

TRUCK PARKING DEVELOPMENT HANDBOOK

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of Transportation

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FOREWORD

The Federal Highway Administration (FHWA) Office of Operations (HOP) is pleased to present the *Truck Parking Development Handbook*.

This Handbook serves as a resource for planners, engineers, local officials, departments of transportation (DOTs), metropolitan planning organizations (MPOs), economic development organizations, and other entities involved in freight and land use planning. The Handbook presents the fundamentals of truck parking issues, including reasons why drivers need to park, factors that influence parking demand, and relevant regulations. The Handbook also introduces quantitative approaches for estimating truck parking demand and for conducting a benefit-cost analysis of truck parking developments. Practices for siting and designing truck parking facilities are outlined, and the Handbook concludes with strategies for developing truck parking to support driver safety and security, quality of life in communities with industrial uses, mobility, and economic competitiveness.

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SI* (MODERN METRIC) CONVERSION FACTORS

APPROXIMATE CONVERSIONS TO SI UNITS

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
in	inches	25.4	millimeters	mm
ft	feet	0.305	meters	m
yd	yards	0.914	meters	m
mi	miles	1.61	kilometers	km
AREA				
in ²	square inches	645.2	square millimeters	mm ²
ft ²	square feet	0.093	square meters	m ²
yd ²	square yard	0.836	square meters	m ²
ac	acres	0.405	hectares	ha
mi ²	square miles	2.59	square kilometers	km ²
VOLUME				
fl oz	fluid ounces	29.57	milliliters	mL
gal	gallons	3.785	liters	L
ft ³	cubic feet	0.028	cubic meters	m ³
yd ³	cubic yards	0.765	cubic meters	m ³
NOTE: volumes greater than 1000 L shall be shown in m ³				
MASS				
oz	ounces	28.35	grams	g
lb	pounds	0.454	kilograms	kg
T	short tons (2000 lb)	0.907	megagrams (or "metric ton")	Mg (or "t")
TEMPERATURE (exact degrees)				
°F	Fahrenheit	5 (F-32)/9 or (F-32)/1.8	Celsius	°C
ILLUMINATION				
fc	foot-candles	10.76	lux	lx
fl	foot-Lamberts	3.426	candela/m ²	cd/m ²
FORCE and PRESSURE or STRESS				
lbf	poundforce	4.45	newtons	N
lbf/in ²	poundforce per square inch	6.89	kilopascals	kPa

APPROXIMATE CONVERSIONS FROM SI UNITS

SYMBOL	WHEN YOU KNOW	MULTIPLY BY	TO FIND	SYMBOL
LENGTH				
mm	millimeters	0.039	inches	in
m	meters	3.28	feet	ft
m	meters	1.09	yards	yd
km	kilometers	0.621	miles	mi
AREA				
mm ²	square millimeters	0.0016	square inches	in ²
m ²	square meters	10.764	square feet	ft ²
m ²	square meters	1.195	square yards	yd ²
ha	hectares	2.47	acres	ac
km ²	square kilometers	0.386	square miles	mi ²
VOLUME				
mL	milliliters	0.034	fluid ounces	fl oz
L	liters	0.264	gallons	gal
m ³	cubic meters	35.314	cubic feet	ft ³
m ³	cubic meters	1.307	cubic yards	yd ³
MASS				
g	grams	0.035	ounces	oz
kg	kilograms	2.202	pounds	lb
Mg (or "t")	megagrams (or "metric ton")	1.103	short tons (2000 lb)	T
TEMPERATURE (exact degrees)				
°C	Celsius	1.8C+32	Fahrenheit	°F
ILLUMINATION				
lx	lux	0.0929	foot-candles	fc
cd/m ²	candela/m ²	0.2919	foot-Lamberts	fl
FORCE and PRESSURE or STRESS				
N	newtons	0.225	poundforce	lbf
kPa	kilopascals	0.145	poundforce per square inch	lbf/in ²

*SI is the symbol for the International System of Units. Appropriate rounding should be made to comply with Section 4 of ASTM E380. (Revised March 2003)
Please view an online version of the SI Conversion table [here](#).

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LIST OF ACRONYMS

AASHTO	American Association of State Highway and Transportation Officials
ADA	Americans with Disabilities Act
APA	American Planning Association
ATA	American Trucking Associations
ATRI	American Transportation Research Institute
BCA	Benefit-cost analysis
CAIT	Center for Advanced Infrastructure and Transportation
CAV	Connected and Autonomous Vehicles
CDL	Commercial Driver License
CFR	Code of Federal Regulation
CHDM	California Highway Design Manual
CMV	Commercial Motor Vehicle
DOT	Department of Transportation
ELD	Electronic logging device
EV	Electric vehicle
FDOT	Florida Department of Transportation
FHWA	Federal Highway Administration
FMCSA	Federal Motor Carrier Safety Administration
GPS	Global positioning system
HDT	Herringbone drive-through
HOS	Hours of service
ICT	Illinois Center for Transportation Studies
KDOT	Kansas Department of Transportation
LNG	Liquefied natural gas
MAASTO	Mid America Association of State Transportation Officials
MAFC	Mid-America Freight Coalition
MAG	Maricopa Association of Governments
MAP-21	Moving Ahead for Progress in the 21st Century
MassDOT	Massachusetts Department of Transportation
MDTA	Maryland Transportation Authority
MoDOT	Missouri Department of Transportation
MPO	Metropolitan planning organization
NAICS	North American Industry Classification System
NATSO	National Association of Truck Stop Operators
NCFRP	National Cooperative Freight Research Program
NHFN	National Highway Freight Network
NHS	National Highway System

NHTSA	National Highway Transportation Safety Administration
O&M	Operations and maintenance
OMSS	Oakland Maritime Support Services
OOIDA	Owner-Operator Independent Driver Association
RV	Recreational vehicle
SBI	Straight back-in
SHRP2	Strategic Highway Research Program 2
TPO	Transportation planning organization
TTI	Texas A&M Transportation Institute
USDOT	U.S. Department of Transportation
VMT	Vehicle-miles traveled

EXECUTIVE SUMMARY

The U.S. economy depends on the trucking industry. According to FHWA's Freight Analysis Framework (FAF) 5.1, trucks carry over 19 billion tons of freight valued at more than \$18 trillion annually in the U.S. This represents 67 percent of all the freight moved in the U.S. by weight and 73 percent by value.¹ According to the Federal Motor Carrier Safety Administration (FMCSA), in 2019, there were 10,160,433 single-unit trucks (straight trucks), and 2,925,210 combination trucks (tractor-trailers) registered in the U.S.² There are nearly seven million commercial vehicle drivers in the U.S. and 3.4 million drivers that operate in interstate commerce.

Just as the trucking industry is critical to our Nation's economic success and way of life, safe, accessible truck parking is critical to the people who drive trucks, the traveling public, and the broader community. The Federal Highway Administration (FHWA) developed this *Truck Parking Development Handbook* to help communities integrate the truck parking needed to support local industry and commerce that is sited and designed to be compatible with local community development.

WHY IS TRUCK PARKING IMPORTANT TO MY COMMUNITY?

Since the enactment of Jason's Law (section 1401 of MAP-21) in 2012, many States and communities have come to better understand the public benefits of truck parking. Truck parking shortages are a national concern affecting the safety of commercial motor vehicle drivers and other roadway users as well as the efficiency of U.S. supply chains. Drivers need adequate rest in safe places to continue to safely operate on the nation's roadways and continue to play a vital role in the American economy. Lack of designated, well lit, secure parking increases personal risk from a driver safety perspective, as well as driver stress. Providing drivers with safe, designated places to park reduces the use of locations like highway shoulders, freeway exit/entrance ramps, vacant lots, and side streets. Averting parking in undesignated locations improves community safety for all and reduces maintenance costs for repairing highway shoulders, ramps, and private property not designed for heavy vehicle parking. Communities often express concern about the impact of truck intensive development on community livability. The research and case studies presented in this Handbook show how well-planned, well-designed, and appropriately sited truck parking facilities are positive attributes for economic development that can support community livability goals.

Demand for truck parking is a culmination of factors determined by the type of parking drivers require, as summarized in figure 1. Determining where and how much parking is needed at the local level to accommodate staging and temporary parking requires knowledge about how local industry supply chains impact communities and land-use planning.

This Handbook explores approaches used in both the private and public sectors to determine the location of facilities that provide services directly to the trucking industry or

¹ FHWA, Freight Analysis Framework version 5.2. 2022. <https://faf.ornl.gov/faf5/Default.aspx>.

² <https://www.fmcsa.dot.gov/sites/fmcsa.dot.gov/files/2022-01/FMCSA%20Pocket%20Guide%202021.pdf>.

truck drivers for parking or associated needs through the demand for other services (e.g., manufacturing, warehousing, and distribution).

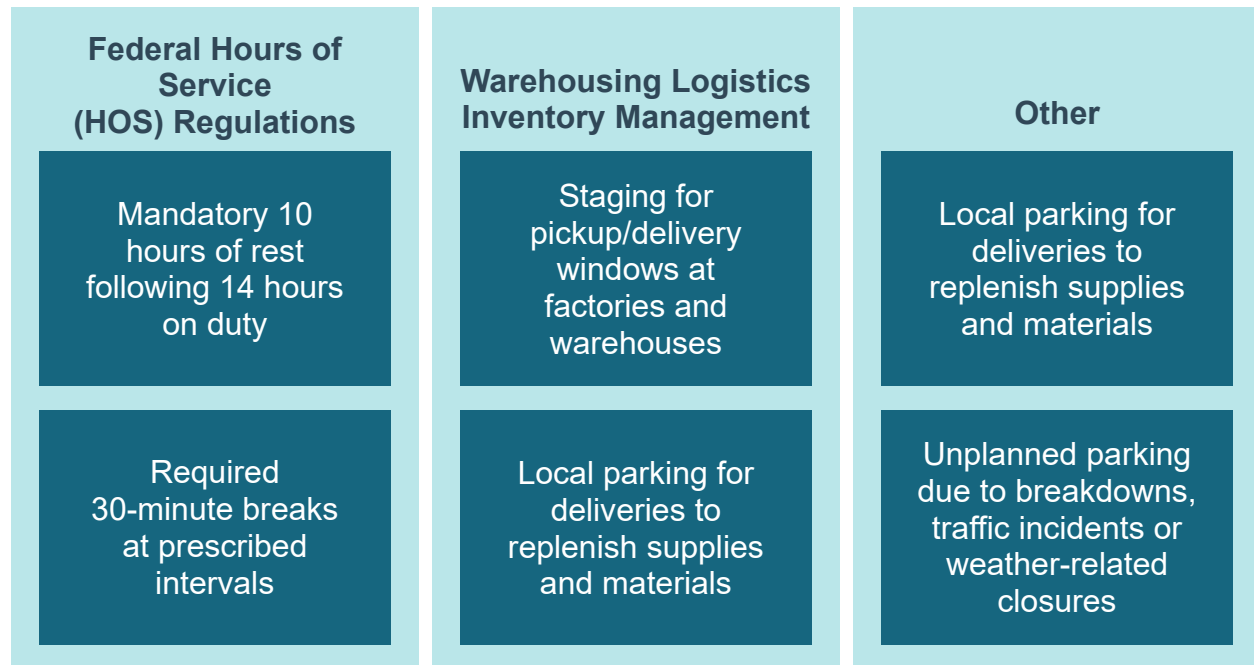


Figure 1. Graphic. Factors influencing or generating the demand for truck parking.
(Source: FHWA, 2021.)

Every day, truck drivers experience frustration as they look for parking to rest, to comply with State and Federal safety laws, or to stage loads for customer appointments: more than 75 percent of truck drivers reported regularly experiencing problems with finding safe parking locations in 2019.³ Since the enactment of Jason’s Law, progress has been made to better assess truck parking needs, especially those associated with Federal regulations for driver Hours of Service (HOS) breaks.

In 2015, the U.S. Department of Transportation (USDOT) established the National Coalition on Truck Parking (the Coalition) with the trucking industry to find common solutions and raise awareness about the need for additional truck parking.⁴ The Coalition formed several working groups to explore current practices and create products for disseminating information on truck parking issues and solutions. Working group members also identified the need for a comprehensive Handbook to address planning for and developing truck parking facilities, including integration with land use development through improved zoning and design guidance.

³ FHWA, Jason's Law Truck Parking Survey Results and Comparative Analysis. https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/jasons_law/truckparkingsurvey/es.htm.

⁴ [National Coalition on Truck Parking: Parking Capacity Working Group - Considerations for Maintaining Low-cost Truck Parking Facilities - FHWA Office of Operations \(dot.gov\)](#).

WHAT IS IN THIS HANDBOOK?

This Handbook presents tools and strategies for local planners and land use officials to integrate truck parking into local planning efforts, land use and zoning policy, and community education efforts to improve the state of truck parking in their communities.

The Handbook covers a wide range of technical issues, making it a valuable reference for local, regional, and State planners. Its provisions are based on widely accepted and used publications to provide a sound basis for designing safe, practical, and efficient roadways and associated facilities. Through planning and land use policies, truck parking can harmonize with community livability goals. The purpose of this Handbook is to provide State and local practitioners with resources to plan for, describe the benefits of, and implement truck parking that supports local economies while minimizing negative externalities. This Handbook presents strategies and case studies for developing truck parking that:

- Support safe freight transportation corridors.
- Integrate parking needs with truck demand generating facilities.
- Ensure compatibility with adjacent land uses through good siting and design.

While incorporating truck parking with new develop can be implemented over time, this handbook also highlights case studies where improvements or operational changes have been made at existing facilities to incorporate some truck parking in the short term. Examples of creative siting of truck parking, shared usage, and expansion of existing commercial locations can be found in several reports prepared by the working groups of the National Coalition on Truck Parking available at:

https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/workinggroups.

This Handbook provides tools for evaluating truck parking demand and discusses factors that communities should consider in order to estimate, understand, and address their truck parking needs. The amount of parking required for a specific development or site will vary based on the operational conditions of truck demand generators, the function of specific facilities, driver employment models, and emergency parking.

This Handbook identifies public benefits that arise from providing adequate truck parking.

Projects that increase the availability of truck parking spaces are likely to generate benefits across several dimensions, making it easier for drivers and reducing both the time spent searching and the distance traveled to reach available parking. These improvements reduce trucking costs and impact communities (emissions, congestion, noise, etc.). Availability also reduces parking in unsafe locations. Truck parking supports local economic development by generating jobs, income, and tax revenues. The benefits derived from reductions in transportation costs enhance regional business competitiveness whether they rely on trucks to deliver goods or provide services to drivers.

This Handbook discusses how to conduct benefit-cost analysis and economic impact analysis of truck parking projects, following USDOT guidelines and conventions. One of the hurdles that often prevent agencies from developing or expanding truck parking capacity is the associated capital and operational costs. The cost and availability of land in urbanized areas may limit the development of privately- or publicly-owned truck parking. However, understanding

the monetary value of parking and knowing how to quantify the safety, travel time savings, and infrastructure preservation benefits, along with the costs and to whom they accrue, may facilitate the development of safe truck parking through developments led by the public sector, the private sector, or through public-private partnerships (P3s).

This Handbook provides local planners with information on factors to consider when identifying and designing locations for truck parking. Transportation logistics, warehousing, and industry generate significant truck traffic and the need for truck parking in many communities. The Handbook reviews site selection criteria used by developers to identify truck stops and businesses that generate significant amounts of truck traffic and, thus, truck parking demand. Better knowledge about truck parking and freight intensive development siting criteria can aid in the adoption of effective land-use policies that incorporate the provision of adequate staging and temporary truck parking. Increased understanding of design requirements for truck parking facilities is important to ensure safe and efficient truck operations and mitigation of community impacts.

This Handbook examines attributes that ensure truck parking areas are safe. Suggested geometric design standards are also provided to give engineering staff a ready resource for understanding the parking needs of large trucks. The design criteria presented draw from *A Policy on Geometric Design of Highways and Streets, 7th Edition* (a.k.a., the “Green Book”) published by the American Association of State Highway and Transportation Officials (AASHTO) and the *California Highway Design Manual* (CHDM). The CHDM covers a wide range of technical issues related to truck parking design, making it a valuable reference for other jurisdictions. In addition to the parking design, other important features for safe parking environments include restrooms, lighting, and security features such as fencing, cameras, or on-site personnel.

This Handbook provides case studies showing successful examples of how communities have implemented truck parking developments across the nation. The successful implementation of truck parking depends on collaboration between the public and private sectors. The barriers to providing needed truck parking are many; funding for facility construction and maintenance is limited, and finding locations to provide parking is difficult in the areas with the highest demand due to land cost and availability. Urbanized areas, especially around industrial, warehousing, or commercial clusters and freight hubs such as ports, international gateways, and intermodal facilities, have the greatest land-related challenges due to the concentration of existing development. When local land availability and economic factors make it difficult to meet truck parking needs, collaboration between public and private partners has proven to successfully implement shared parking facilities.

1. INTRODUCTION

The Nation’s multimodal freight network plays a critical role in meeting the everyday needs of communities and businesses. Timely deliveries keep retail food shelves stocked, manufacturing plants operational, and critical medicine and supplies available. Truck drivers provide critical connections for freight throughout our communities.

Trucks often function as “warehouses on wheels” as they make their way to destinations across the Nation. Long-haul trucks traveling from border crossings, seaports, and other points of entry make multi-day trips across the country, necessitating stops for required breaks and overnight rest. Local and regional drivers making first and last mile pickups and deliveries often need to park while waiting for their designated loading/unloading time. To meet these demands, truck drivers depend on sufficient truck parking in communities throughout the country. The inability to find safe, authorized parking can result in fatigued drivers and unsafe driving conditions, loss of productivity and income, increased congestion, and higher costs for businesses and consumers.

According to FHWA’s Freight Analysis Framework (FAF) 5.1, trucks carry over 19 billion tons of freight valued at more than \$18 trillion annually in the U.S. This represents 64 percent of all the freight moved in the U.S. by weight and 72 percent by value.

Source: FHWA, Freight Analysis Framework version 5.2. 2022.

America relies on trucking to support consumer needs, serve the housing and construction sectors, improve quality of life, and sustain economic competitiveness. Activities such as buying ingredients at the grocery store or receiving an online purchase at home depend on trucks making deliveries to warehouses, fulfillment centers, and other commercial/industrial centers. Over many decades, manufacturing and consumer buying preferences have increased the demand for time-sensitive trucking services. Meanwhile, many urban and suburban communities’ populations have increased, forcing freight intensive developments such as warehousing, distribution, and manufacturing to rural communities.

Land use policy and development practices in urban and suburban communities have shifted to include more live-work-play options and complete-streets implementation. This roadway design practice which typically includes designated facilities accommodating pedestrians, bicycles, transit vehicles, and automobiles. These developments can create additional challenges for trucking operations, increasing the demand for truck parking while limiting opportunities to add safe, efficient, authorized truck parking. This Handbook will help address these issues by providing guidance for incorporating trucking operation needs into planning and development.

WHY DO TRUCKS NEED TO PARK IN OUR COMMUNITIES?

As freight activity and the vehicles that move goods and facilitate services have increased throughout the country, some communities have pushed back. Some cities have forced freight intensive land uses (warehousing, manufacturing, distribution centers, etc.) to move away from urban population centers in response to citizen complaints about noise and traffic. Pushing truck parking areas further into the suburbs or banning truck parking altogether can lead to additional truck traffic issues, reducing economic competitiveness and compromising the time-definite

delivery needs of many businesses. By definition, freight-intensive land uses generate demand for freight movement, often requiring truck activity even when other modes are also used. Appropriate planning and policy can alleviate most community concerns and provide sound, proactive land use strategies.

Truck drivers need to park for many reasons and there are unique challenges for various types of parking needs (see figure 2). Drivers must adhere to Federal and State hours of service (HOS) regulations that place time-definitive limits on driving and rest intervals; modern supply chains and consumer buying habits also influence parking patterns. Finally, truck drivers are essential workers who need to take breaks for rest and safety. A primary goal of this Handbook is to provide local communities with recommendations and practices they can use to create adequate, safe, and appropriately located truck parking. More detailed information addressing this topic is included in chapter 2.

				
Long-Haul	Staging	30-minute Break	Emergency	Time Off
Long-haul drivers are on the road for days or weeks traveling across the country. They need more amenities than drivers who are home regularly.	Truck drivers picking up and delivering freight at manufacturers, warehouses, and distribution centers need to park nearby to await an appointment, often in busy urban areas.	As part of the Federally mandated 30-minute break, the driver must be off duty, meaning they are no longer working and will not have to move the truck for any reason.	Drivers may be impacted by an incident that has closed or severely congested the roadway. Their original itinerary is disrupted, and parking is needed immediately.	Independent drivers do not have a company facility for off-duty parking. They need a place to park while off-duty, but ordinances may prohibit parking at their home.

Figure 2. Graphic. Reasons truck drivers park.

(Source: Adapted from Texas Department of Transportation, Statewide Truck Parking Study, 2020.)

WHY IS THE LACK OF SAFE TRUCK PARKING A PUBLIC CONCERN?

The lack of safe, convenient, and available parking along corridors forces truck drivers to make difficult choices with potentially dangerous consequences. Therefore, providing truck parking also benefits the traveling public, consumers, and communities. Potential impacts include:

Safety: A lack of available safe parking forces some truckers to drive longer than is safe while they search for a place to stop to rest or to park illegally, endangering themselves and, when

parked on the side of the road, creating a hazard for the motoring public. Lack of designated, well lit, secure parking increases personal risk from a driver safety perspective.

The Moving Ahead for Progress in the 21st Century Act (MAP-21) sought to address the shortage of truck parking nationally through Jason's Law,⁵ which gathered information on long-term parking for commercial motor vehicles on the National Highway System (NHS) to improve the safety of motorized and non-motorized users and for commercial motor vehicle operators. Specifically, Jason's Law requires the USDOT to conduct a survey and comparative assessment in consultation with relevant State motor carrier representatives to:

Safe truck parking came into the national spotlight in 2009 following the murder of 35-year-old Jason Rivenburg, a husband, father, and a truck driver. On March 4, 2009, Jason stopped for a delivery in Virginia and then headed toward a delivery destination in South Carolina. While only 12 miles from the delivery location, he needed to find parking to rest through the night since his arrival location was not yet open to receive deliveries. Jason did not have a safe place to park. Jason had heard from truckers familiar with the area that a nearby abandoned gas station was a safe location to park for the night. Tragically, he was attacked and murdered at this location while he slept; his killer took both his life and just \$7.00 that he had in his wallet.

Following his death, Jason's widow, Hope Rivenburg, advocated alongside family, friends, and representatives of the trucking industry to pass Jason's Law under the Moving Ahead for Progress in the 21st Century (MAP-21) Act in 2012. Jason's Law established truck parking safety and security as a national priority and requires the U.S. Department of Transportation (USDOT) to regularly evaluate the need for safe truck parking.

Source:

https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/jasons_law/truckparkingsurvey/ch1.htm

- Evaluate the capability of each State to provide adequate parking and rest facilities for commercial motor vehicles engaged in interstate transportation.
- Assess the volume of commercial motor vehicle traffic in each State.
- Develop a system of metrics to measure the adequacy of commercial motor vehicle parking facilities in each State.

Law Enforcement Dilemma: When truck drivers are tired or reach the limit of how long they can legally drive without having found an appropriate parking location, they must choose whether to park illegally or drive illegally. This presents a difficult problem for law enforcement faced with trucks parked along highways or roadway shoulders. Parking on shoulders or ramps of a limited-access highway is prohibited in most States and poses a hazard to other motorists; however, having fatigued drivers operate beyond the Federal HOS regulations can also be dangerous.

⁵ FHWA. Jason's Law Truck Parking Survey Results and Comparative Analysis, 2015. https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/jasons_law/truckparkingsurvey/.

Preservation of Public Infrastructure: When drivers cannot find authorized parking and reach the end of their HOS, they might park on roadway shoulders or ramps. Frequent stops and starts from heavy trucks create more wear than the infrastructure was designed for, often leading to pavement rutting and cracking of the roadside. The need to do shoulder reinforcements and repairs can be costly for local and State governments which already face funding shortfalls. Funding spent on these repairs may take away from needs in other areas.

Impacts to Shipping Costs and the Economy: A survey conducted by the American Transportation Research Institute (ATRI) documented the amount of lost revenue-earning time that drivers experience by parking earlier than they otherwise needed to find parking. With an average of 56 minutes of revenue drive time sacrificed by drivers per day, the parking shortage effectively reduces an individual driver's productivity by 9,300 revenue-earning miles a year, which equates to lost wages of \$4,600 annually.⁶

These costs are either passed onto shippers, and thus consumers, or absorbed by drivers. Either way, they increase the cost of doing business and the cost of consumer goods. Difficulty and costs associated with finding safe, reliable truck parking can also negatively impact driver retention and recruiting, exacerbating an already tight labor market. The American Trucking Associations (ATA) estimate that the driver shortage hit a historic high of over 80,000 drivers in 2021.⁷ Without enough drivers, manufacturers and retailers must increase inventories to avoid stock outs, thus increasing inventory carrying costs and ultimately, consumer prices. In addition, to get the just-in-time service required to meet today's supply chain demands, shippers often pay premiums for guaranteed on-time deliveries. All these factors add to overall freight transportation costs, supply chain costs, and overall economic competitiveness.⁸ More detailed information addressing this topic is included in chapter 2.

HOW DO COMMUNITIES ADDRESS THE NEED FOR TRUCK PARKING?

Many communities view "big-rig" parking in their communities unfavorably, focusing on negative aspects of truck parking like noise, emissions, and litter. Since the adoption of Jason's Law, USDOT and States have worked to educate communities about the benefits associated with providing truck parking facilities, as noted above. Truck parking facilities can instead be a positive attribute as part of modern logistics centers, making communities more attractive to site developers, increasing local jobs and tax revenues, and reducing negative impacts associated with trucks parked in unauthorized areas.

In 2015, the USDOT and several stakeholder organizations established the National Coalition on Truck Parking (the "Coalition"), responding to the documented need for truck parking solutions. Coalition members include the trucking industry, commercial vehicle safety officials, State departments of transportation (DOTs), and commercial truck-stop owners and operators. In 2016, the Coalition held meetings around the country to get input from key stakeholders on approaches to solve the Nation's truck parking problem. Recognizing the need for a venue to implement

⁶ <https://truckingresearch.org/2016/12/13/atri-truck-parking-case-study/>.

⁷ American Trucking Associations. Driver Shortage Update 2021. https://www.trucking.org/sites/default/files/2021-10/ATA%20Driver%20Shortage%20Report%202021%20Executive%20Summary.FINAL_.pdf.

⁸ [Truck-Parking-in-The-American-Jobs-Plan-Letter-to-Sec-Buttigieg.pdf \(ooida.com\)](#).

ideas brought forth by stakeholders, the Coalition convened Working Groups around key topic areas. The Coalition Working Groups met from November 2017 to July 2019 to explore current practices and create products for disseminating information on truck parking issues and solutions. Working group members also identified the need for a comprehensive handbook to address planning for and developing truck parking facilities, including how to integrate truck parking with land use development through improved zoning and design guidance. More information about these topics is included in chapters 3 and 4.

WHAT IS THE PURPOSE OF THIS TRUCK PARKING DEVELOPMENT HANDBOOK?

This Handbook is a resource for entities that develop and operate truck parking facilities or facilities that create trucking activity that may require truck drivers to park for safety, regulatory, or work duty reasons. This Handbook presents tools, design guidance, and case studies suggesting how truck parking can be viewed as a development opportunity and key element of sound local land use practices.

TARGET AUDIENCE OF THE HANDBOOK

- Planners
- Engineers
- City managers
- Public officials
- Community groups
- Developers

WHAT IS INCLUDED IN THE HANDBOOK?

This Handbook presents tools and strategies for local planners and land use officials integrate truck parking into land use plans and improve the state of truck parking in their communities.

Chapter 2, “Quantifying Truck Parking Needs, Benefits, and Costs,” presents three topics intended to inform planning and engineering practitioners about the importance of truck parking in supporting the Nation’s economy, way of life, and how it impacts local communities:

- ***The National Truck Parking Shortage*** presents facts and data about the importance of the trucking industry and the need for adequate parking opportunities for the safety of truck drivers and other road users.
- ***Estimating Truck Parking Demand in Your Community*** provides recommendations to help planners estimate truck parking demand generated by industrial, warehousing, and commercial land uses.
- ***Benefits and Costs of Truck Parking*** reviews the benefits (safety, time savings, emissions, etc.) and costs (capital, operations, and maintenance) associated with truck parking projects. This section also provides practitioners information on evaluating projects using benefit-cost analysis (BCA) and presents case study examples.

Chapter 3, “Siting and Designing Truck Parking Facilities,” examines truck parking at the community level and provides information on including truck parking in current and planned commercial/industrial developments.

- ***Siting Truck Parking Facilities*** identifies some of the factors used by retail, commercial, and industrial site developers to locate facilities that will generate significant truck traffic and demand for truck parking. The section also explores land use considerations for siting and integrating truck parking into local communities through several case studies. These case studies address new development as well as examples of how truck parking can be integrated at existing facilities.
- ***Designing Truck Parking Facilities*** provides recommendations to local planning and engineering staff for geometric design considerations, and compatible amenities such as lighting, fencing and other safety features.

Chapter 4, “Encouraging and Requiring Truck Parking,” provides tangible steps for use in addressing the truck parking shortages.

- ***Improving Land Use and Zoning Policies*** discusses how land use policies have failed to keep pace with modern shipping practices. Communities can benefit from reviewing land use and zoning policies to ensure they encourage adequate truck parking for new developments that generate truck traffic.
- ***Case Studies of Successful Local Truck Parking Developments*** presents real examples of communities that have addressed truck parking needs.

2. QUANTIFYING TRUCK PARKING NEEDS, BENEFITS, AND COSTS

In 2019, tractor-trailer combinations carried nearly three-quarters of the Nation's freight by weight and 80 percent by value and traveled more than 175.3 billion miles on our Nation's roadways.⁹ While there was a decline in vehicle-miles traveled (VMT) for tractor-trailer or combination trucks in 2011 and 2019, the trend over the past decade is clear; truck travel is growing (figure 3). When single-unit trucks are included, truck vehicle-miles traveled climb to more than 300 billion in 2019, a 12-percent increase from a low in 2011. Single-unit truck miles of travel have steadily climbed since recovery from the recession in 2008.

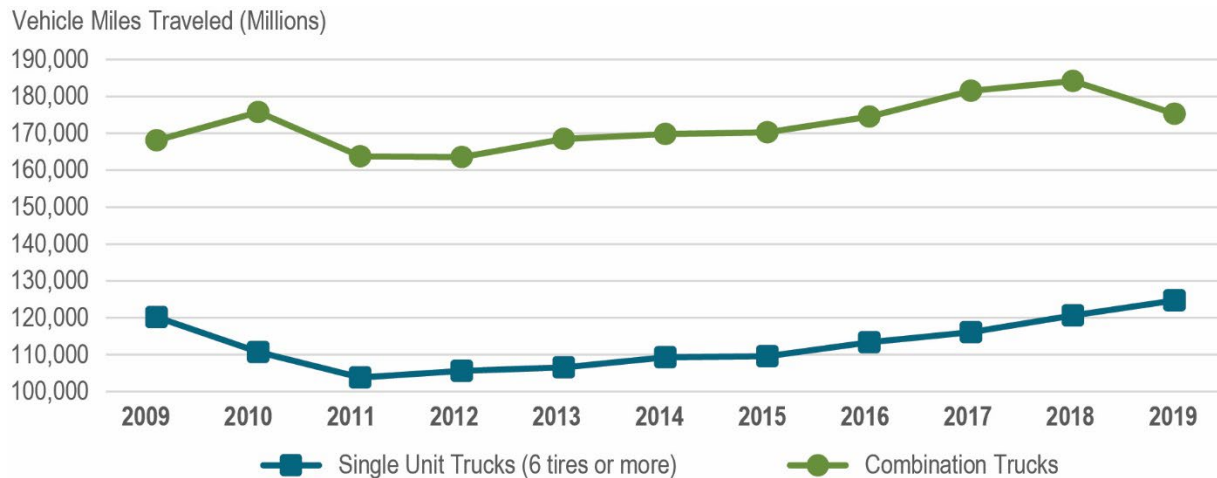


Figure 3. Line chart. National combination truck vehicle-miles traveled (2009-2019).
(Source: U.S. Bureau of Transportation Statistics, 2021.)

Combination trucks are typically used for regional and interstate travel over long distances. Long-haul operations require more hours on the road, with trips often lasting multiple days, creating demand for overnight parking and rest. Modern logistics relying on practices like just-in-time or lean manufacturing, require drivers to stage their loads to meet tight delivery windows. The FHWA projects that trucks will remain the central mode of transport in American commerce; FHWA estimates a 1.5 percent average annual growth in combination truck vehicle-miles between 2017-2030.¹⁰

As a critical component of the Nation's commerce, the trucking industry is also an important jobs creator. According to the ATA, trucking activities supported 7.95 million workers in the economy in 2019—excluding those self-employed. Of that number, the industry employed 3.6 million truck drivers.¹¹

⁹ American Trucking Associations (ATA), Economics and Industry Data online at: <https://www.trucking.org/economics-and-industry-data>.

¹⁰ Federal Highway Administration. *FHWA Forecasts of Vehicle Miles Traveled (VMT)*: Spring 2019. Accessed from: https://www.fhwa.dot.gov/policyinformation/tables/vmt/vmt_forecast_sum.pdf.

¹¹ ATA: [Economics and Industry Data | American Trucking Associations](#).

THE NATIONAL TRUCK PARKING SHORTAGE

Every day, thousands of truck drivers experience frustration as they look for parking to rest, comply with State and Federal safety laws, or stage loads for customer appointments. Transportation planning professionals should be aware that truck drivers are held to strict adherence to HOS regulations using electronic logging devices (ELDs) that precisely track the time, location, speed of travel, and other travel attributes. As a result, truck drivers nearing the end of their allowable drive time may need to stop immediately. Alternatively, drivers may choose to stop in a location far from their destination to ensure they can find parking, losing productivity and creating demand for truck parking outside of congested urban areas. The failure to locate safe parking near a route or a shippers' facility often leads to desperation, and drivers may need to park in undesignated areas like ramp shoulders, side streets, or abandoned lots.

For public agencies, the lack of designated truck parking typically makes a challenging issue worse; through premature damage to roads not designed to handle heavy loads, higher crash risk from trucks parked in the right-of-way or on side streets, and complaints from residents. For drivers, the stress of finding legal parking is just one of many concerns. The time spent looking for parking results in lost productivity and lost wages. Parking illegally or in undesignated areas often presents the risk to personal health and safety, fines, cargo theft, or vehicle damage.

According to the National Highway Transportation Safety Administration (NHTSA), 885 large-truck drivers died in 2018 and 4,678 total people died in collisions with trucks.¹² Providing over-the-road truck drivers with safe opportunities to park improves safety for all road users. In one of the most extensive crash analyses of its kind, the *Large Truck Crash Causation Study* found that 13 percent of commercial motor vehicle (CMV) drivers were considered fatigued at the time of their crash.¹³

To prevent incidents involving fatigued truck drivers, Federal regulations at 49 CFR part 395 require that drivers hauling loads in interstate commerce adhere to HOS rules set by the FMCSA. The HOS requirements largely dictate when, where, and how long truck drivers must park for rest. Table 1 shows the current Federal HOS rules. The FMCSA also requires interstate carriers to use ELDs to record driving hours to ensure compliance (49 CFR 395.8).

Table 1. Summary of Hours-of-Service (HOS) rules for property-carrying drivers.

Rule	Description
11-Hour Driving Limit	May drive a maximum of 11 hours after 10 consecutive hours off duty. (49 CFR 395.3(a)(3)(i)). May be extended by up to 2 hours when a truck driver encounters adverse driving conditions. (49 CFR 395.1(b)(1)).
14-Hour Limit	May not drive beyond the 14th consecutive hour after coming on duty, following 10 consecutive hours off duty. Off-duty time does not extend the 14-hour period. (49 CFR 395.3(a)(2)). May be extended by up to 2 hours when a truck driver encounters adverse driving conditions.

¹² Jerry Hirsch. "Trucking Fatalities Reach Highest Level in 30 Years." Trucks.com. October 22, 2019. Accessed from: <https://www.trucks.com/2019/10/22/trucking-fatalities-reach-highest-level-30-years/>.

¹³ U.S. Department of Transportation Federal Motor Carrier Safety Administration. (2007). *The Large Truck Crash Causation Study*. (Publication No. FMCSA-RRA-07-017).

Rule	Description
30-Minute Driving Break	Drivers must take a 30-minute break when they have driven for a period of 8 cumulative hours without at least a 30-minute interruption. The break may be satisfied by any non-driving period of 30 consecutive minutes (e.g., on-duty not driving, off-duty, sleeper berth, or any combination of these taken consecutively). (49 CFR 395.3(a)(3)(ii)).
60/70 Hour Limit	May not drive after 60/70 hours on duty in 7/8 consecutive days. A driver may restart a 7/8 consecutive day period after taking 34 or more consecutive hours off duty. (49 CFR 395.3(b)-(c)).
Sleeper Berth Provision	Drivers may split their required 10-hour off-duty period, if one off-duty period (whether in or out of the sleeper berth) is at least 2 hours long and the other involves at least 7 consecutive hours spent in the sleeper berth. All sleeper berth pairings must add up to at least 10 hours. When used together, neither time period counts against the maximum 14- hour driving window. (49 CFR 395.1(g)(1)(ii)).
Short-Haul Exception	A driver is exempt from the above requirements if: the driver operates within a 150 air-mile radius of the normal work reporting location, and the driver does not exceed a maximum duty period of 14 hours. Drivers using the short-haul exception must report and return to the normal work reporting location within 14 consecutive hours and stay within a 150 air-mile radius of the work reporting location. (49 CFR 395.1(e)(1)).

(Source: Federal Motor Carrier Safety Administration, 2021.)

In 2015, FHWA conducted the first *Jason's Law Truck Parking Survey and Comparative Assessment*.¹⁴ Among the study conclusions:

- Most States report problems with truck parking shortages.
- Those States that did not report shortages were mostly rural (except for Ohio).
- States report higher levels of shortages in public parking facilities than in private facilities.
- States with the highest numbers of spaces are clustered along major corridors with high truck volumes.

In 2019, FHWA updated the *Jason's Law Truck Parking Survey and Comparative Assessment*.¹⁵ The new assessment found that the truck parking shortage identified in the 2015 report persists. Shortages occur at every time of day, in every State, and throughout the year. Challenges are more acute on major freight corridors, such as busy interstates, and in cities that act as freight hubs. Key observations from the 2019 survey include:

¹⁴ FHWA, Jason's Law Truck Parking Survey Results and Comparative Analysis, August 2015. https://ops.fhwa.dot.gov/Freight/infrastructure/truck_parking/jasons_law/truckparkingsurvey/index.htm.

¹⁵ FHWA, Results of 2018-2019 Jason's Law Survey, December 2020. https://ops.fhwa.dot.gov/Freight/infrastructure/truck_parking/workinggroups/2020/mtg/mtg12012020_jasons_law.htm.

- More than 90 percent of drivers reported that parking was difficult to find between 7 PM and midnight, and more than 60 percent reported difficulty between midnight and 5 AM.
- Truck-stop operators reported a similar pattern of parking constraints, with the busiest times occurring overnight and some level of constraint throughout the day.
- The inventory found an average of 10.0 publicly-owned parking spaces per 100,000 daily truck vehicle miles traveled.
- The Southwest region has the lowest number of parking spaces per miles of travel, with Texas, Arkansas, Louisiana, and Oklahoma having the lowest ratio.
- Approximately 2,000 public and 27,000 private truck parking spaces were added since 2015.
- The 2019 *Jason's Law Survey Update* also found that challenges related to planning, funding, and finding locations for truck parking persisted.

The 2019 *Jason's Law Survey Update* notes that local government involvement and education are needed to improve conditions. The need is particularly prevalent in urban areas where truck parking likely conflicts with nearby land uses and where the need for load staging most directly conflicts with higher land costs. The 2019 study noted that the 32 urbanized areas with the greatest number of freight origins/destinations only have 8.5 percent of the total truck parking spaces. Since zoning and land use development guidelines are most often decided at the local level, the study results indicate that outreach and education of local officials may be beneficial to addressing truck parking needs.

The demands for truck parking extend beyond just complying with HOS regulations. Truck drivers may need to park while waiting on their shipping and receiving appointment schedule which is set by the customers. Despite customer needs, shippers and receivers often do not provide space for drivers to park and wait for scheduled appointments. Additionally, despite popular belief, truck parking at big box retailers is not widely allowed, and permission to park at large retailers can change at any time based on policies set by shopping center owners or local ordinances.

Nationwide, respondents to the *Jason's Law Survey Update* echoed common issues, noting that citizens and local governments need to better understand trucking operations and the value communities receive from prioritizing infrastructure like truck parking. Increasing awareness and understanding of this vital industry can also improve local planning, zoning, and regulatory decisions to serve the community at large. At the same time, truck parking facilities can be designed to mitigate community impacts and concerns.

ESTIMATING TRUCK PARKING DEMAND IN YOUR COMMUNITY

Every community has different generators of truck parking demand. Local manufacturing, warehousing, and distribution activities depend on timely trucking service, which in turn depends on designated and predictable truck parking. Rail, marine, and air intermodal hubs as well as international border crossings can also generate significant parking demand within and outside of the gates of the facilities. Even in communities with relatively low industrial activity, retail business, agriculture, natural resource extraction, and through traffic on a major highway can lead to high truck parking demand.

Understanding Demand in Your Community

The first step in understanding where, when, and why truck drivers are parking in your community is identifying the infrastructure and industries that attract truck traffic. Crowdsourced information on parking availability can help determine the areas of high demand; there are mobile applications that collect and share this information. Additionally, awareness of oversize or overweight truck traffic traveling to, from, or through your community is essential. These loads can be subject to additional constraints related to routing, hours of operation, and parking that influence when and where parking is feasible. Table 2 summarizes information practitioners should seek to characterize truck parking demand in their communities. Collaboration with State, regional, and local planning partners, including economic development corporations attuned to industry needs, can help answer many of these questions efficiently.

Table 2. Taking stock of truck parking generators in your community.

Factor Attracting Trucks	Questions to Better Understand Parking Demand	Planning Implications
Commercial and industrial land uses	• Where are these land uses located? Are they clustered, or spread out? • Are deliveries and pick-ups confined to a time window, or do they occur 24 hours? • Do sites have on-site truck parking? • Are trucks carrying oversize loads, such as heavy equipment or wind blades?	• Drivers typically want to park as close to their destination as possible. • Time limitations can result in accumulating staging demand prior to opening hours. • On-site truck parking can reduce the demand for parking in other locations, such as rest areas. • Parking spaces with a larger footprint may not be available at truck stops and rest areas. Additionally, some jurisdictions have oversize/overweight curfew hours, resulting in parking demand just outside of their limits.
Intermodal generators	• Are deliveries and pick-ups confined to a time window, or do they occur 24 hours? • How much freight is moved to/from trucks? Has this volume changed since initial facility design?	• Time limitations can result in accumulating staging demand prior to opening hours. • Longer trains, larger vessels, and increased utilization of intermodal service can all lead to increased truck traffic.

Factor Attracting Trucks	Questions to Better Understand Parking Demand	Planning Implications
Through traffic	• Which highways carry the greatest truck traffic? • Are there existing truck stops or rest areas along major highways? • Do nearby communities have existing truck stops or rest areas? Do they prohibit truck parking?	• Corridors with the greatest truck traffic often also have the greatest demand for parking. • Drivers seeking parking may anticipate parking availability at a location that is full upon arrival. This can lead to parking in undesignated locations. • Accommodation or restriction of truck parking in nearby communities will either alleviate or intensify demand nearby.

(Source: FHWA, 2021.)

State, regional, or local collaborators may be able to provide data or plans related to truck parking. Many States and regions have conducted detailed truck parking studies in response to the findings of Jason's Law, the national truck parking shortage, and the negative safety and mobility impacts of truck parking in undesignated areas. Planning and engineering practitioners can benefit from coordinating with their planning collaborators and adjacent jurisdictions to determine whether data have been collected on truck parking demand, utilization at rest areas, and safety impacts related to unmet truck parking demand.

Gaining perspective on the greater context of truck parking is also important because not all parking demand occurs directly adjacent to industrial uses. The same truck driver may begin a journey at a shipper, park overnight at a rest area or truck stop, park again to stage near their delivery, and end the journey at the receiver (figure 4). The first parking stop may occur hundreds of miles away from the receiver. The second parking stop could occur within a mile of the receiver, or it could occur 90 miles from the receiver. The driver will determine the best location for both parking stops based on several factors, including anticipated or actual availability of truck parking near their destination, anticipated or actual congestion between the parking location and the destination, amenities offered at various parking locations, contract obligations between trucking companies and truck stop operators, peak hour tolls, and personal preferences. It is also important to recognize that drivers cannot rely on restrooms, water, or other amenities at customer sites, and they may need to make additional local stops to fulfill these needs.

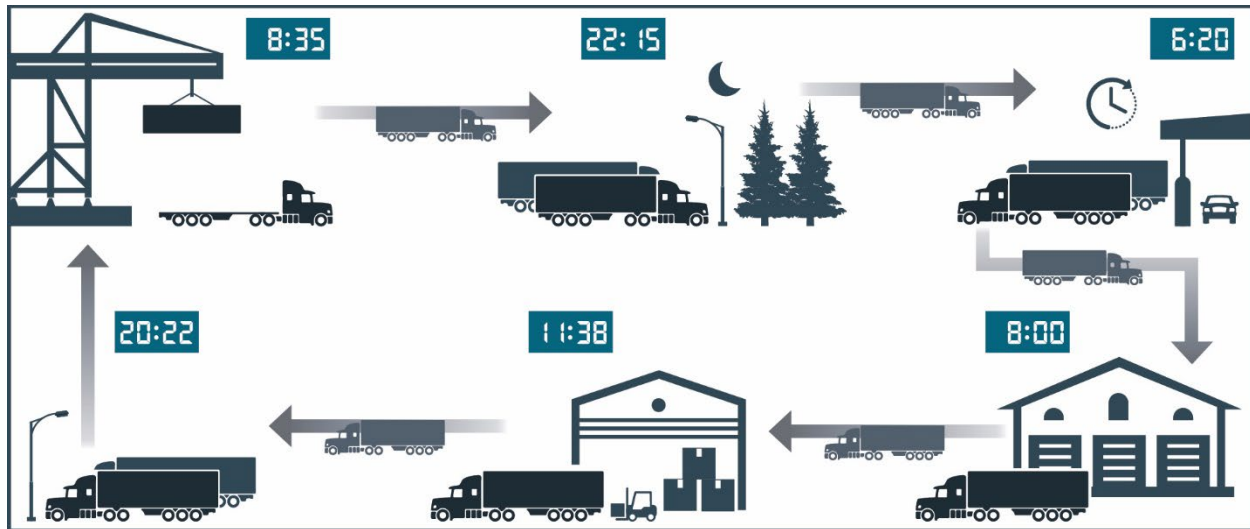


Figure 4. Diagram. Illustrative truck trip with parking stops.
(Source: FHWA.)

Estimating Truck Parking Demand at a Site

As truck-served facilities are developed or expanded, the truck parking impacts of increased truck traffic can be evaluated. Truck parking demand generated by a site should be included in the traffic impact analysis process used by municipalities to systematically evaluate and accommodate truck parking demand as the industrial base of a community grows. Ad-hoc estimations or estimations at existing sites can also provide insight into current and future truck parking demand for a specific development.

National and regional studies have been conducted to develop estimates of the number of truck parking events generated per employee, per square footage, or per truck bay at a given site. Four notable case studies on estimating truck parking demand are highlighted below.

Case Study 1: National Cooperative Freight Research Program (NCFRP) Research Report 37

NCFRP Research Report 37: Using Commodity Flow Survey Microdata and Other Establishment Data to Estimate the Generation of Freight, Freight Trips, and Service Trips: Guidebook is a 2016 publication.¹⁶ This research combined survey data from New York and New Jersey establishments with data from the national Commodity Flow Survey to estimate freight trip generation rates. The report further estimates peak freight and service vehicle parking demand in *Application 1* using the following assumptions:

- Twenty-five percent of all freight trips generated take place in the peak hour.
- Service trips are uniformly distributed throughout an 8-hour workday.
- Delivery vehicles occupy a parking space for 0.5 hours.

¹⁶ <https://www.nap.edu/catalog/24602/using-commodity-flow-survey-microdata-and-other-establishment-data-to-estimate-the-generation-of-freight-freight-trips-and-service-trips-guidebook>.

- Service vehicles occupy a parking space for 1.5 hours.

While this research is helpful for estimating trip generation based on employment and industry, there are some limitations to its applicability to truck parking demand:

- Some industries in the North American Industry Classification System (NAICS) are not included.
- The establishment sample included mostly large establishments, and smaller establishments (by employment) may have a different rate of production per employee due to economies of scale.
- The sample is concentrated in the Northeast U.S., and application to other regions of the country with different development patterns may be inaccurate.
- Peak generation, time-of-day distributions, and parking-specific data are not included in this research. However, assumptions were developed in one of the practical applications.

See *Application 1: Quantification of Commercial Parking Needs for a Commercial Center* in NCFRP 37 for a sample application of this model.

Case Study 2: Strategic Highway Research Program 2 (SHRP2): Winston-Salem Innovations in Local Freight Data

The Winston-Salem Metropolitan Planning Organization (MPO) proposed one of seven projects selected to develop and pilot innovations in local freight data under the Strategic Highway Research Program 2 (SHRP2) Implementation Assistance Program.¹⁷ The MPO and its planning partners faced challenges in planning for freight movement because the regional travel demand model was not sufficiently describing freight flows in the region. One major challenge facing practitioners in the region was a shift from the historically dominant textile industry to broader freight distribution and logistics activity. The research effort conducted under SHRP2 included identification of data needs, interviews with peer MPOs, identification of freight nodes, and a comprehensive survey of freight facilities in the Winston-Salem region. The survey resulted in estimates of daily truck trip generation for each of four site types: distribution center, intermodal facility, retail, and shipper (or manufacturer).

The project estimated the relationships between these factors, including equations to estimate the number of daily truck trips for each facility type based on the number of truck bays. These equations can be used in lieu of the employment-based estimates from NCFRP 37 and are shown in figure 5.

¹⁷ https://www.fhwa.dot.gov/goshrp2/Content/Documents/Factsheets/c20_wnstnslm_case_study.pdf.

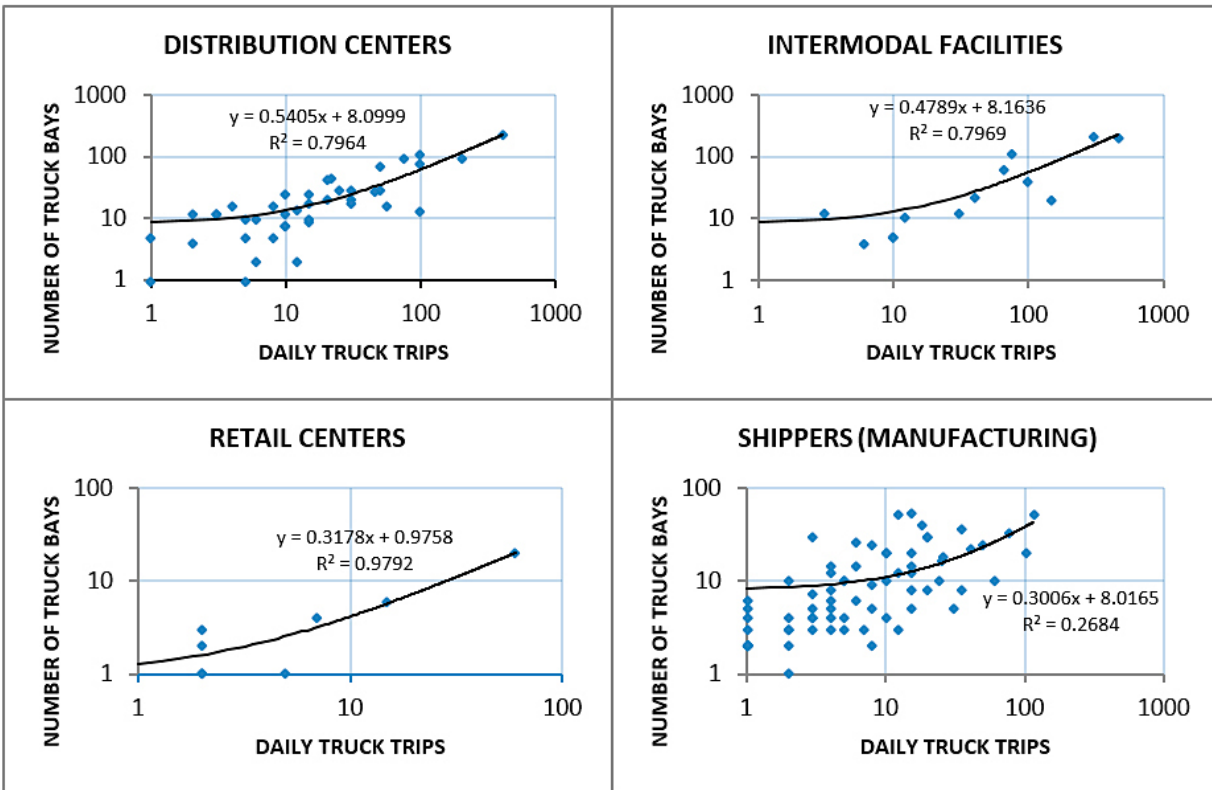


Figure 5. Scatter plot charts. Relationship between daily truck trips and number of truck bays.

(Source: Federal Highway Administration, Winston-Salem Innovations in Local Freight Data, 2016.)

This research provides an alternative to employment-based estimates. This approach can be beneficial for estimating trip generation at a site with an unknown future tenant, such as speculative industrial and warehousing developments. Practitioners should be aware of the following limitations:

- This model uses facility role rather than industry to classify data. The amount of freight generated by shippers varies significantly by industry, resulting in a weak relationship between truck bays and daily truck trips for shippers when all industries are grouped together.
- Data from this region may not be directly transferable to another.
- Additional assumptions are needed to develop truck parking generation rates based on these truck trip generation rates.

Case Study 3: Maricopa Association of Governments (MAG) Truck Parking Study

The 2021 MAG Truck Parking Study used truck global positioning system (GPS) data from ATRI to determine when, where, and for how long trucks stopped in the region. The study included a comparison of stops to land uses, enabling estimation of the number of truck trips

generated by various industries. The study estimated parking activity rates per employee for industrial and commercial establishments categorized at the two-digit and three-digit NAICS level. These estimates were the primary data source used in the development of the FHWA truck parking demand estimation tool, discussed below. Notably, the study found that industrial land uses created the highest amount of truck trips and the longest duration of stopped trucks (figure 6). The MAG study also found that truck parking demand during the peak parking hour was approximately twice the average for the rest of the day.

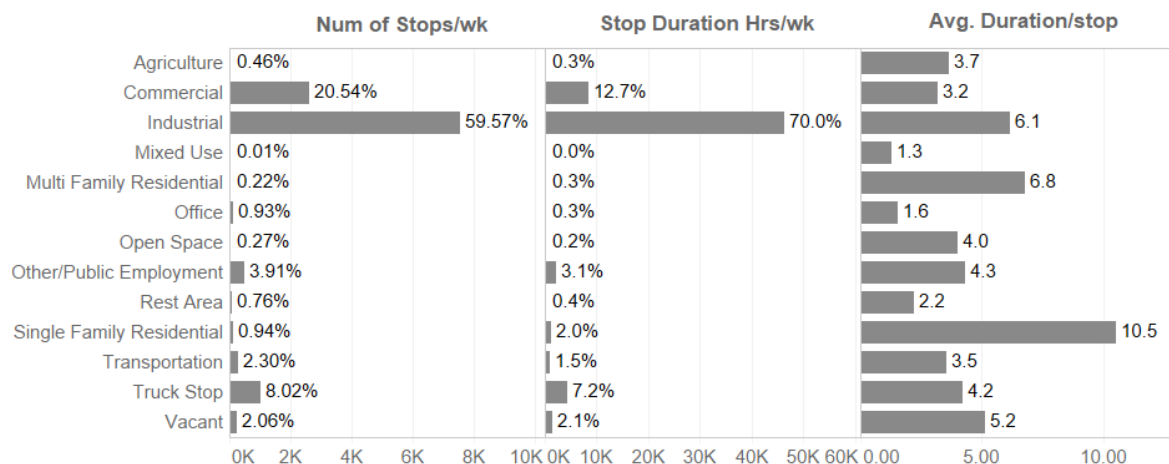


Figure 6. Bar chart. Truck stop data by land use in the Maricopa region.
(Source: Maricopa Association of Governments, 2021.)

The following limitations should be considered when interpreting these findings:

- ATRI data include a sample of trucks that typically overrepresent large fleets. Independent owner-operators and small fleets may not be fully included. An expansion factor was developed to account for this during the study and was uniformly applied across the region.
- The trip generation rates developed do not distinguish between stops at generators to park or stage and stops to pick up or drop off a load.
- Rates should be interpreted as total trucks that need to be accommodated at a site.
- Data from this region may not be directly transferable to another.

Case Study 4: Texas A&M Transportation Institute Truck Trip and Truck Parking Generation Using Truck GPS Data

The Texas A&M Transportation Institute (TTI) developed several case studies using truck GPS data. The study included data from sites in Texas and Maryland, and it included analysis of truck parking generated off-site (e.g., at rest areas) by industrial land uses. The analysis of off-site parking included stops both before and after the study site. The locations studied included:

- Port of Houston, Bayport (Houston, Texas): Traditional Port Area.
- Cedar Port (Houston Area, Texas): Industrial Warehouse Near Major Port.

- Alliance (Dallas, Texas): Major Industrial Facility with Warehouse, Distribution, and Intermodal.
- H-E-B Warehouse and Distribution (San Antonio, Texas): Grocery Warehouse and Distribution.
- Agribusiness Facility (Salisbury, Maryland): Agricultural Processing Facility.
- Rural Crossroad Industrial cluster (Hagerstown, Maryland): Rural Area Industrial Clusters at Crossroad of Major Interstates and Nearby Rail Intermodal.

Notably, this study provided insight into truck parking that supports a specific site, including parking that occurs at other truck parking or industrial locations. This analysis found that more than 85 percent of presumed parking stops were located within 50 miles of the truck driver's destination (see table 3).

Table 3. Distribution of truck parking locations: last stop before arrival at destination.

Distance from Case Study Site	Commercial/ Industrial (prior pick-up or delivery)	Near Highway (parking)	Designated Parking Lot (parking)	Possible Parking Area (parking)
Less than 20 miles	2,176	322	1,199	1,518
20-50 miles	7,910	358	777	2,374
50-150 miles	1,026	60	165	424
Longer than 150 miles	413	30	114	176

(Source: Texas A&M Transportation Institute, 2021.)

FHWA's Truck Parking Demand Estimation Tool

Findings from these case studies can be used to develop a planning level tool that allows local planners to estimate the demand for truck parking for freight-intensive land uses and developments at a high level. The [Truck Parking Demand Estimation Tool](#) allows practitioners to quickly estimate the peak number of trucks requiring parking. Estimates from this tool can help practitioners establish truck parking requirements at new industrial developments, assess a community's current ability to handle new truck parking demand, and plan for increased truck traffic in a community. Table 4 summarizes the parking generation rate for every 100 employees for the NAICS industries with sufficient data. The tool also provides estimates for certain three-digit NAICS codes and estimates of spatial distribution of truck parking demand. Manufacturing facilities should be evaluated using three-digit NAICS codes whenever possible due to significant variation in product types, sizes, and shipping needs. The parking generation rates used at the two-digit and three-digit level come from the 2021 MAG study.

Understanding NAICS Codes

NAICS codes are used to describe the goods or services produced by an establishment. An establishment may have multiple co-located functions, such as a primary function as a manufacturing facility and secondary warehousing activities on site. The primary purpose of the establishment will determine the NAICS code applied to a location. The source data for this analysis categorized different sites of the same business separately based on the primary function of that site. As a result, a distribution center supporting a retail business would be classified under 48-49 Transportation and Warehousing, while the retail stores would be classified as 44-45 Retail Trade.

Table 4. Truck parking demand estimates by employment and industry.

Industry	Parking Stops per 1,000 Employees	Peak Parking per 1,000 Employees
Manufacturing: Facilities that process materials or assemble parts into finished goods (NAICS 31-33, use of 3-digit code is recommended)	36.0	5.0
Wholesale Trade: Facilities that sell bulk goods to retailers (NAICS 42)	77.0	14.3
Retail Trade: Facilities that sell goods directly to consumers (NAICS 44-45)	81.1	11.5
Transportation: Facilities providing transportation by any mode (NAICS 48*)	1810.4	770.9
Warehousing: Facilities for storing, transloading, fulfilling or distributing products, materials, or cargo (NAICS 49**)	222.6	34.7
Accommodation and Restaurants: Facilities providing lodging or food service (NAICS 72)	4.8	2.1

* NAICS 48-49: Transportation and Warehousing is typically presented as a single group. The values presented in this row apply predominantly to truck transportation facilities.

** NAICS 48-49: Transportation and Warehousing is typically presented as a single group. The values presented in this row apply to warehousing facilities only. The research supporting this did not develop a statistically significant value for estimating warehousing parking demand, and these values should be applied with caution.

Note: Variation within industries may be significant based on the size of operations and commodity types shipped to and from the facility.

(Source: Maricopa Association of Governments, 2021).

As with each of the case studies, the [Truck Parking Demand Estimation Tool](#) for estimating truck parking demand at sites has limitations. Practitioners should consider:

- Variation within industries may be significant based on the size of operations and commodity types shipped to and from the facility. For example, a vehicle manufacturer with 1,000

employees will generate a different volume of freight than a packaged food manufacturer of the same size.

- Estimates are based on employment-based studies conducted between 2016 and 2021. As workplace automation and efficiency increases, the output per employee will increase.
- Additionally, facilities may co-locate staff not directly related to freight production, such as marketing or accounting. Individual sites may have a different ratio of freight-producing employees than typical within a NAICS sector.
- The tool includes the option to override the employment-based estimates with a known daily truck volume. Working with economic development corporations and future tenants to understand daily truck volumes will improve the accuracy of these estimates.

When to Use the FHWA Truck Parking Estimation Tool

The estimation tool combines research from many sources and regions of the Nation to make methods more widely accessible to practitioners. This tool applies to truck parking demand from commercial and industrial development, and it does not include approximation of parking demand from through traffic. There are several ways to use the estimation tool:

- Estimate parking generated by a specific development: This tool can be used to develop a baseline estimate for negotiation with developers. All sites will generate truck parking demand, and the tool provides a starting point for discussions related to a specific location as well as wider community impacts.
- Estimate parking impacts of hypothetical changes in land use: Communities throughout the country are experiencing changes in warehousing and distribution patterns, including where facilities are locating and how the trucking industry serves them. This tool can be used to estimate the impact of anticipated increases in industrial development on truck parking demand. For example, what would happen if our manufacturing base grew by 2,000 employees? Scenarios should align with economic development goals to plan for future parking needs.
- Develop guidelines for your community's truck parking requirements: Policymakers can assess how various measures for requiring on-site parking (employment, square footage, and loading bays) result in different peak parking requirements. The tool can also be used for sensitivity testing to confirm whether a guideline will meet the truck parking needs for scenarios anticipated in your community. For example, a speculative site may have an unknown tenant and industry, or workplace efficiency could change production per employee.

BENEFITS AND COSTS OF TRUCK PARKING

Two of the hurdles that often prevent agencies from funding truck parking capacity projects are the associated capital and operational costs. In order to justify these costs, accurate information is needed to quantify the safety benefits, travel time savings, and asset preservation savings from the provision of truck parking. Understanding the benefits and costs and to whom they accrue is important to support funding to develop adequate safe truck parking.

Projects that increase the availability of truck parking spaces are likely to generate benefits across several dimensions, making it easier for drivers to find a space by reducing both the time spent searching for parking and the length of detours needed to reach an open space. These improvements not only reduce trucking costs, but they also reduce the negative impacts of trucking on communities (emissions, congestion, safety, etc.). Making it easy to find parking will also reduce the need for truck drivers to park in undesignated locations, many of which are unsafe and are a nuisance for local communities. Many truck drivers end their drive early to avoid running out of HOS and having to park in undesignated locations. This truck parking safeguard decreases the productivity of the sector and leads to higher costs. Increasing parking availability can improve the productivity and reliability of the trucking sector.

Truck parking projects may also generate broader economic development impacts. Economic development impacts include jobs, income, and taxes generated in the economy. These benefits derive from reductions in transportation costs that in turn enhance regional economic competitiveness, from attracting and retaining business establishments that serve truck drivers in the surrounding area, and from the operations of the parking facility.

This section provides guidance on how to conduct benefit-cost analysis and economic-impact analysis of truck parking projects, following USDOT guidelines and conventions. This section describes the main sources of benefits (decreased undesignated parking, avoided detours, improved productivity, improved reliability, and other), and discusses the estimation of costs (capital and operations and maintenance). Economic impacts are then discussed separately, as these provide an additional valuable perspective to project development. Finally, this section concludes with a summary of two case studies that demonstrate how a benefit-cost analysis can be used to demonstrate how a truck parking project will have a positive impact on the community.

Truck Parking Benefits

USDOT publishes guidance for conducting BCAs, including which benefits can be consistently monetized.¹⁸ In addition, USDOT has conducted annual meetings on truck parking with stakeholder groups as well as facilitated over 20 workshops with States and MPOs. Information from these meetings supports the following observations on truck parking. The guidelines as of 2021 were used to outline specific benefits associated with truck parking. The quantitative benefits of truck parking projects are summarized below:

- Safety for truck drivers.
- Safety for other motorists.
- Enhanced security for truck drivers.
- Reduced emissions of pollutants.
- Reduced trucking costs.

¹⁸ USDOT, Benefit-Cost Analysis Guidance for Discretionary Grant Programs, 2022. <https://www.transportation.gov/office-policy/transportation-policy/benefit-cost-analysis-guidance-discretionary-grant-programs-0>.

- Reduced congestion.
- Reduced infrastructure deterioration.
- Other benefits.

The above benefits are provided from the following outcomes of increased truck parking access:

- Decreased undesignated parking.
- Avoided detours while searching for truck parking.
- Improved trucking efficiency and productivity.
- Improved trucking reliability.
- Other factors.

Decreasing Undesignated Parking: Projects that improve truck parking availability will also reduce undesignated parking in a community. Truck drivers avoid detours to search for parking as an inconvenience and as an extra cost that cuts into wages and profitability. Drivers park in undesignated locations along their route—such as on highway shoulders, interchanges, ramps, and or vacant lots—to avoid unproductive miles or because HOS rules require them to stop and take mandated rest.

Truck parking in undesignated locations is undesirable and potentially dangerous, and therefore projects that reduce this activity can generate the following benefits:

- *Improved Safety:* Truck parking in locations that were not designed to accommodate them pose safety risks to the driver of the truck, the driver and passengers of other vehicles, and pedestrians and cyclists. Projects that augment designated truck parking supply, thus reducing undesignated truck parking, can help to mitigate the following safety risks:
 - Undesignated parking on roadway shoulders poses a significant **crash risk with through traffic** because of the large speed differentials between a stationary parked truck and motorized travel speeds.
 - Undesignated parking on the shoulders can also **prevent other vehicles from using the shoulders**, which poses additional safety risks, particularly during emergency situations.
 - Roads are designed to give drivers lines of sight onto other vehicles so they can make safe decisions. However, trucks parked in undesignated locations can **obstruct these lines of sight**, reducing the visibility of drivers and making it harder for them to see other vehicles and anticipate potential conflicts.
 - In urban areas, delivery trucks that cannot find curbside parking often resort to parking in a travel lane while they make a delivery, often in the middle turning lane. **Blocking a travel lane** represents a safety risk as other vehicles do not expect the lane to be blocked and might make avoidance maneuvers, potentially onto incoming traffic.
- *Improved Security:* Undesignated parking places the driver and the cargo at a security risk. Designated truck parking facilities often have lighting, security cameras, fencing, controlled access, and other drivers, which make them significantly more secure than undesignated

locations. The driver and cargo at undesignated locations have higher exposure to theft, damage, and driver assault. Projects that reduce undesignated parking reduce these risks, benefiting the drivers, the trucking companies, and the owners of the cargo.

- *Other Considerations:*
 - Undesignated parking at public lots or retail establishments **takes up parking capacity** that would otherwise be available for passenger vehicles.
 - Drivers parked for a longer period of time (overnight or staging) often leave their engines running to power heating or cooling systems. This creates **noise** that impacts nearby residents.
 - Engine idling also results in additional **emissions of pollutants** relative to parking in a facility that offers auxiliary power units or other technologies that avoid truck idling.
 - Undesignated parking can accelerate **infrastructure deterioration**, leading to the need for more frequent repaving or rehabilitation expenses. A heavy truck starting to move from a stopped position on the side of the road, while turning the front wheels onto the road, puts significantly greater pressure on the pavement than does a continuously moving vehicle. In addition, shoulders may not have the same specifications as the mainline roadway and could be more susceptible to deterioration by heavy vehicles. Trucks can also hit signs and guiderails while trying to park in an undesignated location.
 - Undesignated parking is often associated with **litter and waste** because drivers do not have access to needed amenities.
 - In urban areas, trucks making deliveries might stop for an extended time on the travel lane if curbside parking is not readily available, creating **roadway congestion** and slowdowns for other vehicles.

Avoided Detours: Truck parking projects that increase the availability of spaces where they are needed will reduce the detours that truck drivers must make to find an open space or access needed amenities and services (such as restaurants). This translates into decreased truck travel on the roadway system, which can be calculated in terms of vehicle miles traveled and vehicle hours traveled. Decreased truck travel generates the following benefits:

- *Decreased Trucking Costs:* Reducing unnecessary truck travel will decrease the costs of trucking associated with driver wages, fuel, vehicle costs, etc. In a competitive environment, these savings tend to be passed onto shippers, and ultimately to customers in the form of lower-cost products.
- *Avoided Externalities:* Trucks generate externalities because of their size and weight. As these large and heavy vehicles travel throughout the roadway system, alongside passenger vehicles, pedestrians, and cyclists, they generate costs to the general public. These costs include increased crash risk, emission of criteria pollutants, emissions of greenhouse gasses, and increased congestion. The public sector also faces an additional cost from the premature deterioration of pavements and additional stress on bridges. Projects that reduce truck travel in general will generate benefits by reducing these costs.
- *Reduced Driver Fatigue Safety Risks:* Drivers are more likely to be fatigued when searching for parking, as this comes at the end of their shift, and drivers might even be distracted if they

have difficulty finding a place to rest. Projects that make it easier for truck drivers to find a spot are likely to reduce these safety risks.

Improved Trucking Productivity: The lack of parking availability often leads truck drivers to end their day early to avoid running out of driver time under HOS regulations. Recent studies have found that drivers often end their day early by 30 minutes or more, with some ending their day early by more than 1 hour.^{19,20} Drivers can be reluctant to wait until the very end of their day to seek parking if they believe parking may be difficult to find, instead ending their shift early if they see available spaces along their route.

Parking projects that make it easier to find a space and allow truck drivers to work more hours each day will reduce the time that it takes to complete shipments. The additional driving time will allow the shipment to be completed sooner, reducing time-dependent costs per shipment, such as driver wages, permits, licenses, insurance premiums, and overhead, among other costs.

ATRI estimated that each hour of additional drive time per day (within HOS limits) reduces daily trucking costs by 0.8 percent.²¹ This value was estimated using conservative assumptions and could be significantly higher for certain types of trucking.

The limited availability of parking, over a region or corridor, will directly reduce the productivity of trucking. Over time, the lower productivity of trucking will lead to higher transportation costs, and, ultimately, higher consumer prices.

Improved Trucking Reliability: The reliability of shipments is an important variable for trucking companies and shippers.²² Modern supply chains are highly optimized and depend on freight arriving at its destination on time. Projects that increase the availability of truck parking can improve the reliability of transport services along a corridor, especially in dealing with unforeseen events, such as snowstorms or vehicle breakdowns. More parking options could allow the truck driver to deal with these circumstances and return to the road as quickly as possible.

Increasing reliance on just-in-time supply chains for reducing inventory costs places a premium on shipments arriving during their appointment delivery windows. Truck drivers respond by increasing the “slack,” or buffer time, in their schedule to ensure on-time performance in the face of traffic congestion and unexpected issues. Trucks that arrive early for a pickup or delivery are often not allowed to wait on premise, which creates a need for “staging” or temporary parking in

¹⁹ Oregon Commercial Truck Parking Study, 2019. Accessed from: <https://www.oregon.gov/ODOT/Projects/Pages/Commercial-Truck-Parking-Study.aspx>.

²⁰ Texas Statewide Truck Parking Study. April 2020. Accessed from: <https://ftp.txdot.gov/pub/txdot/move-texas-freight/studies/truck-parking/final-report.pdf>.

²¹ American Transportation Research Institute. An Analysis of the Operational Costs of Trucking: 2020 Update. Accessed from: <https://truckingresearch.org/wp-content/uploads/2020/11/ATRI-Operational-Costs-of-Trucking-2020.pdf>.

²² Guerrero, S. E., Hirschman, I., Bryan, J., Noland, R., Hsieh, S., Schrank, D., and Guo, S. 2019. NCHRP Research Report 925: Estimating the Value of Truck Travel Time Reliability, Transportation Research Board, National Academies of Science.

or near industrial and commercial areas. Difficulties finding parking can make it harder for truck drivers to meet their appointments and decrease the reliability of supply chains.

Other Benefits: Truck parking projects that improve the availability of parking spaces can also have the following benefits:

- *Driver satisfaction and retention:* Having readily available truck parking decreases the stress of drivers, particularly on unfamiliar routes, which could improve driver retention. The amenities available at truck stops and rest areas can also make life on the road easier. All this could help ameliorate the driver shortage.
- *Facilitate regulation compliance:* Readily available parking would make it easier for trucking companies to comply with HOS rules. Otherwise, trucking companies and drivers must spend time and effort planning routes and stops so that they maximize the productive driving time and be able to find safe parking within the HOS rules. This takes effort, and might cause stress for drivers, particularly on new routes.
- *Increased productivity of nondriving time:* The amenities and services available at truck stops allow truck drivers to be productive during nondriving time, and even to get better rest relative to parking at a location without these amenities. The ability to refuel or perform maintenance on the trucks while meeting the HOS allows drivers to get more out of their workday.
- *Better rested drivers:* The ability to shower, eat well, and be in a safe environment also allows drivers to rest more fully. Better-rested drivers are likely to be more attentive and drive more safely.
- *Deployment of green technologies:* Truck parking facilities can be designed to have auxiliary power units that feed power to the cab that enable heating and cooling without having to run the engine. Parking facilities could also have stations that allow for recharging of electric trucks. All this leads the parking facilities to support the deployment of green technologies in the truck fleet that reduce emissions of criteria pollutants and greenhouse gasses.

Truck Parking Costs

Previous sections discussed the benefits of providing truck parking. This section discusses the costs. Capital costs are the one-time expenses incurred to build the project. Operations and maintenance (O&M) costs should also be included in the analysis, however in a BCA framework they should be included as a negative benefit, and not added to the capital costs. Some projects might decrease O&M costs, which would result in a benefit, however most projects that involve new construction are likely to increase O&M costs, and therefore would be included in a BCA as reducing the net benefits of the project.

Capital and O&M Costs: The capital costs of creating new truck parking spaces, whether by constructing a new facility or expanding an existing one, should be estimated with as precise information as possible, and should consider local factors and project specifics. Engineering estimates are the best source of cost information, because they consider local material costs, wages, and constraints. If engineering estimates are not available, planning-level estimates can also be used. However, care should be taken to ensure they are realistic and representative.

Capital costs include all expenses required to build the project, including project planning, design, environmental reviews, utility relocation, construction, and transaction costs to secure financing. Capital costs should not be limited to those for which public funds are sought for the project.

The USDOT guidance for conducting benefit-cost analyses includes land acquisition costs.²³ These costs will vary widely throughout the U.S. Some municipalities make parcel and property tax data available, which can help provide estimates of a parcel's value.

The O&M costs of the parking facility should also be included. O&M costs can be broken down into costs relating to the operation of the parking facility and costs related to sales activities (gas and concessions). These include:

- Employees.
- Utilities.
- Maintenance.
- Administrative costs.
- Consumables.

Economic Development: The private-sector benefits of truck parking projects will, over time, support economic development, in terms of additional jobs, income, and taxes. The following types of economic development impacts are typically associated with truck parking projects:

- *Facility Operations:* The expenditures required to run the parking facility will also have positive economic impacts. These expenditures support jobs involved in the operation and maintenance of the facility, as well as jobs involved in the supply of products purchased at the facility such as fuel and food.
- *Adjacent Development:* New truck parking facilities will also attract truck-related businesses to locate in the surrounding area. A recent study in Little Rock, Arkansas found that land values are higher closer to truck parking facilities, holding other factors constant, reflecting increased demand for locating in these areas.²⁴
- *Regional Economic Competitiveness:* The lower transportation costs, improved reliability, and other private-sector benefits will lead businesses to be more competitive, do more business, hire more workers, and contribute to raising the level of economic activity in a region.

²³ U.S. Department of Transportation. Benefit-Cost Analysis Guidance for Discretionary Grant Programs. 2022. <https://www.transportation.gov/office-policy/transportation-policy/benefit-cost-analysis-guidance-discretionary-grant-programs-0>.

²⁴ Mahmud, S., Hernandez, S., and Mitra, S. 2021. Impact of Truck Parking Facilities on Commercial and Industrial Land Values: A Spatial Hedonic Model. Presented at Transportation Research Board Annual Conference, Washington, DC. 2021.

- **Construction:** The expenditures made to build a new parking facility, or expand an existing one, positively impact the local economy. This supports not just jobs in the construction sector, but jobs in other sectors that supply goods and services for construction activities.

Economic development impacts can be presented alongside the results of a BCA analysis to tell a compelling project story, but based on standard practices, should not be included in the BCA itself. For a broader discussion of the benefits of freight to local communities see the FHWA Freight and Land Use Handbook.²⁵

Benefit-Cost Case Studies

Two case studies were developed to demonstrate how to apply the benefit-cost methodologies to evaluate truck parking projects. These case studies were drawn from two existing studies. The projects were hypothetical, however, and no new data collection was conducted. These case studies illustrate how to estimate the benefits of these types of projects and balance needs with costs. The following is a summary of their context and findings:

Case Study 1: Portland, Oregon: The 2019 Oregon Commercial Truck Parking Study found that areas in and around Portland, OR have the highest demand for truck parking, leading parking facilities in these locations to operate at capacity.²⁶ This case study examines the benefits of a hypothetical project that increases truck parking capacity on I-84 approaching Portland. This corridor already has a few parking facilities. They have limited availability, however, and forecasts show that by 2040 there is likely to be a capacity shortfall of 39 spaces. The project would also reduce undesignated parking on this corridor, which is significant as the study found 10 sites of undesignated parking nearby. Approximately 95 trucks park at these locations (for 30 minutes or more), for an average of 2.4 hours each. The hypothetical project involves the construction of a 100-space parking facility that offers amenities to truck drivers. The project is assumed to have capital costs of \$7.5 million and yearly operating costs of \$200,000.

A benefit-cost analysis shows that this project would generate significant benefits, yielding a benefit-cost ratio of 1.8 discounted at three percent and 1.0 discounted at seven percent. As shown in figure 7, approximately 58 percent of the benefits are expected to come from the reduction of undesignated parking, and 21 percent come from the reduced need for detours to find a parking space. The rest of the benefits of the project are expected to come from improvements in trucking productivity and avoided trucking externalities (e.g., emissions, roadway crashes, and pavement deterioration).

²⁵ FHWA. Freight and Land Use Handbook. April 2012.
<https://ops.fhwa.dot.gov/publications/fhwahop12006/fhwahop12006.pdf>.

²⁶ Oregon Department of Transportation, Commercial Truck Parking Study, 2019.
<https://www.oregon.gov/odot/Projects/Pages/Commercial-Truck-Parking-Study.aspx>.

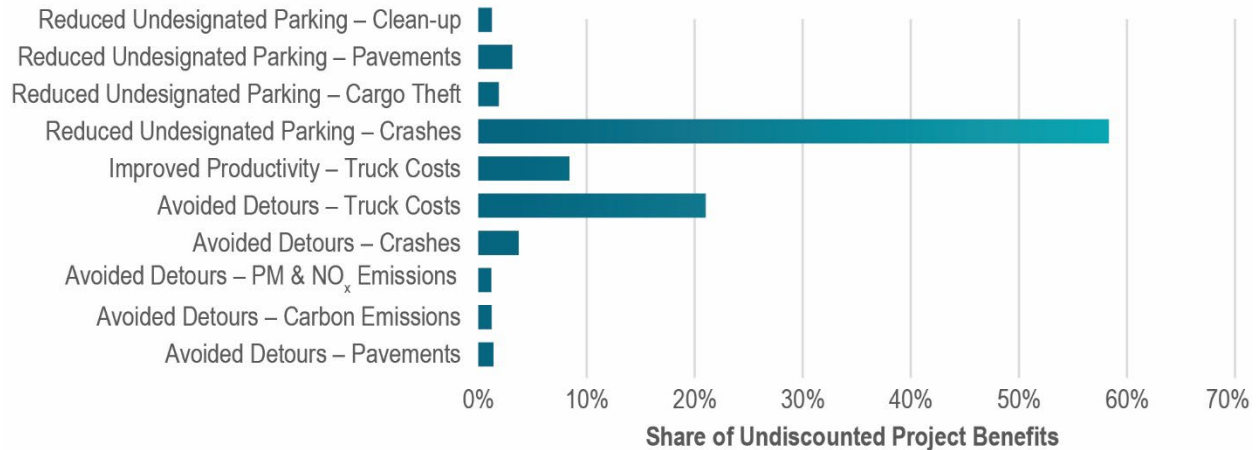


Figure 7. Bar chart. Distribution of undiscounted benefits in the Portland case study.
(Source: FHWA, 2021.)

Case Study 2: Phoenix, Arizona: The 2020 MAG Truck Parking Study identified a large imbalance of parking demand relative to the supply of spaces in the Tolleson area of Phoenix, AZ, which is located where I-10 meets the Agua Fria Freeway.²⁷ This area is home to significant industrial and commercial activity, making it a major attractor of truck traffic. This creates a large demand for truck parking, particularly for staging purposes as drivers wait for a delivery or pickup appointment. There are several truck parking facilities in this area, however, they are currently operating at capacity. Difficulties finding parking contribute to the high proportion of undesignated parking observed in the Tolleson area. The MAG Truck Parking Study estimated that four locations in this area accumulate 71,300 hours of undesignated parking per year, after expanding the GPS records.

Faced with this need, FHWA analyzed a hypothetical project that repurposes a vacant lot in the Tolleson area into a low-cost public truck parking facility with the capacity to accommodate 100 trucks. This hypothetical project was assumed to be accompanied by an information campaign and stricter enforcement to reduce undesignated truck parking. The project was assumed to cost \$3.5 million (including land acquisition and construction costs) and have yearly operations and maintenance costs of \$100,000. While acquiring land in an industrial area such as this one is typically expensive, the project is expected to generate significantly more in benefits from improved safety, improved trucking productivity, and avoided externalities.

The project was estimated to have a benefit-cost ratio of 1.2 when discounting at seven percent, and 2.15 when discounting at three percent. As shown in figure 8, approximately 60 percent of the benefits would come from safety improvements from reduced undesignated parking.

²⁷ <https://www.azmag.gov/Programs/Transportation/Freight-Transportation/MAG-Truck-Parking-Study>.

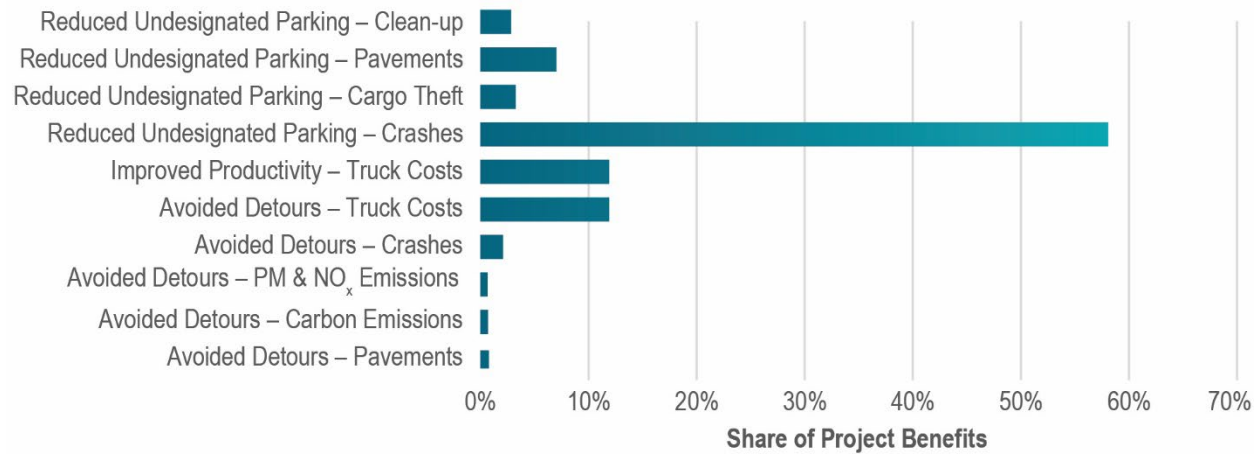


Figure 8. Bar chart. Distribution of undiscounted benefits in the Phoenix case study.
(Source: FHWA, 2021.)

3. SITING AND DESIGNING TRUCK PARKING FACILITIES

New truck parking facilities will be most effective if they are located where drivers need and expect to find truck parking. However, communities also need to balance industrial and transportation land uses with residential, recreational, educational, medical, and other uses. Proactive planning and requirements for truck parking siting and design can reduce tension between the goals of supporting quality of life and industry.

SITING TRUCK PARKING FACILITIES

Zoning and developing appropriate locations for truck parking facilities are essential steps for harmonious coexistence of truck parking and other community uses. This section describes considerations for siting truck parking as well as land use compatibility concerns.

Freight Intensive Land Use and Truck Parking

Truck drivers make decisions about when and where to park based on many factors and optimizing the journey between customers is a central consideration. As a result, the highest truck parking demand in an area is typically located near industrial land uses and along major truck routes. Just as a commuter stopping for fuel would look for a gas station on their route to work in favor of introducing a detour, a truck driver would prefer to park along their route or near their next stop. Truck drivers have additional reasons not to deviate from their planned route: rural and local roads may have restrictions against large heavy trucks and have narrow roadways, low bridge clearance, or other elements not designed to accommodate large trucks. Effective siting for truck parking blends an understanding of driver needs with land use considerations. While truck intensive land uses may naturally locate near highway interchanges, agencies should consider access and traffic impact to ensure that traffic generated from the use will not adversely impact traffic operations in the area.

Where to start: evaluating your community

Knowing that truck drivers are making decisions based on operational needs, safety, and security, the following questions can guide exploration of likely high-demand areas:

- Where are the existing land uses that attract truck traffic? For example, an industrial park or a port.
- Which highways in your community carry the highest levels of truck traffic?
- Where are existing truck parking facilities near or over capacity? Consider that drivers will easily find and utilize new capacity near places they already search for parking.
- Where are commercial and industrial developments expected to occur?

Lessons from Private Truck Stop Development

Most truck stops provide parking at no charge. A truck stop's largest revenue source is diesel fuel, though fuel typically has a low profit margin. Truck stops also sell food, convenience, and travel items, and many offer truck repair services. A key feature distinguishing truck stops from

other retail fueling locations is the provision of amenities such as restrooms with driver showers, laundry facilities, free Wi-Fi, game rooms, and financial services.

To provide amenities and free parking, truck stops must attract a high volume of customers. The most important consideration in the site selection process for locating a new truck stop travel center is proximity to major roadway corridors such as a highway, interstate, or turnpike. Understanding the truck driver's perspective is paramount to location decisions: most truck drivers will not venture beyond locations they can see from the mainline highway, especially when available parking is uncertain.

Warehousing and distribution patterns can also guide planners toward areas of emerging truck parking demand. Since the rise of e-commerce in the 21st Century, changing consumer patterns and expectations have led to the development of large warehouses and fulfillment centers in urban areas. The magnitude of this growth is demonstrated in figure 9. These facilities are served by large trucks as well as smaller trucks and vans. They also generate significant demand for truck parking due to the staging that occurs while drivers wait to access the facility. Modern warehousing requirements typically include:

- Proximity to urban centers.
- Proximity to ports and highways.
- Capacity of the highway to support the truck traffic.
- Sufficient square footage to support efficient operations.
- Adequate land for tractor trailers to park and move goods.

Ideal sites for both truck parking facilities and other industrial uses also have compatible adjacent land uses. These concerns will be discussed further later in this section. Proactively zoning and preserving land meeting these criteria to accommodate truck parking will reduce future conflicts between truck parking and other development types.

Case Studies from Public Sector Siting and Planning

Several truck parking studies led by the public sector have applied industry needs to truck parking siting exercises. Some studies assessed demand generally, while others examined the suitability of specific sites. This section describes four case studies and highlights key findings from each.

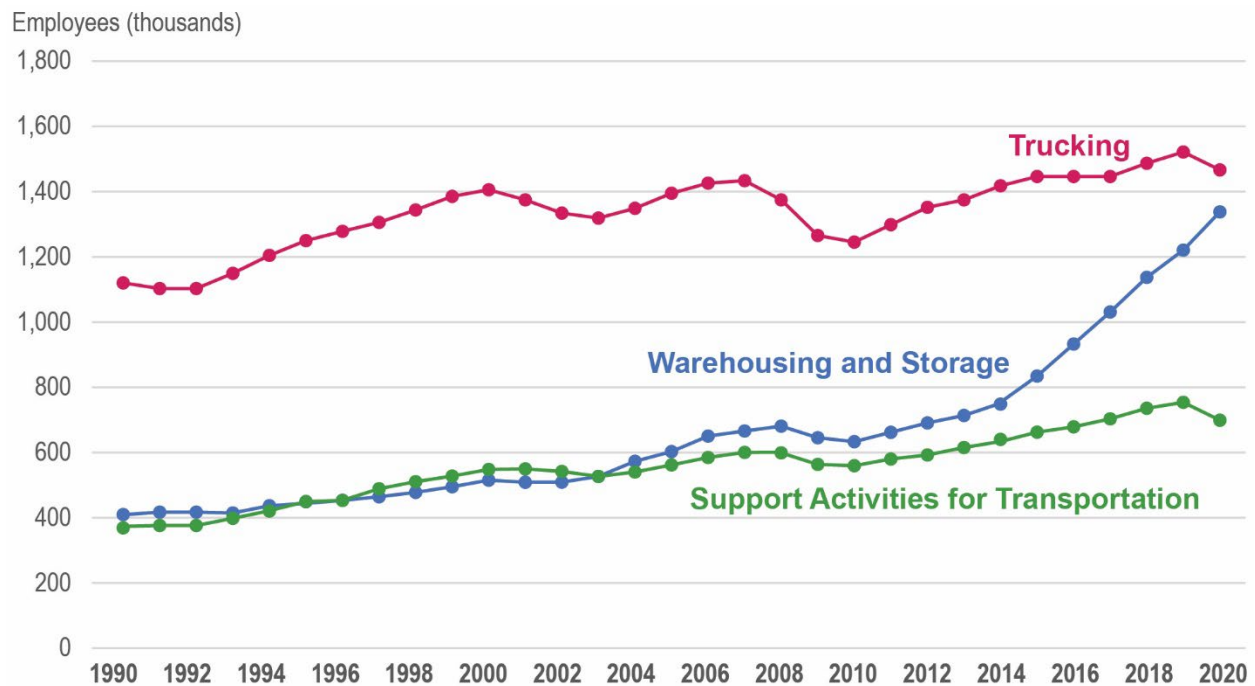


Figure 9. Line chart. Transportation related labor force employment (1990–2020).
(Source: USDOT, Bureau of Transportation Statistics, 2021.)

Case Study 1: The Mid-America Freight Coalition (MAFC) examined the potential truck parking availability of vacant urban parcels to reduce the frequency and severity of truck parking shortages related to staging within the Mid America Association of State Transportation Officials (MAASTO) region.²⁸ The study methodology identified parcels and assessed parcel suitability for truck parking within metropolitan areas of its 10 member States. The MAASTO study used the National Highway Freight Network (NHFN) to identify truck parking locations for staging purposes that required access to the metropolitan areas of the region.²⁹ The methodology imposed a five-acre threshold to accommodate truck parking and associated infrastructure and limited potential parking sites to those within 0.25 miles of the identified major road corridor or on/off ramp. Using satellite imagery researchers identified parcels that were homogenous and undeveloped. Using filters related to freight volumes, security, parcel ownership/value, and environment, the process identified 72 potential parcels.

Key Takeaways:

- Study focused on the NHFN, limiting evaluation to corridors with high truck traffic.

²⁸ Vorhes, G., Perry, E., and Ahn, S. *Identification of Urban Truck Parking Locations in the MAASTO Region*. Report No. MAFC 21. Mid-America Freight Coalition. 2019. <https://midamericafreight.org/wp-content/uploads/2019/03/MAFC21-Identification-of-Urban-Truck-Parking-Locations.pdf>.

²⁹ The NHFN is designated by FHWA under 23 U.S.C. 167(c)(1). It represents the Nation's most significant highways for freight movement. The NHFN is established under 23 U.S.C. 167 to strategically direct Federal resources and policies toward improved performance of the Network.

- Parcels were at least five acres to ensure meaningful new parking would be added.
- Sites were within 0.25 miles of a major highway to meet truck driver needs.

Case Study 2: The Illinois Center for Transportation Studies (ICT) explored truck parking in southern suburbs of Chicago.³⁰ ICT evaluated policy and design issues related to planning and developing overnight truck parking facilities. ICT researchers found that access to an arterial highway was the most important prerequisite to site selection. Adequate or easily-upgraded pre-existing infrastructure was identified by the authors as a factor that minimizes costs for the developer and the local or State municipality. Infrastructure prerequisites included roads with proper width, pavement quality, and vertical clearances of bridges and traffic signals. Greenfield, adjacent residential uses, farmland, and wetland/floodplain parcels were considered undesirable for truck parking developments. The researchers also noted that intersection design and signal phasing may need to be updated to accommodate increased truck traffic.

Key Takeaways:

- Access to a major highway was the most important factor identified for site selection.
- Brownfield redevelopment was prioritized, and development adjacent to residential or agricultural uses was discouraged.
- Cost can be minimized when existing pavement, bridge, and signal designs already accommodate truck traffic.
- Intersection design and operation may need to be adjusted to accommodate increased truck volumes.

Case Study 3: The Center for Advanced Infrastructure and Transportation (CAIT) at Rutgers University also produced a framework for evaluating truck parking locations and capacity expansion.³¹ The study highlighted the need to make truck parking a priority in facility siting decisions, and compared population density, manufacturing density, warehousing density, and retail density to truck parking locations. The framework established in the CAIT study focused on the potential benefits and costs associated with truck parking to evaluate sites in New Jersey (figure 10). During the examination of specific sites, the researchers found that some factors were more impactful than others. For example, noise pollution had a greater cost than air pollution based on impacts to property values. Of financial impacts, sales tax had the greatest potential benefit.

³⁰ Rohter, L., Fain, J., Lohman, H., and Beltemacchi, P. Guidelines, Site Selection, and Design for Implementing Truck Parking/Rest Facilities in Chicago's South Suburbs. Report No. FHWA-ICT-12-015. Illinois Institute of Technology, College of Architecture. 2012. <https://www.ideals.illinois.edu/handle/2142/45788>.

³¹ Higgins, C., Chiu Y., and Bai, Y. *Methodological Framework Development for Evaluating Highway Truck Parking Location and Capacity Expansion*. Report No. CAIT-UTC-NC15. Center for Advanced Infrastructure and Transportation. November 2015. https://cait.rutgers.edu/wp-content/uploads/2018/05/cait-utc-nc15-final_0.pdf.

Economy	Environmental	Fiscal	Safety
Benefits • Employment size • Payroll volume, sale volume • Economy multiplier effect Costs None identified	Benefits • Reduction of greenhouse gas emissions Costs • Increased noise pollution • Increased emission concentrations in and around truck stops	Benefits • Sales tax • Payroll tax • Property tax Costs • Land cost • Investment opportunity cost	Benefits • Reduced parking on roadway shoulders • Reduced fatigued driving Costs • Increased safety or security concerns in surrounding area

Figure 10. Diagram. Cost-benefit based truck stop location methodology framework.
(Source: Adapted from CAIT, 2015.)

Key Takeaways:

- Density of population, manufacturing, warehousing, and retail were used to identify areas for further examination.
- Brownfield development can minimize externalities and reduce land use conflicts.
- Siting decisions should incorporate how neighboring uses will be impacted by air and noise pollution.

Case Study 4: Florida DOT (FDOT) District 6 recently identified locations for truck parking in Miami-Dade County.³² An initial study by the county in 2012 identified 21 vacant or FDOT owned parcels greater than 9.5 acres in size and within 1 mile of a highway interchange. A screening process reduced the number of sites to 12. Incompatible development and traffic studies reduced the total feasible sites to nine. In 2018, a second study effort examined 14 potential truck parking sites: seven were found to have fatal flaws and two others had potential contamination issues. Five remaining sites were evaluated by engineering feasibility and stakeholder support, resulting in four more sites being removed. The remaining site received support from the Miami-Dade Transportation Planning Organization (TPO) Freight Transportation Advisory Committee and as of 2018 was being planned under a Public-Private Partnership (P3) Concessionaire Agreement Location in a potential rapid transit corridor was identified as a project risk. In the most recent effort FDOT District 6 identified an additional 19

³² *Assessment for Potential Truck Parking Location within Miami-Dade County, Final Report.* FDOT. August, 2018. https://fdotwww.blob.core.windows.net/sitefinity/docs/default-source/rail/publications/d6/assessmentpotentialtruckparking_aug2018.pdf?sfvrsn=2196e313_2.

potential sites that are either owned by FDOT or Miami-Dade County. These 19 sites are now the focus of additional analysis.

Key Takeaways:

- The study focused on vacant and publicly-owned parcels to reduce future risk associated with right-of-way acquisition.
- Parcels were over 9.5 acres and within 1 mile of a highway interchange to ensure reasonable use as a truck parking area.
- Multiple stages of screening allowed high-level feasibility to be determined prior to investing in engineering, stakeholder engagement, and environmental study.

Land Use Compatibility and Community Concerns

Community opposition to truck parking facilities can stem from concerns about incompatibility, especially between freight and residential land uses. Communities throughout the Nation are experiencing land use conflicts as populations spread out, industrial developments become more intense, and as distribution and fulfillment centers strive to locate near population centers. Recognizing the interdependency between economic vitality, quality of life, and goods movement can begin to alleviate opposition. The American Planning Association (APA) encapsulates the balance between supporting freight industries and promoting sustainable communities in its *Policy Guide on Freight*.³³ Similarly, the *FHWA Freight and Land Use Handbook* (Publication FHWA-HOP-12-006) encourages practitioners to conduct land use and transportation planning in a complementary way.³⁴

Appropriately-located truck parking facilities can serve community needs: they can improve roadway safety, increase economic competitiveness of local freight intensive businesses, and contribute to local tax revenue. Case studies of successful developments are included in the final sections of this Handbook. However, siting of truck parking facilities should be done in consideration of the potential externalities such as:

- Roadway impacts from increased truck traffic.
- Nighttime light pollution.
- Noise and air pollution from idling trucks.
- Trash and dumping at the site.
- Perceptions of security and crime issues.
- Equity impacts to neighborhoods adjacent to freight-intensive land uses.

³³ American Planning Association. *APA Policy Guide on Freight*. Adopted 2016.
<https://www.planning.org/policy/guides/adopted/freight/>.

³⁴ U.S. Department of Transportation, Federal Highway Administration *FHWA Freight and Land Use Handbook*. April 2012.

These concerns can be mitigated through thoughtful siting and design of truck parking facilities, and design will be discussed in greater detail in the following section. Truck parking siting considerations mirror other commercial and industrial siting considerations:

- Avoid sites near residential land uses, schools, and other community amenities where people may be exposed to air, noise, and light pollution. Site design and buffering can be used to further mitigate these issues.
- Prioritize locations near major highways with suitable access to reduce traffic impacts and increase trucking efficiency.
- Evaluate how siting choices will positively or negatively impact the equitable distribution of transportation externalities in your community.

Assess the ability of access roadways to accommodate large trucks and identify necessary changes for safe operation. For example, intersection and traffic control may need to be improved to support truck traffic.

- Co-locate with existing industrial developments to better serve the freight industry and reduce community impacts.
- Choose sites with sufficient space and utilities for restrooms and trash service.
- Consider how truck traffic may impact other critical transportation services, such as ambulances or firetrucks.

Siting that results in separation of incompatible uses is effective at mitigating concerns. However, not all communities will reasonably be able to separate uses. The design of truck parking facilities is also critical for creating a safe, secure environment for both truck drivers and community members.

DESIGNING TRUCK PARKING FACILITIES

The following section presents geometric design considerations for creating truck parking facilities. Most of today's modern tractor-semitrailer combinations moving in interstate commerce include a 53-foot semitrailer. This so-called *interstate semitrailer* combination depicted in figure 11, is also referenced as a wheelbase 67 (WB-67) design vehicle. Key values used for the WB-67 design vehicle include a trailer length of 53 feet and a trailer with tractor width of 8.5 feet (table 5). AASHTO's *A Policy for the Geometric Design of Highways and Streets* (the "Green Book") establishes standards governing the design of highways and freeways in the United States (23 CFR 625.4(a)(1)). The 2018 edition of the Green Book states:

*The WB-67 truck should generally be the minimum size design vehicle considered for intersections of freeway ramp terminals with arterial crossroads and for other intersections on State highways and industrialized streets that carry high volumes of truck traffic or that provide local access for large trucks, or both.*³⁵

³⁵ AASHTO's *A Policy for the Geometric Design of Highways and Streets* (the "Green Book"), Section 2.1.1 General Characteristics, p. 2-5. 2018.

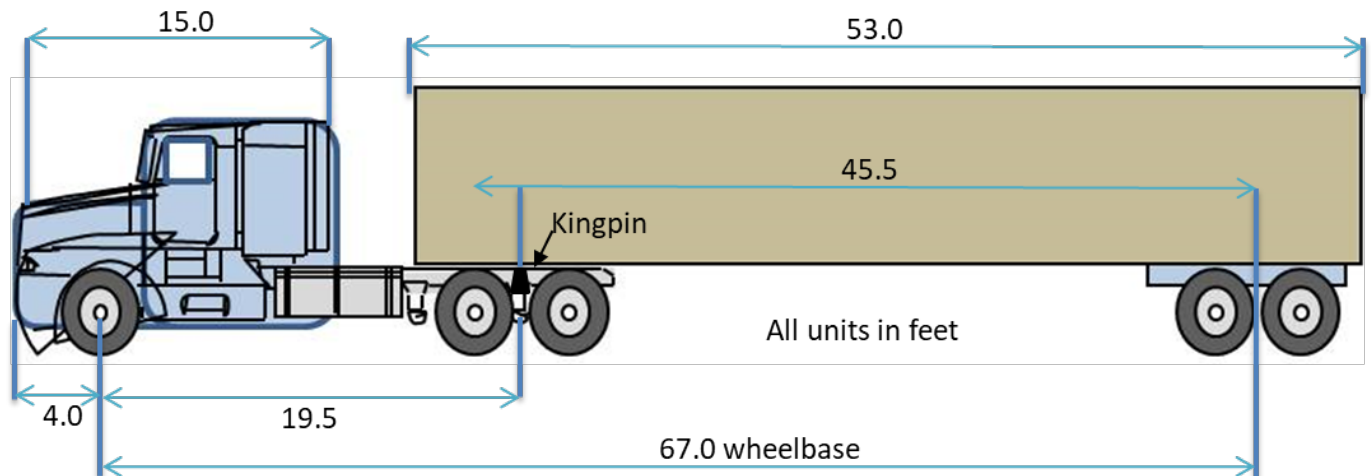


Figure 11. Diagram. AASHTO WB-67 combination truck design vehicle dimensions.
(Source: AASHTO Green Book, 2018, Illustration by Quetica.)

Table 5. AASHTO WB-67 combination truck design vehicle dimensions.

Design Vehicle Dimension	Measurement
Trailer Length	53 feet
Trailer and Tractor Width	8.5 feet
Tractor Nose to Kingpin	23.5 feet
Tractor Nose to Trailer Nose	20.5 feet
Kingpin to Rear Truck Centerline	45.5 feet

(Source: AASHTO Green Book, 2018.)

It should be noted that when planning a truck parking facility, planners and engineers should assess whether there are any oversize/overweight considerations in the surrounding area. For example, modular home and/or heavy equipment manufactures often move over-dimension cargoes that may require considerations for parking space beyond standard design vehicle requirements. Nearby industrial uses as well as common through traffic should be considered in an assessment.

Geometric Considerations for Truck Parking Design

There are several important geometric attributes to consider when designing a truck parking facility, including:³⁶

1. Turning radius.
2. Parking stall design.
3. Parking slot type.

³⁶ Another useful reference for understanding truck design attributes is NCHRP Report 505: Review of Truck Characteristics as Factors in Roadway Design.

4. Swept path.
5. Slot density.
6. Access, layout, and circulation.

Turning Radius

The turning diameter of a vehicle refers to the minimum diameter (or "width") of available space required for that vehicle to make a circular turn such as a U-turn. The term thus refers to a theoretical minimal circle in which the design vehicle can be turned around. The turning metrics for the WB-67 truck are shown in figure 12.

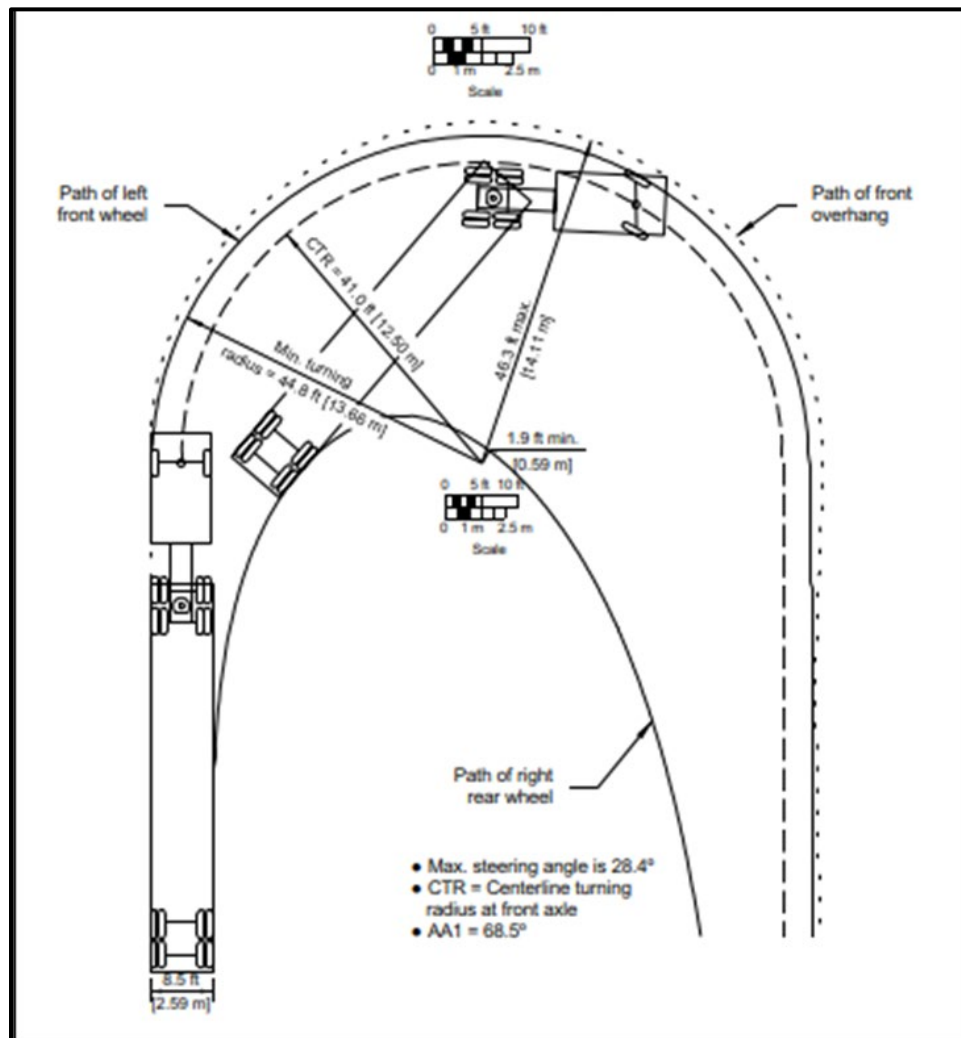


Figure 12. Diagram. Design vehicle turning pattern.
(Source: AASHTO Green Book, figure 2-24, 2018.)

For the remainder of this section, the CHDM is referenced. The CHDM describes design standards for large trucks and is accessible online.³⁷ The CHDM covers a wide range of technical issues related to truck parking facility design, making it a valuable reference for other jurisdictions. Its provisions are widely accepted and provide a sound basis for the design of safe, practical, and efficient roadways and associated facilities. Use of the CHDM is not required by Federal law or regulations.

Parking Stall Design

The CHDM provides information on laying out vehicle parking areas and dimensions for vehicle parking stalls (table 6). The specified stall width for “long vehicles,” like semi-trailer trucks, is 12 feet. A space of 8 feet is suggested between each stall to allow safe foot traffic between parked vehicles. These dimensions allow room for safe vehicle maneuvering where other drivers or pedestrians may be present while still providing efficient parking density.

Table 6. Vehicle parking stall standard dimensions (feet).

Vehicle Type	Minimum Stall Width	Aisle Width	Aisle Location
1 Auto	9	5	Passenger side
2 Autos	9	5	Between stalls
1 Van	9	8	Passenger side
1 Van/1 Auto	9	8	Between stalls
1 Long Vehicle	12	8	Passenger side
2 Long Vehicles	12	8	Between stalls

(Source: California Highway Design Manual, 2020.)

Parking Slot Type

The two main types of parking slots used in truck parking areas are straight back-in (SBI) slots and herringbone drive-through (HDT) slots.

SBI slots achieve the highest parking density with many maritime and intermodal facilities using this configuration with 10-foot-wide slots. Factory loading docks, warehouses, retail facilities, and distribution centers also use this configuration with slots ranging from 15 to 20 feet wide. Many truck stops also use SBI slots ranging from 10 to 12 feet wide. While truckers are adept at backing into and pulling out of such spaces, the sometimes-narrow parking space can lead to damaged mirrors, broken lights and other vehicle damage as vehicles come and go in busy lots. SBI slots do provide the highest parking density and offer the lowest per-slot development cost.

Driver surveys routinely show a preference for HDT slots. The slots are at an acute angle to the access aisle, typically 45°. The truck enters from one end of the slot and departs through the far end, never having to back up. This configuration is easier for the drivers and reduces the incidence of collisions between moving and parked trucks. Highway rest areas use HDT slots for long vehicles, including trucks, buses, and long recreational vehicles. HDT parking density is

³⁷ California Highway Design Manual, 2020. <https://dot.ca.gov/-/media/dot-media/programs/design/documents/hdm-complete-12312020a11y.pdf>.

about 50 percent of SBI parking density, and per-slot development costs are proportionally higher. However, the difference in development cost is generally outweighed by the geometric benefits to safety and truck operating efficiency.

Another consideration is the driver's personal safety. Truck drivers in interstate commerce are required by Federal law to conduct daily vehicle inspections (49 CFR 396.11(a)). Drivers frequently use truck stops and rest stops to inspect loads and vehicles. A driver will walk around the vehicle to check tires, lights, mirrors and other safety equipment, load security, and generally ensure no damage has occurred to the vehicle or load. SBI slots limit driver visibility at the rear of the parking slot, potentially creating a hazard for drivers on foot.³⁸ By contrast, the HDT slot allows the driver to readily see the entire parking slot and the edges of adjacent slots.

Swept Path

As trucks maneuver into and out of parking slots, their vehicles sweep out a path. As the turning angle sharpens, the swept path is wider. Figure 13 shows the paths swept for the design Vehicle as it enters or leaves a herringbone parking block of angle = 60°, assuming a slot width of 20 feet. The dimension of 62 feet is sufficient to allow a truck to enter or leave a slot without its swept path hitting an adjacent vehicle.

³⁸ Refer to appendix A for guidance on calculating the geometric requirements for HDT parking slots.

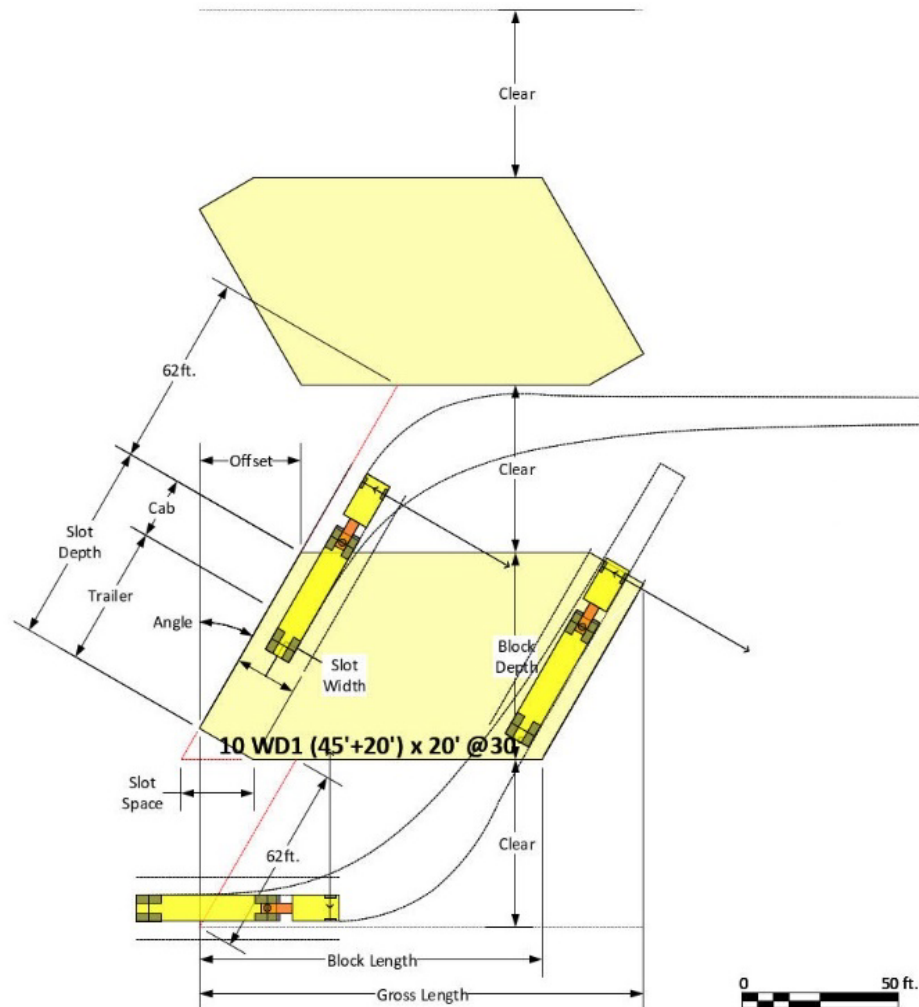


Figure 13. Diagram. Paths swept by truck.
(Source: California Statewide Truck Parking Study, 2021.)

Slot Density

Slot density refers to the number of truck parking slots that can be configured per acre. Table 7 shows the relationship between stall dimensions and overall truck parking slot density for a range of different slot configurations, assuming a row length of 40 single-truck parking slots. Using the WB-67 standard, with 74-foot trucks in 20-foot slots at a 45° angle, ideal parking density is 13.5 trucks per acre. Changing the herringbone angle over a range of 30° to 50° has only a modest impact on density. A 45° herringbone angle is recommended unless the overall site area would be more effectively used at a different angle. The final row in the table shows the density for SBI slots 12 feet wide, like the arrangement commonly used in commercial truck stops. This configuration has about twice the density of the 74-foot/45° herringbone but is not optimal for truck parking areas.

Table 7. Alternative Herringbone drive-through (HDT) dimensions and density, 40-slot blocks.

Slot Depth (Feet)	Slot Width (Feet)	Angle (Degrees)	Density (Trucks/Acre)	Relative Density	Description
74	20	45	13.5	1.00	WB-67 Herringbone
74	20	30	14.3	1.05	30°
74	20	40	13.8	1.02	40°
74	20	50	13.2	0.97	50°
74	12	0	26.7	1.98	Straight Back-In

(Source: Federal Highway Administration, 2021.)

Access, Layout, and Circulation

Access to truck parking areas should be clearly marked in advance and designed to ensure safe operations. Truck parking areas can be designed for access via:

- *Freeway or Highway Ramp:* Medium-speed approach with limited turning. The ability to add new entry and exit ramps on an existing freeway depends on the proximity of existing interchanges and arterial crossings. Establishing freeway connections for a truck parking area in an urban or suburban setting will typically constrain facility size. Even in exurban settings, the spacing of arterial road crossings, whether at an interchange or grade-separated, may limit the size of a freeway truck parking area. Freeway truck parking areas will most likely be limited to interurban sites.
- *Arterial Road “Curb Cut:”* Low-speed approach, typically through a sharp or right-angle turn on entry and/or exit. Urban truck parking areas may be viable on areas that have limited utility for urban development, such as spaces under highway or rail viaducts.

Because truck drivers leave their rigs to use service facilities in the truck parking area, it is advisable to include a clearly-striped walkway along the noses of the tractors. The walkway should be a minimum of 6 feet wide, allowing a pedestrian to dodge a hazard while staying within the striped area.

HDT parking rows are usually laid out in pairs to conserve circulation space. There are two ways for trucks to circulate through such paired rows. Figure 14 shows trucks arriving from outside the row pair and departing along a shared lane between the rows. Figure 15 shows the reverse, with trucks arriving along a shared access lane and departing outside the row pair. Both layouts show pedestrian walkways along the fronts of the parking slots. Both layouts are viable, providing alternative approaches to site utilization and pedestrian circulation.

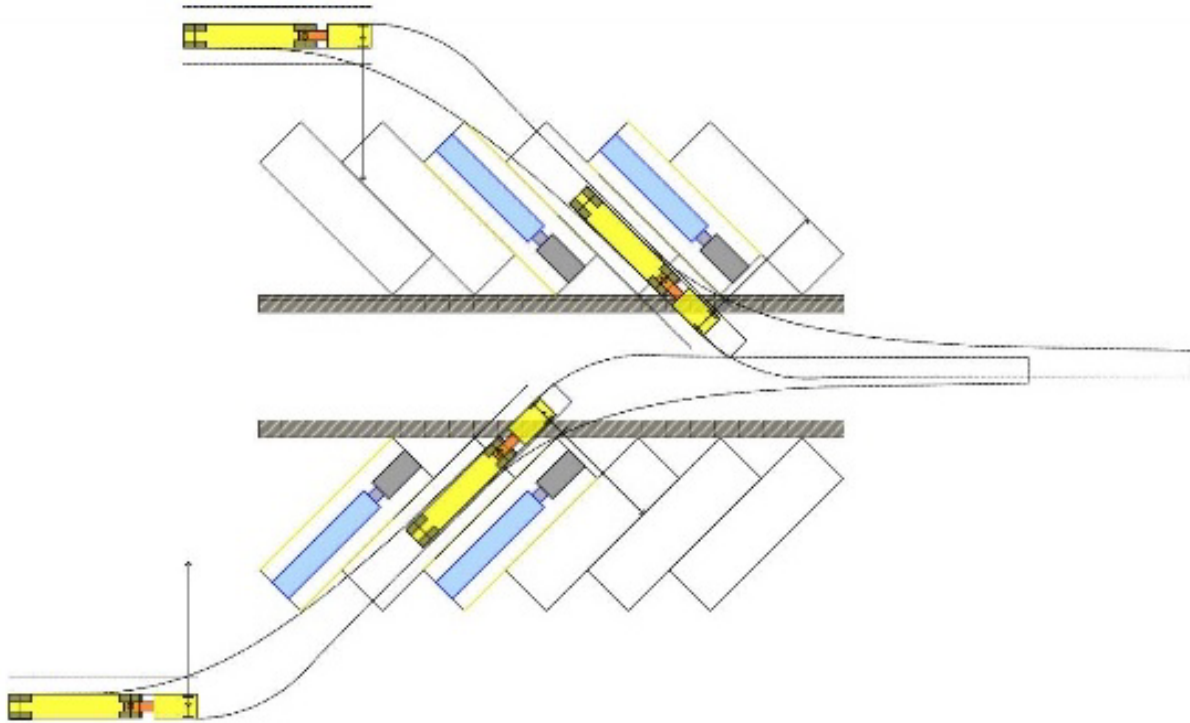


Figure 14. Diagram. Herringbone drive-through circulation—outside-in.
(Source: California Statewide Truck Parking Study, 2021.)

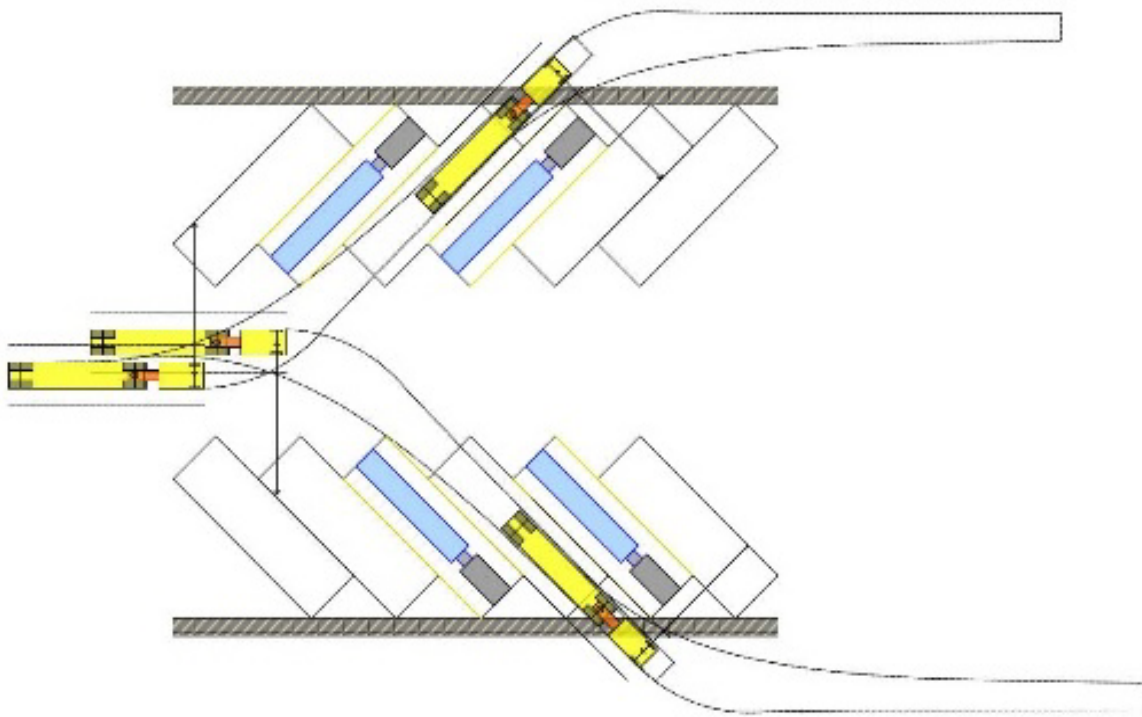


Figure 15. Diagram. Herringbone drive-through circulation—inside-out.
(Source: California Statewide Truck Parking Study, 2021.)

Pedestrian circulation should allow for safe, accessible, and direct navigation between parking stalls and on-site amenities. Additionally, while access to adjacent sites is not always appropriate, consider whether drivers are likely to walk to nearby sites for goods, services, or exercise. Pedestrian safety can be improved by placing emergency call boxes throughout the site, using convex mirrors to reduce blind corners, and using appropriate lighting. Site layouts that reduce distance between parking and restrooms can reduce waste management issues.

Truck Parking Area Safety and Security

Since Congress passed Jason’s Law, concerns over adequate and safe truck parking have intensified, including what constitutes “safe” truck parking. Many statewide truck parking plans and studies have identified trucks parking on highway shoulders, on entrance/exit ramps, or in undesignated lots as “unsafe,” but few studies clearly define what makes a “safe” parking area.³⁹ Common themes from these studies suggest safe restrooms, adequate lighting, and security features such as fencing, cameras or on-site personnel are necessary features for safe parking environments. Figure 16 shows commonly-identified elements that define safe parking areas.



Figure 16. Graphic. Common features of safe truck parking.
(Source: FHWA, 2021.)

The *National Coalition on Truck Parking: Activity Report 2015-2016* notes the importance of involving local police departments as stakeholders due to local public perception of truck parking as an issue/problem due to fear of criminal activity. Local police can also serve as a point of contact for highlighting issues related to driver safety and cargo theft.⁴⁰ Cargo theft is yet another issue across the U.S. which is heightened by the lack of secure parking facilities: In 2017, 75 percent of thefts occurred within unsecured parking areas, such as public parking, truck stops, and drop lots.⁴¹

³⁹ See table 14 for examples of recently completed statewide truck parking studies.

⁴⁰ Federal Highway Administration’s (FHWA) “National Coalition on Truck Parking—Activity Report 2015-2016” (2017). Accessed from: <https://ops.fhwa.dot.gov/publications/fhwahop17026/fhwahop17026.pdf>.

⁴¹ Supply Chain Intelligence Center. “Cargo Theft Annual Report, United States & Canada,” 2017.

The Illuminating Engineering Society (IES) offers voluntary design guidance for parking lot illumination that involves interpretation of the overall lighting conditions and use of the site.⁴² The following lighting is recommended:

- Minimum average horizontal illuminance of 0.5 foot-candle to provide essential safety.
- Maximum ratio of maximum/minimum illuminance of 3:1 to prevent dark spots.
- Full upward cutoff to prevent sky glow and light pollution.
- Full lateral cutoff at the edge of the site to prevent glare and light pollution in adjacent sites.
- Color temperature of 4000K to 5000K to support accurate color differentiation.

Lighting designed to these standards will allow drivers to see where they are going and allow pedestrians to see moving and stationary obstacles, while minimizing external impacts. Directional lighting should also be used at facilities in proximity to residential land uses, so that it does not negatively impact nearby neighborhoods. This is discussed in greater detail later in this chapter.

Security

Control of truck access to the truck parking area is a major planning and design consideration needed to implement secure environments where truck drivers can rest safely in accordance with the goals of Jason's Law. The safety, security, and utility of truck parking areas are maximized if access is limited to truckers who need them. Allowing passenger vehicles, buses, and recreational vehicles into truck parking areas increases the risk of pedestrian and vehicular accidents as well as theft and other criminal activity.

Truck parking planning and design should reflect intended uses of the facility (e.g., whether it is for short-term staging versus overnight parking for rest). Parking areas near a major logistics hub, such as a marine terminal, rail yard, or distribution complex, may tempt drivers to use the facility for short-term storage of trailers. Allowing trailer parking may limit utility facility as a rest or holding area and may add security risks. Prohibiting trailer parking requires detection and enforcement.

Control options include:

- **Soft Control:** Access control can be achieved with a combination of the following: 1) an ordinance limiting truck parking area access; 2) signage advising approaching vehicles of access limitations; and 3) enforcement of the ordinance by citations or other actions. Such soft control of access would not require major infrastructure and would not affect the design of the site.
- **Hard Control:** Access control also can be achieved by installing an access gateway that: 1) can only be opened by truckers that are permitted to use the facility, and 2) can be opened by any trucker needing to use the facility. The challenge is establishing a trucker access

⁴² IES, IES Research Report: Lighting for Parking Facilities, 2019. <https://store.ies.org/product/res-2-19-ies-research-report-lighting-for-parking-facilities/>.

system that limits access without excluding those who need it. Ideally, the access system would need to be usable by any trucker in the country, making use of any State- or region-based truck identification, such as a radio-frequency toll tag, impractical. Charging for access may be impractical or contrary to State or Federal regulations. Using vehicle front axle weight would not allow differentiation between truck tractors and laden intercity buses. In summary, hard control of access is probably not practicable.

- **Control Recording:** Soft access control can be augmented by capturing the image and license tag of any vehicle attempting to enter the truck parking area. This would require installation of imaging and recording equipment, activated by a ground loop, weight sensor, or another instrument. Having a record of entries and exits would assist in access enforcement.

Human Trafficking Prevention Strategies

Safe, secure truck parking facility design is also a tool to prevent or halt human trafficking. The trucking industry is on the front lines in the fight against human trafficking, serving as the eyes and ears of America's roads. Groups such as the National Association of Truck Stop Operators (NATSO), Truckers Against Trafficking, and the Owner-Operator Independent Driver Association (OOIDA) are active in creating and disseminating resources.

Table 8 summarizes human trafficking prevention strategies from a wide range of organizations, associations, and companies that are working closely to identify and combat human trafficking along truck stops and rest areas.

Table 8. Summary of human trafficking prevention strategies.

Organization	Recommendations/Activities
National Association of Truck Stop Operators (NATSO)	Key components for any anti-human trafficking program: • Education. • Awareness. • Be Well Informed. • Advocate. • Power of Partnership. NATSO has created a <i>Combating Human Trafficking Toolkit</i> and other valuable resources to combat human trafficking available on their website: https://www.natso.com/human-trafficking
Owner-Operator Independent Driver Association (OOIDA)	OOIDA educates drivers, private businesses, legislatures, and decision-makers on human trafficking issues and prevention.
Truckers Against Trafficking	Crucial red flags to help identify if human trafficking is taking place: • Anyone who has a lack of knowledge of their whereabouts and is not in control of ID/passport.

Organization	Recommendations/Activities
	• Anyone who has restricted or controlled communication, e.g., not allowed to speak for her-/himself, or unable to come and go unrestricted. • Anyone mentioning a quota or having a pimp/daddy. • Anyone heading to the shower area that seem inappropriate together. • Anyone with signs of branding or tattooing of a trafficker's name (often on the neck). • A van, recreational vehicle (RV) or vehicle with multiple women in a mainly male area and/or dropping women off and picking them up 15-20 minutes later. • Signs of bruising or other physical trauma. • Signs of flashing lights or other equipment used as a signal.
USDOT Advisory Committee on Human Trafficking	Main practices to combat human trafficking: • Establish comprehensive strategies and policies. • Train employees. • Engage in public awareness initiatives.
American Trucking Associations	Encourage all trucking companies and organizations to provide anti-human trafficking training to the drivers and professional staff and implement and enforce company-wide zero tolerance policies for those who engage or participate in commercial sex of any kind.
Sapp Bros.	Install "Help Now" buttons and anti-trafficking posters near the doors of all restrooms that turns on a discreet light at the front desk to report human trafficking to the cashier/staff.

(Source: FHWA.)

Truck drivers are the eyes and the ears of the highway, making them essential in the fight against human trafficking. Employees at all levels, from those at the plazas to the actual truck drivers, and local law enforcement personnel should be trained to work together to combat human trafficking at truck parking areas.

Designing Truck Parking Amenities

Truck parking areas should be equipped with lighting, toilet facilities, communications services, and open space. Additional amenities may also be provided depending on truck parking needs at a given location and whether existing private truck stops exist to meet these needs. For example, food, laundry, and shower facilities are commonly needed by long-haul drivers, but may be cost-prohibitive to provide without a compelling gap in available services.

Restrooms

Given the potential of truck parking areas to be isolated, the personal security of facility users should be of paramount importance in restroom or water closet design. Truck parking areas should have toilet facilities compliant with local, State, and Federal regulations. Where toilet

facilities are provided, they must comply with the 2010 Americans with Disabilities Act (ADA) Standards for Accessible Design (for State and local governments, see 28 CFR 35.151 and the 2004 ADA Accessibility Guidelines (ADAAG) at appendices B and D to 36 CFR part 1191; for public accommodations and commercial facilities, see 28 CFR part 36, subpart D, and the 2004 ADAAG at appendices B and D to 36 CFR part 1191). Figure 17 shows the components of an accessible single user toilet room along with citations to the applicable provisions of the 2004 ADAAG. There is no standard minimum area for all toilet room configurations, and required space depends on the configuration and features of the toilet room. A minimum of 40 square feet of building area should be budgeted for each single use toilet room.

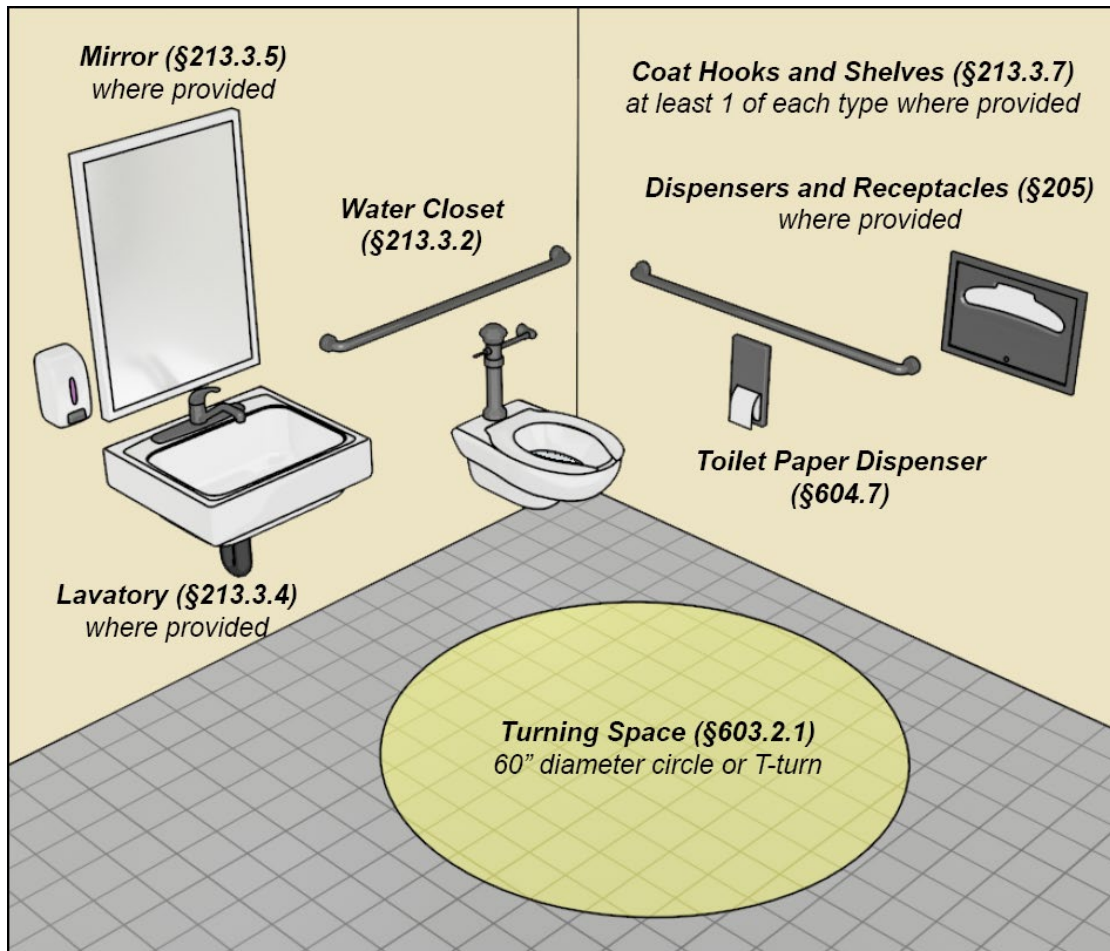


Figure 17. Diagram. Components of an accessible single user toilet room.
(Source: Guide to the ADA Accessibility Standards, U.S. Access Board, 2021.)

Truck parking area restrooms should be in fixed, permanent structures, should be properly plumbed for water and for effluent discharge to an enclosed sewer system, and should be ventilated and climate-controlled for the comfort of the users. Restroom facilities should be sized to accommodate the expected number of visitors based on the number of parking slots in the truck parking area and passenger vehicle parking area. One way to determine the proper size for restroom facilities is based on the Occupational Safety and Health Administration's requirement governing the minimum number of water closets, or bathroom stalls, for workplaces (see 29 CFR

1910.141(c)(1)(i)). In this example, the number of parking slots is substituted for the number of employees that establishes the minimum number of required bathroom stalls, as summarized in table 9.

Table 9. Example of minimum required bathroom stalls.

Truck and Passenger Parking Slots	Bathroom Stalls
1 to 15	1
16 to 35	2
36 to 55	3
56 to 80	4
81 to 110	5
111 to 150	6
Over 150	+1 per 40

(Source: Adapted from 29 CFR 1910.141, table J-1.)

Communications Services

Access to wireless communications services, including both Wi-Fi and cellular service, is an important amenity for truck parking facilities. Communications can be used for commercial or personal purposes and need to be secure to prevent attacks on increasingly complex and technologically advanced transportation equipment. In rural areas with otherwise poor services, provision of Wi-Fi also improves safety. To provide reliable cellular service, truck parking areas should be sited close enough to cellular communications antennae to support a minimum sustained signal strength of -85 dBA, approximately equivalent to “three bars” of signal strength on most phones. As most smartphones rely on 4G and 5G protocols, these protocols should be available at the site.

Open Space

It is recommended that truck parking areas provide open space where drivers can exercise. Truck drivers may also want to take meal breaks at truck parking areas, so the provision of outdoor picnic tables where drivers can eat and gather outside the confines of their trucks is also encouraged. Additionally, truck drivers may be accompanied by pets or service animals, and designated pet relief areas are recommended to facilitate exercise as well as waste management. As an element of good urban planning, boundary landscaping should provide a visual and noise buffer between freight intensive land uses including truck parking and adjacent residential or commercial sites. Additional detail on land use practices is provided in the “Siting Truck Parking Facilities” section of this Handbook.

Mitigating Impacts on Adjacent Land Uses

When planning or developing a truck parking project, the surrounding community may have a negative perception of the trucking industry and truck parking. Some of the potential concerns discussed earlier in this Handbook include increased truck traffic, light pollution, noise and air pollution, trash and dumping, and perceptions that truck parking facilities attract crime. Practitioners should understand and be able to communicate the positive benefits associated with

more efficient trucking operations and safe, secure parking so that residents can weigh both positive and negative impacts of potential projects.

Designing facilities to manage trash and waste effectively, to fit the community character, and to provide well-lit, secure parking can mitigate these concerns. In general, mitigation approaches for site expansions should be like new sites; however, local requirements for new developments, redevelopments, and site improvements may differ. Some specific strategies that can be to incorporated into site design, as permitted under local requirements, include:

- **Comparing impacts of multiple uses at a site.** A single industrial site may incorporate several functions. For example, a site may include a warehouse, a laydown area, equipment storage, and truck parking. The relative impacts of each of these uses should be compared, and those uses with the lowest impacts should be located nearest sensitive adjacent land uses.
- **Buffering impacts.** Distance, trees, or physical barriers may be necessary to separate the light, noise, and air pollution generated at a truck parking facility. These buffers can also reinforce existing community character, such as utilizing native foliage between parking and adjacent uses.
- **Using directional lighting.** Lighting is an essential element of any truck parking facility to ensure safety and security. Directional lighting illuminates the parking area while reducing light pollution for the surrounding community. The International Dark-Sky Association has published resources to prevent light pollution, including common practices, ordinances, and other guides.⁴³
- **Providing adequate waste service.** Littering is a common community concern related to truck parking facilities. Sites should be designed to include sufficient trash volume and frequent enough service to prevent littering. Additionally, providing restroom facilities reduces waste concerns. If a site cannot accommodate flush toilets, portable toilets are recommended to reduce human waste issues.
- **Prioritizing access points to and from major roadways.** Truck traffic impacts will be reduced when truck drivers need to make fewer turns and travel a shorter distance to access parking facilities. Primary entrance and exit points should efficiently move trucks between thoroughfares and the site while minimizing travel on local streets.

Figure 18 demonstrates how these mitigations can be applied. The *FHWA Freight and Land Use Handbook* includes additional considerations related to freight intensive land uses.⁴⁴

⁴³ International Dark-Sky Association, 2022. <https://www.darksky.org/our-work/lighting/>.

⁴⁴ FHWA, <https://ops.fhwa.dot.gov/publications/fhwahop12006/>.



Figure 18. Diagram. Mitigating impacts on adjacent land uses.
(Source: FHWA, 2021.)

Designing for Future Freight Vehicles

Two emerging trends in freight vehicle technology may lead to questions about the future of truck parking facilities: electric vehicles (EVs) and connected and autonomous vehicles (CAVs). Truck parking sites will continue to serve a significant role in trucking and transportation logistics as these vehicle technologies evolve. As EVs are adopted in more contexts, the presence of powerful charging infrastructure at truck parking sites will become a critical asset. Parking for rest breaks or other purposes presents an ideal opportunity for charging infrastructure because drivers are already planning to remain at the site for an extended period of time. When incorporating EV infrastructure considerations into site design, consider whether utilities to support charging exist or could be added or upgraded. Additionally, determining the necessary space at each stall to accommodate charging infrastructure may be helpful for determining the layout and overall footprint of parking to reduce cost of future improvements. The Infrastructure Investment and Jobs Act (Public Law 117-58, also known as the “Bipartisan Infrastructure Law”) included funding for EV infrastructure. This Federal assistance may help offset costs associated with providing charging infrastructure.

The future of logistical and regulatory requirements related to CAV operation remain unknown. However, it is reasonable to assume that CAVs will remain staffed with a driver or operator for the foreseeable future to manage cargo as well as the vehicle, and these operators will require breaks to rest and meet basic needs. Additionally, the need to stage prior to arrival at a customer or gateway would remain largely unchanged in a CAV environment. Depending on location and size, rest areas may also have the potential to become transition zones where cargo and/or vehicles shift from autonomous operation to driver-led operation. This transition may be necessary to navigate more complex environments or meet future regulatory requirements. While the precise future of trucking logistics in a CAV environment will evolve over time, the need for dedicated truck parking and staging locations is anticipated to remain.

Truck Parking Area Design Summary

Table 10 summarizes design considerations for providing efficient and safe truck parking areas including slot type, swept paths, slot density, access, layout, circulation, facility amenities, sizing, and layout.

Table 10. Summary of truck parking area design considerations.

Design Element	Options	Recommendations
Parking Slot Type	• Straight Back-In (SBI) slots. • Herringbone Drive-Through (HDT) slots.	HDT slots are recommended for truck parking areas to maximize driver efficiency and safety.
Swept Paths	• The parking slot needs to be wide enough to allow a truck to avoid hitting trucks parked next to it as it enters or leaves it.	Assuming HDTs with a 60° angle, parking slots need to be 20 feet wide.
Slot Density	• HDT slots with a 45° angle. • HDT slots with a 30° angle. • HDT slots with a 40° angle. • HDT slots with a 50° angle. • SBI slots with a 0° angle.	While the SBI slots can achieve the highest parking density with 28.6 trucks/acre, HDT slots with a 45° angle is recommended (14.4 trucks/acre parking density).
Access, Layout, and Circulation	• Site access point with sufficient spacing from nearby intersections, interchanges and other access points. • HDT Circulation—Outside-In. • HDT Circulation—Inside-Out.	Different layouts are viable, providing alternative approaches to site utilization and pedestrian circulation. Traffic impact study findings and State access management standards must be considered.
Safety and Security	• Lighting. • Hard and soft controls. • Human trafficking prevention.	Lighting and secure facilities are essential for safety. Assess the surrounding context to determine the amount of additional security measures are appropriate.
Facility Amenities	• Toilet Facilities. • Communication Services. • Open Space.	Inclusion of all these types of facility amenities is recommended for truck parking areas.
Mitigating Impacts	• Traffic impacts. • Air, noise, and light pollution. • Waste management. • Crime and security.	Facility design should reduce impacts on adjacent uses through design of access, buffering, waste planning, and security measures.
Future Freight Vehicles	• Electric vehicles. • Connected and autonomous vehicles.	Technology may change what activities occur at a site but will not eliminate the need for truck parking.

(Source: FHWA, 2021.)

4. ENCOURAGING AND REQUIRING TRUCK PARKING

Previous sections have discussed the role of trucking and truck parking on our economy and quality of life and the truck parking shortage. This section provides resources for communities to consider when updating land use and zoning policies to address current and future parking needs.

IMPROVING LAND USE AND ZONING POLICIES

When land use and zoning decisions allow for new commercial/industrial development, but do not account for the increased demands for truck parking, the costs for future mitigation are often passed on to the local jurisdiction. These costs include the cost of providing truck parking and costs associated with safety, congestion, and community disruption. A common reaction is to pass ordinances restricting truck parking, which redistributes the need to another area in the community or a nearby community.

Incorporating Truck Parking into Traffic Impact Assessments

Counties, cities, and municipalities across the Nation already develop traffic impact assessments and review site plans for new developments. However, these processes do not always consider the specific transportation and truck parking needs generated by freight activity. Traffic impact assessment processes should be reviewed to include anticipated truck volumes at a site and the impacts of staging near the site. Truck parking demand generated farther from the site should also be evaluated. These estimates can then be used to evaluate development of parking or contributions to pooled parking.

The FHWA Truck Parking Demand Estimation Tool can be used to approximate the relationship between the number of daily truck trips and parking required within various distances of the site. The distance bands included in the tool are based on available datasets from communities across the country, but every community is different. Estimates from the tool should be refined based on your community and input from industry. For example, the estimation tool may predict a given number of trucks parking within 20 miles of the site. However, if your community has a rest area 30 miles from the site, truck drivers may park there when spaces are available. Understanding the directionality of travel in your community may also impact adjustments to estimates of off-site parking locations. Drivers will be more willing to park farther away if a parking facility is on their route compared to a detour.

Local data and observations may supplement or replace estimates from the truck parking estimation tool. For example, the Winston-Salem study highlighted earlier in this Handbook established estimates based on facility type, employment, square footage, and number of truck bays in that community. Consult with partner planning organizations in your region and State to verify whether additional information is available to support traffic impact analyses.

Revising Planning Ordinances and Policies

Communities balance many priorities when developing land use policies, including safety, quality of life, economic competitiveness, and environmental quality. These values are important, but they can be undermined when truck parking is not proactively accommodated.

Consider whether and where compromise can be achieved through project design and mitigation of the underlying community concerns that initially led to restrictions.

Local ordinances routinely set employee and customer parking requirements for developments; however, on-site truck parking and staging areas are rarely required. In 2017, the Township of Upper Macungie, Pennsylvania, in the Lehigh Valley became a notable exception to this rule. The Township passed a new zoning requirement that requires one off-street truck parking space for every loading dock at a new warehouse or distribution facility.⁴⁵ The new zoning regulations also mandate one truck staging space (with 10-foot x 80-foot dimensions) for every two loading spaces at a distribution or warehouse facility.⁴⁶ Further, the new requirements specified that applicants (developers) must present evidence that parking will be adequate to accommodate expected demand. The language is integrated into the Township's zoning code, which applies to the passenger parking requirements for employees and visitors/customers of various land uses.

Each community documents its parking and development requirements uniquely. This Handbook provides the following suggestions that agencies may consider.

Requiring Truck Parking

The following options demonstrate how parking requirements can be based upon loading docks, building area, or employees:

- **Option based on loading docks:** One 10-foot by 80-foot (10' x 80') parking space for truck staging for every two (2) loading docks. Parking shall be maintained and available for truck parking prior to or after a scheduled delivery or pickup.
- **Option based on building square footage:** One 10-foot by 80-foot (10' x 80') parking space for truck staging for the following building areas:

⁴⁵ Township of Upper Macungie Municipal Code § 27-605. <https://ecode360.com/14517379>.

⁴⁶ Township of Upper Macungie Municipal Code § 27-601. <https://ecode360.com/14517379>.

Table 11. Truck parking spaces by land use and building square footage.

Land Use	Gross Floor Area (Square Feet)	Minimum Number of Spaces
Retail, manufacturing, wholesaling, commercial, institutional, personal services, funeral homes, and similar uses	Under 8,000	1
	8,000 to 40,000	2
	40,000 to 100,000	3
	100,000 to 250,000	4
	Each additional 200,000	1
Office buildings, hotels, motels, and similar uses	Under 100,000	1
	100,000 to 300,000	2
	Over 300,000	3
Warehouse, distribution, truck terminals, and similar uses	Per loading dock	1

(Source: Adapted from Township of Upper Macungie, PA, Zoning Code, 2017.)

- **Option based on employees:** One 10-foot by 80-foot (10' x 80') parking space for truck staging for the following employment levels (result should be rounded up to next whole number):

Table 12. Truck parking spaces by industry and 1,000 employees.

Industry	Peak Parking per 1,000 Employees
Manufacturing: Facilities that process materials or assemble parts into finished goods (NAICS 31-33)	5.0
Wholesale Trade: Facilities that sell bulk goods to retailers (NAICS 42)	14.3
Retail Trade: Facilities that sell goods directly to consumers (NAICS 44-45)	11.5
Transportation: Facilities providing transportation by any mode (NAICS 48*)	770.9
Warehousing: Facilities for storing, transloading, fulfilling or distributing products, materials, or cargo (NAICS 49**)	34.7
Accommodation and Restaurants: Facilities providing lodging or food service (NAICS 72)	2.1

* NAICS 48-49: Transportation and Warehousing is typically presented as a single group. The values presented in this row apply predominantly to truck transportation facilities.

** NAICS 48-49: Transportation and Warehousing is typically presented as a single group. The values presented in this row apply to warehousing facilities only. The research supporting this did not develop a statistically significant value for estimating warehousing parking demand by employment, and these values should be applied with caution.

(Source: Maricopa Association of Governments, 2021.)

- Additional parking or storage needed for maximum number of vehicles stored, displayed, or based at the lot at any point in time shall not be counted towards the above required parking.

Ensuring Quality of Parking

The following options demonstrate how to require a standard of quality for parking:

- Each off-street loading space shall have a minimum size based on the largest vehicle intended:
 - Tractor-trailer: 10 feet by 80 feet.
 - Trucks other than tractor-trailers, pickups, or vans: 10 feet by 25 feet.
 - Pickup truck or van: 9 feet by 18 feet.
- Each space shall have sufficient maneuvering room to avoid conflicts with parking and traffic movements within and outside of the lot. No facility shall be designed or used in such a manner that it threatens a safety hazard, public nuisance, or a serious impediment to traffic off the lot.
- Each space and the needed maneuvering room shall be located entirely on the lot being served and be located outside of required buffer areas, paved area setbacks and street rights-of-way.
- An appropriate means of access to a street shall be provided.
- Paving, grading, drainage, and lighting standards apply to loading areas.
- Parking spaces shall be reserved for truck parking and shall not be utilized for storage or other use.

Allowing Exceptions to Parking Requirements

The following language demonstrates options for allowing exceptions to parking requirements:

- To prove that fewer parking spaces are needed, the applicant shall provide existing and projected employment, customer, resident, or other relevant data. Such data may include a study of parking at similar developments during peak periods of use.
- An applicant may seek to prove that parking permanently shared with another use or another lot with shared internal access will reduce the total amount of parking needed because the uses have different peak times of parking need or overlapping customers.
- Parking areas for trucks may be shared between adjacent business. An industrial development with multiple businesses may provide a consolidated parking area for truck staging and parking serving all uses.
- If this Section permits a reduction, the reservation of areas for use in future parking may be required permanently or for a specified number of years:
 - Reservations should be legally documented, such as in a binding deed restriction.
 - Plans should be submitted showing where and how additional parking could be accomplished.

- Such additional parking shall be required to be provided within one year by the owner of the lot at that time after notification that such parking has become needed. Such determination shall be based upon an on-site review on least three different days.

CASE STUDIES OF SUCCESSFUL LOCAL TRUCK PARKING DEVELOPMENTS

On-Site Truck Parking at Industrial Uses

Proactively integrating truck parking needs into the planning process (e.g., requiring shippers and receivers to provide onsite parking or contribute their fair share to the cost of a common parking area) will help meet the parking demand while also helping to spread the costs of providing truck parking. A requirement for new industrial developments to provide on-site truck parking would be like employee and customer parking requirements that are generally included in zoning ordinances.

Shippers and receivers can also benefit from providing on-site parking. Economic growth increases the demand for trucking. When capacity of available trucking services is tight, truckers can afford to be selective, and there can be strong competition to book available trucks. “Even in a bull market, for carriers to capitalize on earnings from elevated rates, they still need to move new freight as fast and as efficiently as possible.”⁴⁷ Businesses that offer truck parking and associated amenities available to drivers, whether on property or in a shared staging lot nearby, become “shippers of choice,” greatly increasing their ability to have their load requests accepted. Table 13 summarizes the benefits of implementing on-site parking as well as potential barriers to implementation.

Table 13. Benefits of and barriers to implementing on-site parking.

Benefits	Potential Barriers to Implementation
• Concentrates parking supply at point of staging demand. • Improves driver conditions and favorability of customer. • Site already generates truck traffic, and new externalities are minimized.	• Not commonly required today. • May be limited to new developments or major redevelopments. • State and local zoning powers vary throughout the Nation. • Regulations related to impervious cover and stormwater runoff may deter development of additional parking space.

(Source: FHWA, 2021.)

⁴⁷ Dooner, T., FreightPlus, “Shipper of Choice: A How To Guide,” June 27, 2018. Accessed June 8, 2021 from <https://www.freightplus.io/2018/06/27/shipper-of-choice-a-how-to-guide>.

Town of Mount Olive and the Mt. Olive Pickle Company⁴⁸

An example of a successful P3 is the recent efforts of the Town of Mount Olive and the Mt. Olive Pickle Company to address truck traffic and parking issues in the town.

The Town of Mount Olive is in Duplin and Wayne counties of North Carolina and had a population of roughly 5,000 in 2017.⁴⁹ The town is served by a network of highways with U.S. Highway 117 and NC Highway 55, linking the town to Interstate 40 and the North Carolina Eastern Region Global TransPark. A large local employer in town is the Mt. Olive Pickle Company, Inc.

Approximately 50,000 tractor-trailer trucks service the pickle company warehouses and its distribution center each year. This created safety and congestion issues with the high volume of heavy truck traffic in downtown and residential areas. Insufficient turning radii on streets turning off the main thoroughfare to the pickle company warehouse and distribution centers often resulted in damage to infrastructure. Lack of wayfinding also led to some drivers becoming lost on local streets, and some of their maneuvers have led to downed utility poles, broken fire hydrants, and destroyed signs.

A lack of a staging area for trucks also has resulted in trucks having to park in shopping centers to stage for picking up and delivering to the pickle company and/or for drivers to adhere to HOS regulations. Increasingly, the shopping centers have been moving towards banning the parking of commercial vehicles on their property due to liability, property damage, and litter issues, further aggravating the truck issue.

The Town and the Mt. Olive Pickle Company have taken measures over the years to address the increasing truck traffic in the Town. The Town erected several way-finding signs to direct trucks to and from the pickle company to help truck drivers from getting lost and the company provided detailed directions for truck drivers and a video of the routes to take to arrive at the facilities without getting lost on their company website. Given the volume of truck traffic servicing the company, these measures could only do so much to alleviate the problem. Therefore, the Town of Mount Olive, with the support of the Mt. Olive Pickle Company, approached North Carolina Department of Transportation to build a road off N.C. Highway 55 East over to Talton Avenue to take the truck load off the main thoroughfare, Breazeale Avenue.

The pickle company also is constructing a staging area located on Talton Drive adjacent to the new road that will handle up to 60 trucks at one time with included weight scales, restrooms, and refrigeration hookups at the site. All the information about the new route has been forwarded to the county to get an official address assigned for the new road and to have it added to GPS systems to help truckers navigate when coming to Mount Olive and the pickle plant.

The cost of the new road and staging area is reported to be approximately \$3 million. The new road and staging area will help eliminate much of the heavy truck traffic on Breazeale Avenue,

⁴⁸ North Carolina Department of Transportation. Truck Parking Study: Phase 2. https://connect.ncdot.gov/projects/planning/Statewide-Freight-Plan/Documents/NCDOT_TruckParkingStudy_PhaseII_Concepts_of_Operations_2020.pdf.

⁴⁹ U.S. Census. <https://data.census.gov/cedsci/>.

Church Street, and Park Avenue, reduce truck incursions into residential areas, and allow trucks to stage on the company property rather than along roads or in retail shopping areas in town. The new onsite facilities will also improve conditions for drivers by reducing stress in parking and staging and provides amenities for their comfort. The company believes that the staging area and amenities will increase efficiency of its operations, make the facility more attractive to trucking companies to service, and allow the company to be a good corporate citizen to the Town of Mount Olive.

Shared Truck Parking Facilities

As many States seek to address their truck parking shortages, shared parking facilities provide an opportunity to leverage partnerships to meet truck parking demand. Partnerships can exist between private entities, between public entities, and between public and private entities. Additionally, collaboration between the public and private sectors may illuminate opportunities to provide additional parking without resulting in a formal P3.

Collaborations have capitalized on available, underutilized land to fill the truck parking gap in several localities. Many of these shared facilities are at ports, but shared lots have been introduced at industrial parks, airports, and park-and-ride lots. The design of existing facilities should be carefully reviewed before repurposing for truck parking because pavement and access at shopping malls and other large sites may not be designed to support heavy weights. By utilizing shared parking facilities, cities can capitalize on underutilized space to provide safe and convenient parking. Private property owners may be able to monetize underutilized space: the Washington State Joint Transportation Committee Truck Parking Action Plan recommended promoting participation in parking reservation programs facilitated by mobile applications.⁵⁰ These applications create a financial incentive to offer use of parking spaces for a fee, offsetting additional maintenance costs from parked trucks.

Recommendations from statewide freight plans and other State initiatives, such as the ones listed in table 14, introduce the value and strategies to develop, fund, and maintain shared facilities.

Table 14. Statewide freight plan recommendations for shared parking facilities.

Agency	Recommendations
Washington State Joint Transportation Committee	• Develop more publicly-owned truck parking. • Encourage shippers and receivers to provide basic amenities. • Develop parking information systems. • Better utilize existing urban parking areas. • Better utilize existing infrastructure in mountain passes.
Massachusetts Department of Transportation (MassDOT)	• Collaboration between State, local, regional, and multistate authorities to manage zoning, permitting, taxation, traffic, and other logistical and quality-of-life-issues. • P3s.

⁵⁰ Washington State Legislature, Joint Transportation Committee. Truck Parking Action Plan, 2021.

Agency	Recommendations
Kansas Department of Transportation (KDOT)	- Explore changing parking enforcement rules—encourage local Government and business support for constructing and operating. - Commercial truck stops and travel plaza facilities in or near their community industrial and business parks (i.e., zoning).
Missouri Department of Transportation (MoDOT)	- Conversion of general-purpose rest areas to truck parking. - Conversion of weigh stations to truck parking.
Wisconsin Department of Transportation (WisDOT)	- Increased truck parking implemented at State safety scales with 24/7 access to vending and restrooms. - Double-width egress ramps at State safety scales to accommodate oversized trucks.

(Sources: JTC, 2021; National Coalition on Truck Parking, 2018; and National Coalition on Truck Parking, 2020.^{51,52,53})

While the Statewide plans provide the framework and vision for shared facilities, several localities have already developed and implemented these shared facilities to provide safe parking for drivers:

- The Oakland Maritime Support Services (OMSS) Center at the Port of Oakland:* When the City of Oakland acquired a portion of an Army base for development in support of port operations, 15 acres were set aside for truck parking and related services at the urging of a coalition of drayage carriers and local residents interested in removing parked trucks from neighborhood streets. A private enterprise leased the property at fair market value and developed a truck parking facility adjacent to the Port called the OMSS Center. Later, the parking area was expanded with support from a \$5 million grant from the Alameda County Transportation Commission. The center serves as a service destination for trucks at the Port of Oakland with several amenities, including biodiesel and liquefied natural gas (LNG) truck fuel, a truck wash, maintenance and repair, and a truck scale and cargo weighing stations. The private owner charges fees to generate revenue to cover the cost of capital improvements and ongoing maintenance and operations. The OMSS gets trucks out of their neighborhoods and into designated facilities to the benefit of their community and the drivers.⁵⁴
- Port of Seattle:* In 2009, the Port of Seattle created a nearly 2-acre truck parking area with more than 100 truck parking spaces. One of the goals was to encourage truckers to park in the secured, free facility rather than using off-street parking in the local neighborhoods. Trucks

⁵¹ Joint Transportation Committee. *Truck Parking Action Plan*. December 2021.

https://leg.wa.gov/JTC/Documents/Studies/Truck%20Parking/Final_TruckParkingActionPlan_2021.pdf.

⁵² Federal Highway Administration. *Including Truck Parking in State and Metropolitan Planning Organization (MPO) Freight Plans*.

2018. https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/workinggroups/state_reg_lgov_coord/product/freight_plans.pdf.

⁵³ Federal Highway Administration. *National Coalition on Truck Parking: Parking Capacity Working Group - Creative Uses of the Right-of-way and Adjacent Areas*. 2022.

https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/workinggroups/parking_capacity/product/row.htm.

⁵⁴ OMSS Center Company Brochure. 2014.

are allowed to park for a maximum of 14 days. The Port is now considering development of a 10-acre site with the potential for 200 spaces.⁵⁵

- *Miami International Airport Overnight Truck Parking Lot:* The Miami International Airport in Florida has an overnight parking lot with 20 truck parking spaces. The total lot is 2.5 acres and has no amenities.⁵⁶
- *Port of Brownsville:* The Port of Brownsville, TX developed staging parking inside its gates to meet the needs of its tenants, especially exporters to Mexico. The Port funded this improvement by increasing its gate fee by \$3.00 to offset operations and maintenance costs. Port staff were interviewed during the development of the Rio Grande Valley Freight and Trade Transportation Plan. Staff commented that using the available parcel for truck parking would facilitate trade in the near term while not prohibiting future industrial development at the site as land at the Port becomes sparse.
- *Texas-Mexico International Bridges:* Several international bridge operators on the Texas-Mexico border have developed truck staging lots near bridges to accommodate the export process. Drivers must wait for Mexican customs paperwork to clear prior to approaching the southbound bridge, and drivers cannot always wait at the shipper's site for this to occur. These facilities can increase competitiveness of the bridge while reducing the negative impacts to the surrounding community.
- *Overnight Parking in Weed, CA:* The City of Weed developed a parking lot to accommodate 30 trucks on industrial-zoned city-owned land. The community was supportive of the development and recognized the need for truck parking to support the local economy.
- *Park-and-Ride Lot in Fallbrook, California:* North of San Diego, at Interstate 15 (I-15) and State Route 76 includes an area for dedicated truck parking. There are 11 designated truck parking spaces.

These shared facilities provide parking in areas of high truck parking demand, and benefit from economies of scale in design, operation, and maintenance compared to parking supporting a single business. Table 15 summarizes the benefits and potential barriers for implementing shared parking areas.

⁵⁵ <https://www.seattle.gov/Documents/Departments/SDOT/FreightProgram/TruckParkingFlyer061609.pdf>.

⁵⁶ <http://miamidadetpo.org/library/studies/development-of-truck-parking-facilities-phase-ii-options-for-implementation-final-2012-08.pdf>.

Table 15. Benefits of and barriers to implementing shared parking.

Benefits	Potential Barriers to Implementation
- Increases efficiency of parking provision in a concentrated area. - Sites can be located near existing centers of truck and industrial activity. - Security, waste management, wayfinding, and maintenance costs are consolidated.	- Property owners may have liability concerns. - Security policies at land, air, and water ports may limit parking hours or duration. - Suitable publicly owned sites often serve an existing purpose (e.g., park-and-rides). - Local ordinances may prohibit overnight parking.

(Source: FHWA, 2021.)

Public-Private Partnerships

P3s are partnerships for developing, operating, and maintaining infrastructure when there are substantial public and private interests and benefits. The public sector invests its land, time, expertise, funding, or other resources to benefit residents and the traveling public. The private sector invests its resources when it expects a return on investment. Truck parking is an appropriate P3 candidate because it sits at the nexus of public interests and private industry operations: when truck parking is adequate, safety and mobility are improved, as is the economic competitiveness of private industry.

State and Federal law may affect the feasibility of some truck parking P3s. For example, 23 U.S.C. 111 prohibits commercialization of Interstate right-of-way, with the exception of certain activities such as providing vending machines. Some turnpikes or toll roads with Interstate designations that were constructed without Federal funds as well as certain commercial establishments on other Interstate highways that were in existence prior to January 1, 1960 and meeting certain other conditions specified in 23 U.S.C. 111 are exceptions to this rule. Other locations of high truck parking demand such as U.S. Highways and local or regional roadways near ports and industrial uses could present good candidates for P3s. Table 16 summarizes benefits of and barriers to implementing P3s.

Table 16. Benefits of and barriers to implementing truck parking public-private partnerships (P3s).

Benefits	Potential Barriers to Implementation
- Reduces public cost of development and/or maintenance of parking locations. - Distributes risk across multiple parties. - May provide additional amenities not typically present at public rest areas.	- Identifying mutually beneficial terms to meet public and private needs can be challenging. - State law may prohibit or limit local authority to enter P3s.

(Source: FHWA, 2021.)

A recent P3 in Maryland exemplifies a commonly considered truck parking P3 model: a public entity provides land and access to infrastructure in exchange for capital, operational, and

maintenance costs provided by a private partner. The Maryland Transportation Authority (MDTA), the State's toll authority, entered into an agreement with Areas USA to redesign and reconstruct two travel plazas along I-95.⁵⁷ MDTA's public benefits included modern travel plazas with fuel, truck parking, restaurants, and convenience items. Their private partner can generate revenue from sales at the travel plazas, and the agreement includes a commitment to return a percent of gross revenue to MDTA. The agreement includes at least \$400 million to MDTA over the 35-year agreement.

Maryland Transportation Authority I-95 Travel Plaza P3

The Maryland Transportation Authority (MDTA) is responsible for Maryland's tolled highway system, including I-95. During 2011, MDTA released a Request for Proposals (RFP) to enter into a 35-year concession agreement for travel plazas along the corridor. There were three goals for the P3 arrangement:

- Obtain new or like-new facilities to replace the current Chesapeake and Maryland Houses.
- Ensure that the facility design and operation will provide a positive customer experience.
- Provide a fair return to the State and provide for transfer of the facilities in satisfactory condition at the end of the term.
- MDTA selected Areas USA for the partnership under the following agreement:
 - Areas USA provided an initial investment of \$56 million, reducing MDTA's debt risk.
 - MDTA receives annual payments totaling over \$400 million across the life of the agreement (35 years).
 - Areas USA funds maintenance, estimated by MDTA as a total benefit of \$35-70 million.
 - Areas USA constructed and opened two new Travel Plazas within first two years.
 - Areas USA benefits from revenue from Travel Plazas.

Source: MDTA report to Report to the Maryland General Assembly. 2012.

https://mdta.maryland.gov/sites/default/files/Files/MD_I-95_Travel_Plazas/travel_plaza_report%20final.pdf.

⁵⁷ The travel plazas located in the right-of-way of Interstate I-95 in Maryland are exempt from the prohibition against commercialization of the Interstate right-of-way under 23 U.S.C. 111. These travel plazas, in existence at the time 23 U.S.C. 111 was enacted, meet the grandfather provisions under 23 U.S.C. 111(a).

5. CONCLUSIONS

Jason Rivenburg's death highlighted the challenges truck drivers face daily. In 2012, Jason's Law brought attention to the truck parking situation across the Nation. The March 2020 *Jason's Law Truck Parking Survey* results show that the number of truck parking spaces in the U.S. has risen 6 percent in recent years; but it is not enough. Every day, thousands of truck drivers continue to experience frustration looking for parking to rest, comply with State and Federal safety laws, or stage loads for customer appointments. Drivers and truck stop operators continue to report frequent truck parking shortages. States and communities frequently report trucks parked in undesignated areas, and unfortunately some cities are responding with prohibitions that only make these issues worse.

Providing safe and secure truck parking has positive benefits for truck drivers, the traveling public, municipalities, States, and private industry. Driver safety, traffic safety and efficient freight movement all depend on access to truck parking. Since Jason's Law, progress has been made to better assess truck parking needs, especially those needs associated with Federal HOS regulations. But significant challenges remain to address the needs for truck parking in the right locations. This Handbook presents tools and strategies for local planners and land use officials to integrate truck parking into local planning efforts, land use and zoning policy, and community education efforts to improve the state of truck parking in their communities.

Projects that increase the availability of truck parking spaces can generate public and private benefits across many dimensions, safety, infrastructure preservation, supply chain reliability and profitability: These improvements not only reduce trucking costs, but they also reduce community impacts (emissions, congestion, safety, etc.). Making it easy to find parking also reduces the need for truck drivers to park in undesignated locations, many of which are unsafe and are a nuisance for local communities. Truck parking supports broader economic development, including jobs, income, and taxes in the local economy. These benefits derive from reductions in transportation costs that enhance regional competitiveness of businesses, from establishments that serve truck drivers locating in the surrounding area, and from the operations of the parking facility.

The successful implementation of truck parking areas depends on collaboration between the public and private sectors. The barriers to providing additional truck parking are many; funding for facility construction and maintenance is limited and finding locations to provide parking is difficult in the areas with highest demand due to land cost and availability. Urbanized areas especially around industrial, warehousing, or commercial clusters and freight hubs such as ports, international gateways, and intermodal facilities have the greatest land-related challenges due to the concentration of existing development. When there is limited land and resources to meet truck parking needs, P3s have proven to be a successful mechanism to implement on-site parking and shared parking facilities. The final chapter of the Handbook provides case studies showing successful examples of how communities across the Nation of implemented parking developments.

Through proper planning and appropriate land use policies truck parking can be in harmony with community livability goals. This Handbook provides State and local practitioners with resources to plan for and implement truck parking that supports local economies, while minimizing

negative externalities. The Handbook presents strategies and case studies for developing truck-parking that supports freight transportation safety corridors, integrates parking needs with truck generating facilities and ensures compatibility with adjacent land uses. This Handbook is designed to help communities address the challenges associated with modern industrial, warehousing, and commercial developments that generate truck traffic and create demand for truck parking.



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