonly called “Jason’s Law.” Exhibit 7 summarizes the characteristics of that submission.\(^3\)

The other source of information was compiled by TxDOT and support staff during the application process for the "I-10 Corridor Coalition Truck Parking Availability System" Advanced Transportation and Congestion Management Technologies Deployment Grant in 2018. During the grant application process, additional publicly owned truck parking locations along I-10 were identified.\(^4\)

2.3.1.2 Inventory Owned by Counties or Municipalities
At this time, no information has been solicited or received from counties or municipalities regarding authorized truck parking lots owned by these sources. Crowdsourced information regarding municipal street parking will not be utilized, as its veracity cannot be easily ascertained, nor is it available in an exportable data format. It is likely that municipal street parking will be discovered during the truck parking utilization analysis. In areas with high concentrations of street parking, the study team will attempt to obtain information about any municipal policies regarding street parking. However, even if allowed, street parking is less than desirable for the drivers and the community and therefore will not be included in the overall capacity.

2.3.2 Inventory Owned by the Private Sector
As described in Exhibit 3, information regarding retail and food service locations where crowdsourced data sites have indicated that truck parking may exist have been discarded.

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\(^3\) Based on data submitted in the 2019 Jason’s Law submission. Work through this study since that submission has identified additional inventory that will be added in future updates.

\(^4\) The grant submittal identified 21 additional sites on I-10 that were not included in the Jason’s Law inventory.
The authorization of truck parking sites cannot be ascertained nor maintained without consistent input from the owners of those locations.

**Exhibit 7: TxDOT’s “Jason’s Law” Submission (2019)**

<table>
<thead>
<tr>
<th>Category</th>
<th>Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Sites</td>
</tr>
<tr>
<td>All Sites</td>
<td></td>
</tr>
<tr>
<td><strong>Total Listed</strong></td>
<td>102</td>
</tr>
<tr>
<td>Active/Open</td>
<td>81</td>
</tr>
<tr>
<td>Inactive</td>
<td>16</td>
</tr>
<tr>
<td>Closed Since Last Submission or Duplicate</td>
<td>5</td>
</tr>
<tr>
<td>Interstate</td>
<td></td>
</tr>
<tr>
<td><strong>Total Listed</strong></td>
<td>72</td>
</tr>
<tr>
<td>Active/Open</td>
<td>52</td>
</tr>
<tr>
<td>Inactive</td>
<td>15</td>
</tr>
<tr>
<td>Closed Since Last Submission or Duplicate</td>
<td>5</td>
</tr>
<tr>
<td>Non-Interstate</td>
<td></td>
</tr>
<tr>
<td><strong>Total Listed</strong></td>
<td>30</td>
</tr>
<tr>
<td>Active/Open</td>
<td>29</td>
</tr>
<tr>
<td>Inactive</td>
<td>1</td>
</tr>
<tr>
<td>Closed Since Last Submission or Duplicate</td>
<td>0</td>
</tr>
</tbody>
</table>

Source: TxDOT. Based on 2019 Jason’s Law submission only.

The truck parking inventory is primarily of larger truck stops and related smaller diesel fuel providers. A mix of sources provided this information, as described below. In order to focus on most relevant, consistent, and active locations, only privately owned locations with 10 or more spaces were included in the inventory, along with all identified publicly owned locations. Additionally, anecdotal information about a small number of truck storage facilities which rent space on a weekly or monthly basis was collected during public outreach.

### 2.3.2.1 Truck Stop Inventory from Truck Stop Owners

The following national truck stop chains publish information about all key attributes from Exhibit 3 on their respective Internet sites:

- Love’s;
- Flying J and Pilot (one corporation owns both brands); and
- Travel Centers of America (TA) and Petro (one corporation owns both brands).
The brand Road Ranger does not provide inventory information about its seven rest areas in Texas but simply states that truck parking is available. Estimates of inventory information for Road Ranger were obtained from secondary sources. The brand Stripes does not have truck parking information available but only identifies locations that are “truck accessible.” Therefore, information about Stripes’ locations is gathered only from secondary sources. Exhibit 8 summarizes the information about the truck stop chain operators with published inventory information.

**Exhibit 8: Truck Stop Chain Operators with Published Information on Truck Parking Inventory**

<table>
<thead>
<tr>
<th>Chain</th>
<th>Number of Texas Locations with Truck Parking</th>
<th>Total Number of Truck Parking Spaces in Texas</th>
<th>Required Attributes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Love’s</td>
<td>68</td>
<td>5,160</td>
<td>Yes</td>
</tr>
<tr>
<td>Pilot and Flying J</td>
<td>60</td>
<td>6,872</td>
<td>Yes</td>
</tr>
<tr>
<td>TA and Petro</td>
<td>22</td>
<td>4,169</td>
<td>Yes</td>
</tr>
<tr>
<td>Road Ranger</td>
<td>7</td>
<td>407</td>
<td>No inventory information</td>
</tr>
</tbody>
</table>

Source: Analysis by Cambridge Systematics (2019).

**2.3.2.2 Truck Stop Inventory from Secondary Sources**

There are an increasing number of secondary sources of information regarding truck parking inventory owned by the private sector. As described earlier in Sections 2.2 and 2.3, while secondary sources are useful, they have challenges for usage. Furthermore, the secondary sources have overlapping information, so using large numbers of secondary sources has diminishing returns in terms of balancing data management versus obtaining additional data.

After assessing a variety of data sources, three secondary sources were utilized:

- **AmericanTruckParking.com** is a project operated by the University of California, Berkeley and partially funded by the FHWA. Staff from American Truck Parking provided an export of data regarding truck parking locations in Texas, both public and private.

- **Allstays.com** is an advertising-driven web site for the trucking community. Their data appears to be a mix of crowdsourced and curated data, and overwhelmingly oriented towards fuel providers. The AllStays data can be downloaded in HTML format and processed to generate tabular information. Optional attribute information was not utilized, however, as it was not consistently formatted.

- **Trucker Path** is a smartphone-based application which allows individuals to crowdsource data regarding truck parking. As a result, there are a number of locations where truck parking may not in fact be authorized. Staff from Trucker Path declined to provide an export of Texas location data. The Trucker Path app was utilized to back-check other
data sources, identifying potential missing locations that were then spot-checked with Google Earth or Google Maps.

A challenge of secondary sources is the estimate of authorized truck parking inventory. Because these are secondary sources, the estimation of inventory is based on the precision and accuracy of the estimator. Some websites report only a range of spaces and have therefore been discarded. Other sites utilize an estimate entered by the person who provided the information about the location to the site. Exhibit 9 shows an example from the Pharr District where three data sources disagreed about inventory for three locations. In addition, a new truck parking location at the Port of Brownsville, opened in 2018, was not listed at all.

Exhibit 9: An Example of Precision Challenges from Secondary Sources

<table>
<thead>
<tr>
<th>Parking Location (Brand and ZIP Code)</th>
<th>Trucker Path Estimated Inventory</th>
<th>ParkMyTruck Estimated Inventory</th>
<th>American Truck Parking Estimated Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Road Ranger – 78535</td>
<td>55</td>
<td>60</td>
<td>58</td>
</tr>
<tr>
<td>Stripes – 78526</td>
<td>3</td>
<td>6</td>
<td>11</td>
</tr>
<tr>
<td>Stripes – 78575</td>
<td>6</td>
<td>5</td>
<td>9</td>
</tr>
<tr>
<td>Port of Brownsville – 78526</td>
<td>Not listed</td>
<td>Not listed</td>
<td>Not listed</td>
</tr>
</tbody>
</table>

Source: Analysis by Cambridge Systematics (2019).

When a truck parking site was found in multiple secondary sources, capacity estimates from American Truck Parking were used first due to its academic background and affiliation with FHWA, followed by AllStays, then Trucker Path. At locations with updated aerial imagery and marked spaces, visual counts were also used to verify the inventory.

2.3.2.3 Truck Storage Locations

Providers of a small number of truck storage locations were part of the stakeholder outreach process. These locations offer monthly or weekly rentals of a truck parking space, typically on a gravel lot with no additional amenities. They are geared towards both trucking companies with repetitive routes where overnight truck parking is required for a truck nearly every day, or for owner-operators who are looking for a storage location near their residence for when they are taking a weekend or longer break from driving.

Two locations identified through stakeholder outreach are included in the inventory in Appendix A of the “Truck Parking Demand in Dedicated and Unauthorized Locations” Memo (one in Ft. Worth, one in Hutto), but not included in the inventory or utilization data. Secondary sources and online searches failed to uncover any type of consistent information. The project team will continue to investigate how to best represent these sites in the future.
2.4 Overview of Texas’ Truck Parking Capacity

The exhibits below reflect the inventory as of February 2018 to allow any sites included in the inventory to have a full set of utilization data from ATRI. While it is not reflective of 100 percent of the truck parking capacity, it includes all identified publicly owned truck parking spaces and privately owned locations with fuel and 10 or more spaces.

Appendix A of the “Truck Parking Demand in Dedicated and Unauthorized Locations” Memo contains district level summaries showing inventory along with additional information about each location.

2.4.1 Publicly Owned Inventory

Texas provides a number of truck parking areas including Travel Information Centers, Safety Rest Areas, and Picnic Areas/Truck Pull-offs where private facilities are not available, offering drivers a safe place to take a break from driving. Some of these locations, notably Travel Information Centers and Safety Rest Areas have basic services such as paved parking, restrooms, water, walking paths, and information. They are typically located along rural highways in between cities and towns. Most in Texas include paved parking spaces for trucks, ranging from 10 or fewer parking spaces, often parallel parking (as shown in Exhibit 10), to some with more than 40 spaces. It is important to note that due to federal law prohibiting commercialization of public facilities on the Interstate system, the types of amenities available at many of these locations are limited.5

Exhibit 10: Medina County Safety Rest Area NB, with Parallel Truck Parking (3274 Interstate 35 Access Rd, Natalia, TX 78059)

Source: Google Streetview, captured May 31, 2019 (https://www.google.com/maps/@29.1970493,98.8261488,3a,75y,73.58h,98.49t/data=!3m6!1e1!3m4!1sswi6ckylI88Cr8mB6zNmoQQ!2e0!7i13312!8i6656)

5 Section 111 of Title 23, USC. Passed in 1958.
Exhibit 11 shows the 177 publicly owned truck parking lots in Texas, with capacities ranging from approximately 5 spaces to a maximum of 60 at the Hill County Rest Area on I-35. The densest districts are Amarillo (227 spaces), Odessa (200 spaces), Childress (197 spaces), Waco (186 spaces), and San Antonio (153 spaces). Exhibit 12 illustrates the total capacity (number of spaces) of publicly owned locations by TxDOT district.\textsuperscript{6}

\textsuperscript{6} Sites on opposite sides of a divided highway but in the median are counted as two sites as truck parking in one direction is not accessible from the other side.
Exhibit 11: Publicly Owned Truck Parking Locations - Inventory

Exhibit 12: Publicly Owned Truck Parking Capacity by District

2.4.2 Parking Inventory at Privately Owned Truck Stops

Most truck drivers prefer to park at locations that offer fuel, a meal, showers, laundry machines, Wi-Fi, truck wash and repair services, and other amenities when away from home for extended periods. Many of these amenities are provided by full service truck stops (such as shown in Exhibit 13), which also tend to have large parking areas for trucks.

Exhibit 13: Petro, El Paso, TX

Source: Cambridge Systematics (2019).

The 462 privately owned truck parking lots in Texas, with a combined total of almost 25,000 spaces, vary in number of truck parking spaces offered—the largest one located in Laredo offers 336 truck parking spaces.

Exhibit 14 and Exhibit 15 present the privately owned locations in a similar format to how Exhibit 11 and Exhibit 12 presented publicly owned locations. Exhibit 12 shows the diversity in capacity of these locations, from those having fewer than 20 truck parking spaces to those with more than 100. The Houston District has the greatest number of privately owned truck parking spaces with 3,142 spaces, while the Brownwood District offers the fewest number of spaces (222).

Exhibit 16 and Exhibit 17 present the information from Exhibit 13 focused on the DFW and Houston/Galveston regions, respectively. The North Central Texas Council of Governments (NCTCOG) which covers the region of DFW, has a total of 65 private truck parking lots. There

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7 American Transportation Research Institute, “Nevada Truck Parking Survey Analysis October 2018.” This report cites six other reports where this information was gleaned from:

are 65 private truck parking lots that fall within the boundaries of the Houston-Galveston Area Council (H-GAC).

**Exhibit 14: Privately Owned Truck Parking Locations - Inventory**

Source: Analysis by Cambridge Systematics (2019).
Exhibit 15: Privately Owned Truck Parking Capacity by District

Source: Analysis by Cambridge Systematics (2019).
Exhibit 16: Privately Owned Truck Parking Locations - NCTCOG Region

Source: Analysis by Cambridge Systematics (2019).
Exhibit 17: Privately Owned Truck Parking Locations - H-GAC Region

Source: Analysis by Cambridge Systematics (2019).
As noted earlier, the disparity between the number of truck parking spaces provided at privately and publicly owned facilities is not surprising or unusual.

Exhibit 18 shows both publicly and privately owned inventory and Exhibit 19 shows this information aggregated at the district level.

Exhibit 20 compares the privately and publicly owned capacity for all TxDOT districts, sorted in order of the highest to lowest total capacity. Houston District is the only one with no publicly owned truck parking locations. While this may seem alarming, the boundaries for the District encompass primarily urban and suburban areas where privately owned facilities are available for those not driving trucks, and thus public rest areas were historically not deemed necessary. Other districts encompass more rural geography and so not surprisingly, have more publicly owned spaces.

Maps with individual district inventory are shown in Appendix A of the “Truck Parking Demand in Dedicated and Unauthorized Locations” Memo.
Exhibit 18: Publicly and Privately Owned Truck Parking Locations - Inventory

Publicly and Privately Owned Truck Parking Locations - Inventory

Source: Analysis by Cambridge Systematics (2019).
Exhibit 19: Publicly and Privately Owned Truck Parking Capacity by District

Source: Analysis by Cambridge Systematics (2019).
### Exhibit 20: Total Truck Parking Capacity by District

<table>
<thead>
<tr>
<th>District</th>
<th>Publicly Owned Truck Parking Spaces</th>
<th>Privately Owned Truck Parking Spaces</th>
<th>Total Truck Parking Spaces</th>
<th>Percentage of Spaces Publicly Owned</th>
<th>Percentage of Spaces Privately Owned</th>
</tr>
</thead>
<tbody>
<tr>
<td>Houston</td>
<td>0</td>
<td>3,142</td>
<td>3,142</td>
<td>0.0%</td>
<td>100.0%</td>
</tr>
<tr>
<td>Dallas</td>
<td>56</td>
<td>2,328</td>
<td>2,384</td>
<td>2.3%</td>
<td>97.7%</td>
</tr>
<tr>
<td>San Antonio</td>
<td>153</td>
<td>2,025</td>
<td>2,178</td>
<td>7.0%</td>
<td>93.0%</td>
</tr>
<tr>
<td>Odessa</td>
<td>200</td>
<td>1,753</td>
<td>1,953</td>
<td>10.2%</td>
<td>89.8%</td>
</tr>
<tr>
<td>Amarillo</td>
<td>227</td>
<td>1,373</td>
<td>1,600</td>
<td>14.2%</td>
<td>85.8%</td>
</tr>
<tr>
<td>Laredo</td>
<td>76</td>
<td>1,359</td>
<td>1,435</td>
<td>5.3%</td>
<td>94.7%</td>
</tr>
<tr>
<td>Waco</td>
<td>186</td>
<td>1,219</td>
<td>1,405</td>
<td>13.2%</td>
<td>86.8%</td>
</tr>
<tr>
<td>Beaumont</td>
<td>87</td>
<td>1,236</td>
<td>1,323</td>
<td>6.6%</td>
<td>93.4%</td>
</tr>
<tr>
<td>El Paso</td>
<td>132</td>
<td>1,153</td>
<td>1,285</td>
<td>10.3%</td>
<td>89.7%</td>
</tr>
<tr>
<td>Fort Worth</td>
<td>8</td>
<td>1,255</td>
<td>1,263</td>
<td>0.6%</td>
<td>99.4%</td>
</tr>
<tr>
<td>Abilene</td>
<td>96</td>
<td>915</td>
<td>1,011</td>
<td>9.5%</td>
<td>90.5%</td>
</tr>
<tr>
<td>Yoakum</td>
<td>102</td>
<td>820</td>
<td>922</td>
<td>11.1%</td>
<td>88.9%</td>
</tr>
<tr>
<td>Corpus Christi</td>
<td>39</td>
<td>862</td>
<td>901</td>
<td>4.3%</td>
<td>95.7%</td>
</tr>
<tr>
<td>Bryan</td>
<td>66</td>
<td>682</td>
<td>748</td>
<td>8.8%</td>
<td>91.2%</td>
</tr>
<tr>
<td>Pharr</td>
<td>30</td>
<td>707</td>
<td>737</td>
<td>4.1%</td>
<td>95.9%</td>
</tr>
<tr>
<td>Tyler</td>
<td>42</td>
<td>617</td>
<td>659</td>
<td>6.4%</td>
<td>93.6%</td>
</tr>
<tr>
<td>Atlanta</td>
<td>40</td>
<td>595</td>
<td>635</td>
<td>6.3%</td>
<td>93.7%</td>
</tr>
<tr>
<td>Paris</td>
<td>136</td>
<td>457</td>
<td>593</td>
<td>22.9%</td>
<td>77.1%</td>
</tr>
<tr>
<td>Lubbock</td>
<td>72</td>
<td>454</td>
<td>526</td>
<td>13.7%</td>
<td>86.3%</td>
</tr>
<tr>
<td>Wichita Falls</td>
<td>145</td>
<td>352</td>
<td>497</td>
<td>29.2%</td>
<td>70.8%</td>
</tr>
<tr>
<td>San Angelo</td>
<td>85</td>
<td>399</td>
<td>484</td>
<td>17.6%</td>
<td>82.4%</td>
</tr>
<tr>
<td>Childress</td>
<td>197</td>
<td>223</td>
<td>420</td>
<td>46.9%</td>
<td>53.1%</td>
</tr>
<tr>
<td>Austin</td>
<td>14</td>
<td>348</td>
<td>362</td>
<td>3.9%</td>
<td>96.1%</td>
</tr>
<tr>
<td>Lufkin</td>
<td>51</td>
<td>301</td>
<td>352</td>
<td>14.5%</td>
<td>85.5%</td>
</tr>
<tr>
<td>Brownwood</td>
<td>84</td>
<td>222</td>
<td>306</td>
<td>27.5%</td>
<td>72.5%</td>
</tr>
</tbody>
</table>

Source: Analysis by Cambridge Systematics (2019).
2.4.3 Truck Parking Capacity by Interstate Corridor

Exhibit 21 shows capacity by key interstate corridors in Texas, providing information by corridor rather than within a district. It also shows the Average Annual Daily Truck Traffic (AADTT) and the length of each corridor.\(^8\) Note that any truck parking facility within 1 mile of the highway centerline is included in this inventory in order to capture both public truck parking areas within the highway right-of-way, as well as private facilities, located near interchanges. This means that some truck parking facilities are included in multiple corridors, and that truck parking facilities in urban areas on bypass routes may not be included.

When adjusting inventory for AADTT and length, in terms of spaces per 100,000 truck-miles traveled, I-27 and I-40 have the greatest capacity, relative to truck traffic, and I-30 has the lowest capacity relative to truck traffic. The following sections discuss truck parking locations in each corridor. Note that loop Interstates (3-digit Interstates) were omitted from this analysis due to the large amount of overlap with primary Interstate corridors in terms of both capacity and demand.\(^9\)

### Exhibit 21: Truck Parking Capacity by Interstate Corridor

<table>
<thead>
<tr>
<th>Interstate Corridor</th>
<th>Publicly Owned Truck Parking Spaces</th>
<th>Privately Owned Truck Parking Spaces</th>
<th>Total Truck Parking Spaces</th>
<th>AADTT</th>
<th>Length (Miles)</th>
<th>Truck Parking Spaces per 1,000 AADTT</th>
<th>Truck Parking Spaces per 100,000 Truck-miles Traveled</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-10</td>
<td>559</td>
<td>5,213</td>
<td>5,772</td>
<td>9,593</td>
<td>877</td>
<td>602</td>
<td>69</td>
</tr>
<tr>
<td>I-20</td>
<td>306</td>
<td>4,293</td>
<td>4,599</td>
<td>8,830</td>
<td>634</td>
<td>521</td>
<td>82</td>
</tr>
<tr>
<td>I-27</td>
<td>70</td>
<td>556</td>
<td>636</td>
<td>3,135</td>
<td>124</td>
<td>203</td>
<td>164</td>
</tr>
<tr>
<td>I-30</td>
<td>98</td>
<td>728</td>
<td>826</td>
<td>11,626</td>
<td>224</td>
<td>71</td>
<td>32</td>
</tr>
<tr>
<td>I-35</td>
<td>318</td>
<td>4,255</td>
<td>4,573</td>
<td>14,603</td>
<td>588</td>
<td>313</td>
<td>53</td>
</tr>
<tr>
<td>I-37</td>
<td>44</td>
<td>448</td>
<td>492</td>
<td>6,056</td>
<td>143</td>
<td>81</td>
<td>57</td>
</tr>
<tr>
<td>I-40</td>
<td>195</td>
<td>1,114</td>
<td>1,309</td>
<td>6,482</td>
<td>177</td>
<td>202</td>
<td>114</td>
</tr>
<tr>
<td>I-45</td>
<td>122</td>
<td>1,416</td>
<td>1,538</td>
<td>11,343</td>
<td>284</td>
<td>136</td>
<td>48</td>
</tr>
</tbody>
</table>

Source: Analysis by Cambridge Systematics (2019).

Key observations regarding each corridor are noted below, and maps showing corridor inventory and use are provided in Section 5.8 of the following memo “Truck Parking Demand in Dedicated and Unauthorized Locations”

---

\(^{8}\) Based on TxDOT Roadway Inventory, 2018. Sum of Single unit and Multi-unit AADT.

\(^{9}\) I-2 and I-14 were omitted due to short length (less than 100 miles for each). I-69 was omitted due to the incomplete nature of the corridor and the changing designation of segments.
- **I-10** is a major freight corridor from the Ports of Los Angeles and Long Beach to Florida. It passes through Texas connecting three major urban areas (Houston, San Antonio, and El Paso) and makes up the south leg of the Texas Triangle.\(^{10}\) These regions have seaport access, an interchange with I-35, and an international border crossing, respectively. Because it traverses so many rural miles, it has the largest inventory of publicly owned spaces. The greatest concentration of privately owned spaces is concentrated in the dense urban regions from San Antonio to Beaumont. Overall, there are 69 total truck parking spaces per 100,000 truck-miles traveled.

- **I-20** connects the Dallas-Fort Worth (DFW) metropolitan area to the energy sector and the natural resources of West Texas. The total truck parking spaces per 100,000 truck-miles traveled at 82 is above average for the State. Most privately owned spaces are concentrated in the urban areas, and publicly owned spaces are in the rural areas.

- **I-27** connects the agricultural regions in the Texas Panhandle, and is part of the ports-to-plains corridor.\(^{11}\) It has 164 truck parking spaces per 100,000 truck-miles traveled, the highest in the State, in part because it is a short corridor at 124 miles in total length—otherwise, the concentration of truck parking inventory is on par with the other corridors.

- **I-30** connects the Dallas-Fort Worth metropolitan area to Texarkana, and continues north and east to Memphis and Chicago. The corridor has three public truck parking locations and the lowest amount of truck parking spaces at 32 spaces per 100,000 truck-miles traveled in the state.

- **I-35** is a major North American Free Trade Agreement (NAFTA) trade corridor from Mexico to Canada, a critical north-south trucking corridor through the central United States that passes through several large metro areas in Texas (Laredo, San Antonio, Austin, and DFW). While there is a relatively large inventory of publicly owned spaces, they are concentrated at only six locations along the statewide corridor. Additionally, there is a dearth of public or private truck parking locations in and around Austin. This corridor has the third lowest spaces at 53 per 100,000 truck-miles traveled.

- **I-37** is a relatively short corridor at 143 miles, connecting San Antonio and Corpus Christi with lower than average truck volumes and truck parking inventory, and only one small publicly owned lot. I-37 has 57 truck parking spaces per 100,000 truck-miles traveled, which is below the state average.

- **I-40**, like I-10 to the south, is a major east to west coast trucking route, passing through Amarillo and the Texas Panhandle. Two large publicly owned rest areas, well-
designed for truck parking, are located east of Amarillo and just west of McLean. I-40 has the second highest number of truck parking spaces at 114 per 100,000 truck-miles traveled.

- **I-45** makes up the eastern leg of the Texas Triangle, connecting the Port of Houston to the DFW metropolitan area, and has only one publicly owned truck parking location. I-45 has the second lowest number of truck parking spaces at 48 per 100,000 truck-miles traveled.
2.4.4 Drive Time Between Authorized Truck Parking Locations

Across most of the Interstate Highway network in Texas there exists an authorized truck parking location within a 15 minute drive. On the less traveled, but still important, US Highway network, drivers may have to drive an hour or more to find an authorized truck parking location. Exhibit 22 shows the drive time to an authorized truck parking location for roads on the THFN (shown in Exhibit 1). Note that this estimate does not address available capacity, but simply total capacity. Thus if the closest location is full, drivers would need an even longer amount of time to find an authorized space. This inventory acts as a baseline for ongoing efforts to better capture the total supply of truck parking in Texas. It will also be used in combination with future demand and utilization analysis to identify gaps in the supply of truck parking in the state.
Exhibit 22: Travel Time on the THFN From Authorized Truck Parking Locations

Source: Analysis by Cambridge Systematics (2019).
2.5 Aggregated Businesses and Other Parking Locations
Trucks parking at a wide range of private businesses such as shippers and receivers, repair facilities, and company parking lots fall into a category between authorized truck parking locations and unauthorized truck parking. These facilities are typically not intended to directly serve the truck parking needs of the general public, but trucks owned by or serving a particular business are allowed to park there. In many cases, trucks serving a particular shipper or receiver may not be allowed to park and wait at the facility. Instead they are asked to stage off-site.

Clusters of businesses, especially warehousing, industrial, or manufacturing centers, will be considered in the next memo (Task 2.5) when examining unauthorized truck parking. This will be done to first, identify if trucks are actually parking in unauthorized locations or in the authorized business locations, and second, to identify potential drivers of demand for unauthorized parking.

2.6 Unauthorized Truck Parking Locations
In contrast to authorized truck parking locations and private businesses, trucks also park in unauthorized locations. In addition to analyzing the gap (or excess) of truck parking compared at publicly owned locations and within districts, hot spots of unauthorized parking will be the focus of the following technical memo (Task 2.5). Commonly, these locations can include the categories described below.

2.6.1 Unauthorized Roadway Parking Locations
Trucks parking on the ramps/shoulders of highways are a key factor driving the increased public awareness of the need for additional authorized truck parking. Trucks stopped in these locations pose a safety hazard to themselves and to the traveling public. In addition, they can cause increased damage to public infrastructure as the ramps and shoulders are not typically designed to bear the weight of a fully-loaded tractor-trailer for long periods of time. Trucks may park roadside because nearby authorized facilities are full, because they need a place to pull over for a short period of time and getting in/out of other potential parking areas is difficult, or because there are limited available options when their HOS run out. Exhibit 23 shows an example of this type of parking.

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12 Information regarding retail and food service locations where crowdsourced data sites have indicated that truck parking may exist are not examined. The authorization of truck parking is based on owner/manager discretion, town ordinances, or other factors that can change rapidly. Available data does not provide a way to distinguish if trucks parked on a specific day were authorized to park at the location or not.
Exhibit 23: Unauthorized Roadway Parking – Fabens, TX

Source: Cambridge Systematics (2019).

2.6.2 Vacant Commercial or Industrial Property
Another set of unauthorized parking locations include empty commercial or industrial properties. These locations often have large surface parking areas (initially designed for cars) and may be located in convenient areas for trucks looking for staging parking, making them an attractive option for some drivers compared to the side of the road. However, these abandoned properties lack the safety features available at authorized truck parking locations, may not be designed to handle large, heavy trucks, and with ownership of the property often unknown, drivers may face liability issues.

2.6.3 Closed Rest Areas
In addition, a number of TxDOT-owned rest areas or public truck parking areas have been closed or become inactive since the first Jason’s Law Truck Parking survey was released in 2015. Exhibit 24 shows the locations of these closed rest areas based on Jason’s Law submittal.
Exhibit 24: Publicly Owned Closed or Inactive Rest Areas

Source: TxDOT. “NHS Rest Stop or Truck Facility #” references Jason’s Law submittal provided by TxDOT
2.6.4 Inspection Facilities

Inspection facilities (also commonly called weigh stations) are important facilities designed to help protect the safety of the motoring public, preserve infrastructure, and promote economic competitiveness by enforcing federal and state commercial motor vehicle size, weight, and safety regulations. Some states have designed these sites to also include truck parking areas, as shown in Exhibit 25. Kentucky weigh stations are often referenced by drivers as being friendly to parked drivers and having amenities available at some locations (such as a restroom).

Exhibit 25: Example Weigh Station with Truck Parking – Walton, Kentucky (I-71)

Source: Google Maps.

The Texas Department of Public Safety (TxDPS) which operates inspection locations in the state does not typically allow trucks to park at these locations unless the vehicle is required to remain due to enforcement action. These locations can range from small paved areas off the side of the highway which are used randomly by roving Commercial Vehicle Enforcement officers to large locations with permanent scales, screening equipment, and permanent staff. When not in use, the entrance and exit to these locations is typically blocked. The next memo will examine any truck parking in the vicinity of these locations to determine if
unauthorized truck parking is occurring, and if so at what levels. Exhibit 26 shows the locations of existing enforcement sites provided by TxDPS.

Exhibit 26: Texas Department of Public Safety Inspection Locations

Source: Texas DPS.
3.0 Calculating Demand
Identifying demand, or the total number of trucks that want to park in a location or geographic area, is the second critical component behind understanding if a specific location, corridor, or geographic area has a shortage or surplus of truck parking. This study uses two approaches to identify demand. The first is a model developed by FHWA. The second uses GPS information provided by ATRI. This section discusses those approaches, initial results, and how the information will be used in later tasks.

3.1 Key Findings and Observations
Below are some key findings and observations that will be presented in the remainder of this section.

- The FHWA model shows that I-35 has the highest overall demand for truck parking, with an estimated daily demand for 12,810 spaces. This equals 22 spaces per mile averaged over the corridor, tied with I-30 for the highest in the state. I-27 has the lowest total demand and the lowest demand per mile.

- The FHWA model has numerous limitations that make it unsuitable for understanding truck parking gaps at a detailed level necessary to drive recommendations.

- ATRI GPS data is both extremely accurate and precise, offering the ability to examine truck parking needs in more detail. However, the data requires a significant amount of processing to be useful and it represents only a portion of the trucks traveling on Texas roadways.

3.2 FHWA Model
There are a number of potential methods for estimating truck parking demand. One of the oldest is a truck parking demand model developed by FHWA in 2002 which calculated demand, split into long-term and short-term truck parking demand, at the corridor level.

The following sections explain the FHWA methodology, provide results from an analysis of Texas’ rural interstate system, and explain the model’s limitations.

3.2.1 FHWA Methodology
Demand for truck parking is based on a number of factors. HOS regulations developed by the Federal Motor Carrier Safety Administration (FMCSA), summarized in Exhibit 27, are one of the key contributing factors. In addition, shipper and receiver delivery needs as well as driver preferences for stopping locations and amenities also influence where trucks park.

The mandatory use of electronic logging devices (ELDs) in most commercial vehicles as of December 2017 is adding to the truck parking demand concern. The adoption of ELDs

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13 Automatic On Board Recording Devices satisfy the requirement for the December 2017 deadline. These devices will not be sufficient after December 2019. Certain other drivers are also exempt from this requirement including those that operate within a 100-mile radius of work and those that use paper records for less than 8 days in a 30 day period. See: https://www.fmcsa.dot.gov/hours-service/elds/implementation-timeline. Accessed May 24, 2018.
does not change any existing FMCSA regulations, but it does make it more difficult to “game the system.” For example, with paper logs, drivers recorded their activities in 15 minute increments and were provided a grace period to find a truck parking space once their HOS were up. The grace period did not count towards driving time. ELDs erase that grace period and can track a truck’s location. This means that drivers either need to search for and find truck parking before their HOS are up (thus sacrificing driving time and decreasing productivity) or park immediately once their time is up, regardless of location. FMCSA does provide an exception for personal conveyance that can allow a driver to slightly extend their driving time.  

**Exhibit 27: Summary of Federal HOS Regulations**

<table>
<thead>
<tr>
<th>HOS Provisions</th>
<th>Descriptions</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>11-Hour Driving Limit</strong></td>
<td>Drivers may drive a maximum of 11 hours after 10 consecutive hours off duty. All time spent at the driving controls of a commercial motor vehicle (CMV) in operation is considered driving time.</td>
</tr>
<tr>
<td><strong>14-Hour Driving Limit</strong></td>
<td>Property-carrying drivers may not drive beyond the 14th consecutive hour after coming on duty, following 10 consecutive hours off duty.</td>
</tr>
<tr>
<td><strong>Rest breaks</strong></td>
<td>Drivers may drive only if eight hours or less have passed since the end of the driver’s last off-duty or sleeper berth period of at least 30 minutes.</td>
</tr>
<tr>
<td><strong>60/70-Hour Limit</strong></td>
<td>Drivers may not drive after 60/70 hours on duty in 7/8 consecutive dates. A driver may restart a 7/8 consecutive day period after taking 34 or more consecutive hours off duty.</td>
</tr>
<tr>
<td><strong>Sleeper Berth Provision</strong></td>
<td>Drivers using the sleeper berth provision must take at least eight consecutive hours in the sleeper berth, plus a separate two consecutive hours either in the sleeper berth or off duty.</td>
</tr>
</tbody>
</table>

Source: Federal Motor Carrier Safety Administration.

FHWA developed a model to estimate truck parking demand in 2002. Two additional studies since then have slightly modified the approach:

- **Pennsylvania State Transportation Advisory Committee—Truck Parking in Pennsylvania (2007).** Referenced as “Pennsylvania STAC.”
- **Virginia DOT—Virginia Truck Parking Study (2015).** Referenced as “Virginia DOT.”

The Pennsylvania STAC and Virginia DOT models are based on the original FHWA approach but update some of the variables based on changes in FMCSA HOS regulations since 2002.

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14 Personal conveyance is the movement of a commercial vehicle for personal use while off-duty. Specifically, this can be used as follows: “Time spent traveling to a nearby, reasonable, safe location to obtain required rest after loading or unloading.” See: [https://www.fmcsa.dot.gov/regulations/hours-service/personal-conveyance](https://www.fmcsa.dot.gov/regulations/hours-service/personal-conveyance)
The model requires 5 key user inputs. These inputs were all included in the original FHWA study:

- Annual Average Daily Truck Traffic (AADTT)
- Corridor Length (L).
- Corridor Speed Limit or Average Speed (S).\(^1\)
- Percent of Trucks making short-haul trips.
- Percent of Trucks making long-haul trips.

The core equation for estimating truck parking demand (D) is shown below.

\[
D = THT \times P_{avg}
\]

Where:

D = Truck parking demand
THT = Truck hours traveled
\(P_{avg}\) = Average truck parking duration

Truck Hours Traveled (THT) is calculated based on:

\[
THT = AADTT \times (L/S)
\]

Where:

THT = Truck hours traveled
AADTT = Annual average daily truck traffic
L = Corridor length (in miles)
S = Average speed

At its most basic level, the more time trucks require to transit a corridor \((L/S)\) the higher the probability that they will need to stop at some point during that trip; and the greater the number of trucks traveling in the corridor \((AADTT)\), the greater the demand for truck parking. The FHWA model also includes a 15 percent “seasonal peak factor” for the average AADTT to account for variations in truck volume due to seasonal shifts in trucking patterns. The Pennsylvania STAC and Virginia DOT models did not include this “buffer”.

Demand for short-term and long-term truck parking are calculated separately within the corridor and then combined to produce an overall truck parking demand number. The key factor in this calculation is determining the percent of traffic on the corridor engaged in long-haul versus short-haul trips using the length of a stop as a proxy. Based on observations and

\(^{1}\) For simplicity, an average speed of 65 miles per hour was used across all corridors.
estimates of the percent of trucks that are parked for less than three hours (termed short-haul) versus those parked for more than three hours (termed long haul), the original FHWA study used a 36 percent short-haul to 64 percent long-haul split for urban segments (defined as within 200 miles of a city with a population of 200,000 or more). A 7 percent short-haul to 93 percent long-haul split was used for rural segments. The Pennsylvania STAC model used a 79 percent short-haul to 21 percent long-haul split while the Virginia DOT used a 65 percent short-haul to 35 percent long-haul split.

Urban area truck parking decisions are much more complex than rural truck parking decisions due to the higher number of trucks in urban areas, the many reasons trucks chose to park (staging, 30 minute rest breaks, etc.), and the increased possibility that driver choice or congestion can influence where trucks park. These factors make the FHWA model less accurate in urban areas.

For these reasons, this analysis focused on identifying truck parking demand on the rural segments of Texas’ Interstate corridors. The AADTT was calculated only for segments outside of urban areas, defined as outside of Metropolitan Planning Organization (MPO) boundaries. Mileage for the entire corridor (including within MPO boundaries) was used since trucks still must traverse the miles within an MPO. The FHWA short haul to long haul split of 93 percent to 7 percent for rural areas was applied to all corridors.

Appendix A contains a more detailed description of the model inputs and calculations.

### 3.2.2 Results

To explore the outputs of the FHWA model in Texas, the State’s rural Interstate corridors were examined using the above methodology. A brief description of each corridor and the results of the model are shown below. Exhibit 28 illustrates the corridors analyzed and shows the AADTT in each.

Exhibit 29 provides the results from the FHWA corridor analysis. According to the model, I-30 and I-35 have the highest truck parking demand per mile, and I-35 has the highest total demand for truck parking. The length of the I-35 corridor combined with high AADTT, especially near the Mexico border and between Austin and DFW, are the primary factors behind this outcome. The FHWA model estimates of truck parking demand by corridor are compared to the capacity of each corridor in Exhibit 30. While gaps exist on all of the major corridors except I-27, I-30 has the highest demand per mile and the second largest gap between the number of spaces needed and existing capacity. I-35 has the largest gap between estimated demand and current capacity with a gap nearly double that of the next highest corridor. I-20 and I-45 also show large gaps based on this methodology.
Exhibit 28: FHWA Demand Model Corridors – AADTT (Truck Volume)

### Exhibit 29: FHWA Model Estimates of Truck Parking Demand by Corridor

<table>
<thead>
<tr>
<th>Interstate Corridor</th>
<th>Corridor Length in Miles</th>
<th>AADTT</th>
<th>“Buffer” AADTT</th>
<th>Short-Haul AADTT</th>
<th>Long-Haul AADTT</th>
<th>Short-Haul Peak Truck Parking Demand</th>
<th>Long-Haul Peak Truck Parking Demand</th>
<th>Total Daily Truck Parking Demand</th>
<th>Parking Demand per Mile</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-10</td>
<td>877</td>
<td>6,043</td>
<td>6,950</td>
<td>486</td>
<td>6,463</td>
<td>450</td>
<td>9,410</td>
<td>9,860</td>
<td>11</td>
</tr>
<tr>
<td>I-20</td>
<td>635</td>
<td>7,545</td>
<td>8,677</td>
<td>607</td>
<td>8,069</td>
<td>400</td>
<td>8,510</td>
<td>8,910</td>
<td>14</td>
</tr>
<tr>
<td>I-27</td>
<td>124</td>
<td>2,557</td>
<td>2,941</td>
<td>206</td>
<td>2,735</td>
<td>30</td>
<td>560</td>
<td>590</td>
<td>5</td>
</tr>
<tr>
<td>I-30</td>
<td>223</td>
<td>11,663</td>
<td>13,413</td>
<td>939</td>
<td>12,474</td>
<td>220</td>
<td>4,620</td>
<td>4,840</td>
<td>22</td>
</tr>
<tr>
<td>I-35</td>
<td>589</td>
<td>11,696</td>
<td>13,451</td>
<td>942</td>
<td>12,509</td>
<td>580</td>
<td>12,230</td>
<td>12,810</td>
<td>22</td>
</tr>
<tr>
<td>I-37</td>
<td>143</td>
<td>5,572</td>
<td>6,408</td>
<td>449</td>
<td>5,959</td>
<td>70</td>
<td>1,410</td>
<td>1,480</td>
<td>10</td>
</tr>
<tr>
<td>I-40</td>
<td>177</td>
<td>5,917</td>
<td>6,805</td>
<td>476</td>
<td>6,328</td>
<td>90</td>
<td>1,860</td>
<td>1,950</td>
<td>11</td>
</tr>
<tr>
<td>I-45</td>
<td>285</td>
<td>10,506</td>
<td>12,082</td>
<td>846</td>
<td>11,236</td>
<td>250</td>
<td>5,320</td>
<td>5,570</td>
<td>20</td>
</tr>
</tbody>
</table>

Source: TxDOT. Analysis by Cambridge Systematics

Note: AADTT, Buffer AADTT, Short-Haul AADTT, Long-Haul AADTT, and Truck Parking Demand per Mile rounded to nearest whole number. Short-Haul Peak Truck Parking Demand, Long-Haul Peak Truck Parking Demand, and Total Truck Parking Demand rounded to nearest ten.
Exhibit 30: FHWA Model Estimates of Truck Parking Demand Compared to Capacity by Corridor

<table>
<thead>
<tr>
<th>Interstate Corridor</th>
<th>Total Daily Truck Parking Demand Estimate</th>
<th>Total Truck Parking Spaces</th>
<th>Total Gap</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-10</td>
<td>9,860</td>
<td>5,772</td>
<td>-4,088</td>
</tr>
<tr>
<td>I-20</td>
<td>8,910</td>
<td>4,599</td>
<td>-4,311</td>
</tr>
<tr>
<td>I-27</td>
<td>590</td>
<td>636</td>
<td>46</td>
</tr>
<tr>
<td>I-30</td>
<td>4,840</td>
<td>826</td>
<td>-4,014</td>
</tr>
<tr>
<td>I-35</td>
<td>12,810</td>
<td>4,573</td>
<td>-8,237</td>
</tr>
<tr>
<td>I-37</td>
<td>1,480</td>
<td>492</td>
<td>-988</td>
</tr>
<tr>
<td>I-40</td>
<td>1,950</td>
<td>1,309</td>
<td>-641</td>
</tr>
<tr>
<td>I-45</td>
<td>5,570</td>
<td>1,533</td>
<td>-4,037</td>
</tr>
</tbody>
</table>

Source: Analysis by Cambridge Systematics (2019).

3.2.3 Model Limitations

While the information developed in the above sections provides a baseline for understanding demand for all trucks traveling in the specified corridors, the FHWA model, as modified for Texas, has a number of inherent limitations which reduce its usefulness for identifying truck parking gaps. For example, while the model provides an adequate baseline to answer state-level, corridor-wide demand questions (is the total truck parking inventory in a corridor sufficient to meet overall demand?), it has a limited ability to quantify demand at a more detailed level (is the truck parking located in areas with the highest demand?). This lack of specificity is a concern in a state like Texas with corridors that traverse both long stretches of very rural land and smaller areas with high population densities. The model’s even distribution of truck parking demand across an entire corridor is unlikely to match reality.

Specifically, the model’s limitations include:

- Distribution throughout corridor does not reflect actual demand locations within the corridor.
- Use of an average speed for the entire corridor does not account for geography, land use, or time of day differences (peak/off-peak).
- Use of an average volume for long corridors, like those in Texas, with significant differences among sub-segments reduces the accuracy.
- Random distribution of truck arrival time in the corridor does not distribute truck volume based on hourly counts.
- Random distribution of remaining hours of service for trucks in the corridor cannot account for freight generators or destinations.
- No consideration of lost productivity due to time used to search for truck parking.
- Limited ability to consider traffic joining or leaving the corridor at intermediate locations (e.g., other overlapping or intersecting corridors).

All of these factors make another approach preferable.

### 3.3 Location Based Data from Active Drivers (ATRI GPS)

A second approach to determining demand and utilization of truck parking is through GPS data. This source provides a highly detailed picture of where trucks are stopping within Texas and can be manipulated to provide information about stop length, location, travel time, and travel direction before and after a stop.

Further details about the data and processing methodology of GPS data can be found in Appendix B.

#### 3.3.1.1 Source and Content

Raw truck GPS data from four date ranges representing different seasons of the year (shown in Exhibit 31) were acquired from ATRI for this truck parking analysis. These periods included at least two for each day of the week, accounting for weekday variations. Seasonal effects were captured by analyzing different months of the year. For each period, ATRI provided GPS location data (referred to as “points”) for every ATRI truck that operated in Texas at any point.

**Exhibit 31: Raw Data Periods**

<table>
<thead>
<tr>
<th></th>
<th>February</th>
<th>May</th>
<th>July</th>
<th>October</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Date</td>
<td>02/01/2018</td>
<td>05/01/2018</td>
<td>07/16/2018</td>
<td>10/16/2018</td>
</tr>
<tr>
<td>End Date</td>
<td>02/15/2018</td>
<td>05/15/2018</td>
<td>07/30/2018</td>
<td>10/31/2018</td>
</tr>
<tr>
<td>Number of Truck</td>
<td>168</td>
<td>161</td>
<td>229</td>
<td>165</td>
</tr>
<tr>
<td>(Thousands)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Number of Points</td>
<td>385</td>
<td>407</td>
<td>415</td>
<td>380</td>
</tr>
<tr>
<td>(Millions)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>


This study is focused on identifying locations where trucks park rather than fully understanding travel patterns of individual vehicles. In order to determine this in a state where many facilities are located close to roadways and other businesses, a high level of accuracy and precision is necessary. These two terms are often used interchangeably, but they are important concepts when using location data of any type. Exhibit 39 provides an illustration of the definition applied for this study.

For truck parking data, the points must be precise enough to distinguish between those inside a truck parking lot and those in another nearby facility. This is especially true when identifying overflow from authorized truck parking areas into unauthorized locations.
Accurate but imprecise data would produce a scattershot of stops in and around a lot, as shown in Exhibit 32, target c). Rules which draw a border tightly around the space would erroneously miss many points. Points from trucks not in the facility of interest may land within the facility. Inaccurate reporting, as in b) and d), could bias the data by putting shifting points in a particular direction, resulting in similar issues to imprecision.

Exhibit 32: Diagram of Accuracy and Precision

Source: Cambridge Systematics.

Raw GPS data from ATRI are fortunately accurate and precise. Exhibit 33 shows an example of pings received from ATRI tracked trucks at the Iraan Rest Area on I-10. There are a total of 847 ATRI points in this sample and none fall more than a few feet from the paved areas based on aerial imagery. While there are too many to clearly see each point even with a sample, they form an outline of the places where trucks go.
Exhibit 33: Example of Raw Data Points (Red Dots) at Iraan Rest Area on I-10 in West Texas

Given there are so many points and they are not far to the side of the road, it is safe to assume that their place along the roadway or ramp is very close also. This allows for a differentiation of trucks on the ramp versus those in the rest area.

3.3.1.2 Translating Raw Data
A stop was generally defined as an occurrence in which a truck was in one place for at least 15 minutes. Trucks stopped at a location may move short distances within the facility or report slightly different locations due to satellite positions, so the stop ended only when it traveled a certain distance based on the moving average of the pings of the stop. Pings which were identified as waypoints – reports from a truck moving on the highway – were marked and filtered out. This was based on the speed of the truck and the frequency of reporting. Unreasonable speeds indicated that points were given an erroneous location or time. They were compared to the adjacent points, and points most likely to be incorrect were filtered out.

16 This length of time reduces the changes that stops are due to delays at construction zones, grade crossings or similar areas.
Even with some allowance for movement within a facility, two stops would occasionally be produced just far enough apart to technically be marked as separate. Consecutive “stops” meeting very specific distance and time criteria were merged at the end of the analysis.

After stops were identified, categories were imposed:

- **Overnight** – A stop which starts before 3 a.m. and ends after 3 a.m., with minimum duration of 4 hours and maximum duration of 48 hours.
- **Long-haul** – A stop between 2 trips of at least 3 hours travel time each.
- **Staging** – A stop with duration between 1 and 4 hours, following a trip of at least 1 hour and followed by a trip of less than 2 hours.
- **Local** – A stop with duration of less than 2 hours and between 2 trips of up to 1 hour travel time each.

These categories will be discussed throughout the analysis to add detail and identify trends in the data. Details about data handling, analysis, and special cases can be found in Appendix B.

### 3.3.1.3 Summary of Processed Data

The output from this process is a set of all stops by all trucks in each period. Exhibit 34 shows a summary of points, stops, and trucks. ATRI trucks made almost 200,000 stops of at least 15 minutes every day.

**Exhibit 34: Summary of Stop Processing Results**

<table>
<thead>
<tr>
<th></th>
<th>Total</th>
<th>Average Per Truck*</th>
<th>Average Per Day</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Raw Data Points</strong></td>
<td>1,587,668,148</td>
<td>2,195</td>
<td>26,027,347</td>
</tr>
<tr>
<td><strong>Processed Stops</strong></td>
<td>10,590,349</td>
<td>15.9</td>
<td>173,612</td>
</tr>
</tbody>
</table>

*Trucks are counted once for each period in which they appear.

A key element to understanding truck parking is the duration of the stop and the travel pattern. In Exhibit 35, stops are broken out by their length. Nearly 60 percent of the stops were less than an hour. The next largest segment were trucks stopping between 1 and 4 hours. Since this data includes trucks stopped for any purpose, at any location in the dataset (including for congestion, incidents, loading/unloading, etc.), the high number of stops of short magnitude is not surprising. The proportions of stops by length did not vary from one season to the next.
Exhibit 35: Stops by Duration—All Stops, All Locations (ATRI Raw Data)

Exhibit 36 shows a statewide heat map indicating density of truck parking activity. This map and Exhibit 35 above include stops of more than 15 minutes for any purpose (loading, sleeping, etc.) and at any location in the state (authorized, business, unauthorized). Future analysis will segregate stops that may have occurred in unauthorized locations.

Exhibit 36: Heat Map of Stops by ATRI Trucks

Heat Map of Stops by ATRI Trucks

ATRI Trucks Stopped per Square Mile
- 0-1 per week
- 2-10 per week
- 11-25 per week
- 26-50 per week
- More than 50 per week

Prepared by Cambridge Systematics. Data for planning purposes only. December 12, 2019

3.3.1.4 *Illustrative Example of Individual Truck Activity*

Exhibit 37 and Exhibit 38 show the pre- and post-processing of the ATRI raw data. The first image is all returned data from the truck over the 61 day period, the second image shows locations where the truck stopped. The truck mapped conducted a large amount of inter-city travel, returning multiple times to Dallas. As a result it had a relatively small number of stops. It made several trips between Dallas and the Abilene area, and a few elsewhere. It parked several times at privately owned truck parking properties like an 11 hour stop at a Love’s West of Abilene.

*Exhibit 37: Example – Pre-Processing*

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17 Pre-processing, ATRI data included GPS “pings” from trucks in motion. Post-processing data are only locations where a stop of at minimum 15 minutes occurred.
Exhibit 38: Example – Post-Processing

4.0 Utilization at Texas’ Publicly Owned Truck Parking Locations (ATRI trucks only)

This section analyzes the truck parking inventory utilization—the number of trucks parked and the total hours parked—at 177 publicly owned truck parking locations throughout the state, based on ATRI GPS data. Exhibit 39 shows trucks parked at one such location on I-10 near Fabens. Utilization is an examination of the number of trucks that are actually parked at a location or within a geography. To provide additional context, trucks parked within 5 miles of each site on the side of highways or ramps were also included in profiles of public sites.18

Exhibit 39: I-10 Rest Area, Westbound, Fabens, TX

Not every truck on the road is included in ATRI’s GPS database; therefore, the number of parked trucks captured in the database, and recorded at any given location, is only a portion of the total number of parked trucks. The ratio of ATRI truck volumes to TxDOT truck volumes from TxDOT traffic counters at locations around the state is needed to “expand” the ATRI count and thereby approximate the actual number of parked trucks. Comparing these numbers will produce an expansion factor (or potentially multiple expansion factors), that can be applied to the raw ATRI GPS data, for a better approximation of total utilization and overall demand for truck parking. This can then be compared to the actual inventory at authorized truck parking locations, and at the district and corridor level, to determine where there are gaps in the truck parking supply.

This section provides an overview of the data and showcases a couple of example locations. Note that data in this section is based on 61 days of “raw” ATRI GPS data, as described in Section 3.3 Thus, utilization compared to inventory will be incomplete until an expansion

18 It is assumed that vehicles stopped within 5 miles on the highway shoulder or ramp would prefer to stop in a rest area or other facility but could not find an open space (thus indicating un-met demand).
factor is applied (Task 2.5). At this stage of the analysis this information is best used as an initial comparison between sites rather than a complete picture of utilization and overall demand.

The analysis looks at utilization using two metrics. One is the actual number of trucks parked, and the second is the total number of hours parked at a location. While both are reported and can provide interesting insights, total truck hours parked will be the focus for determining utilization. This is because the length of time a truck is stopped at a location impacts the availability of a space. For example, an average of 10 trucks parked at a location with 20 spaces over a day gives one view of utilization. An average of ten trucks parked for 10 hours each at that same location gives a more precise view of how heavily the site is utilized.

4.1 Key Findings and Observations

Below are some key findings and observations that will be presented in the remainder of this section.

- This initial look at utilization is based on raw ATRI data (not expanded to represent the entire population of trucks). This means that a direct comparison of supply and estimated demand, needed to estimate the gap or excess of truck parking, is not possible in this memo.

- Based on raw ATRI data, utilization of authorized truck parking locations is highest in the eastern half of the state, especially on I-30, I-20, and I-45 east of DFW.

- The statewide utilization rate based on raw hours parked at publicly owned locations is approximately 13 percent.

- Approximately 66 percent of stops at publicly owned locations are for between 15 minutes and 1 hour, followed by trucks stopped for 8 to 14 hours (15 percent) and 1 to 4 hours (14 percent).

4.2 ATRI-Sample Trucks Parked at Publicly Owned Locations

Based on raw ATRI GPS data, there were approximately 168,000 stops at Texas’ publicly owned locations over the four two-week periods sampled in 2018. Exhibit 40 below shows the total number of trucks parked and the utilization rate based on hours parked compared to the total potential hours of truck parking at each of the locations. This is based on raw ATRI data and provides an initial glimpse at comparative utilization. The busiest publicly owned locations based on both total trucks stopped and utilization of authorized publicly owned sites are in the eastern half of the state surrounding the DFW region, including I-20 east of Dallas, I-45, and I-35 between Austin and the Oklahoma border. These areas also

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19 Potential hours of truck parking calculated as location inventory X 24 hours X 61 days of raw ATRI data.
have high raw utilization rates at many privately owned facilities, indicating overall demand in the region is high.

The top 10 publicly owned locations by total number of trucks parked (raw) during the four two-week sample periods are shown in Exhibit 41. The high number of trucks at some of the sites with smaller inventories indicates that either trucks are stopping for short periods of time (meaning the space turns over quickly) or trucks are parking in areas that are not designated or striped for truck parking within the location.

The top 10 publicly owned locations by percent utilization based on raw truck hours parked are shown in Exhibit 42. Over the 61 days that data were collected, trucks parked for approximately 436,000 hours at publicly owned locations. The total potential truck parking hours at these locations over the same period of time was approximately 3.40 million hours, for a statewide average raw utilization rate of approximately 13 percent. The percent utilization by total potential hours of truck parking uses an average total and does not include potential times of higher demand during peak hours. However, as noted previously, this metric is helpful for comparative analyses, and it creates a baseline for applying an appropriate expansion factor in the next phase of the study.

Exhibit 43 shows a map with the locations of the top publicly owned locations by total trucks stopped and percent utilization of hours parked (ATRI Raw Data over 61 Days).

ATRI estimates that their data covers approximately 45-50 percent of U.S. trucks, although the next memo will develop a Texas-specific expansion factor\(^\text{20}\) to better estimate the total number of trucks parking in Texas. Sites with average raw utilization rates above approximately 35% are indicative of very heavy uses and truck parking at peak times are likely above site inventory.

The Bell County Rest Area on I-35 in Salado is the top location for both total number of trucks parked and percent utilization based on hours parked.

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\(^{20}\) Since ATRI data doesn’t include every truck on the road, this project will identify the gap between ATRI-tagged trucks and trucks captured by TxDOT truck counts at various locations in the state. These will be used to determine what percent of trucks ATRI captures in their data and develop an “expansion factor” that will be applied to the ATRI data to approximate the total volume in the state.
Exhibit 40: Publicly Owned Locations: Trucks Parked and Utilization by Truck Hours Parked (Raw ATRI Data over 61 Days)

### Exhibit 41: Top 10 Publicly Owned Truck Parking Locations by Total Trucks Parked (ATRI Raw Data over 61 Days)

<table>
<thead>
<tr>
<th>Location</th>
<th>Highway, Milepost/Exit</th>
<th>District</th>
<th>Total Trucks Parked</th>
<th>Average Trucks Parked per Day</th>
<th>Location Inventory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bell County Rest Area</td>
<td>I-35 NB MP 281</td>
<td>Waco</td>
<td>7,987</td>
<td>131</td>
<td>28</td>
</tr>
<tr>
<td>Hill County Rest Area</td>
<td>I-35 NB MP 362A</td>
<td>Waco</td>
<td>6,226</td>
<td>102</td>
<td>60</td>
</tr>
<tr>
<td>Bell County Rest Area</td>
<td>I-35 SB MP 282</td>
<td>Waco</td>
<td>6,116</td>
<td>100</td>
<td>28</td>
</tr>
<tr>
<td>Hill County Rest Area</td>
<td>I-35 SB MP 362A</td>
<td>Waco</td>
<td>5,631</td>
<td>92</td>
<td>60</td>
</tr>
<tr>
<td>Gray County Rest Area</td>
<td>I-40 MP 131</td>
<td>Amarillo</td>
<td>4,387</td>
<td>72</td>
<td>47</td>
</tr>
<tr>
<td>Donley County Rest Area</td>
<td>US 287 MP 129</td>
<td>Childress</td>
<td>3,501</td>
<td>57</td>
<td>52</td>
</tr>
<tr>
<td>Ward County Rest Area</td>
<td>I-20 MP 69</td>
<td>Odessa</td>
<td>3,314</td>
<td>54</td>
<td>25</td>
</tr>
<tr>
<td>Walker County Rest Area</td>
<td>I-45 Huntsville, Exit 123</td>
<td>Bryan</td>
<td>3,236</td>
<td>49</td>
<td>28</td>
</tr>
<tr>
<td>Navarro County Rest Area</td>
<td>I-45 SB MP 216</td>
<td>Dallas</td>
<td>3,000</td>
<td>48</td>
<td>28</td>
</tr>
<tr>
<td>Ward County Rest Area</td>
<td>I-20 MP 69</td>
<td>Odessa</td>
<td>2,919</td>
<td>44</td>
<td>25</td>
</tr>
</tbody>
</table>

**Exhibit 42: Top 10 Publicly Owned Truck Parking Locations by Percent Utilization (ATRI Raw Data over 61 Days)**

<table>
<thead>
<tr>
<th>Location</th>
<th>Highway, Milepost/Exit</th>
<th>District</th>
<th>Hours Trucks Parked</th>
<th>Total Potential Hours of Truck Parking</th>
<th>Percent Utilization</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bell County Rest Area</td>
<td>I-35 NB MP 281</td>
<td>Waco</td>
<td>196646</td>
<td>40,992</td>
<td>47.9%</td>
</tr>
<tr>
<td>Bell County Rest Area</td>
<td>I-35 SB MP 282</td>
<td>Waco</td>
<td>176909</td>
<td>40,992</td>
<td>43.7%</td>
</tr>
<tr>
<td>Smith County Picnic Area</td>
<td>I-20 MP 571B</td>
<td>Tyler</td>
<td>3,635</td>
<td>10,248</td>
<td>32.7%</td>
</tr>
<tr>
<td>Midland County Picnic Area</td>
<td>I-20 MP 142</td>
<td>Odessa</td>
<td>2,266</td>
<td>7,320</td>
<td>31.0%</td>
</tr>
<tr>
<td>Van Zandt County Rest Area</td>
<td>I-20 WB MP 538</td>
<td>Tyler</td>
<td>6,320</td>
<td>21,960</td>
<td>28.8%</td>
</tr>
<tr>
<td>Gainesville Travel Information Center</td>
<td>I-35 S Gainesville (Exit 502)</td>
<td>Wichita Falls</td>
<td>7,391</td>
<td>26,352</td>
<td>28.0%</td>
</tr>
<tr>
<td>Van Zandt County Rest Area</td>
<td>I-20 EB MP 538</td>
<td>Tyler</td>
<td>5,682</td>
<td>21,960</td>
<td>25.9%</td>
</tr>
<tr>
<td>Leon County Picnic Area</td>
<td>I-45 MP 159</td>
<td>Bryan</td>
<td>1,893</td>
<td>7,320</td>
<td>25.9%</td>
</tr>
<tr>
<td>Itasca Picnic Area</td>
<td>FM 66 &amp; I-35W MP 8</td>
<td>Waco</td>
<td>1,833</td>
<td>7,320</td>
<td>25.0%</td>
</tr>
<tr>
<td>Walker County Rest Area</td>
<td>I-45 Huntsville, Exit 123</td>
<td>Bryan</td>
<td>7,141</td>
<td>29,280</td>
<td>24.4%</td>
</tr>
</tbody>
</table>

Exhibit 43: Top-10 Publicly Owned Locations by Total Trucks Parked and Percent Utilization of Hours Parked (ATRI Raw Data over 61 Days)

To get a sense of any trucks that may want to park in these facilities but cannot due to potential space constraints, Exhibit 44 below shows publicly owned truck parking locations with high numbers of trucks stopped on the shoulders and ramps of TxDOT owned right of way within 5 miles of the location. Information on trucks parked in the highway right of way will be a focus of future analysis. Exhibit 45 shows an example of a truck parked in Midland on a road shoulder.

### Exhibit 44: Truck Parking Demand within 5 Miles of Publicly Owned Locations (ATRI Raw Data over 61 Days)

<table>
<thead>
<tr>
<th>Location</th>
<th>Highway, Milepost/Exit</th>
<th>District</th>
<th>Total Trucks Parked within 5 Miles on TxDOT right of way</th>
</tr>
</thead>
<tbody>
<tr>
<td>Midland County Picnic Area</td>
<td>I-20 EB, MP 141</td>
<td>Odessa</td>
<td>1,328</td>
</tr>
<tr>
<td>Culberson County Rest Area</td>
<td>I-10 EB, MP 145</td>
<td>El Paso</td>
<td>1,299</td>
</tr>
<tr>
<td>Culberson County Rest Area</td>
<td>I-10 WB, MP 145</td>
<td>El Paso</td>
<td>1,299</td>
</tr>
<tr>
<td>Midland County Picnic Area</td>
<td>I-20 WB, MP 142</td>
<td>Odessa</td>
<td>1,288</td>
</tr>
<tr>
<td>Bell County Rest Area</td>
<td>I-35 NB, MP 281</td>
<td>Waco</td>
<td>936</td>
</tr>
<tr>
<td>Bell County Rest Area</td>
<td>I-35 SB, MP 282</td>
<td>Waco</td>
<td>882</td>
</tr>
<tr>
<td>Texarkana Travel Information Center</td>
<td>I-30 WB, MP 223</td>
<td>Atlanta</td>
<td>806</td>
</tr>
<tr>
<td>Amarillo Travel Information Center</td>
<td>I-40 EB/WB, Exit 76</td>
<td>Amarillo</td>
<td>750</td>
</tr>
<tr>
<td>Chambers County Rest Area</td>
<td>I-10 EB, MP 815</td>
<td>Beaumont</td>
<td>694</td>
</tr>
<tr>
<td>Waskom Travel Information Center</td>
<td>I-20 WB, MP 636</td>
<td>Atlanta</td>
<td>674</td>
</tr>
</tbody>
</table>


### Exhibit 45: Trucks Parked on Road Shoulder in Midland

Source: Cambridge Systematics (2019).

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21 Note that if two sites are opposite of each other, trucks within 5 miles on THFN ROW of one location will be counted in both.
A profile of the Northbound Bell County Rest Area is shown in Exhibit 46. Detailed profiles of all publicly owned truck parking locations are provided in Appendix B of the “Truck Parking Demand in Authorized and Unauthorized Locations” Memo. These profiles contain the following information:

- Location name.
- Route, direction of travel, and milepost or exit.
- Aerial image showing the location and dots representing parked trucks identified from ATRI GPS data during four two-week periods.
- The aerial image also shows an outline of the designated truck parking areas within the publicly owned area in red.
- Key site amenities including restrooms, vending machines, if the site is staffed, wireless internet (WiFi) availability, and if there is angled truck parking.
- Key Data Table including:
  - Inventory – number of authorized truck parking spaces.
  - City and Zip Code.
  - District.
  - Location capacity need based on the utilization of the location during the peak hour (1-2 A.M.) of demand statewide.
- A graph showing hourly utilization using expanded ATRI data compared to site inventory.
Exhibit 46: Bell County NB Rest Area Truck Parking Profile

4.3 Length of Truck Parking at Publicly Owned Locations

Based on the raw ATRI data, Exhibit 47 shows the number of stops by amount of time stopped within publicly owned authorized truck parking locations. Approximately 66 percent of stops lasted between 15 minutes and 1 hour, likely to use the restroom or vending machines (when available)\(^{22}\), or to complete the mandated 30-minute rest break. Trucks stopped for between 8 and 14 hours comprise the second largest total. Most of these vehicles are likely fulfilling a mandated 10-hour break after a full day of driving. Stops between 1 and 4 hours are likely related to staging needs, where vehicles stop for short periods to wait for a delivery window or for congestion to clear. Relatively few trucks stopped between 4 and 8 hours at publicly owned locations. This is not surprising as this amount of time is somewhat high if trucks are stopped for staging reasons but not enough time to meet the 10-hour requirement from FMCSA. The low number of trucks stopped for more than 14 hours indicates publicly owned rest areas are generally not being used to store trucks for longer periods of time such as over a weekend or for a 34-hour reset after multiple consecutive days of driving, which is to be expected due to the fact that these locations only offer minimal, if any, amenities needed for longer stays. Publicly owned truck parking locations do not have any signage restricting the length of time trucks may park.

The location profiles in Appendix B of the “Truck Parking Demand in Authorized and Unauthorized Areas” Memo break out stops at each location by time stopped.

**Exhibit 47: Distribution of Truck Stops at Publicly Owned Truck Parking Locations by Hours Parked**

![Bar chart showing distribution of truck stops by hours parked. 67% of stops lasted 15 Min. to 1 Hour, 23% lasted 1 to 4 Hours, and 3% lasted 4 to 8 Hours.]


\(^{22}\) Of the 177 identified publicly owned locations, 92 do not have restrooms available on site.
5.0 Utilization Across Texas (ATRI trucks only)
Beyond the publicly owned truck parking locations, this analysis also looks at total utilization within all authorized truck parking locations by district and by Interstate corridor using the raw ATRI GPS data. Again, this raw data has not been expanded to estimate the total number of parked trucks. However, the data does allow for an initial comparison between districts and corridors. The following memo (Task 2.5) will expand this data and include an examination of trucks parking in unauthorized areas.

5.1 Key Findings and Observations
Below are some key findings and observations that will be presented in the remainder of this section.

- Across all 639 publicly owned and privately owned truck parking locations in Texas, the statewide percent utilization rate based on raw ATRI data is approximately 17.8 percent. The highest average raw utilization rate occurs in the Dallas District (approximately 25 percent). The lowest raw utilization rate occurs in Pharr District, at approximately 7 percent.

- At the corridor level, the highest raw utilization rate based on hours of activity is on I-30 (27 percent) followed by I-35 (22 percent).

- Statewide, the majority of trucks (64 percent) stopped in authorized truck parking locations are there for less than 1 hour. Parking for 8 to 14 hours is the second highest category in every district except Laredo where there is a higher number of stops between 1 and 4 hours.

5.2 Utilization in TxDOT Districts

5.2.1 Total Utilization
Statewide in Texas, nearly 1.78 million truck parking stops occurred in authorized locations (including both publicly owned and privately owned locations). The Dallas District saw the highest number of total trucks parked within authorized truck parking locations (more than 216,000 over the 61 day period) and the highest raw utilization rate at approximately 25 percent. The Dallas District also has the second highest total capacity of spaces. The Pharr District had the fewest trucks parked in authorized locations with less than 19,000. The Pharr and Corpus Christi Districts had the lowest raw utilization rate based on hours at less than 10 percent.

Statewide, approximately 64 percent of the trucks parked in authorized locations parked for less than 1 hour. These trucks are likely taking short breaks for food or fuel, or to satisfy the 30 minute break requirement in the HOS regulations. The second largest category are trucks stopped between 8 and 14 hours, likely composed of long-haul trucks taking their mandated

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23 The total potential hours of truck parking is derived by taking the total capacity within the district (number of spaces), multiplying by 61 days (ATRI raw GPS sample), and multiplying by 24 hours.
10-hour break after a full day of driving. A breakdown in trucks parked by amount of time parked is shown in Exhibit 48.

**Exhibit 48: Trucks Parked at Authorized Locations by Amount of Time Parked (Statewide)**

![Pie chart showing distribution of time parked]

- 6%: 15 Min. to 1 Hour
- 15%: 1 to 4 Hours
- 3%: 4 to 8 Hours
- 12%: 8 to 14 hours
- 64%: 14+ Hours


Exhibit 49 shows part of an example profile for the Abilene District. Each profile contains a map with the public and private inventory and the capacity need of locations within the district, pie charts showing the length of stay for all trucks at private and publicly owned locations, a data table with expanded truck parking data, and a summary graphic showing the number of locations with high, medium, or low capacity needs in the district.

A second page (not shown) includes two heat maps. One shows the concentrations of stops in each district, the second shows the concentration of trucks stopped on the TxDOT network shoulders and ramps.

Each district profile is also accompanied by a detailed table with publicly owned and privately owned truck parking locations in each district including name, inventory, the minimum and maximum number of trucks parked on average each day, the peak hour demand (with expanded ATRI data), and the number of hours per day that the demand equals or exceeds the inventory.

Full district profiles are provided in Appendix A of the “Truck Parking Demand in Authorized and Unauthorized Locations” Memo.
Exhibit 49: Example District Profile – Abilene District

Exhibit 50 shows the total trucks parked and total hours parked by district for vehicles in authorized truck parking locations, as well as a percent utilization based on the number of hours parked in each category. The statewide average utilization rate using raw ATRI data is approximately 18 percent. Dallas District has the highest utilization rate (26 percent) followed by El Paso (25 percent) and Paris (24 percent).

**Exhibit 50: Truck Parking Utilization Rate at Authorized Locations by District (ATRI Raw Data over 61 Days)**

<table>
<thead>
<tr>
<th>District</th>
<th>Total Parking Spaces</th>
<th>Total Potential Hours of Parking</th>
<th>Total Number of Stopped Trucks</th>
<th>Total Hours of Truck Parking Activity</th>
<th>Total Percent Utilization (Hours)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dallas</td>
<td>2,384</td>
<td>3,490,176</td>
<td>216,217</td>
<td>895,444</td>
<td>25.7%</td>
</tr>
<tr>
<td>El Paso</td>
<td>1,285</td>
<td>1,881,240</td>
<td>84,882</td>
<td>474,211</td>
<td>25.2%</td>
</tr>
<tr>
<td>Paris</td>
<td>593</td>
<td>868,152</td>
<td>61,054</td>
<td>206,896</td>
<td>23.8%</td>
</tr>
<tr>
<td>Tyler</td>
<td>659</td>
<td>964,776</td>
<td>61,560</td>
<td>215,112</td>
<td>22.3%</td>
</tr>
<tr>
<td>Waco</td>
<td>1,405</td>
<td>2,056,920</td>
<td>122,306</td>
<td>453,101</td>
<td>22.0%</td>
</tr>
<tr>
<td>Laredo</td>
<td>1,435</td>
<td>2,100,840</td>
<td>95,755</td>
<td>422,652</td>
<td>20.1%</td>
</tr>
<tr>
<td>San Antonio</td>
<td>2,178</td>
<td>3,188,592</td>
<td>142,906</td>
<td>631,800</td>
<td>19.8%</td>
</tr>
<tr>
<td>Atlanta</td>
<td>635</td>
<td>929,640</td>
<td>47,606</td>
<td>182,839</td>
<td>19.7%</td>
</tr>
<tr>
<td>Austin</td>
<td>362</td>
<td>529,968</td>
<td>29,612</td>
<td>102,634</td>
<td>19.4%</td>
</tr>
<tr>
<td>Fort Worth</td>
<td>1,263</td>
<td>1,849,032</td>
<td>83,075</td>
<td>341,225</td>
<td>18.5%</td>
</tr>
<tr>
<td>Bryan</td>
<td>748</td>
<td>1,095,072</td>
<td>55,429</td>
<td>191,272</td>
<td>17.5%</td>
</tr>
<tr>
<td>Houston</td>
<td>3,142</td>
<td>4,599,888</td>
<td>162,933</td>
<td>784,251</td>
<td>17.0%</td>
</tr>
<tr>
<td>Amarillo</td>
<td>1,600</td>
<td>2,342,400</td>
<td>111,586</td>
<td>375,599</td>
<td>16.0%</td>
</tr>
<tr>
<td>Wichita Falls</td>
<td>497</td>
<td>727,608</td>
<td>32,524</td>
<td>113,182</td>
<td>15.6%</td>
</tr>
<tr>
<td>Beaumont</td>
<td>1,323</td>
<td>1,936,872</td>
<td>72,118</td>
<td>297,432</td>
<td>15.4%</td>
</tr>
<tr>
<td>Yoakum</td>
<td>922</td>
<td>1,349,808</td>
<td>61,467</td>
<td>206,431</td>
<td>15.3%</td>
</tr>
<tr>
<td>Abilene</td>
<td>1,011</td>
<td>1,480,104</td>
<td>70,079</td>
<td>225,616</td>
<td>15.2%</td>
</tr>
<tr>
<td>Lufkin</td>
<td>352</td>
<td>515,328</td>
<td>18,488</td>
<td>76,731</td>
<td>14.9%</td>
</tr>
<tr>
<td>Childress</td>
<td>420</td>
<td>614,880</td>
<td>25,244</td>
<td>84,243</td>
<td>13.7%</td>
</tr>
<tr>
<td>Lubbock</td>
<td>526</td>
<td>770,064</td>
<td>19,279</td>
<td>101,778</td>
<td>13.2%</td>
</tr>
<tr>
<td>San Angelo</td>
<td>484</td>
<td>708,576</td>
<td>26,868</td>
<td>90,219</td>
<td>12.7%</td>
</tr>
<tr>
<td>Brownwood</td>
<td>306</td>
<td>447,984</td>
<td>21,463</td>
<td>55,555</td>
<td>12.4%</td>
</tr>
<tr>
<td>Odessa</td>
<td>1,953</td>
<td>2,859,192</td>
<td>93,509</td>
<td>321,709</td>
<td>11.3%</td>
</tr>
<tr>
<td>Corpus Christi</td>
<td>901</td>
<td>1,319,064</td>
<td>44,214</td>
<td>144,848</td>
<td>11.0%</td>
</tr>
</tbody>
</table>
### 5.2.2 Parking for 15 Minutes to 1 Hour

Parking for between 15 minutes and 1 hour represents the majority of stops in every district. The percent of trucks stopped for this amount of time ranges between approximately 57 percent of all stops in the Lubbock District to 70 percent of all stops in the Paris and Tyler Districts. These stops are likely for one of two reasons:

- To fulfill the FMCSA required 30-minute rest break.
- To get food and fuel.

Additional short-term parking at unauthorized locations such as highway shoulders/ramps and at businesses (for loading and unloading) will be examined in the next memo (Task 2.5).

### 5.2.3 Parking for More than 1 Hour

Exhibit 51 shows the total number of stops at authorized locations for each of the following durations:

- 1-4 hours.
- 4-8 hours.
- 8-14 hours.
- 14 or more hours.

Across every district except the Laredo district, the highest number of trucks based on the raw data at authorized locations are stopping for between 8-14 hours, most likely associated with overnight stops to reset daily HOS requirements. In every district (with the exception of Laredo where they are the highest), stops of between 1 and 4 hours are the second highest total. These stops are often related to staging parking—drivers arrive near a pickup or delivery location early to avoid missing an appointment, but cannot park at the facility itself so find authorized parking nearby to wait.

Dallas, Houston, and San Antonio also have a high number of trucks parked for more than 14 hours. This may indicate that drivers in these areas are leaving their vehicles at authorized parking locations (nearly the entire capacity of spaces in both districts is privately owned) for the mandated 34-hour reset after consecutive days of driving, or they are owner-operators leaving their truck parked for an extended period while they are home.
Exhibit 51: Number of Trucks Stopped by District by Amount of Time Over One Hour Parked - Hour (ATRI Raw Data)

5.3 Utilization on Texas’ Interstate Corridors

The use of authorized truck parking locations within 1 mile of Texas’ main Interstate corridors is summarized in Exhibit 52 below. The following sections provide a brief overview of parking by corridor based on raw ATRI GPS data. Note that this is averaged data across the entire time sample and does not necessarily represent conditions during peak hours of parking demand.

Exhibit 52: Truck Parking Utilization by Interstate Corridor (ATRI Raw Data over 61 Days)

<table>
<thead>
<tr>
<th>Interstate Corridor</th>
<th>Publicly Owned Truck Parking Spaces</th>
<th>Privately Owned Truck Parking Spaces</th>
<th>Total Truck Parking Spaces</th>
<th>Total Number of Trucks Stopped (Raw)</th>
<th>Total Truck Hours Parked</th>
<th>Percent Utilized (raw, hourly)</th>
</tr>
</thead>
<tbody>
<tr>
<td>I-10</td>
<td>559</td>
<td>5,213</td>
<td>5,772</td>
<td>350,487</td>
<td>1,569,892</td>
<td>19%</td>
</tr>
<tr>
<td>I-20</td>
<td>306</td>
<td>4,293</td>
<td>4,599</td>
<td>316,870</td>
<td>1,146,206</td>
<td>17%</td>
</tr>
<tr>
<td>I-27</td>
<td>70</td>
<td>556</td>
<td>636</td>
<td>35,219</td>
<td>162,167</td>
<td>17%</td>
</tr>
<tr>
<td>I-30</td>
<td>98</td>
<td>728</td>
<td>826</td>
<td>95,319</td>
<td>327,450</td>
<td>28%</td>
</tr>
<tr>
<td>I-35</td>
<td>318</td>
<td>4,255</td>
<td>4,573</td>
<td>387,445</td>
<td>1,547,670</td>
<td>23%</td>
</tr>
<tr>
<td>I-37</td>
<td>44</td>
<td>448</td>
<td>492</td>
<td>26,838</td>
<td>84,536</td>
<td>12%</td>
</tr>
<tr>
<td>I-40</td>
<td>195</td>
<td>1,114</td>
<td>1,309</td>
<td>95,037</td>
<td>321,967</td>
<td>17%</td>
</tr>
<tr>
<td>I-45</td>
<td>122</td>
<td>1,416</td>
<td>1,538</td>
<td>109,426</td>
<td>433,532</td>
<td>19%</td>
</tr>
</tbody>
</table>


Key observations regarding each corridor are noted below. Maps with inventory and utilization data are provided in Section 5.8 of the “Demand in Authorized and Unauthorized Locations” Memo.

- **I-10** is a major freight corridor from the Ports of Los Angeles and Long Beach to Florida. It passes through Texas connecting three major urban areas (Houston, San Antonio, and El Paso) and makes up the south leg of the Texas Triangle. The average utilization rate based on raw ATRI data is approximately 19 percent. The busiest location based on raw utilization rates in Texas is on I-10—a Love’s Travel Stop in Anthony with a raw utilization rate based on hours parked of 80 percent.

- **I-20** connects the DFW metropolitan area to the energy sector and natural resources of West Texas. The utilization rate based on raw ATRI data for the corridor is approximately 17 percent with busier sites located around Dallas and points further east.
- **I-27** connects the agricultural regions in the Texas Panhandle, and is part of the Ports-to-Plains corridor. It has the second lowest average utilization rate (17 percent) based on raw data and second lowest number of total spaces within 1 mile of the corridor.

- **I-30** connects the DFW metropolitan area to Texarkana, and continues north and east to Memphis and Chicago. It has the highest raw utilization rate of any corridor at 28 percent. It also has the lowest amount of parking spaces per 100,000 truck-miles traveled in the state (32 spaces per 100,000 truck-miles traveled) and the lowest number of spaces per 1,000 AADTT at 71. This also matches data from the FHWA demand analysis which found I-30 to have the highest demand per mile (30 stops per day per mile), which ties with I-35.

- **I-35** is a major NAFTA trade corridor from Mexico to Canada, a critical north-south trucking corridor through the central United States that passes through several large metropolitan areas in Texas (Laredo, San Antonio, Austin, and DFW). The average utilization rate (23 percent) is the second highest and the corridor also has the highest raw number of stops. This corridor has the third lowest spaces per 100,000 truck-miles traveled (53) and the highest average AADTT in the state (14,603).

- **I-37** is a relatively short corridor, connecting San Antonio and Corpus Christi. It has the lowest raw utilization rate (12 percent) with lower than average truck volumes and parking inventory.

- **I-40**, like I-10 to the south, is a major east to west coast trucking route, passing through Amarillo and the Texas Panhandle. Average percent utilization based on raw data is approximately 17 percent, and the total number of stops and hours parked is in the middle for all corridors. The corridor has the second highest number of truck parking spaces per 100,000 truck-miles traveled.

- **I-45** makes up the eastern leg of the Texas Triangle, connecting the Port of Houston to the DFW metropolitan area. It had the third highest raw utilization rate of approximately 19 percent, and the second lowest number of truck parking spaces per 100,000 truck-miles traveled. This also matches the FHWA demand analysis which found I-45 had the third highest demand for stops per mile (20).
6.0 Topics Affecting Demand and Utilization
Truck parking is subject to technology and trends beyond the control of any driver that play a large role in determining if a truck can find a safe and legal location to park on any given day. Congestion, both specific to trucks and for the public at large plays a significant role in this. The role of pre-paid or reserved parking is an emerging topic within the truck driving community that may shift travel trends and potentially the entire shipping market. Finally, the development of automated vehicles may in the future completely change the way truck trips are conducted and the subsequent demand for parking. These topics and their current or potential future impact on truck parking are considered in the following sections.

6.1 Key Findings and Observations
Below are some key findings and observations that will be presented in the remainder of this section.

▪ Texas is home to 13 of the top 100 truck bottlenecks in the U.S., including the #5 location (I-45 at I-69/US 59 in Houston).

▪ Charging for parking and/or providing reserved spaces is becoming more common amongst privately owned locations and is a contentious topic in the trucking community. While some companies will reimburse drivers for parking, many drivers must pay out-of-pocket for a space.

▪ In the near-term (next 5 years), automated trucks will likely have minimal impacts on truck parking in Texas, as most automation will be focused on driver-assistance technology rather than technology that can replace a driver. In the longer-term, as technology improves and can replace drivers, it will likely be deployed initially on pre-tested and chosen corridors and under specific circumstances. This automation has the potential to greatly decrease the demand for parking along rural portions of selected highways, though there may be an increase in demand for parking on the edges of urban areas. Full automation, when trucks can drive anywhere under any condition without a driver, is likely decades in the future.
6.2 *Congestion – ATRI top bottlenecks*

Each year, ATRI identifies locations where congestion is having the largest impact on truck-borne freight. The 2019 report of the 100 top truck bottlenecks in the nation contains 13 locations in Texas (the most of any state), with 9 of the locations in the Houston metropolitan area including:

- #5: I-45 at I-69/US 59 in Houston
- #13: I-10 at I-45 in Houston
- #16: I-45 at I-30 in Dallas
- #22: I-35 in Austin
- #24: I-45 at I-610 (North) in Houston
- #27: I-10 at I-610 (West) in Houston
- #42: US 75 at I-635 in Dallas
- #57: I-10 at I-610 (East) in Houston
- #61: I-610 at US 290 in Houston
- #69: I-35W at I-30 in Ft. Worth
- #79: I-610 at I-69/US 59 (West) in Houston
- #89: I-45 at I-610 (South) in Houston
- #100: I-10 at I-69/U.S. 59 in Houston

A report by the Texas A&M Transportation Institute (TTI) also identified a “top 10” list of the most congested highway segments in Texas ranked by annual hours of truck delay per mile. As shown in Exhibit 53, most of those segments overlap with the ATRI top bottleneck list.
### Exhibit 53: Texas A&M Transportation Institute Top Congested Roadways in Texas (2019)

<table>
<thead>
<tr>
<th>Rank</th>
<th>County</th>
<th>Road Segment</th>
<th>From</th>
<th>To</th>
<th>ATRI Truck Bottleneck Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Travis</td>
<td>I-35</td>
<td>US 290N / SS 69</td>
<td>SH 71 (Ben White Blvd)</td>
<td>▪ #22: I-35 in Austin</td>
</tr>
<tr>
<td>3</td>
<td>Webb</td>
<td>SL 20 (Bob Bullock Loop)</td>
<td>U.S.-Mexico Border</td>
<td>I-35 / US 83</td>
<td>▪ N/A</td>
</tr>
<tr>
<td>4</td>
<td>Harris</td>
<td>I-610 (W Loop Fwy)</td>
<td>I-10 / US 90 (Katy Fwy)</td>
<td>I-69/US 59 (Southwest Fwy)</td>
<td>▪ #27: I-10 at I-610W ▪ #79: I-610W at I-69/US 59</td>
</tr>
<tr>
<td>5</td>
<td>Harris</td>
<td>I-45 (Gulf Fwy)</td>
<td>IH 10 / US 90</td>
<td>I-610 (S Loop E Fwy)</td>
<td>▪ #13 I-10 at I-45 ▪ #89 I-45 at I-610 (South)</td>
</tr>
<tr>
<td>6</td>
<td>Travis</td>
<td>I-35</td>
<td>SH 71 (Ben White Blvd)</td>
<td>Slaughter Ln</td>
<td>▪ #22: I-35 in Austin</td>
</tr>
<tr>
<td>7</td>
<td>Harris</td>
<td>I-10 / US 90</td>
<td>IH 45 (North Fwy)</td>
<td>US 59 (Eastex Fwy)</td>
<td>▪ #13 I-10 at I-45 ▪ #100: I-10 at I-69/U.S. 59</td>
</tr>
<tr>
<td>8</td>
<td>Harris</td>
<td>I-10/US 90 (Katy Fwy)</td>
<td>N Eldridge Pkwy</td>
<td>Sam Houston Tollway W</td>
<td>▪ N/A</td>
</tr>
<tr>
<td>9</td>
<td>Dallas</td>
<td>I-35E/US 77 (Stemmons Fwy)</td>
<td>SH 183 (John W Carpenter)</td>
<td>I-30 (Tom Landry Fwy)</td>
<td>▪ N/A</td>
</tr>
<tr>
<td>10</td>
<td>Harris</td>
<td>I-69/US 59 (Southwest Fwy)</td>
<td>I-610 (W Loop Fwy)</td>
<td>SH 288 (South Fwy)</td>
<td>▪ #79: I-610W at I-69/US 59</td>
</tr>
</tbody>
</table>


Since many drivers are paid based on the number of miles they drive, every minute spent sitting in traffic reduces the miles they can drive before needing to stop and subsequently, reduces drivers’ daily income. Exhibit 54 provides ATRI estimates of the total economic impacts of congestion on the trucking industry nationally.
Exhibit 54: Congestion Costs to the Trucking Industry

<table>
<thead>
<tr>
<th>$74.5 billion</th>
<th>1.2 billion</th>
<th>425,533</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual cost to the trucking industry as a result of congestion on the nation’s highways</td>
<td>Lost hours of trucking industry productivity due to congestion</td>
<td>Equivalent number of truck drivers sitting idle for an entire year</td>
</tr>
</tbody>
</table>

Source: ATRI (2019).

Similarly to any commuter or driver, congestion that is “predictable” and happens all the time is easier for truck drivers to plan around. However, when the level of congestion is unpredictable, travel time reliability goes down and the ability to pre-plan a route, as well as, truck parking options decreases. This means drivers either need to plan to park at a different truck stop closer to the congested area to allow sufficient “buffer” or risk running out of hours before reaching the intended truck parking location.

In addition to trucks conducting long-haul operations through a corridor, congestion also negatively impacts trucks making local deliveries or staging for short periods of time while waiting for a pickup or delivery window. If areas of severe congestion are located near industrial/warehousing concentrations, then trucks are more likely to allow for additional drive-time and may arrive early to their appointment. Drivers then need a place to park directly adjacent to their pickup/delivery rather than risk parking in authorized locations further out where they may be delayed by congestion. Therefore, congestion increases the need for dispersed short-term staging areas adjacent to shippers/receivers.

Exhibit 55 shows projected highway congestion in 2045.24 Not surprisingly, the urban areas of the state are those most at risk of congestion.

The next memo examining unauthorized truck parking, will identify areas where trucks are parked on the highway shoulder/ramps and compare those locations with the 13 locations identified above to determine the potential role of congestion in contributing to unauthorized truck parking.

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6.3 Pre-Paid Parking
Pre-paid parking or truck parking reservation systems are becoming more prevalent across the United States. These approaches are currently only deployed at private truck stops due to the prohibition on commercializing public rest areas on the Interstate system and the difficulty
of enforcing reservations at a publicly owned location. All of the “Big 3” providers (Pilot/Flying J, Love’s Travel Stops, and TA/Petro) offer reservation systems.

Reservation systems can reduce the stress associated with finding parking. This is especially true if a company is willing to reimburse a driver for paid parking.\textsuperscript{25} For other drivers, especially independent owner-operators, the cost for parking is typically borne by the driver themselves. Reservation systems also benefit large fleets who can contract with specific truck parking providers to reserve spaces for their fleet drivers. Reservation systems also create a revenue stream and financial incentive for truck stop operators to expand or maximize the number of parking spaces on site.

However, for drivers who do not have access to the reserved spaces (either due to financial or user restrictions), reservation systems and pre-paid parking further reduce the capacity of authorized truck parking.

6.4 Autonomoust Vehicles

CMV equipped with automated driving systems (ADS) have the potential to completely change the way freight is moved by truck in the US and around the world. While still in development, the medium and long-term potential impacts of this technology is an important consideration for public agencies attempting to address short-term truck parking issues.

Discussions with industry stakeholders, and research of trade publications and academic papers indicates that multiple configurations, levels of autonomy, and possible deployment scenarios (see 6.4.2) are envisioned in the near-future.

6.4.1 Background

The Society of Automotive Engineers (SAE) “Levels of Driving Automation” (SAE J3016) is the standard classification schema for automated vehicles.\textsuperscript{26} It spans six levels ranging from no automation to full automation, as shown in Exhibit 56. The United State Department of Transportation (USDOT) uses this classification in its Federal Automated Vehicles Policy, and has become the standard reference.

Essentially, SAE Level 0 vehicles have no autonomous functions, while SAE Level 1 and Level 2 vehicles have features which can assist a human driver in certain functions (such as staying in the center of the lane, maintaining a consistent following distance, etc.) but do not replace the human driver. SAE Level 3 vehicles can operate without driver intervention, however, a human must be behind the steering wheel and ready to take control of the vehicle at all times with notice.

SAE Level 4 and Level 5 vehicles do not require any human presence in the vehicle. Level 4 vehicles can operate without a human driver in specified Operational Design Domains

\textsuperscript{25} For example, Nussbaum reimburses drivers for paid truck parking. See: https://jobs.nussbaum.com/wages

\textsuperscript{26} https://www.sae.org/standards/content/j3016_201401/
(ODD). The ODD may include prescribed weather conditions, road conditions, and pre-selected and mapped routes. If outside these parameters, the vehicle either requires a human driver or will not function. SAE Level 5 vehicles can operate in all circumstances without a human driver.

Exhibit 57 provides additional clarification of what actions a human driver is responsible for at each level of autonomy.
Exhibit 56: Society of Automotive Engineers (SAE) Levels of Vehicle Autonomy

Source: National Highway Transportation Safety Administration
Exhibit 57: SAE Levels of Driving Autonomy – Human Responsibility

Truck platooning is an example of a SAE Level 1 system. While operating in the current two-vehicle configuration, the lead vehicle is fully controlled by a human driver while in the second vehicle, steering is under the control of the human driver but vehicle speed (following distance) is controlled by a computer system. As of the end of 2018, 18 states allow commercial truck platooning on highways.27

More broadly, as of February 2019, the majority of states have enacted legislation or passed Executive Orders allowing some amount of automated vehicle operation or testing with the state, as shown in Exhibit 58.


Exhibit 58: Status of State Legislation and Executive Orders Related to Automated Driving


ADS vehicle operation in Texas is governed by Section 545.062 and Section 545.452-454 of the Texas Transportation Code. The first subsection reduces the required following distance for vehicles operating in a platoon. The second allows ADS-equipped vehicles to operate without a human driver as long as the vehicle:

- Is capable of operating in compliance with applicable traffic and motor vehicle laws in the state;
- Is equipped with a recording device installed by the vehicle manufacturer or ADS manufacturer;
- Is equipped with an ADS in compliance with federal law and safety standards;
- Is registered and titled;
- Is covered by motor vehicle liability insurance.

28 https://statutes.capitol.texas.gov/Docs/TN/htm/TN.545.htm. Note that this legislation is not specific to CMV.
Beyond platooning, it appears that the emerging market is split into two groups. One group is focusing on deploying a robust SAE Level 2 system that will provide driver assistance across all weather and traffic conditions. The second group is focusing on deploying SAE Level 4 vehicles operating under specific ODD. None of the companies contacted as part of this study anticipate deploying SAE Level 3 vehicles.

6.4.2 Operational Deployment Scenarios
Although the SAE Levels are a standard way to discuss ADS, they do not capture the full range of options or use-scenarios that industry are pursuing. A 2018 study identified six broad deployment scenarios for ADS equipped CMV. They include:

- **Human-human platoon**: platoon with human driver in each vehicle in the platoon
- **Human-drone platoon**: human drives the first vehicle, remaining vehicles in platoon operate autonomously. Local human drivers would drive loads to/from an origin/destination to a transfer hub near the highway and would swap the trailer with the platooning trucks.
- **Highway automation + drone operation**: vehicle operates autonomously on the highway, and a drone operator drives the vehicle for the first/last mile off of the highway (remote teleoperation). See Exhibit 59 below.
- **Autopilot**: human operates the vehicle for first/last mile and then sleeps in the truck during autonomous operation on/off the highway.
- **Highway exit-to-exit automation**: human operates vehicle on first/last mile on/off the highway and handles non-driving tasks (paperwork, pre-trip inspection, etc.). Driver brings trailer to a transfer hub next to the highway and switches trailer to automated vehicle for highway portion. See Exhibit 60 below.
- **Facility-to-facility automation**: vehicle operates autonomously for the entire trip, with origins/destinations located close to the highway and in areas with few complicated traffic patterns (e.g., industrial roads with few pedestrians and simple intersections).

---

As discussed above, all of these potential scenarios with the exception of the human-human platooning would operate over specified routes and only under certain weather conditions as defined by each company’s ODD. Interviews with industry stakeholders confirmed companies are actively pursuing the following scenarios:

- Human-human platoon.
- Highway automation + drone operation.
- Highway exit-to-exit automation.
- Facility-to-facility automation.
Exhibit 61 provides an overview of publicly known testing and deployment scenarios in the US as of May 2019. Due to the nature of this fast paced, competitive, and evolving industry, information may have changed since publication and some deployment information is not publicly available due to confidentiality concerns.

**Exhibit 61: Known Testing and Deployment of CMV ADS**

<table>
<thead>
<tr>
<th>Company</th>
<th>SAE Level Testing/Deployed</th>
<th>Operating in Texas?</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Peloton Technologies</td>
<td>1</td>
<td>✓</td>
<td></td>
</tr>
<tr>
<td>Daimler</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pronto AI</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Embark</td>
<td>2 (goal of Level 4)</td>
<td>✓</td>
<td>Manufacturing in Denton, TX</td>
</tr>
<tr>
<td>Tesla</td>
<td>2 (goal of Level 4)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Ike Robotics</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Paccar</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Phantom Auto</td>
<td>4</td>
<td></td>
<td>Focus on “yard truck” CMV operation</td>
</tr>
<tr>
<td>Starsky Robotics</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TuSimple</td>
<td>4</td>
<td>✓</td>
<td>US Postal Service Testing (Phoenix to Dallas)</td>
</tr>
<tr>
<td>Uber ATG</td>
<td>4</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Waymo (Google)</td>
<td>4</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Analysis by Cambridge Systematics (2019).

### 6.4.3 Impact on Truck Parking

Exhibit 62 provides one potential timeline for the deployment of CMV ADS.

In the short-term (within the next 3-5 years), ADS-equipped CMV are unlikely to have a substantial impact on the demand for truck parking. SAE Level 1 and Level 2 systems that control speed, following distance, and/or lane positioning will not remove the need for a driver. Trips made using these CMV will likely remain subject to all existing FMCSA HOS regulations. In addition, it is unlikely that SAE Level 4 systems will be widely deployed beyond very specific corridors and driving conditions, limiting the change for truck parking demand.

<table>
<thead>
<tr>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Driver in each truck</td>
<td>Driver in leading truck</td>
<td>Driver for pickup and drop-off</td>
<td>Driverless</td>
</tr>
</tbody>
</table>

- 2018–20: Driver in each truck
- 2022–25: Driver in leading truck
- 2025–27: Driver for pickup and drop-off
- 2027+: Driverless

In the medium and long-term (beyond 2025), CMV ADS have the potential to significantly decrease the demand for overnight parking, especially on rural segments of the interstate system with good wireless connectivity. These long-haul corridors are one of the primary targets of ADS developers due to the (relatively) simple driving scenario and lack of unanticipated outside events more common in urban areas. These areas are often the most difficult to entice private sector investment—reducing the need for parking would help reduce the need for public investment in rest areas, truck turnouts/pull-offs, etc. Rural sections of I-10, I-20, and I-40 are could be among the first corridors to see widespread use of the technology, with testing already underway on segments of I-10.\(^{30}\)

However, depending on the scenario(s) that evolve, CMV ADS may increase the demand for short-term parking and staging, especially near interstate interchanges. A number of current use-scenarios envision a highway-only CMV ADS, with local and urban driving handled by a human driver. This approach would require locations to switch the trailer between a human-driven tractor and an ADS-equipped tractor, as well as provide an area for the human driver to wait. Adding parking in these areas (whether public or private) will likely face some of the

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same challenges as today (community opposition, high land prices, limited available opportunities).
7.0 Next Steps
Because ATRI does not capture every truck in its GPS data, the next step in the analysis is to compare ATRI truck volumes to TxDOT truck volumes at a number of locations around the state. Comparing these numbers will produce an expansion factor (or potentially multiple expansion factors) that can be applied to the ATRI raw GPS data to get a better approximation of total utilization and demand. This can then be compared to the actual inventory at authorized truck parking locations and at the district and corridor level to determine where there are gaps in the truck parking supply. This memo lays the groundwork for that examination which will occur as part of the next memo (Task 2.5 and 2.7).

Task 2.5 and 2.7 will also include an examination of the impact that weather or incident road closures have on truck parking. Some of these events are random, so their impact is hard to predict. However, there are locations in the state where road closures are common enough that alternate routes and alternate parking arrangements may be known. This task will assess road closure data from TxDOT to better understand what trucks do during these events and if these events increase the use of unauthorized parking locations.

Finally, the Tasks 2.5 and 2.7 will also take a closer look at trucks parking in unauthorized locations which is a subset of the full data explored in this memo. Identifying hotspots on highway shoulders and ramps will feed the safety analysis (Task 2.6). Trucks parked at closed TxDOT or DPS facilities and trucks parked in vacant lots or other unauthorized areas will help identify areas with parking gaps. Additionally, it will identify industry segments or other stakeholders that are impacted by the shortage of authorized parking spaces.