

Technical Memorandum
**Connecticut
Truck Parking Study**

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June 2023



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I. INTRODUCTION

As a part of the Connecticut Statewide Freight Plan Update, the Connecticut Department of Transportation (CTDOT) conducted the *Connecticut Truck Parking Study* to better understand truck parking needs throughout the state. The safe and efficient operation of trucks depends on the ability of truck drivers to have reliable access to designated parking spaces. Currently, truck drivers face a choice of stopping early to take an available parking spot or risking that a designated parking space may not be available before their hours of service expire. In the latter case, truck drivers may be forced to park in undesignated locations—such as highway shoulders and ramps, roadsides, or automobile parking lots—which may present a safety concern. As a part of this effort to better understand truck parking needs in Connecticut, this report provides the following:



- Review of truck parking regulatory requirements and case studies
- Inventory of existing truck parking in the state and utilization analysis of identified truck parking sites
- Analysis of undesignated truck parking at identified truck parking sites
- Truck parking supply and demand assessment of key corridors
- Summary of truck driver surveys from a truck parking perspective
- Truck parking implementation strategies

Additional truck parking is a critical need throughout the nation and in Connecticut to ensure the safe operation of trucks on the transportation network. **Table I.1** describes some of the key elements driving the need for truck parking demand.

Table I.1: Drivers for Truck Parking Demand

Reason	Description
Hours of Service	To reduce excessively long work hours that increase both the risk of fatigue-related crashes and long-term health problems, the Federal Motor Carrier Safety Administration (FMCSA) introduced hours-of-service regulations ¹ in 49 CFR Parts 385, 386, 390, and 395 that have been updated over the years. To comply with these requirements, truckers need truck parking sites to be present uniformly over the transportation system and match the demand, and preferably with parking availability information.
Staging	Trucks need a space to park while waiting for pickup/delivery, also called staging. While normally this is a short-term parking demand it can become overnight parking demand when a truck misses the last pickup/delivery time window of a business day.
Large Size of Trucks and Safety	Trucks with five or more axles are large in dimensions and when parked on streets they pose safety concerns for smaller vehicles, bikes, pedestrians, and other modes. Thus, moving these trucks to off-street sites would improve safety. Oversized truck parking may need additional safety considerations.
Emissions	Trucks are a major source of nitrogen oxides (NOx) and particulate matter emissions. Providing adequate truck spaces reduces the need for trucks idling while waiting to pickup/deliver.
Overnight Parking	Trucks that travel long-haul do not always have a home base or truck depot to return after the end of day’s business and thus require a location for overnight parking.
Amenities	Truckers need amenities such as restroom, food, fuel, shower, ATM, laundry, truck wash/repair, auxiliary power, etc. at truck parking sites to meet their personal and cargo needs, and to maximize the time spent moving cargo.
Undesignated Parking & Safety	Some truckers park in undesignated spaces, which creates a safety concern and is subject to enforcement. The causes for this can be the inability to find a truck parking space before hours-of-service run out, unwillingness to pay the cost of parking (which can vary from low to high), no overnight truck parking sites, emergency/weather-related closures, and lack of truck parking availability information.

I.1 ANALYSIS METHODOLOGY

The truck parking assessment consisted of three components: (1) truck parking supply inventory and utilization, (2) undesignated truck parking, and (3) truck parking demand and supply forecast using the data and methodology shown in **Figure I.1**.

¹ <https://www.fmcsa.dot.gov/regulations/hours-of-service> (last accessed on July 15, 2022)

Figure 1.1: Truck Parking Assessment Methodology



The truck parking supply assessment developed a supply inventory, including the site name, site location (geo-coordinates, address, highway, milepost), and number of truck parking spaces and amenities using trucker information websites and Jason's Law databases.

The truck parking utilization assessment was conducted using American Transportation Research Institute (ATRI) truck parking events sample^{2,3} and sample to population expansion factors.⁴ ATRI data were used to estimate total demand at a truck parking site in units of peak hourly parking arrivals.^{5,6} Utilization is defined simply as the ratio of the demand in peak hourly parking arrivals to supply in parking spaces. Site validation of truck parking arrivals was not a part of this analysis. ATRI data was also used to estimate undesignated truck parking along ramps and shoulders at each truck parking site.

While ATRI data were useful in understanding utilization at truck parking sites, corridor-level demand forecasting was conducted using a Federal Highway Administration (FHWA) truck parking demand estimation methodology⁷ enhanced by an hours-of-service factors update from a 2007 Pennsylvania study.⁸ The FHWA methodology is expected to provide the total truck parking demand, including the following demand components: (a) parking demand met at truck parking sites, (b) parking demand met at locations beside the truck parking sites, and (c) unmet/latent demand.

The FHWA methodology estimated current (2019) and future (2040) peak hourly short-term and overnight parking demand along state routes with high truck use.⁹ The calculated demand is a function of local data on traffic volumes, speeds and percentages of short- and long-haul, and FHWA default parameters for hours-of-service and peaking factors. On a few corridors, the demand estimates based on the FHWA methodology were adjusted upwards when the aggregated demand for truck parking sites using ATRI data exceeded the former. The corridor level truck parking demand estimates were compared to the aggregated supply based on the truck parking supply inventory.

² ATRI provides GPS-based spatial (coordinates) and temporal (time/date stamp) data for a large sample of trucks with onboard, wireless communication systems (probe vehicles) in the U.S. The truck parking events sample is a processed format of data prepared by ATRI using in-house programming. The parking data was collected for 56 days in the year 2019 and obtained as four 2-week periods representing four seasons of the year while avoiding holiday weeks.

³ The ATRI sample used in this study excludes truck parking events that have duration less than 30 minutes long, which may cover short-term activities such as driver's use of restroom, truck fueling, driver's food takeout, etc.

⁴ The truck parking events sample was expanded to truck population using comparisons between ATRI truck GPS data-based truck flows to the truck AADT in the State's Highway Performance Monitoring System (HPMS) data on the highway closest in access to the truck parking facility. This assumes that truck parking arrivals as a share of the highway truck traffic is the same in the sample and population.

⁵ 'Hourly parking arrivals' is an average across all 56 days of the ATRI data, and the hour on an average day with the highest number of parking arrivals represented as the 'peak hour.' The peak hour varied from truck parking facility to facility.

⁶ An alternate measure for utilization is 'parking space occupancy,' which is net of parking arrivals and parking departures. The ATRI data used in this study did not support calculation of the parking space occupancy.

⁷ Federal Highway Administration (FHWA), Model Development For National Assessment of Commercial Vehicle Parking, March 2002, Available at: <https://www.fhwa.dot.gov/publications/research/safety/01159/01159.pdf> (last accessed on July 15, 2022)

⁸ Pennsylvania State Transportation Advisory Committee, Truck Parking in Pennsylvania, December 2007, Available at: <https://talkpatransportation.com/perch/resources/documents/truck-parking-in-pennsylvania-december-2007-final-report.pdf> (last accessed on July 15, 2022)

⁹ Corridors with over 1,000 trucks per day and coverage over all existing truck parking facilities were used.

1.2 KEY TAKEAWAYS

- Almost 92 percent of the estimated truck parking demand in 2019 (i.e., 642 out of the 700 truck parking spaces needed during peak hour) is concentrated on I-95, I-84, I-91, and I-395 corridors. Parts of I-84, I-91, and I-395 corridors have a non-uniform supply (i.e., lack truck parking facilities once every hour of truck travel). The non-uniformity in truck parking supply makes it difficult for truck drivers to meet their hours of service (HOS) regulations on the state's transportation network. At the time of this analysis, a major supply shortfall location is identified as I-84 corridor between US 7 and I-691, which needs development of new truck parking sites.
- While truck parking occupancy was not available, estimated peak hourly truck arrivals for parking at existing truck parking sites are fast approaching the available supply at I-95 Northbound Darien Service Plaza, I-95 Southbound Darien Service Plaza, I-84 Eastbound Southington Rest Area and I-84 Eastbound West Willington Rest Area. The truck parking arrivals peak during the night hours (6 pm to 6 am) at these sites when there is also a higher share of longer-term parking (4 to 8 hours, and 8+ hours duration). The presence of residual parking from the hours prior to the truck arrivals peak hour and the slow turnover of parking spaces forces trucks to park at undesignated areas such as the shoulders of ramps to/from the truck parking sites.
- Peak hourly truck arrivals and thus utilization was found to vary across the existing truck parking sites in the state. The sites of I-95 Southbound North Stonington Welcome Center, Pilot Travel Center #882 and Pride Hartford Truck Stop (with 30 or more parking spaces each) are facing an under-utilization for truck parking use. The first two sites are located in rural parts of the state while the third site is in an urban part of the state. To support new truck parking developments, to reduce undesignated truck parking issues, and to resist pressures from competing land uses, all in the vicinity of these sites; it is essential to closely review reasons for their under-utilization (proximity to freight generators, cost, etc.) and right-size their land use.
- The comparisons between aggregated demand (peak hourly truck arrivals) and aggregated supply (available truck parking spaces) at corridor level show I-95 corridor between NY/CT border and SR 8, I-91 corridor between SR 9 and US 5/I-84 and all I-395 corridor segments as having supply shortfalls that are expected to become worse with truck traffic growth by 2040. The demand on the I-95 corridor segments is much higher compared to I-91 and I-395 corridor segments, and hence should be prioritized for expansions around the existing truck parking sites or development of new truck parking sites.
- The state's truck parking sites have limited access to showers, laundry, and truck washes, which are essential for long-haul truckers. Showers and truck wash as amenities at truck parking sites are present only on I-95 corridors and laundry as an amenity at truck parking sites is present on I-95, I-84, and I-91 corridors. Future private truck parking developments should be encouraged (through policy) or required (through permitting) to provide these types of amenities.

2. TRUCK PARKING LITERATURE REVIEW

A review of existing truck parking literature was performed including available studies from CTDOT and surrounding jurisdictions and information from FHWA. The *Workshop on the Draft Truck Parking Development Handbook* was developed by FHWA in 2021 and provides insight into best practices for increasing truck parking. CTDOT’s previous truck parking study is the *Connecticut Statewide Rest Area and Service Plaza Study*, developed in 2008. Detailed information on these studies, and studies performed in nearby jurisdictions is provided in **Table 2.1**.

Table 2.1: Truck Parking Literature Review Findings

Report/Study	Key Findings
Workshop on the Draft Truck Parking Development Handbook, 2021 ¹⁰	Truck parking shortages are a major problem in every state and region; major freight corridors and large metro areas have the most acute shortages.
	Economic benefits of truck parking include avoiding detours (i.e., reduced emissions), reducing undesignated parking thereby improving safety, and improved trucking sector performance.
	Siting of truck parking should consider land uses that attract truck traffic, highways that carry the highest levels of truck traffic, existing parking facility capacity, future land use, and development that will impact truck traffic.
	Highway access and parcel size are the most important elements to ensure parking utilization.
	The design and siting of truck parking facilities and truck traffic inducing land uses should mitigate impacts to communities (e.g., earthen berms, nature barriers, physical barriers, directional lighting).
	Key design attributes include turning radius, parking stall design, parking slot type, swept path, slot density, access, layout, and circulation.
	Improving land use and zoning policies can encourage and/or require truck parking. For example, truck parking could be incorporated into traffic impact assessments and zoning should require minimum truck parking on-site.
	Shared parking facilities and public-private partnerships can be used to increase truck parking.
2008 Connecticut Statewide Rest Area and Service Plaza Study ¹¹	A truck parking deficit was found under existing conditions and future “do-nothing” conditions. Deficits found are most pronounced in southwestern Connecticut along I-95 and on I-84 west of Hartford.
	Long stretches of road were found with no roadside traveler facilities. Examples included Route 9, Route 2, and I-91 between Hartford and the Massachusetts state line.
	Overnight truck parking demand exceeded the number of available spaces. Deficits were found along I-84, I-91, I-95, and I-395.
	Future truck parking deficits were analyzed and included I-84, I-91, I-95, and I-395.
	Land constraints, including both availability and cost, are challenges to the truck parking issue throughout Connecticut, but most particularly in the areas of greatest need – I-95 in the southwestern part of the state and I-84 west of Hartford.

¹⁰https://ops.fhwa.dot.gov/freight/infrastructure/truck_parking/docs/PPT_TruckParkingHandbook_Workshop.pdf

¹¹ <https://portal.ct.gov/-/media/DOT/documents/dpolicy/RestArea/MASTERVOL1.pdf?la=en>

Report/Study	Key Findings
	<p>The service plazas on I-95 are inundated with trucks seeking overnight parking. Trucks are routinely found lining the access ramps, shoulders of the mainline interstate, and in every conceivable open space at service plazas. In addition to affecting safety on the interstate, this issue spills onto local roads and into neighborhoods in the vicinity of interchanges and becomes a community issue as well.</p> <p>Policies and programs are needed to increase and enhance the capabilities of the private sector to help meet the truck parking shortage.</p> <p>Strategies to address the deficit of truck parking include increasing truck parking wherever possible including improving existing facilities and encouraging new private truck plazas.</p>
<p>Multi-State Truck Stop Inventory & Assessment Study, 2009¹²</p>	<p>The New York Metropolitan Transportation Council and surrounding jurisdictions (i.e., New Jersey and southwestern Connecticut) do not have sufficient parking supply to meet the demand during peak overnight hours. Some facilities exceeded capacity by 20 percent while others did not exceed capacity at all.</p> <p>Excess capacity exists at off-highway private truck stops while nearly all on-highway public rest areas are at or above capacity during overnight hours.</p> <p>Parking facilities nearest the urban core are generally the most overcrowded and near or at capacity during most periods of the day.</p> <p>Some excess automobile parking capacity and bus spaces could be converted to truck parking permanently to alleviate trucking parking demands during overnight hours.</p> <p>Real-time information systems are recommended to guide drivers to available parking alongside advocacy within planning agencies to address deficiencies.</p>
<p>State of Rhode Island Freight and Goods Movement Plan, Interim Update, 2022¹³</p>	<p>Rhode Island has two highway rest areas, two weigh station areas, and eight truck pull-off parking areas located alongside the interstates and other primary roadways. One of the rest areas is currently closed, and the two permanent weigh station areas are also closed.</p> <p>The 8-truck pull-off parking facilities are located along I-295, Route 146, Route 6, and Route 24.</p> <p>A private truck stop with a range of amenities and services is located in West Greenwich off I-95.</p>
<p>Boston Metropolitan Planning Organization Technical Memorandum: Rest Locations for Long-Distance Truck Drivers in Massachusetts, 2016¹⁴</p>	<p>Twenty-four-hour diesel locations with a travel store, showers, large lot, and food are located in Massachusetts near the Connecticut border off of I-84.</p> <p>Overnight truck parking is located near the Connecticut border off of I-84 and I-91; no overnight facilities are available off I-395.</p> <p>The three truck stops highlighted in <i>Trucker's Friend</i> for their large parking lots have this kind of convenient access: the Watley location at Exit 23 off I-91, Chicopee at Exit 6 off I-90, Sturbridge at Exit 1 off I-84, and the medium-sized truck stop in Leominster at Exit 7 off I-190.</p>

¹² https://www.nymtc.org/portals/0/pdf/Fright%20planning/TruckStop_Study.pdf

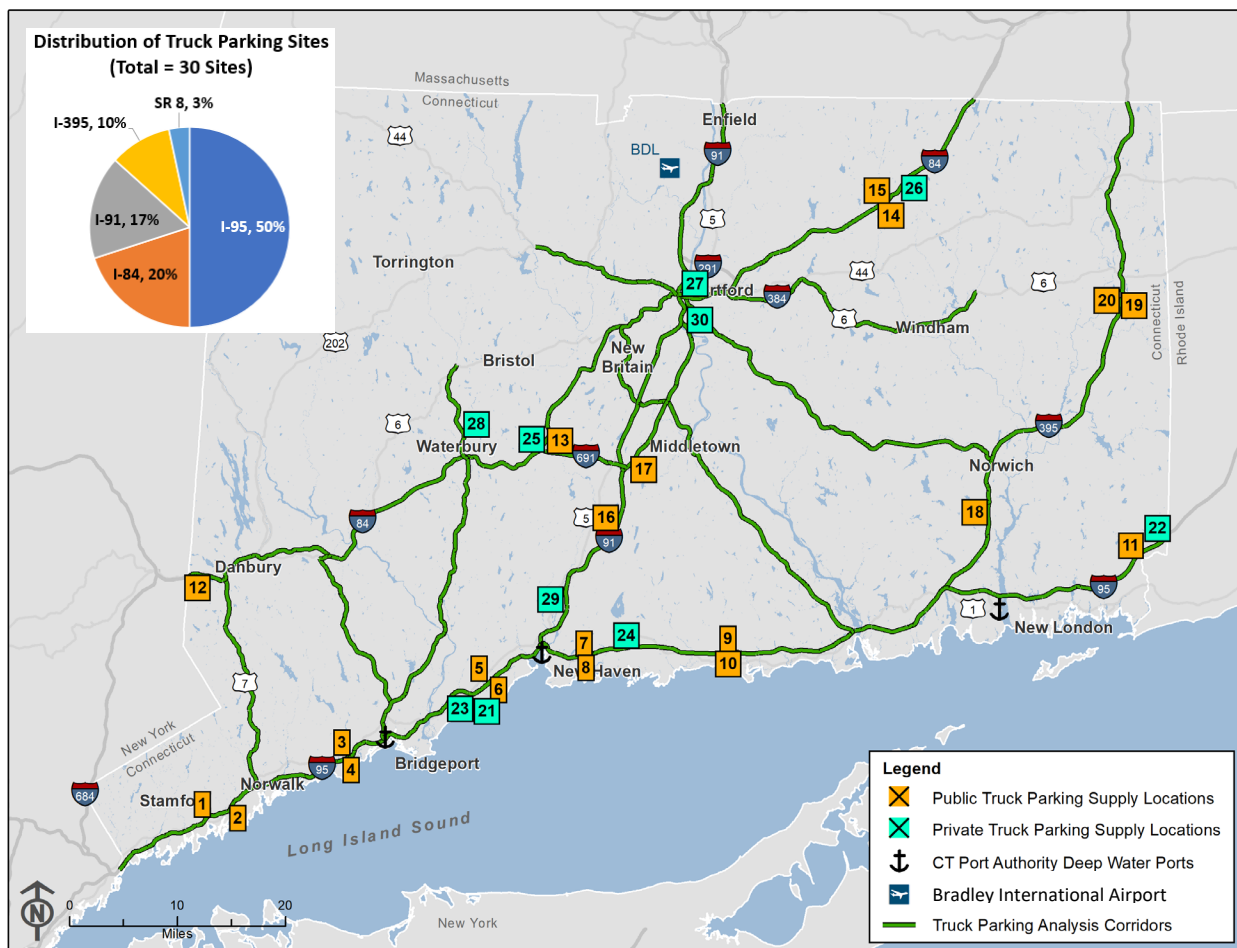
¹³ https://planning.ri.gov/sites/g/files/xkgbur826/files/documents/about/2022/5_2022-Interim-Freight-Plan-Update-Supplement-5_16_22.pdf

¹⁴ https://ctps.org/data/calendar/pdfs/2016/MPO_1006_Truck_Stop_Memo.pdf

3. TRUCK PARKING INVENTORY AND UTILIZATION

The corridors analyzed for truck parking include state routes with a minimum truck annual average daily traffic (AADT) of 1,000 trucks per day (including both directions) in 2019, see **Figure 3.1**. The state has 30 truck parking sites, as shown in **Figure 3.1** and listed in **Table 3.1**. Twenty of these are public and on-freeway sites while 10 are private and off-freeway sites. The sites are fairly uniformly distributed along the I-95 corridor, but non-uniform, or interspersed, on other corridors within the state.

Figure 3.1: Truck Parking Site Locations



Source: Base (2019) and updated (2021) Jason’s Law databases; Connecticut Statewide Rest Area and Service Plaza website; AllStays.com Pro Account trucker information website

Table 3.1: Truck Parking Sites

Site ID	Site Name	Site ID	Site Name	Site ID	Site Name
1	I-95 SB Darien Service Plaza	11	I-95 SB North Stonington Welcome Center	21*	Pilot Travel Center #255/TA Milford
2	I-95 NB Darien Service Plaza	12	I-84 EB Danbury Welcome Center	22*	Pilot Travel Center #882
3	I-95 SB Fairfield Service Plaza	13	I-84 EB Southington Rest Area	23*	Wheels Citgo #365/Secondi Truck Stop
4	I-95 NB Fairfield Service Plaza	14	I-84 EB West Willington Rest Area	24*	TA Express New Haven #171
5	I-95 SB Milford Service Plaza	15	I-84 WB West Willington Rest Area	25*	TA Southington #154
6	I-95 NB Milford Service Plaza	16	I-91 SB Wallingford Rest Area	26*	TA Willington #022
7	I-95 SB Branford Service Plaza	17	I-91 NB Middletown Rest Area	27*	Pride Hartford Truck Stop I-91
8	I-95 NB Branford Service Plaza	18	I-395 SB Montville Service Plaza	28*	Waterbury Valley Truck Stop LLC
9	I-95 SB Madison Service Plaza	19	I-395 NB Plainfield Service Plaza	29*	Gulf Truck Stop
10	I-95 NB Madison Service Plaza	20	I-395 SB Plainfield Service Plaza	30*	Mercury Mobil

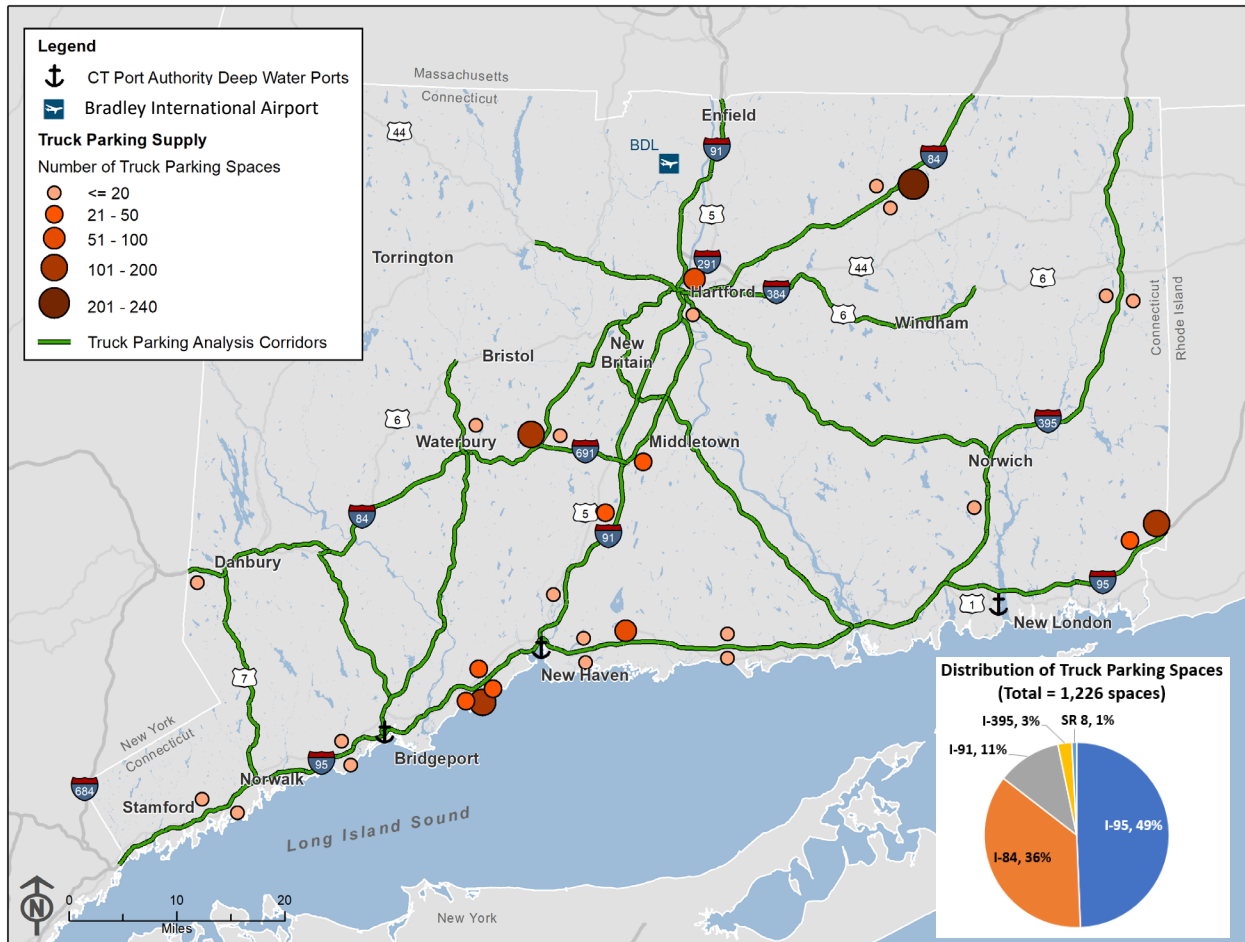
Source: Base (2019) and updated (2021) Jason's Law databases; Connecticut Statewide Rest Area and Service Plaza website; AllStays.com Pro Account trucker information website. Note: Unstarred: Public and On-freeway Type, Starred (*): Private and Off-freeway Type. Site #29: Gulf Truck Stop and Site #30: Mercury Mobil are service stations.

The state's 30 truck parking sites have 1,226 truck parking spaces in total. The dimensions of the truck parking stalls generally suit five-axle or greater trucks. The 10 private sites provide approximately 70 percent of the total truck parking supply within the state (863 truck parking spaces) with an average of 86 spaces per site. The 20 public sites provide approximately 30 percent of the total truck parking supply within the state (363 truck parking spaces) with an average of 18 spaces per site. At the time of this analysis, CTDOT became aware that a new truck stop¹⁵ is being constructed off of I-84 at Exit 71 (3 Polster Road) and will provide 56 truck parking spaces. This site was not included in the truck parking supply and demand assessment.

¹⁵ <https://www.loves.com/en/news/2022/july/loves-travel-stops-opens-first-location-in-connecticut> (last accessed on August 11, 2022)

About 49 percent of all the truck parking spaces are located along I-95, followed by I-84 and I-91 (36 percent and 11 percent of the supply, respectively). Limited supply is seen on I-395 and SR 8; no supply is seen on other corridors within the state. **Figure 3.2** shows the distribution of the truck parking spaces across the state.

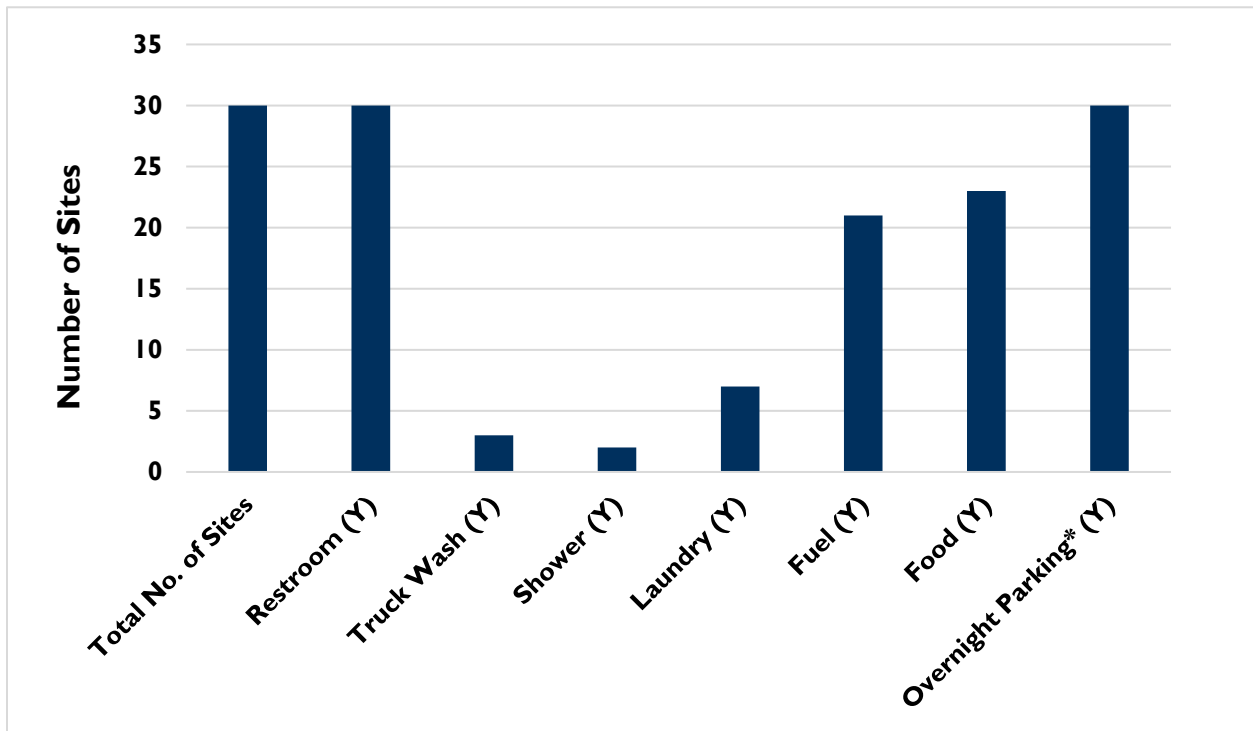
Figure 3.2: Truck Parking Spaces by Truck Parking Site



Source: Base (2019) and updated (2021) Jason's Law databases; Connecticut Statewide Rest Area and Service Plaza website; AllStays.com Pro Account trucker information website

Amenities at each truck parking site were analyzed, as certain amenities are desirable for long-haul and overnight drivers. Restrooms, overnight parking, food, and fuel are the most common amenities found at truck parking sites within the state (**Figure 3.3**). The state’s truck parking sites have limited access to showers, laundry, and truck washes, which are essential for long-haul truckers. Additional information on amenities provided at the truck parking sites are included in **Appendix B**.

Figure 3.3: Truck Parking Amenities at Truck Parking Sites



Source: Base (2019) and updated (2021) Jason’s Law databases; Connecticut Statewide Rest Area and Service Plaza website; AllStays.com Pro Account trucker information website. Note: Starred (*): For 2 supply locations, the overnight parking amenity was verified based on the source, and for the remaining 26 supply locations, this amenity was verified based on overnight use seen in 2019 ATRI Truck Parking Events data.

Existing peak hour¹⁶ parking demand and utilization was analyzed at each trucking parking site using ATRI data. In total, the truck parking sites have a demand of 467 truck parking arrivals during peak hour. The highest demand (95 peak hourly arrivals) is seen at site #26, TA Willington along I-84 south of the CT/MA border (**Figure 3.4**). Other top parking demand locations with over 20 peak hourly arrivals include:

- Site #21: Pilot Travel Center #255/TA Milford along I-95 west of New Haven
- Site #22: Pilot Travel Center #882
- Site #24: TA Express New Haven #171
- Site #25: TA Southington #154 close to I-84/I-691 interchange

Figure 3.4: Truck Parking Demand by Truck Parking Site



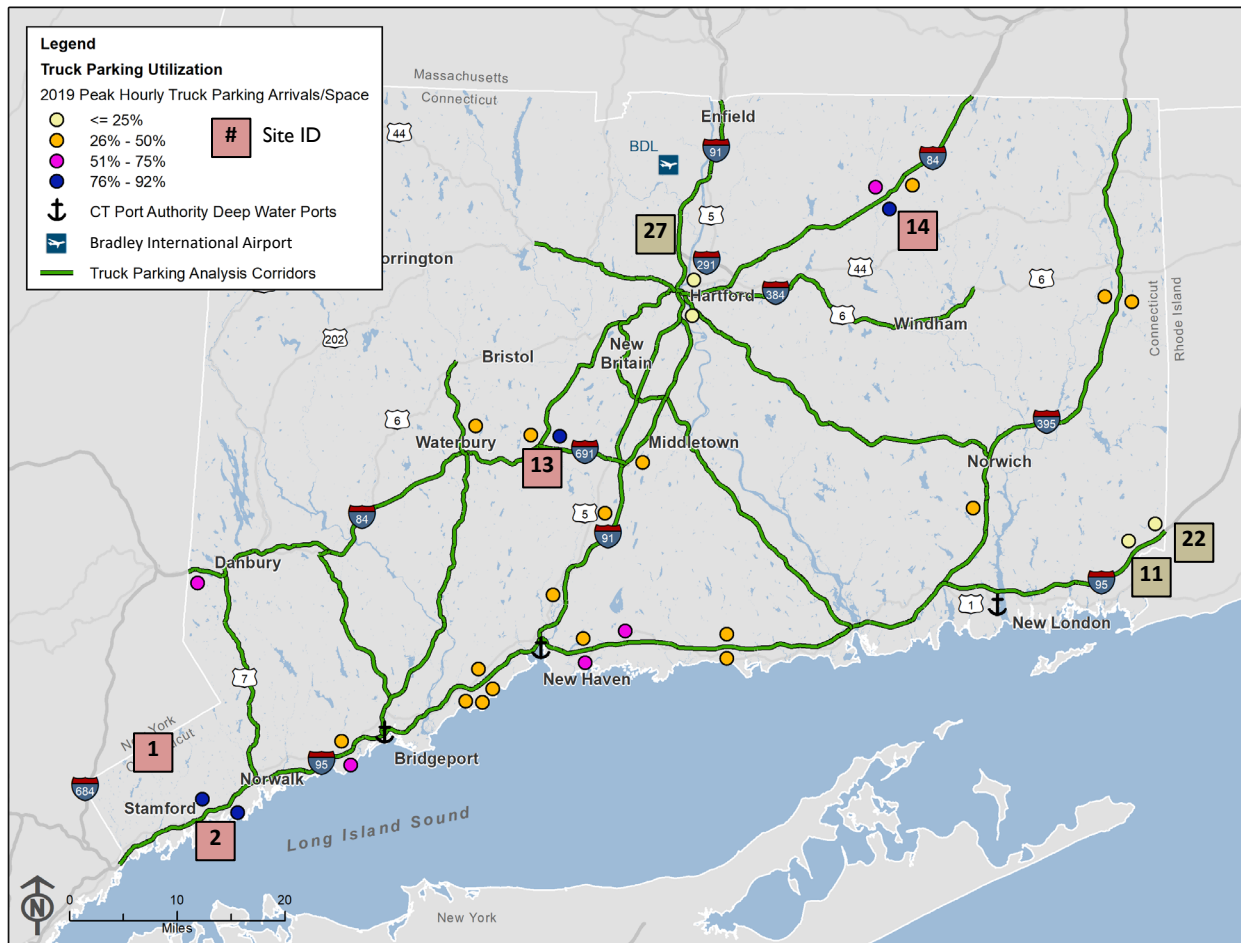
Source: Base (2019) and updated (2021) Jason’s Law databases; Connecticut Statewide Rest Area and Service Plaza website; AllStays.com Pro Account trucker information website; ATRI 2019 Truck Parking Events Sample; ATRI 2019 Truck GPS Sample-Based Truck Flows; CTDOT 2019 HPMS Bidirectional Combined Unit Truck AADTs

¹⁶ Peak hour varies by truck parking site; however, the truck parking arrivals peak during 12 am to 1 am at 24 of the 30 truck parking sites (i.e., 80 percent of the sites). The peak hour at the remaining sites are spread across the PM hours for five sites and the AM hours for one site.

The truck parking site utilization analysis results are shown in **Figure 3.5**. A high utilization indicates that most or all of the truck parking stalls at that location are occupied by trucks in the peak hour, a low utilization means there are available truck parking stalls at that location. The most highly utilized truck parking sites (utilization exceeded 75 percent) include:

- Site #1 I-95 SB Darien Service Plaza between Stamford and Norwalk (close to New York/Connecticut (NY/CT) border)
- Site #2 I-95 NB Darien Service Plaza between Stamford and Norwalk (close to NY/CT border)
- Site #13 I-84 EB Southington Rest Area near I-84/I-691 interchange
- Site #14 I-84 EB West Willington Rest Area

Figure 3.5: Truck Parking Utilization by Truck Parking Site



Source: Base (2019) and updated (2021) Jason’s Law databases; Connecticut Statewide Rest Area and Service Plaza website; AllStays.com Pro Account trucker information website; ATRI 2019 Truck Parking Events Sample; ATRI 2019 Truck GPS Sample based Truck Flows; CTDOT 2019 HPMS Bi-directional Combined Unit Truck AADTs.

Some of the less-utilized sites (less than 25 percent) include:

- Site #11 I-95 SB North Stonington Welcome Center
- Site #22 Pilot Travel Center #882
- Site #27 Pride Hartford Truck Stop

The utilization metric is below 100 percent at most locations within the state, but this does not mean that the sites do not have parking capacity related issues. Reasons for this may include:

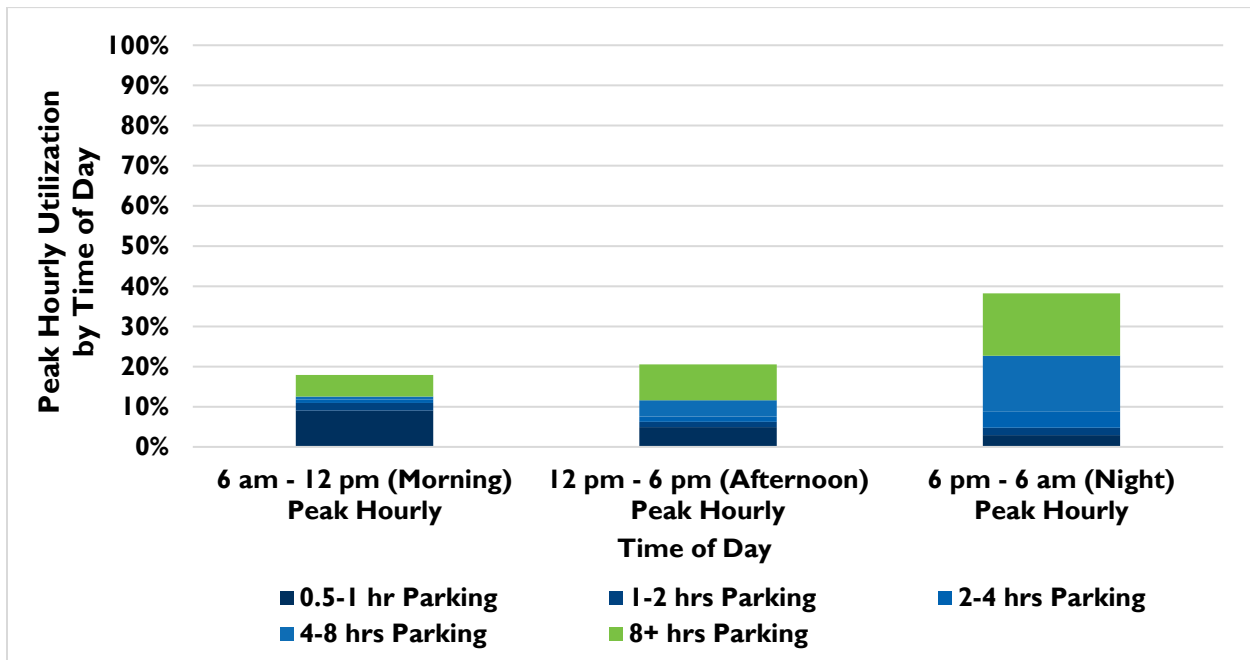
- The utilization metric is based on peak hourly parking arrivals and is not based on peak parking occupancy, which is net of arrivals and departures. If the start of the peak hour has residual parking from prior hours, then spaces available to park for trucks arriving in the peak hour is less than the total supply at the site. This was not captured in the processed ATRI data.
- When the parking occupancy reaches approximately 90 percent of the total supply, then the site is assumed to reach an operational capacity limit. The ability for a driver to reach a site, identify a turned-over space, and re-use it becomes increasingly challenging (unless there is a truck parking availability system in place to indicate to drivers the spaces available).

The utilization metric is useful in understanding the relative levels of use of the truck parking sites. A key observation is that utilization in the state is uneven across the truck parking sites. This may mean that the truck parking supply is not optimally located and sized to meet the demand and truckers may have a preferential use of truck parking sites. The following are possible reasons for this:

- Truckers coming out of/going to Ports of New York/New Jersey (NY/NJ) attempt to park close to the NY/CT border. As they move further north and east in the state, they attempt to park at sites with adequate amenities or at truck stops close to their customers, as seen at I-84/I-691 and I-84/Exit 71 locations. So, overcrowding tends to happen at some truck parking sites but not all.
- Some of the truckers that see truck parking sites that are full and also are approaching their hours-of-service limit get anxious about not finding parking at the next rest area and try to park in undesignated areas. This leads to some high-utilized sites with undesignated parking while also leading to some low-utilized sites.
- The utilization metric may be more sensitive for smaller sites than larger sites.

Combining all truck parking sites, the assessment also studied utilization by time of day (**Figure 3.6**). Arrivals peak in night hours (6 pm to 6am). Night arrivals also have a higher share of longer-term parking (4 to 8 hours, and 8+ hours duration).

Figure 3.6: Truck Parking Utilization by Time of Day



Source: Base (2019) and updated (2021) Jason’s Law databases; Connecticut Statewide Rest Area and Service Plaza website; AllStays.com Pro Account trucker information website; ATRI 2019 Truck Parking Events Sample; ATRI 2019 Truck GPS Sample based Truck Flows; CTDOT 2019 HPMS Bidirectional Combined Unit Truck AADTs

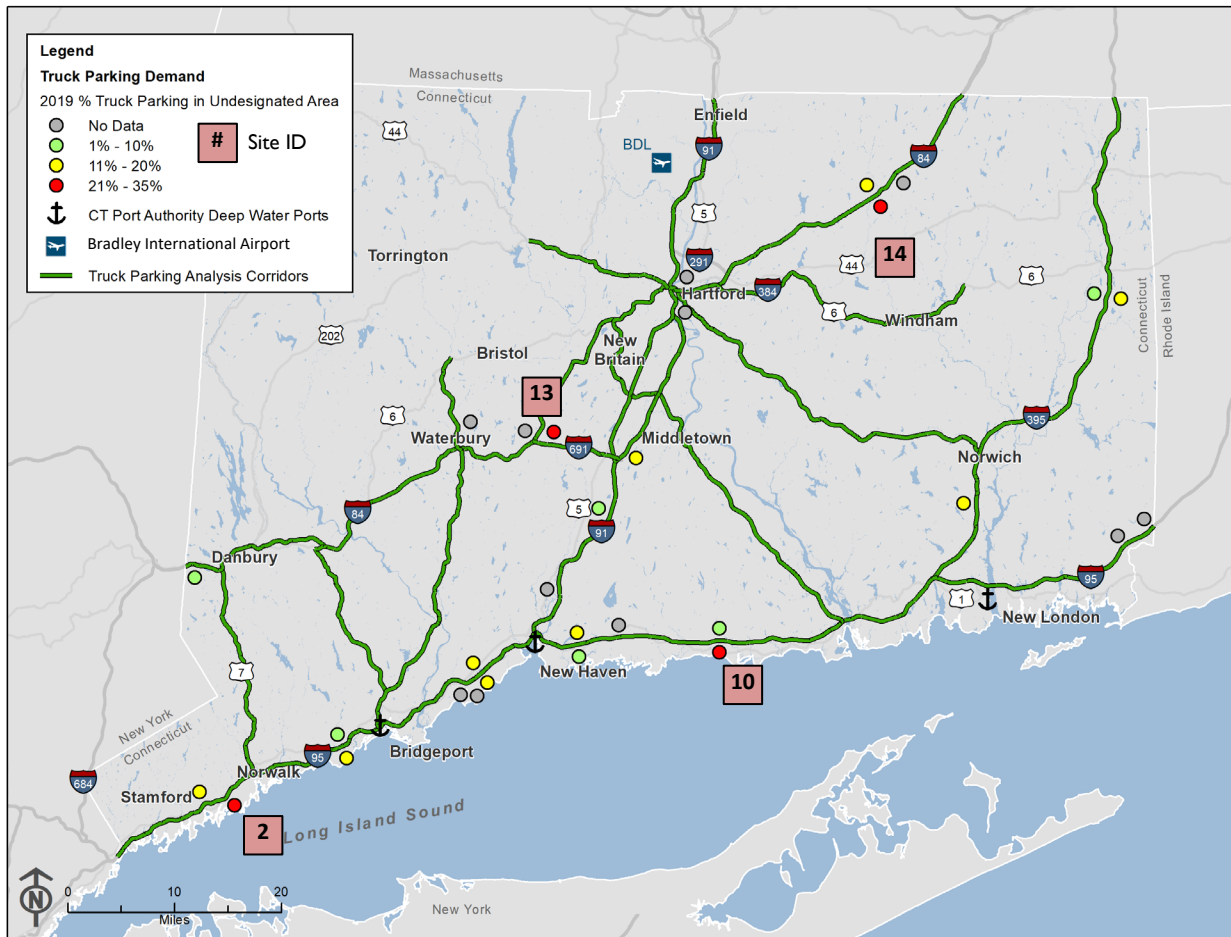
3.1 TRUCK PARKING ASSESSMENT AT UNDESIGNATED LOCATIONS

Two types of inputs were used to identify locations of undesignated truck parking. The first is based on ATRI data and the second is based on input from truck drivers as well as law enforcement and Connecticut Department of Motor Vehicles via online surveys. ATRI data determined the percentage of undesignated parking at public sites that are on-freeway and accessed through off- and on-ramps, and areas not designated for trucks (shoulders to off- and on-ramps and passenger vehicle parking area). The truck parking in undesignated areas were attributable to a parking spillover effect from the public on-freeway truck parking site. Private off-freeway sites were not analyzed for undesignated parking in the same way because the trucks parking in undesignated areas (such as the local street network) adjacent to a truck parking site could not be clearly attributed to a parking spillover effect just from the private off-freeway truck parking site.

Undesignated parking is likely a major issue at the following locations where the percentage of undesignated parking exceeds 20 percent (**Figure 3.7**):

- Site #2 I-95 NB Darien Service Plaza between Stamford and Norwalk (close to NY/CT border)
- Site #10 I-95 NB Madison Service Plaza along I-95 east of New Haven
- Site #13 I-84 EB Southington Rest Area north of I-84/I-691 interchange
- Site #14 I-84 EB West Willington Rest Area along I-84 south of Connecticut/Massachusetts (CT/MA) border

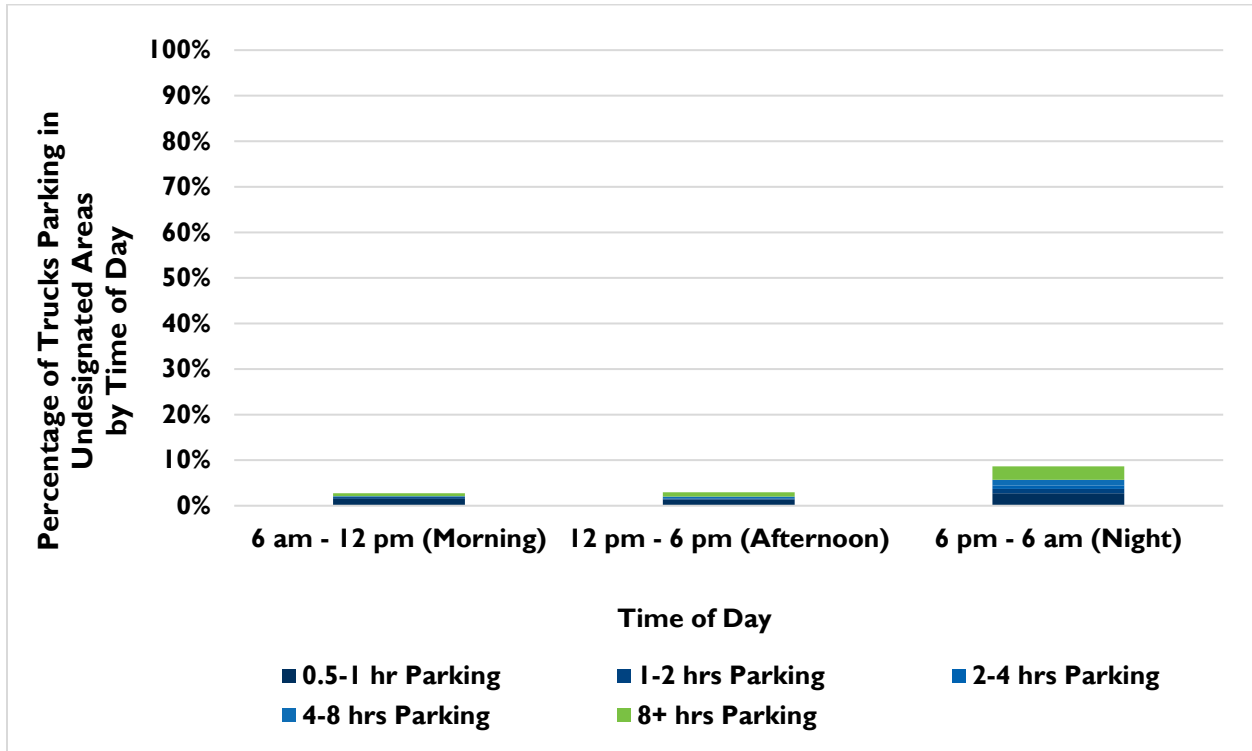
Figure 3.7: Percentage of Undesignated Truck Parking by Truck Parking Site



Source: Base (2019) and updated (2021) Jason's Law databases; Connecticut Statewide Rest Area and Service Plaza website; AllStays.com Pro Account trucker information website; ATRI 2019 Truck Parking Events Sample; ATRI 2019 Truck GPS Sample based Truck Flows; CTDOT 2019 HPMS Bidirectional Combined Unit Truck AADTs

Combining all truck parking sites, the assessment also analyzed the percentage of undesignated truck parking by time of day (**Figure 3.8**). There is a higher volume of truck parking at night and a higher percentage of undesignated truck parking. Undesignated truck parking at night presents a bigger safety issue because visibility is lower.

Figure 3.8: Percentage of Undesignated Truck Parking by Time of Day

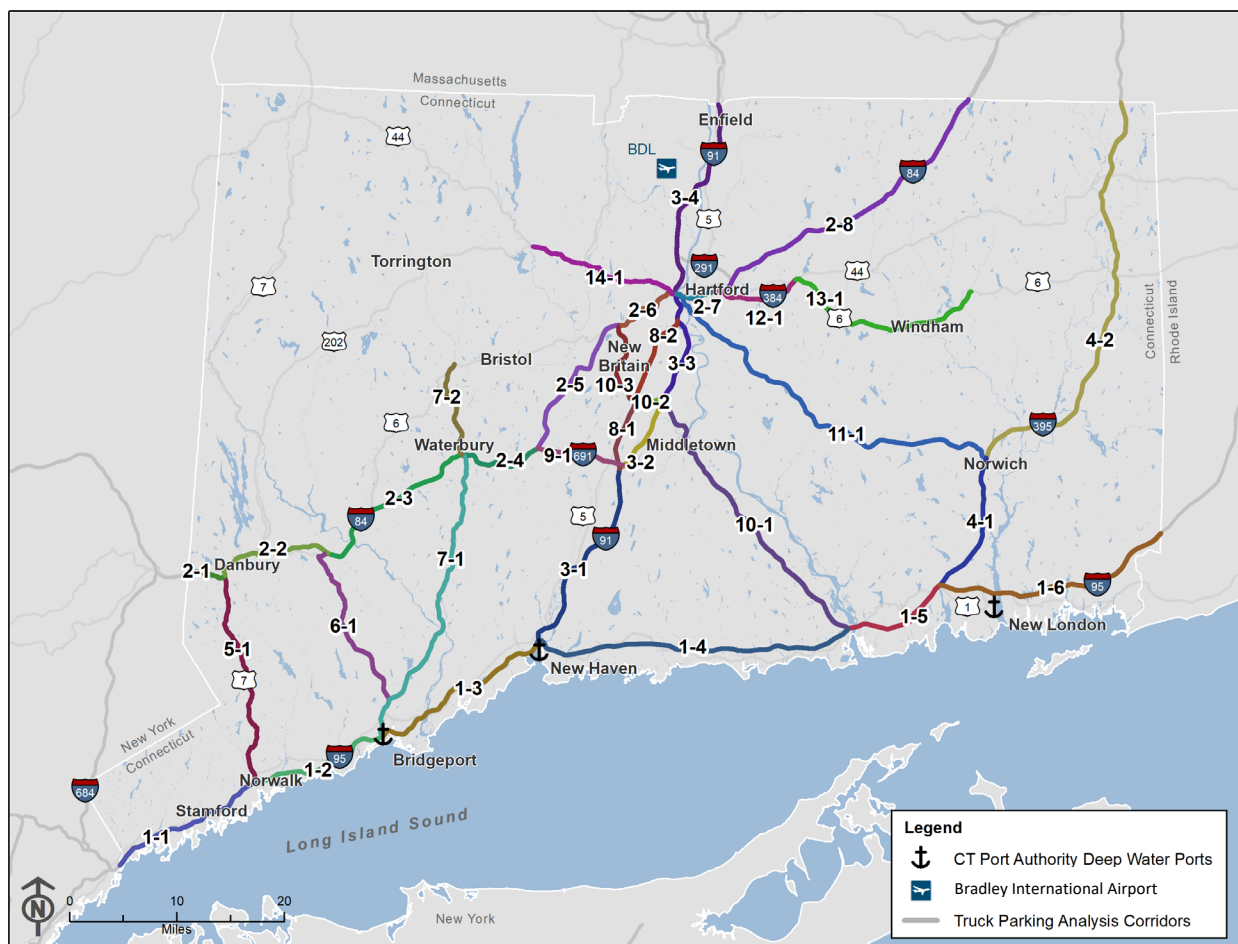


Source: Base (2019) and updated (2021) Jason’s Law databases; Connecticut Statewide Rest Area and Service Plaza website; AllStays.com Pro Account trucker information website; ATRI 2019 Truck Parking Events Sample; ATRI 2019 Truck GPS Sample based Truck Flows; CTDOT 2019 HPMS Bidirectional Combined Unit Truck AADTs

4. TRUCK PARKING DEMAND AND SUPPLY FORECAST

This assessment forecasts truck parking demand by the Year 2040 using bidirectional truck data from the Year 2019. The corridor segments for this analysis are located on state routes with a minimum truck AADT of 1,000 trucks per day (including both directions) with existing truck parking sites available. Thirty-four corridors were analyzed, as shown in **Figure 4.1** and listed in **Table 4.1**.

Figure 4.1: Truck Parking Analysis Corridors for Demand Forecasting



Source: CTDOT Highways GIS Data; CTDOT 2019 HPMS Bidirectional Combined Unit Truck AADTs

Table 4.1: Truck Parking Analysis Corridors for Demand Forecasting

Seg. #	Segment Name	Seg. #	Segment Name	Seg. #	Segment Name
1-1	I-95 between NY/CT Border and US 7	2-7	I-84 between I-91/US 44 and I-384	8-1	US 5 between I-691 and SR 9
1-2	I-95 between US 7 and SR 8	2-8	I-84 between I-384 and CT/MA Border	8-2	US 5 between SR 9 and I-91
1-3	I-95 between SR 8 and I-91	3-1	I-91 between I-95 and I-691	9-1	I-691 EB between I-84 and I-91
1-4	I-95 between I-91 and SR 9	3-2	I-91 between I-691 and SR 9	10-1	SR 9 between I-95 and I-91
1-5	I-95 between SR 9 and I-395	3-3	I-91 between SR 9 and US 5/I-84	10-2	SR 9 between I-91 and US 5
1-6	I-95 between I-395 and CT/RI Border	3-4	I-91 between US 5/I-84 and CT/MA Border	10-3	SR 9 between US 5 and I-84
2-1	I-84 between NY/CT Border and US 7	4-1	I-395 between I-95 and SR 2	11-1	SR 2 between I-395 and I-84
2-2	I-84 between US 7 and SR 25	4-2	I-395 between SR 2 and CT/MA Border	12-1	I-384 between I-84 and US 6
2-3	I-84 between SR 25 and SR 8	5-1	US 7 between I-95 and I-84	13-1	US 6 east of I-384
2-4	I-84 between SR 8 and I-691	6-1	SR 25 between SR 8 and I-84	14-1	US 44 WB between I-84 / I-91 and US 202
2-5	I-84 between I-691 and SR 9	7-1	SR 8 between I-95 and I-84		
2-6	I-84 between SR 9 and I-91/US 4	7-2	SR 8 north of I-84		

Source: CTDOT Highways GIS Data; CTDOT 2019 HPMS Bi-directional Combined Unit Truck AADTs

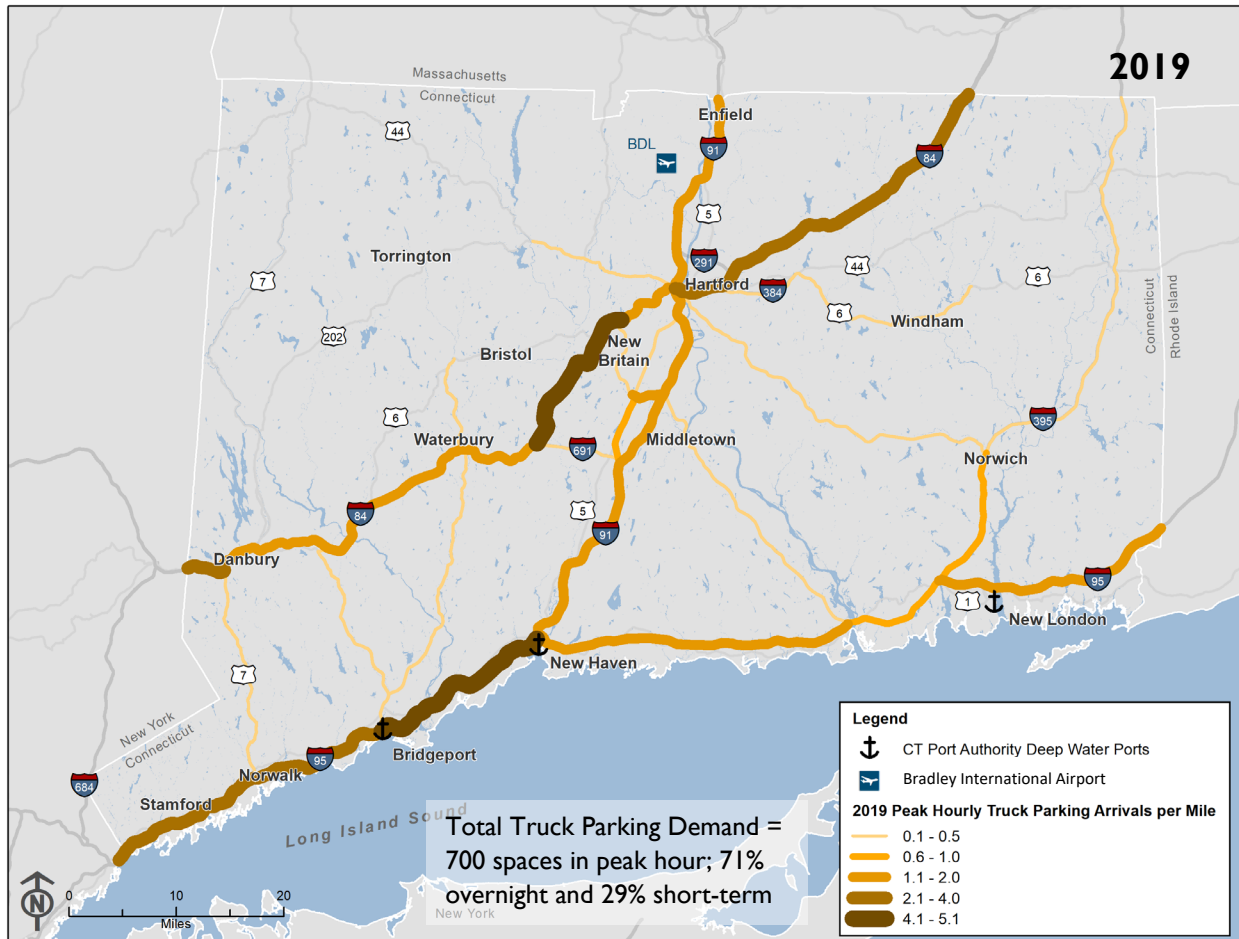
In 2019, the supply of truck parking spaces was 1,226 spaces and bi-directional truck AADT estimated a demand of 700 truck parking spaces in the peak hour along the study corridor segments. By 2040, the demand for truck parking is estimated to increase to 829 spaces in the peak hour, representing an 18 percent increase in demand. Just over 70 percent of the existing (2019) statewide truck parking demand is overnight parking and about 30 percent is short-term parking. Methodology for determining truck parking demand is further described in **Appendix A**. These shares are expected to remain similar through 2040. Comparing this to the supply of 1,226 spaces, the state seems to have reserve parking capacity, although utilization or availability of supply may vary by corridor.

Figure 4.2 and **Figure 4.3** show normalized truck parking demand estimates by corridor segment for peak hour in 2019 and 2040. Normalization is dividing the corridor segment demand by its length (in miles); this was done so that demand for corridor segments of varying lengths is comparable. Major 2019 truck parking demand corridor segments are:

- I-95 between CT/NY border and New Haven
- I-84 west of Danbury, from I-691 to SR 9
- I-84 east of Hartford to CT/MA border

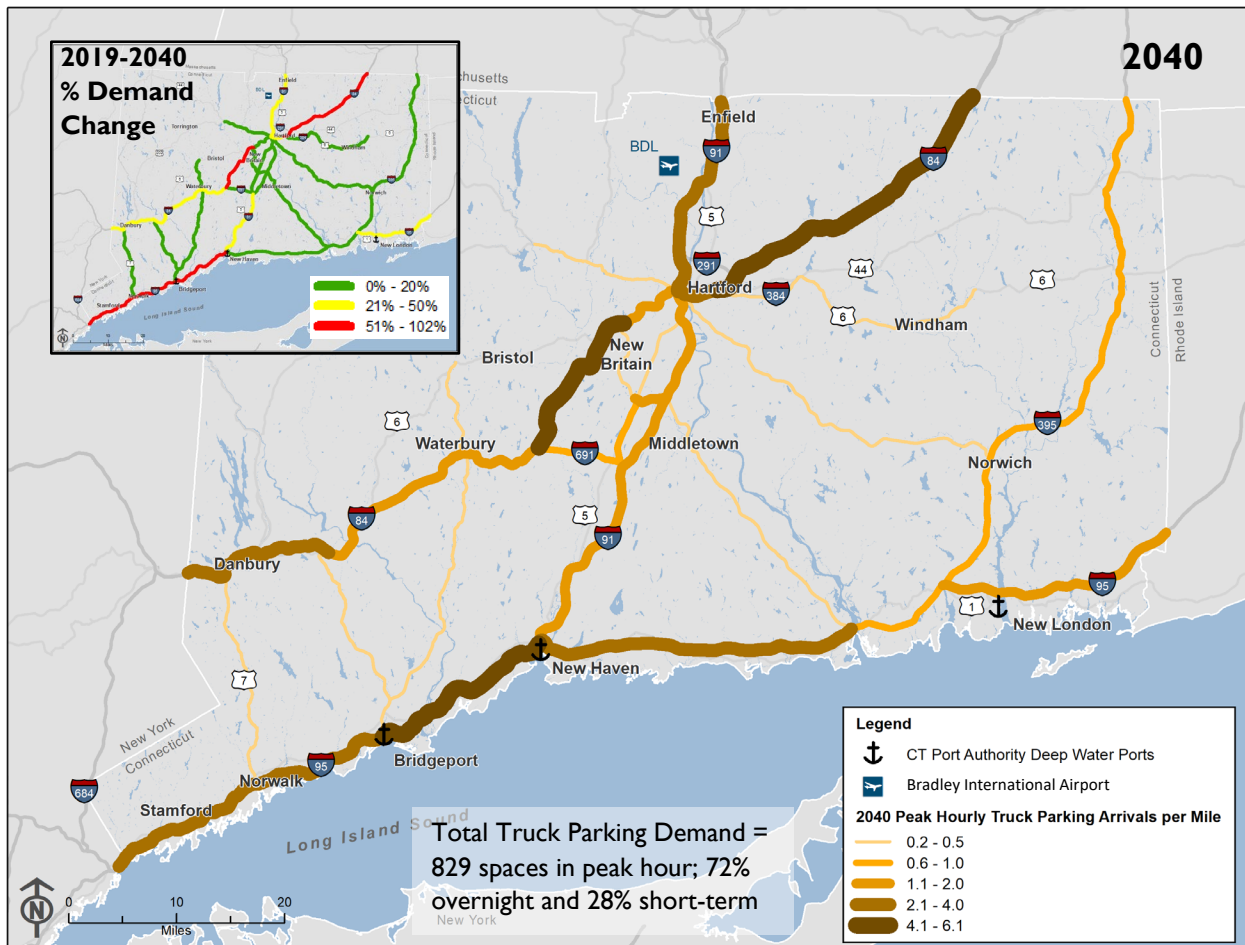
The percentage change in demand mostly follows the base year demand pattern. The corridor segments with the highest 2019–2040 percentage demand growth are also the corridor segments with the highest 2019 demand, as listed above.

Figure 4.2: 2019 Truck Parking Demand on Analysis Corridors



Source: CTDOT Highways GIS Data; CTDOT 2019 HPMS Bi-directional Combined Unit Truck AADTs; CTDOT Travel Demand Model (TDM); base year (2016); CTDOT TRANSEARCH truck-based commodity flows origin-destination database; ATRI 2019 Truck Parking Events Sample; ATRI 2019 Truck GPS Sample-Based Truck Flows.

Figure 4.3: 2040 Truck Parking Demand on Analysis Corridors



Source: CTDOT Highways GIS Data; CTDOT 2019 HPMS Bidirectional Combined Unit Truck AADTs; CTDOT Travel Demand Model (TDM): base year (2016) and forecast year (2040); CTDOT TRANSEARCH truck-based commodity flows origin-destination database; ATRI 2019 Truck Parking Events Sample; ATRI 2019 Truck GPS Sample based Truck Flows. Note: The inset in 2040 map is showing the percent change in 2019–2040 truck parking demand growth. Red = more than 50-percent change in demand; Yellow = 21- to 50-percent change in demand; and Green = less than 20-percent change in demand.

Corridor segments with noticeable truck parking demand increase from 2019 to 2040 are:

- I-95 between New Haven and SR 9
- I-84 east of Danbury
- I-91 north of Hartford

The assessment also analyzed truck parking utilization for 2019 and 2040 (**Figure 4.4** and **Figure 4.5** respectively). For 2019, corridor segments with a high (over 75 percent) truck parking utilization are:

- I-95 west of Bridgeport to CT/NY border
- I-91 north of SR 9 (Middletown) to south of I-84 (Hartford)
- I-395 north of I-95

Truck parking demand on majority of the above corridor segments would exceed the capacity by 2040 (utilization of over 100 percent).

Other corridors that are forecasted to have an increase in truck parking utilization from 2019 to 2040 with truck parking utilization reaching over 50 percent are:

- I-95 east of New Haven to SR 9
- I-91 north of New Haven to SR 9 (Middletown)
- I-84 from I-691 to SR 9 and east of Hartford to CT/MA border

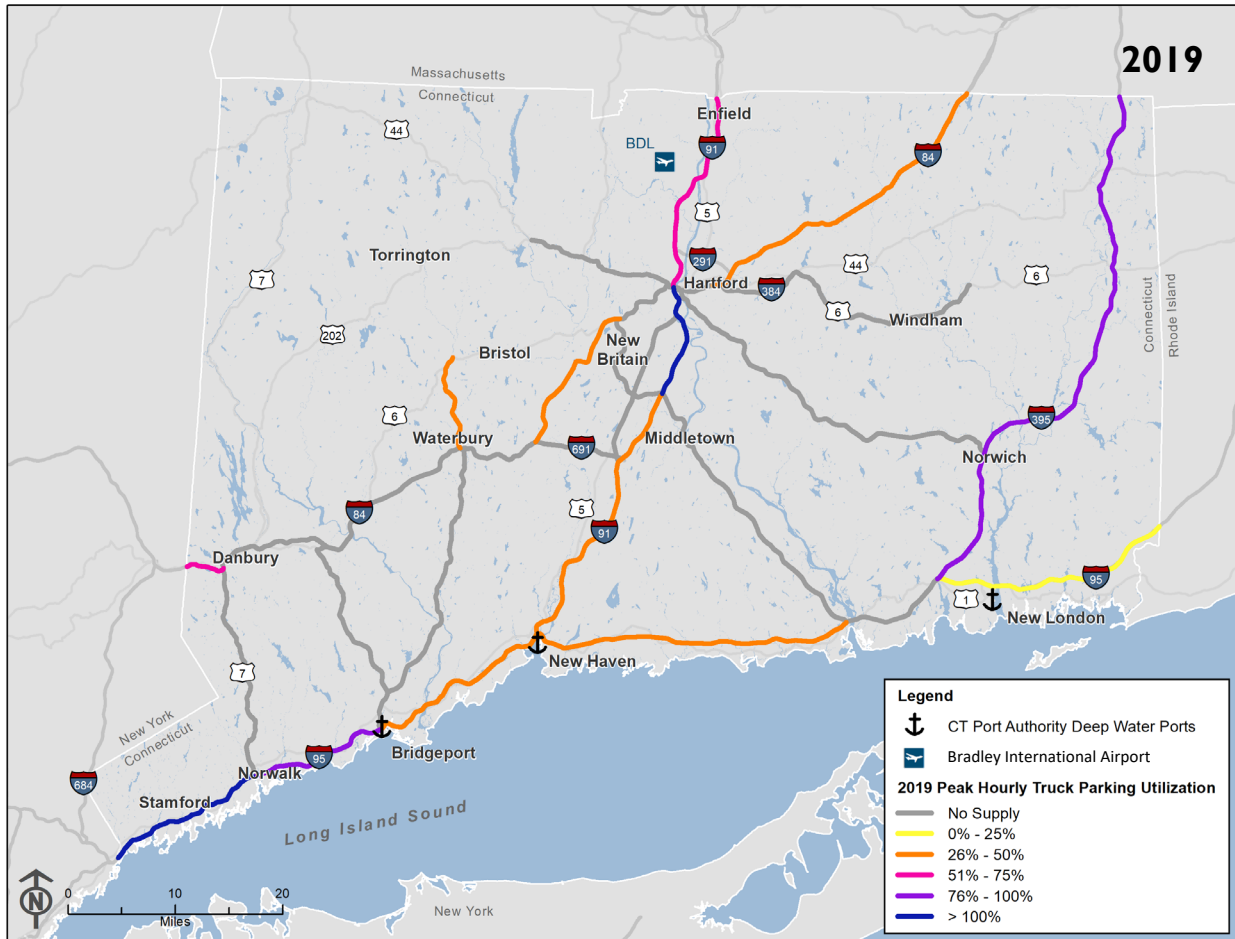
The presence of adjacent corridor segments with truck parking demand higher than capacity could increase the utilization of the immediately above corridor segments beyond the estimated level.

Along some corridor segments forecasted to have high truck parking demand in 2040 (**Figure 4.5**), there is presently no truck parking available (**Section 3, Figure 4.4**). These include:

- I-84 from Danbury to I-691
- SR 9 to Hartford
- I-691 from I-84 to I-91
- SR 9 from US 5 to I-91
- US 5 from I-691 to SR 9

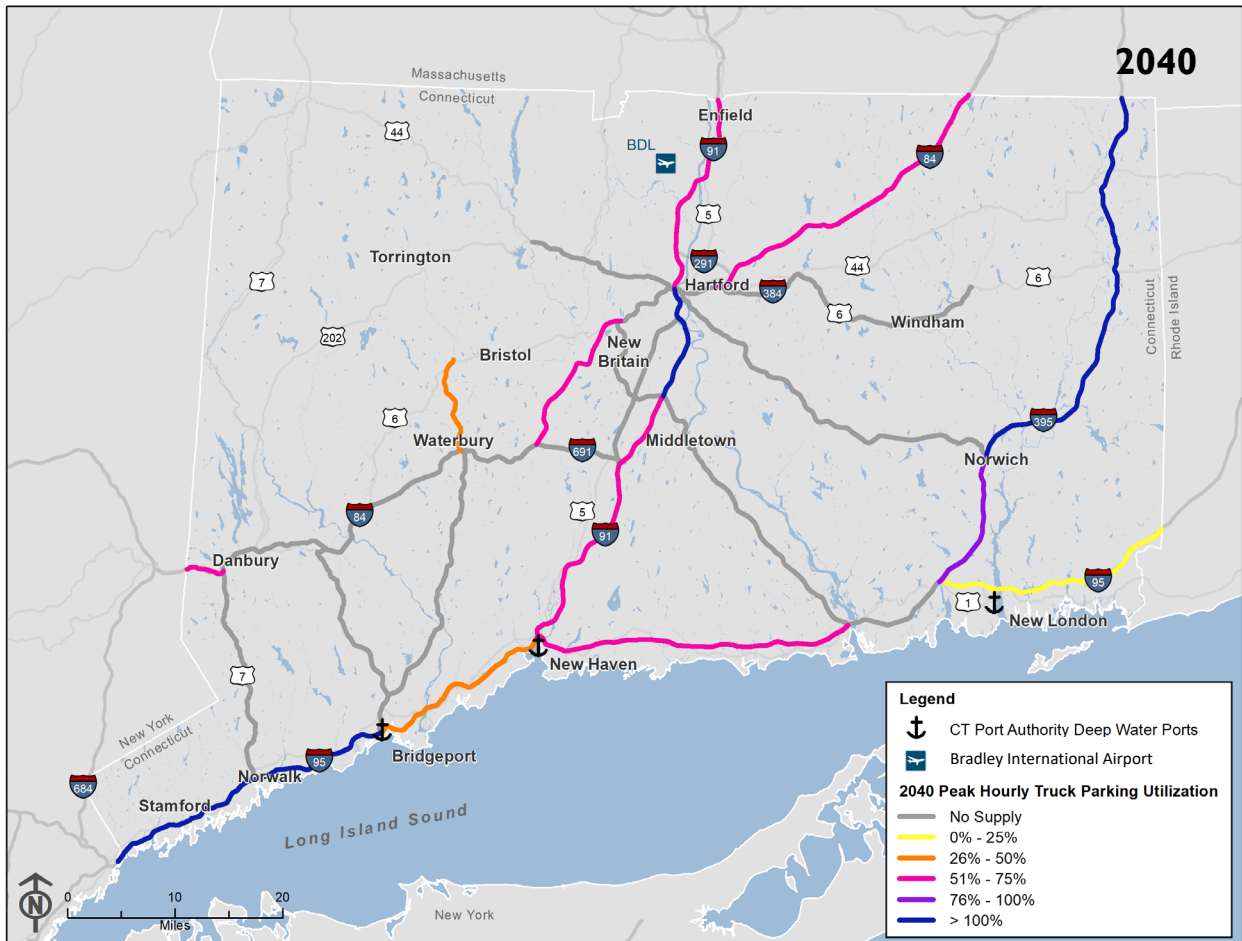
The lack of truck parking supply on portions of I-84 between Danbury and I-691 likely increases the truck parking demand near Danbury and I-84/I-691 interchange and may result in undesignated parking along I-84. This could be exacerbated by 2040.

Figure 4.4: 2019 Truck Parking Utilization on Analysis Corridors



Source: CTDOT Highways GIS Data; CTDOT 2019 HPMS Bidirectional Combined Unit Truck AADTs; CTDOT Travel Demand Model (TDM); base year (2016); CTDOT TRANSEARCH truck-based commodity flows origin-destination database; ATRI 2019 Truck Parking Events Sample; ATRI 2019 Truck GPS Sample-Based Truck Flows

Figure 4.5: 2040 Truck Parking Utilization on Analysis Corridors

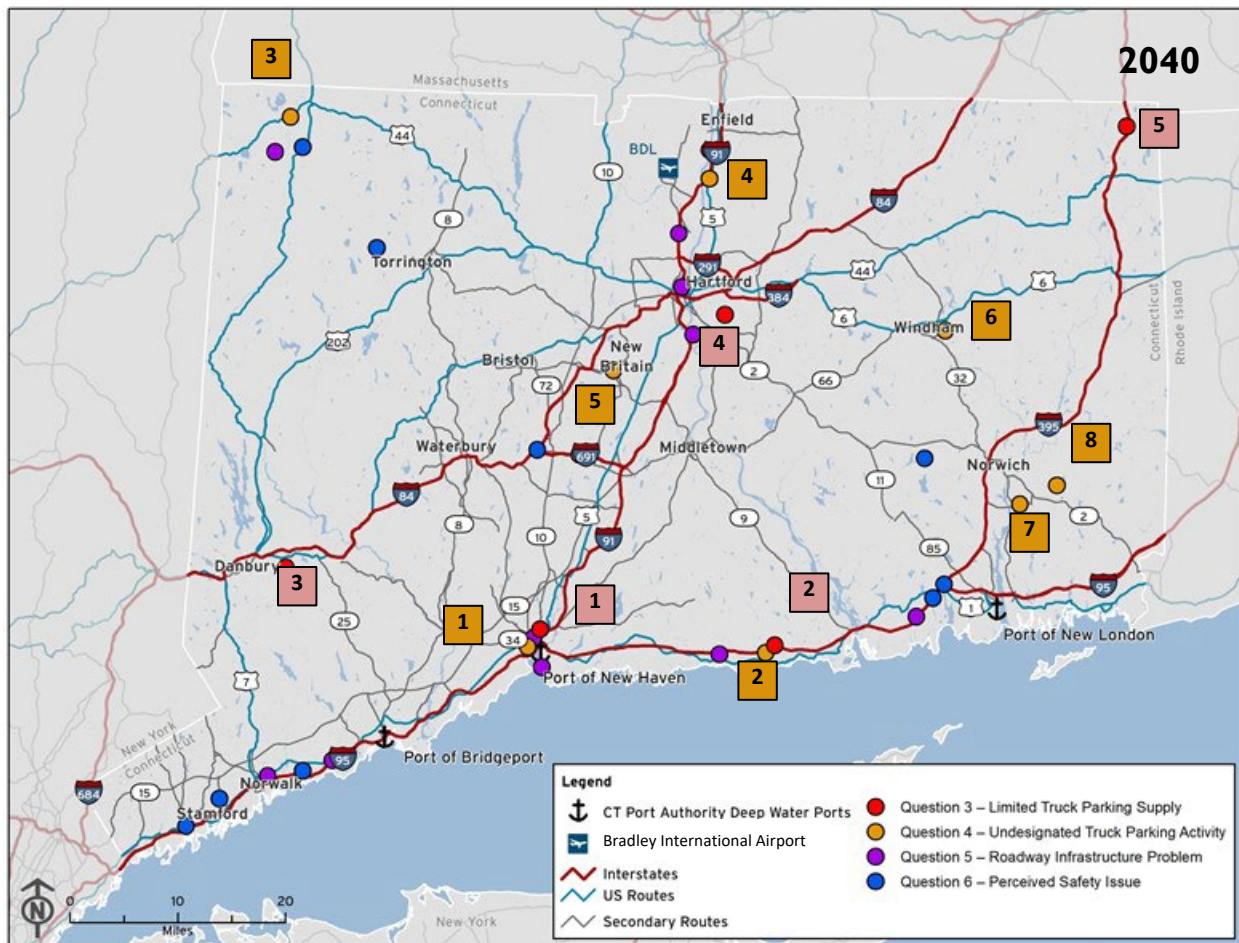


Source: CTDOT Highways GIS Data; CTDOT 2019 HPMS Bidirectional Combined Unit Truck AADTs; CTDOT Travel Demand Model (TDM): base year (2016) and forecast year (2040); CTDOT TRANSEARCH truck-based commodity flows origin-destination database; ATRI 2019 Truck Parking Events Sample; ATRI 2019 Truck GPS Sample-Based Truck Flows

4.1 STAKEHOLDER (TRUCK DRIVER) INPUTS

CTDOT conducted an online truck driver survey via the Connecticut Motor Transport Association. This survey requested feedback on freight issues related to enforcement, truck parking, and truck movement constraints. Truck drivers provided input on locations of limited truck parking supply and undesignated truck parking activity (locations identified in **Section 3, Figure 3.7**). The survey respondents used an online mapping feature to provide input, shown in **Figure 4.6**. The locations marked on the map are approximate.

Figure 4.6: Truck Driver Inputs on Freight Issues (including Truck Parking)



Source: CTDOT's 2021 Online Truck Driver Survey

Based on the survey, the truck drivers perceived two types of truck parking issues and identified a limited number of locations for each of the issues as follows:

- Type A: Limited truck parking supply (red circles in **Figure 4.6**):
 - Location #1: near to and north of I-91/I-95 interchange
 - Location #2: west of I-95/SR 9 interchange
 - Location #3: on I-84 near Danbury
 - Location #4: southwest of Hartford
 - Location #5: on I-395 close to CT/MA border

- Type B: Undesignated truck parking activity (orange circles in **Figure 4.6**):
 - Location #1: near to and west of I-95/I-91 interchange
 - Location #2: west of I-95/SR 9 interchange
 - Location #3: on US 44 near CT/MA border
 - Location #4: on I-91 between Hartford and Enfield
 - Location #5: along I-84 and in the vicinity of New Britain
 - Location #6: along US 6 and in the vicinity of Windham
 - Locations #7 and #8: along SR 2 southeast of Norwich

The findings of the truck driver survey were compared with the findings of the truck parking demand and utilization analysis. Truck driver's responses validate the truck parking supply gaps identified in the corridor-based assessment (as discussed in **Section 4** after **Figure 4.5**). 'Type A' issue locations #1, #2, and #3 have nearby existing truck supply locations. There is the possibility to expand nearby existing sites to overcome the limited supply. 'Type A' issue locations #4 and #5, on the other hand, do not have nearby existing truck supply locations, so the possibility to provide new sites should be explored.

'Type B' issue (the undesignated truck parking activity) is seen at locations mostly beyond the analysis corridor segments used in the truck parking supply and demand assessment. Hence, this complements the supply and demand assessment by identifying the locations of on-street truck parking violations or the presence of informal truck parking lots. Because of the fluidity with such demand, a formal demand analysis may not be useful. However, we are documenting this unmet need for truck parking.

While some of these locations identified by the survey respondents are consistent with the truck parking and utilization analysis, there are additional locations identified in the survey both on and off the study corridor segments:¹⁷

- I-91 north of Hartford
- Near southeast Hartford, New Britain, Norwich, and Windham
- US 44 in northwestern part of the state

Locations that are consistent between the survey data and the truck parking demand and utilization analysis are:

- I-95/I-91 junction near New Haven – although there are no supply sites at this exact location, demand on corridors approaching this location are high and utilization is growing
- I-95 NB and SB Madison Service Plazas
- US 395 between SR 2 and CT/MA Border – corridor level utilization analysis showed a high utilization (due to low supply) and increasing utilization into the future

¹⁷ Further study is needed to confirm locations identified during the truck driver survey.

5. EXISTING AND FUTURE TRUCK PARKING NEEDS

The truck parking supply and demand assessment identified different aspects of truck parking needs for Connecticut, as shown in **Table 5.1**.

Table 5.1: Truck Parking Needs for Connecticut

Need Category	Description	Identification Method	Locations
<p>Non-uniform and/or non-existent supply</p>	<p>HOS regulations require all trucks on the national transportation network to take breaks at regular time intervals. This generally implies the need for a uniform distribution of truck parking supply, and, in special cases, concentrated supply at discrete distances from major freight generators.</p> <p>In meeting the HOS regulations, long road segments of no truck parking supply (that is, large spacing between consecutive truck parking supply locations on a corridor) imply either operational inefficiencies for truckers who park in designated places ahead of the 'no supply' segment and their time limit or safety issues for truckers who park in undesignated places (ramps, cross-streets, etc.) along the 'no supply' segment.</p> <p>In Connecticut, both issues are seen and further confirmed by truck driver inputs.</p>	<p>Visual evidence and supply statistics by corridor and stakeholder (truck driver) inputs were used to identify this need.</p>	<p>Non-uniform supply corridors: I-84, I-91 and I-395</p> <p>No supply corridors (with demand \geq 10 peak arrivals on average day):</p> <ul style="list-style-type: none"> ■ Segment 2-2: I-84 between US 7 and SR 25 ■ Segment 2-3: I-84 between SR 25 and SR 8 ■ Segment 2-4: I-84 between SR 8 and I-691 ■ Segment 2-6: I-84 between SR 9 and I-91/US 44 <p>Truck driver identified limited truck parking supply ('Type A') issue locations with nearby existing supply:</p> <ul style="list-style-type: none"> ■ Location #1: near to and north of I-91/I-95 Interchange ■ Location #2: Location west of I-95/SR 9 interchange ■ Location #3: on I-84 near Danbury <p>Truck driver identified limited truck parking supply ('Type A') issue locations without nearby existing supply:</p> <ul style="list-style-type: none"> ■ Location #4: southwest of Hartford ■ Location #5: on I-395 close to CT/MA border

Need Category	Description	Identification Method	Locations
<p>Current supply shortfall at supply locations</p>	<p>When peak hourly truck arrivals to parking supply locations approach or exceed the supply in spaces, some of the arriving trucks are denied parking. This is due to any residual trucks parked in the hour prior to the peak hour, or the lack of information on the turnover and availability of a space, or the competition from other truckers who may approach the same empty space. A truck supply location facing a shortfall thus has reached an operational capacity. Some of the truck parking sites in the state are facing a supply shortfall.</p>	<p>Truck parking supply locations with high truck parking utilization in a peak hour (more than 75 percent) or high undesignated truck parking (more than 20 percent) were used to identify this need.</p>	<p>High-utilization and high-undesignated parking sites:</p> <ul style="list-style-type: none"> ■ Site #2: I-95 NB Darien Service Plaza between Stamford and Norwalk (close to NY/CT border) ■ Site #13: I-84 EB Southington Rest Area near I-84/I-691 interchange ■ Site #14: I-84 EB West Willington Rest Area <p>High-utilization and low-undesignated parking sites:</p> <ul style="list-style-type: none"> ■ Site #1: I-95 SB Darien Service Plaza between Stamford and Norwalk (close to NY/CT border) <p>Low-utilization and high-undesignated parking sites:</p> <ul style="list-style-type: none"> ■ Site #10: I-95 NB Madison Service Plaza along I-95 east of New Haven
<p>Underutilized supply locations</p>	<p>Urban areas hold a majority of freight generators but competing land uses make new developments for truck parking here difficult to implement. Given this, there is a need to maximize utilization of existing large truck parking sites and truck parking supply locations in urban areas. This is not being achieved at some supply locations in the state.</p>	<p>Truck parking supply locations with underutilization (below 25 percent) was used to identify this need.</p>	<p>Less utilized truck parking sites:</p> <ul style="list-style-type: none"> ■ Site #11: I-95 SB North Stonington Welcome Center ■ Site #22: Pilot Travel Center #882 (On I-95 close to CT/RI border) ■ Site #27: Pride Hartford Truck Stop (On I-91 in Hartford urban area)
<p>Future supply shortfall on corridor basis</p>	<p>On a corridor basis, future high utilization on some corridors is seen in the state, which is indicative that the existing designated truck parking supply in these corridors is likely to be overrun by projected demand. This may also result in a spillover truck parking demand to nearby corridors.</p>	<p>Truck parking analysis corridors with high utilization (more than 75 percent) and major growth in utilization (currently less than 50 percent to future above 50 percent) was used to identify this need.</p>	<p>High-future-utilization corridors:</p> <ul style="list-style-type: none"> ■ Segment 1-1: I-95 between NY/CT Border and US 7 ■ Segment 1-2: I-95 between US 7 and SR 8 ■ Segment 3-3: I-91 between SR 9 and US 5/ I-84 ■ Segment 4-1: I-395 between I-95 and SR 2 ■ Segment 4-2: I-395 between SR 2 and CT/MA Border <p>Major growth in utilization corridors:</p> <ul style="list-style-type: none"> ■ Segment 1-4: I-95 between I-91 and SR 9 ■ Segment 2-5: I-84 between I-691 and SR 9 ■ Segment 2-8: I-84 between I-384 and CT/MA Border ■ Segment 3-1: I-91 between I-95 and I-691

Need Category	Description	Identification Method	Locations
<p>Inadequate amenities supporting overnight parking truck drivers¹</p>	<p>While overnight parking appears to be present at all supply locations in the state, few of them have services essential to truck drivers performing overnight parking, which include showers and laundry. Truck wash sites are also limited in the state.</p>	<p>Availability of showers, laundry, and truck wash amenities by corridor was used to identify this need.</p>	<p>Showers – present only on the segments, absent on others:</p> <ul style="list-style-type: none"> ■ Segment 1-3: I-95 between SR 8 and I-91 ■ Segment 1-6: I-95 between I-395 and CT/RI Border <p>Laundry – present only on the following segments, absent on others:</p> <ul style="list-style-type: none"> ■ Segment 1-3: I-95 between SR 8 and I-91 ■ Segment 1-4: I-95 between I-91 and SR 9 ■ Segment 1-6: I-95 between I-395 and CT/RI Border ■ Segment 2-5: I-84 between I-691 and SR 9 ■ Segment 2-8: I-84 between I-384 and CT/MA Border ■ Segment 3-4: I-91 between US 5/I-84 and CT/MA Border <p>Truck Wash – present only on the following segments, absent on others:</p> <ul style="list-style-type: none"> ■ Segment 1-3: I-95 between SR 8 and I-91 ■ Segment 1-6: I-95 between I-395 and CT/RI Border
<p>Undesignated truck parking activities away from supply locations</p>	<p>Truck drivers have identified locations where undesignated truck parking activities are seen to occur in the state. These may represent on-street truck parking violations or informal truck parking lots.</p>	<p>Stakeholder (truck driver) inputs were used to identify this need.</p>	<p>Truck driver identified undesignated truck parking activities ('Type B') issue locations:</p> <ul style="list-style-type: none"> ■ Location #1: near to and west of I-95/I-91 Interchange ■ Location #2: west of I-95/SR 9 interchange ■ Location #3 on US 44 near CT/MA border ■ Location #4: on I-91 between Hartford and Enfield ■ Location #5: along I-84 and in the vicinity of New Britain ■ Location #6: along US 6 and in the vicinity of Windham ■ Locations #7 & #8: along SR 2 southeast of Norwich

Note: Analysis performed in June 2022. In the truck parking supply and demand assessment, utilization is defined as the ratio of the demand in peak hourly parking arrivals to supply in parking spaces and undesignated truck parking identification is limited to public on-freeway facilities. Truck driver inputs are not limited to the truck parking supply locations, or the analysis corridors used in the truck parking supply and demand assessment. Non-uniform supply corridor means a corridor on which a truck is not able to find a truck rest area or truck stop once every hour of travel (that is roughly, every 30-45 miles of driving in traffic).

¹Base (2019) and updated (2021) Jason’s Law databases; Connecticut Statewide Rest Area and Service Plaza website; AllStays.com Pro Account trucker information website. Note: Starred (*): For 2 supply locations, the overnight parking amenity was verified based on the source, and for the remaining 26 supply locations, this amenity was verified based on overnight use seen in 2019 ATRI Truck Parking Events data.

6. IMPLEMENTATION STRATEGIES

This final chapter of the Truck Parking Study discusses potential truck parking strategies derived by reviewing system deficiencies for freight, current parking supply, optimum supply, and suggestions for expanding or developing new truck parking. These strategies listed in **Table 6.1** emphasize using technology to communicate the location and availability of parking; expansion of facilities through land use and zoning adjustments; public truck parking capacity expansion; and private truck parking capacity expansion.

Table 6.1: Implementation Strategies by Category

Category	Description	Lead	Priority (Short or Mid)
Technology Strategies	Provide real time parking availability using advanced technology such as Truck parking information management system (TPIMS) or a truck parking dashboard. Parking could also be communicated via dynamic road signage messaging and/or providing cell phone notification systems at truck staging areas.	CTDOT	Mid
	*Evaluate implementation opportunities for Truck Parking Availability Services (TPAS) , an intelligent transportation system designed to gather, fuse, and disseminate real-time information on truck parking availability and reservation of spaces at connected sites.	CTDOT	Mid
Land Use Strategies	Work with MPOs and local municipalities to coordinate land use and zoning policies to account for the increased demands for truck parking such as incorporating truck parking into Traffic Impact Assessments.	MPOs Local Municipalities	Mid
	Work with MPOs and local municipalities to identify/provide incentives and/or require freight-related businesses to allow truck parking . Possible opportunities to do so include adjusting local zoning to require minimum truck parking on-site, where applicable, similar to minimum parking requirements for residents, employees, or customers.	MPOs Local Municipalities	Mid
	Coordinate with local municipalities to identify small lots adjacent to existing amenities that could incorporate truck parking.	CTDOT Local Municipalities	Short
	Work with local municipalities to designate areas for long term street parking or overnight parking . For example, street parking could be allowed or encouraged in appropriate places, such as near industrial parks or other freight-intensive land uses. Signage could be provided where long term street parking or overnight parking are allowed.	CTDOT Local Municipalities	Short
	Work with local municipalities to develop education platforms that engage citizens ; address truck parking needs and stigmas.	CTDOT Local Municipalities	Short

Category	Description	Lead	Priority (Short or Mid)
Public Capacity Expansion Strategies	Identify alternative truck parking locations within CTDOT right-of-way or State-owned property and consider truck parking opportunities as part of corridor studies.	CTDOT	Mid
	* Develop design standards for truck parking. Use already collected ATRI data to develop information for use in designing truck parking facilities, e.g., 85th percentile peak demand in terms of occupancy. This can be done by analyzing all days of ATRI data and selecting the day with 85th percentile value of daily total truck arrivals. On this day, build temporal patterns for occupancy (net of arrivals minus departure) starting from a near-empty occupancy hour. Estimate departures from truck parking sites by superimposing the truck parking arrivals and dwell time patterns by arrival hour and derive the occupancy by hour. Collaborate with local government to draft design guidelines for new truck parking locations.	CTDOT	Mid
	Utilize rest areas, weigh stations, and park-and-ride locations to increase parking capacity. Repurpose closed weigh stations and excess commuter parking spaces for truck parking.	CTDOT	Short
	*Evaluate opportunities to include ADA accommodations when identifying and designing future truck parking locations.	CTDOT	Mid
	* Monitor growth in state truck parking demand and compare to the growth projected by CTDOT TRANSEARCH truck-based freight projections and FHWA truck parking demand methodology.	CTDOT	Mid
	* Develop truck parking related safety analysis by developing statewide crash information that isolates crashes from all truck-involved crashes with the following two characteristics: (a) crashes with parked trucks and (b) crashes due to truck driver fatigue.	CTDOT	Mid
	Expand undesignated truck parking analysis to understand related issues and identify strategies to address those issues, especially if there are safety, pollution, or other community concerns.	CTDOT	Short
Private Expansion Strategies	Encourage private investments in and expansion of truck stops to provide additional parking capacity and availability of amenities.	CTDOT	Short
	Use public-private partnerships to increase parking capacity. Public entities can provide land and access to infrastructure while private entities can cover capital, operational, and maintenance costs. Consider the ability to create incentives for businesses if they allow truck parking in their lots. Identify businesses (shippers/ receivers) that are able to provide parking for early arrival and staging and encourage businesses to do so. Incentivize low-cost amenities at existing or new parking locations.	CTDOT	Short

*Included as part of the Freight Plan Recommendations

Appendix A – DETAILED METHODOLOGY

The truck parking assessment for the State consisted of three components: 1) truck parking supply inventory and utilization, 2) undesignated truck parking, and 3) truck parking demand and supply forecast using the data and methodology as shown in **Figure A-1**.

A.1 TRUCK PARKING SUPPLY INVENTORY AND UTILIZATION

The truck parking supply assessment developed a supply inventory, including the site name, site location (geo-coordinates, address, highway, milepost), and number of truck parking spaces and amenities using trucker information websites and Jason's Law databases.

The State has 30 truck parking sites at locations as shown in **Figure A-2**. **Table A-1** lists the sites along with the supply attributes gathered from the various data sources.

Figure A-1: Truck Parking Assessment Methodology

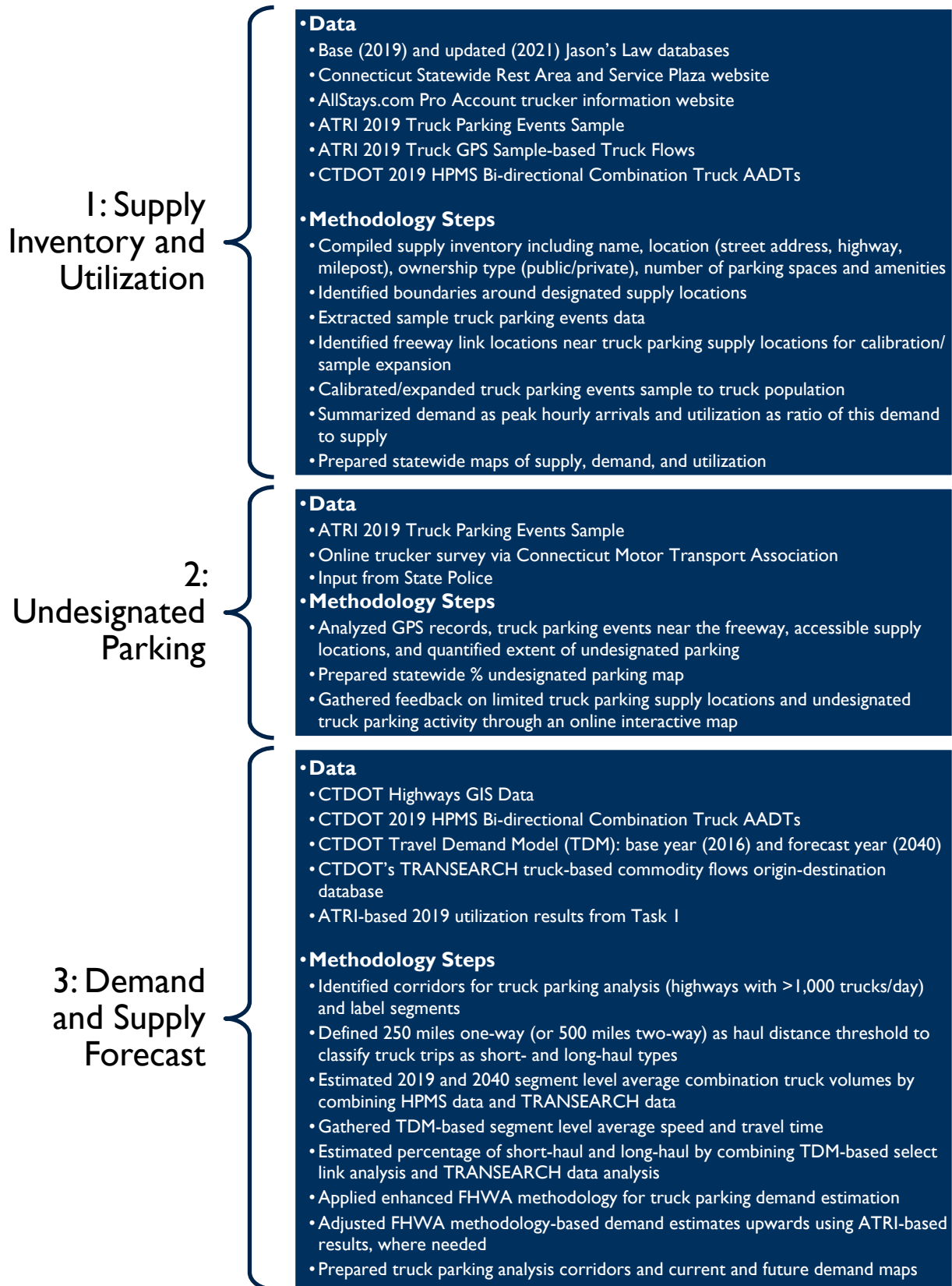
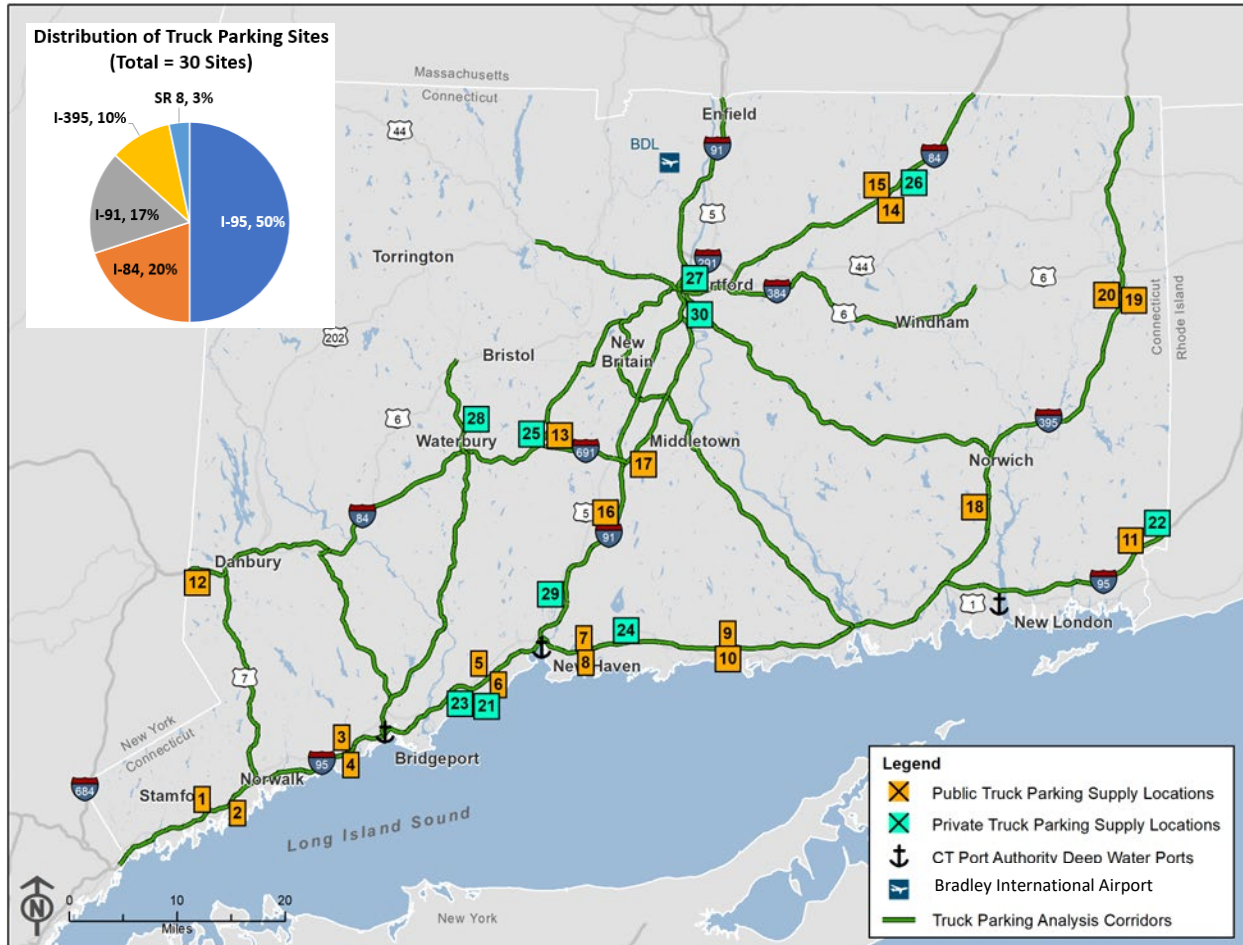


Figure A-2: Truck Parking Site Locations



Source: Base (2019) and updated (2021) Jason's Law databases; Connecticut Statewide Rest Area and Service Plaza website; AllStays.com Pro Account trucker information website

Table A-1: Truck Parking Sites Inventory

Site ID	Site Name	Ownership Type	Coordinates	Address	Place	Truck Parking Spaces	Restroom	Truck Wash	Shower	Laundry	Fuel	Food	Overnight Parking
1	I-95 SB Darien Service Plaza	Public	41.068212,-73.501397	I-95 SB Exit 10	Darien	20	Y	N	N	N	Y	Y	Y
2	I-95 NB Darien Service Plaza	Public	41.078322,-73.463741	I-95 NB Exit 12	Darien	20	Y	N	N	N	Y	Y	Y
3	I-95 SB Fairfield Service Plaza	Public	41.1478803,-73.255076	I-95 SB Exit 22	Fairfield	20	Y	N	N	N	Y	Y	Y
4	I-95 NB Fairfield Service Plaza	Public	41.1463534,-73.258037	I-95 NB Exit 21	Fairfield	20	Y	N	N	N	Y	Y	Y
5	I-95 SB Milford Service Plaza	Public	41.248064,-73.006918	I-95 SB Exit 41	Milford	25	Y	N	N	N	Y	Y	Y
6	I-95 NB Milford Service Plaza	Public	41.244731,-73.011533	I-95 NB Exit 40	Milford	25	Y	N	N	N	Y	Y	Y
7	I-95 SB Branford Service Plaza	Public	41.286741,-72.830359	I-95 SB Exit 54	Branford	10	Y	N	N	N	Y	Y	Y
8	I-95 NB Branford Service Plaza	Public	41.285399,-72.837374	I-95 NB Exit 53	Branford	10	Y	N	N	N	Y	Y	Y
9	I-95 SB Madison Service Plaza	Public	41.29103,-72.576786	I-95 SB Exit 62	Madison	20	Y	N	N	N	Y	Y	Y
10	I-95 NB Madison Service Plaza	Public	41.291008,-72.583511	I-95 NB Exit 61	Madison	10	Y	N	N	N	Y	Y	Y
11	I-95 SB North Stonington Welcome Center	Public	41.418473,-71.848234	I-95 SB Exit 93	North Stonington	30	Y	N	N	N	N	N	Y
12	I-84 EB Danbury Welcome Center	Public	41.392579,-73.527994	I-84 EB Exit 2	Danbury	20	Y	N	N	N	N	N	Y
13	I-84 EB Southington Rest Area	Public	41.573695,-72.905541	I-84 EB Exit 28	Plantsville / Southington	20	Y	N	N	N	N	N	Y
14	I-84 EB West Willington Rest Area	Public	41.891268,-72.300444	I-84 EB Exit 69	West Willington	6	Y	N	N	N	N	N	Y
15	I-84 WB West Willington Rest Area	Public	41.894671,-72.293977	I-84 WB Exit 70	West Willington	12	Y	N	N	N	N	N	Y
16	I-91 SB Wallingford Rest Area	Public	41.464619,-72.776372	1-91 SB Exit 15	Wallingford	40	Y	N	N	N	N	N	Y
17	I-91 NB Middletown Rest Area	Public	41.550665,-72.745329	I-91 NB Exit 23	Middletown	25	Y	N	N	N	N	N	Y

Site ID	Site Name	Ownership Type	Coordinates	Address	Place	Truck Parking Spaces	Restroom	Truck Wash	Shower	Laundry	Fuel	Food	Overnight Parking
18	I-395 SB Montville Service Plaza	Public	41.475224,-72.116578	I-395 SB Exit 79A	Uncasville/Montville	10	Y	N	N	N	Y	Y	Y
19	I-395 NB Plainfield Service Plaza	Public	41.752172,-71.878517	I-395 NB Exit 90	Moosup/Plainfield	10	Y	N	N	N	N (for Diesel)	Y	Y
20	I-395 SB Plainfield Service Plaza	Public	41.756033,-71.876759	I-395 SB Exit 89	Moosup/Plainfield	10	Y	N	N	N	N (for Diesel)	Y	Y
21*	Pilot Travel Center #255/TA Milford	Private	41.2368815, -73.0222282	433 Old Gate Lane, Milford, CT 06460	Milford	150	Y	Y	Y	Y	Y	Y	Y
22*	Pilot Travel Center #882	Private	41.4419112, -71.8002626	273 Clarks Falls Road, North Stonington, CT 06359	North Stonington	120	Y	Y	Y	Y	Y	Y	Y
23*	Wheels Citgo #365 /Secondi Truck Stop	Private	41.236203,-73.025543	365 Old Gate Ln, Milford, CT, 06460	Milford	50	Y	Y	N	Y	Y	Y	Y
24*	TA Express New Haven #171	Private	41.296984, -72.759431	3 East Industrial Road, Branford, CT, 06405	New Haven	75	Y	N	N	Y	Y	Y	Y
25*	TA Southington #154	Private	41.564427, -72.909937	1875 Meriden-Waterbury Turnpike, Milldale, CT, 06467	Southington	145	Y	N	N	Y	Y	Y	Y
26*	TA Willington #022	Private	41.917700, -72.261363	327 Ruby Road, Willington, CT, 06279	Willington	240	Y	N	N	Y	Y	Y	Y
27*	Pride Hartford Truck Stop I-91	Private	41.787547, -72.655526	10 Jennings Road, Hartford, CT 06120	Hartford	60	Y	N	N	Y	Y	Y	Y
28*	Waterbury Valley Truck Stop LLC	Private	41.584202, -73.052286	990 Huntingdon Ave, Waterbury CT 06704	Waterbury	10	Y	N	N	N	Y	Y	Y
29*	Gulf Truck Stop	Private	41.350416, -72.868566	11 Universal Dr, North Haven CT 06473	North Haven	3	Y	N	N	N	Y	Y	Y
30*	Mercury Mobil	Private	41.737400, -72.659406	110 Brainard Rd, Hartford CT 06114	Hartford	10	Y	N	N	N	Y	Y	Y

Source: Base (2019) and updated (2021) Jason's Law databases; Connecticut Statewide Rest Area and Service Plaza website; AllStays.com Pro Account trucker information website. Note: Unstarred: Public and On-freeway Type, Starred (*): Private and Off-freeway Type. Site #29: Gulf Truck Stop and Site #30: Mercury Mobil are service stations.

A truck parking utilization assessment was conducted using American Transportation Research Institute (ATRI) truck parking events sample and sample to population expansion factors. ATRI data was used to estimate total demand at a truck parking site in units of peak hourly parking arrivals and to estimate utilization as the ratio of the demand in peak hourly parking arrivals to supply in parking spaces. Further information on this methodology is discussed below.

A.1.1 About ATRI Sample

ATRI provides GPS-based spatial (coordinates) and temporal (time/date stamp) data for a large sample of trucks with onboard, wireless communication systems (probe vehicles) in the U.S. A large portion (around 80 percent) of the equipped vehicles in this data are combination truck type. The truck parking events sample is a processed format of data prepared by ATRI using in-house programming. The parking data was collected for 56 days in the year 2019 and obtained as four 2-week periods representing four seasons of the year while avoiding holiday weeks.

The sample was collected for the following four 2-week periods:

- March 10-23, 2019
- June 9-22, 2019
- August 11-24, 2019
- November 3-16, 2019

ATRI staff used programming with the sample to identify the hour of arrival of trucks for parking (hour zero through 23, which represented the times 12-1 am, 1 am – 2am, etc. till 11 pm - 12 am). They also used it to categorize the durations for which the trucks are stopping into the following bins:

- 30 minutes to 1 hour (which is labeled as 0-1)
- 1 to 2 hours
- 2 to 4 hours
- 4 to 8 hours
- 8+ hours

The methodology did not include trucks stops that have duration less than 30 minutes long as truck parking events, which may cover short-term activities such as driver's use of restroom, truck fueling, driver's food takeout, etc.

A.1.2 Sample to Population Expansion Factors

The study team expanded the truck parking events sample to truck population using comparisons between ATRI truck GPS data-based truck flows to the combination truck AADT in State's Highway Performance Monitoring System (HPMS) data on the highway closest in access to the truck parking facility. This assumes that truck parking arrivals as a share of the highway truck traffic is the same in the sample and population. The expansion factors developed are summarized in **Table A-2**.

Table A-2: Truck Parking Demand Sample to Population Expansion Factors by Truck Parking Site

Site ID	Site Name	Address	Place	Bi-directional Combination Truck AADT (rounded to nearest 10 vehicles)	ATRI Daily Average Truck Flow	Expansion Factor
1	I-95 SB Darien Service Plaza	I-95 SB Exit 10	Darien	12,150	2,634	4.6
2	I-95 NB Darien Service Plaza	I-95 NB Exit 12	Darien	11,540	2,191	5.3
3	I-95 SB Fairfield Service Plaza	I-95 SB Exit 22	Fairfield	9,820	2,673	3.7
4	I-95 NB Fairfield Service Plaza	I-95 NB Exit 21	Fairfield	9,820	2,673	3.7
5	I-95 SB Milford Service Plaza	I-95 SB Exit 41	Milford	10,350	2,859	3.6
6	I-95 NB Milford Service Plaza	I-95 NB Exit 40	Milford	10,350	2,859	3.6
7	I-95 SB Branford Service Plaza	I-95 SB Exit 54	Branford	5,850	893	6.6
8	I-95 NB Branford Service Plaza	I-95 NB Exit 53	Branford	5,850	893	6.6
9	I-95 SB Madison Service Plaza	I-95 SB Exit 62	Madison	4,670	804	5.8
10	I-95 NB Madison Service Plaza	I-95 NB Exit 61	Madison	4,670	804	5.8
11	I-95 SB North Stonington Welcome Center	I-95 SB Exit 93	North Stonington	3,330	502	6.6
12	I-84 EB Danbury Welcome Center	I-84 EB Exit 2	Danbury	8,660	1,609	5.4
13	I-84 EB Southington Rest Area	I-84 EB Exit 28	Plantsville/ Southington	6,620	1,164	5.7
14	I-84 EB West Willington Rest Area	I-84 EB Exit 69	West Willington	9,650	1,892	5.1
15	I-84 WB West Willington Rest Area	I-84 WB Exit 70	West Willington	9,650	1,892	5.1
16	I-91 SB Wallingford Rest Area	I-91 SB Exit 15	Wallingford	9,450	1,622	5.8
17	I-91 NB Middletown Rest Area	I-91 NB Exit 23	Middletown	9,450	1,687	5.6
18	I-395 SB Montville Service Plaza	I-395 SB Exit 79A	Uncasville/Montville	2,420	384	6.3
19	I-395 NB Plainfield Service Plaza	I-395 NB Exit 90	Moosup/Plainfield	2,500	470	5.3
20	I-395 SB Plainfield Service Plaza	I-395 SB Exit 89	Moosup/Plainfield	2,500	470	5.3
21	Pilot Travel Center #255/TA Milford	433 Old Gate Lane, Milford, CT 06460	Milford	8,960	2,859	3.1
22	Pilot Travel Center #882	273 Clarks Falls Road, North Stonington, CT 06359	North Stonington	3,330	502	6.6

Site ID	Site Name	Address	Place	Bi-directional Combination Truck AADT (rounded to nearest 10 vehicles)	ATRI Daily Average Truck Flow	Expansion Factor
23	Wheels Citgo #365/Secondi Truck Stop	365 Old Gate Ln, Milford, CT, 06460	Milford	8,960	2,859	3.1
24	TA Express New Haven #171	3 East Industrial Road, Branford, CT, 06405	New Haven	5,720	893	6.4
25	TA Southington #154	1875 Meriden-Waterbury Turnpike, Milldale, CT, 06467	Southington	5,420	1,164	4.7
26	TA Willington #022	327 Ruby Road, Willington, CT, 06279	Willington	9,650	1,892	5.1
27	Pride Hartford Truck Stop I-91	10 Jennings Road, Hartford, CT 06120	Hartford	7,810	1,283	6.1
28	Waterbury Valley Truck Stop LLC	990 Huntingdon Ave, Waterbury CT 06704	Waterbury	1,300	206	6.3
29	Gulf Truck Stop	11 Universal Dr, North Haven CT 06473	North Haven	Not Collected	Not Collected	5.8
30	Mercury Mobil	110 Brainard Rd, Hartford CT 06114	Hartford	Not Collected	Not Collected	5.8

Source: CTDOT Highway Performance Monitoring System (HPMS) - 2019 Truck Volumes Data; ATRI Average Daily Truck Flows Data

Note: ATRI Daily Average Truck Flow data was not collected for Site #29 and Site #30. Instead, the average of expansion factors for Site #16, Site #17 and Site #27 was used for as the expansion factor for Site #29 and Site #30 based on the similarity of the corridor (I-91 NB or I-91 SB).

A.1.3 Peak Hourly Parking Arrivals

“Hourly parking arrivals” is an average across all 56 days of the ATRI data after expansion, and the hour on an average day with the highest number of parking arrivals represented the “peak hour”. The peak hour varied from truck parking facility to facility.

ATRI staff initially summarized the hourly parking arrivals by day of the week (Sunday through Saturday), month of data (March, June, August, or November), and stopping duration bin using a computer program applied to raw GPS sample. Considering the state’s economy and transported goods to be more retail- and wholesale-trade based and less agriculture-based, the study team placed less emphasis on the seasonal variation of truck parking and more emphasis on the variation of truck parking within a typical weekday and a typical weekend day. As a result, CDM Smith staff aggregated the initial summary further into hourly parking arrivals by day type (weekday/weekend) and stopping duration bin. The aggregated summary provided estimates of the peak hourly parking arrivals within the following time periods of arrival:

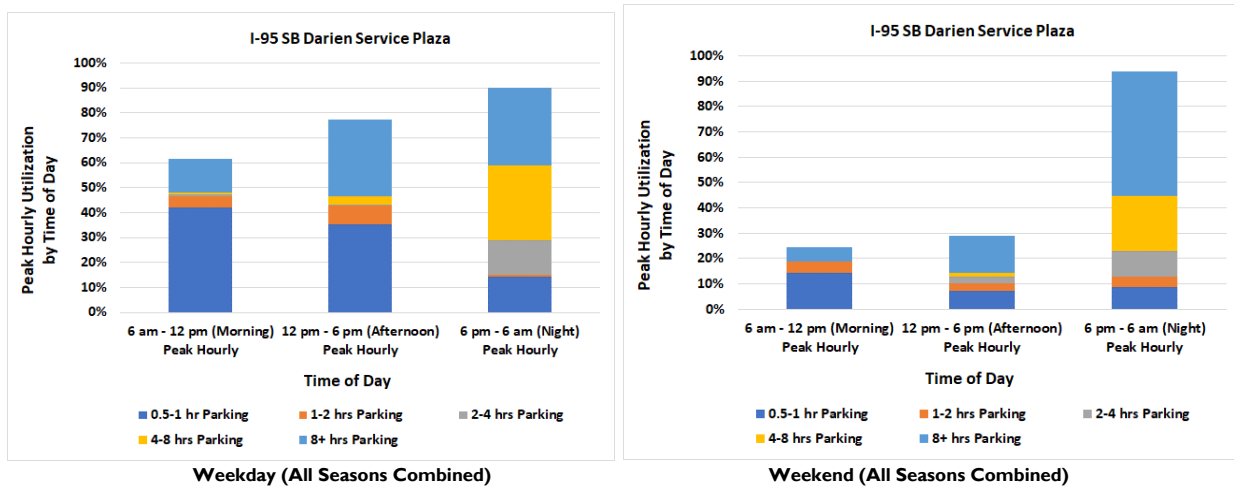
- Morning: 6 am-12 pm
- Afternoon: 12-6 pm
- Night: 6 pm-6 am
- Daily (All Times of Day)

A.1.4 Utilization

In this methodology, utilization is defined simply as the ratio of the demand in peak hourly parking arrivals to supply in parking spaces.

The study team developed stacked column visualizations for the peak hourly utilization by time of day for arrival (columns) and splits among the duration bins (stacked data within each column) within a CTDOT Truck Parking Supply and Demand Spreadsheet Model. The model user controls the display by selecting Site ID, season, and day type for a main site and a comparative site. Example visualizations for Site ID #1 on a weekday versus weekend is shown in **Figure A-3**. This visualization is available in the analysis spreadsheet for CTDOT’s use.

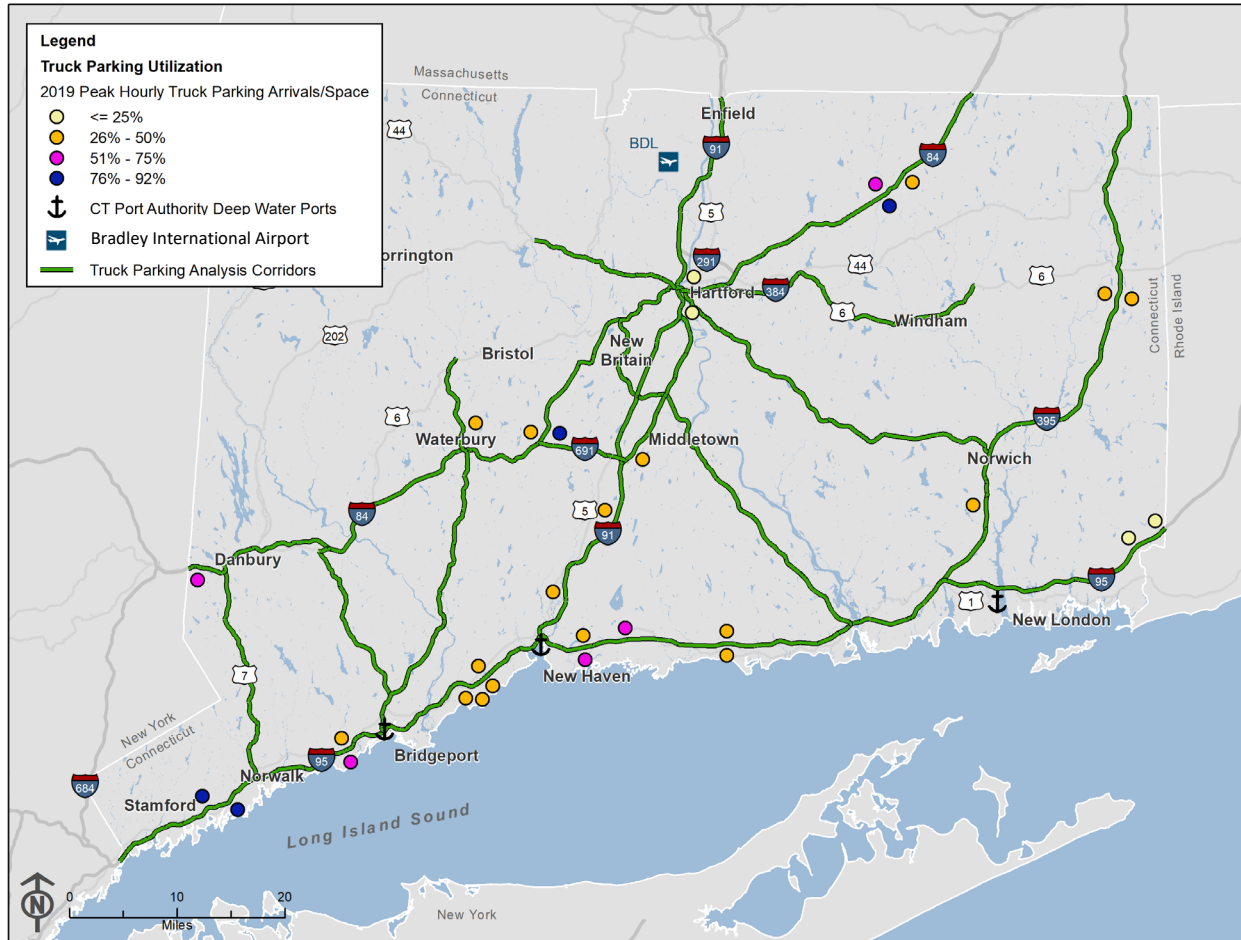
Figure A-3: Weekday versus Weekend Peak Hourly Utilization at Site ID#1



Source: CTDOT Truck Parking Supply and Demand Spreadsheet Model (developed and last updated on July 25, 2022 by CDM Smith)

The study team also developed a statewide peak hourly utilization map (**Figure A-4**) that shows the peak hourly parking arrivals for each truck parking site while combining the data for all day types, all stopping durations and all times of day for arrival. This map was used in the comparative analysis of all sites and the truck parking needs identification in the CTDOT Statewide Freight Plan.

Figure A-4: Truck Parking Utilization by Truck Parking Site



Source: Base (2019) and updated (2021) Jason’s Law databases; Connecticut Statewide Rest Area and Service Plaza website; AllStays.com Pro Account trucker information website; ATRI 2019 Truck Parking Events Sample; ATRI 2019 Truck GPS Sample based Truck Flows; CTDOT 2019 HPMS Bi-directional Combination Truck AADTs

A.1.5 Limitations

There are two main limitations to the utilization methodology as follows:

- The sample to population expansion factors are based on highway truck flow instead of arrivals to truck parking sites. Site validation of truck parking arrivals was not a part of this analysis.
- An alternate measure for utilization is “parking space occupancy”, which is net of parking arrivals and parking departures. The ATRI data used in this study did not support calculation of the parking space occupancy.

A.2 UNDESIGNATED TRUCK PARKING

ATRI data was also used to estimate undesignated truck parking along ramps and shoulders at each truck parking site. The methodology identified designated and undesignated truck parking areas for each on-freeway type site. These areas for Site ID# are shown as an example in **Figure A-5** along with the distribution of truck stopping locations in the ATRI sample. Considering on-freeway sites are dedicated facilities for parking use by trucks on the freeway corridor (a closed system) and there is no cost for parking at these sites, the methodology assumes that undesignated truck parking seen at these sites is a result of either no vacant/usable spaces being available to park at the truck arrival times or safety violations by truck driver. Percent of undesignated truck parking at an on-freeway site is estimated as the percentage of peak hourly arrivals to the undesignated area to the full (designated + undesignated) area used by trucks for parking.

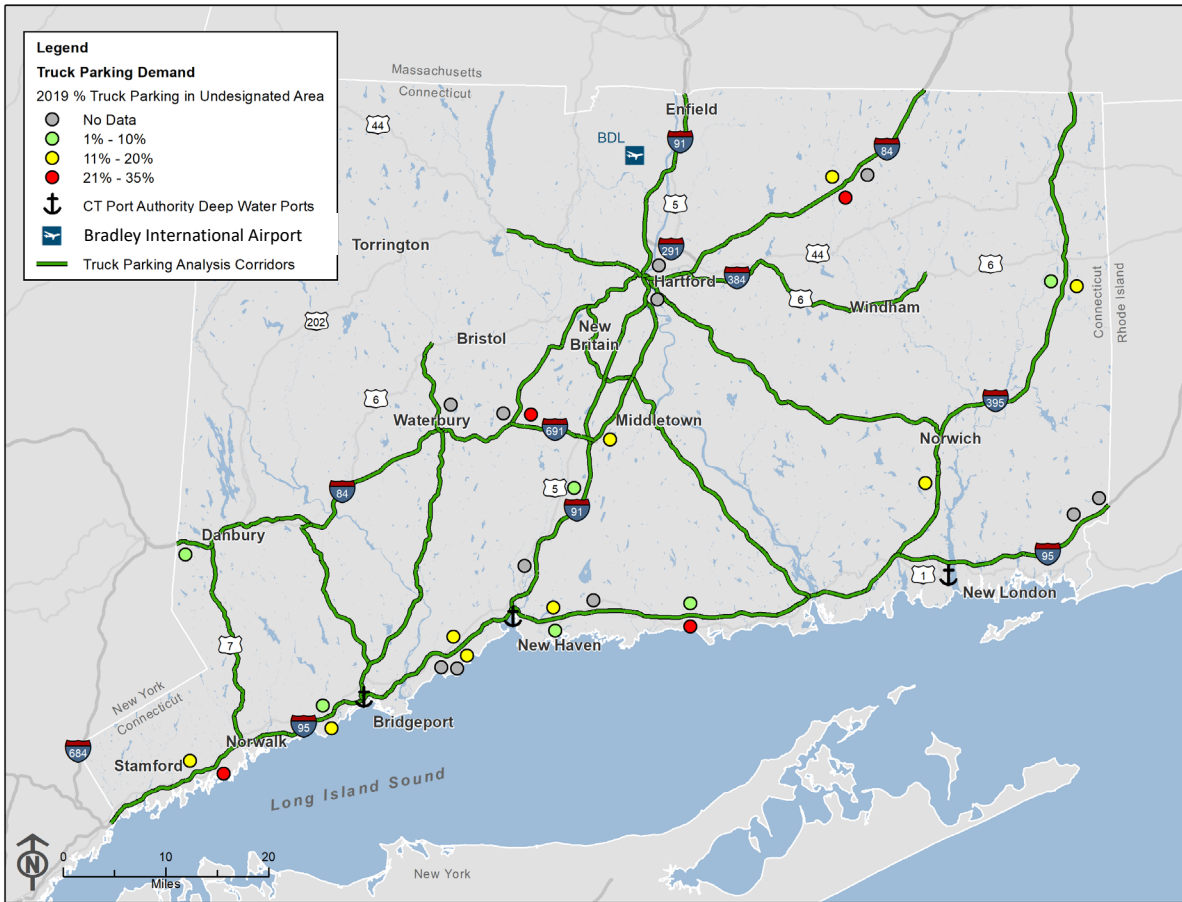
Figure A-5: Designated and Undesignated Parking Areas at Truck Site ID#1



Source: Base (2019) and updated (2021) Jason’s Law databases; Connecticut Statewide Rest Area and Service Plaza website; AllStays.com Pro Account trucker information website; ATRI 2019 Truck Parking Events Sample

The study team developed a statewide percent undesignated truck parking map (**Figure A-6**) that was used in the comparative analysis of all sites and the truck parking needs identification in the CTDOT Statewide Freight Plan.

Figure A-6: Percent of Undesignated Truck Parking by Truck Parking Site



Source: Base (2019) and updated (2021) Jason’s Law databases; Connecticut Statewide Rest Area and Service Plaza website; AllStays.com Pro Account trucker information website; ATRI 2019 Truck Parking Events Sample; ATRI 2019 Truck GPS Sample based Truck Flows; CTDOT 2019 HPMS Bi-directional Combination Truck AADTs

For off-freeway type sites, the property limits of the truck parking site were used as the designated truck parking area. The undesignated truck parking assessment methodology was not applied to off-freeway type sites because any undesignated truck parking occurring on local streets close to but outside the truck parking site’s property limits cannot be attributed with certainty to the truck parking site. Trucks may be stopping to serve businesses other than the truck parking site.

Additional undesignated truck parking assessment was carried out in this study using online truck driver survey conducted via the Connecticut Motor Transport Association, which was conducted as a part of the CTDOT Statewide Freight Plan. This survey requested feedback on freight issues related to enforcement, truck parking, and truck movement constraints. Truck drivers provided approximate locations of limited truck parking supply and undesignated truck parking activity.

The above information jointly was used in the undesignated truck parking issues identification in the CTDOT Statewide Freight Plan.

A.3 TRUCK PARKING DEMAND AND SUPPLY FORECAST

While ATRI data was useful in understanding utilization at truck parking sites, a corridor level demand forecasting was conducted using a FHWA truck parking demand estimation methodology¹⁸ enhanced by an hours-of-service factors update in a 2007 Pennsylvania study¹⁹. The FHWA methodology estimated current (2019) and future (2040) peak hourly short-term and overnight parking demand along State routes with high truck use. The calculated demand is a function of local data on traffic volumes, speeds and percentages of short- and long-haul, and FHWA default parameters for hours-of-service and peaking factors. The FHWA methodology is expected to provide the total truck parking demand, including the following demand components: (a) parking demand met at truck parking sites, (b) parking demand met at locations beside the truck parking sites, and (c) unmet/latent demand. On a few corridors, the demand estimates based on the FHWA methodology were adjusted upwards when the aggregated demand for truck parking sites using ATRI data exceeded the former. The corridor level truck parking demand estimates were compared to the aggregated supply based on the truck parking supply inventory.

The details of this methodology are as follows:

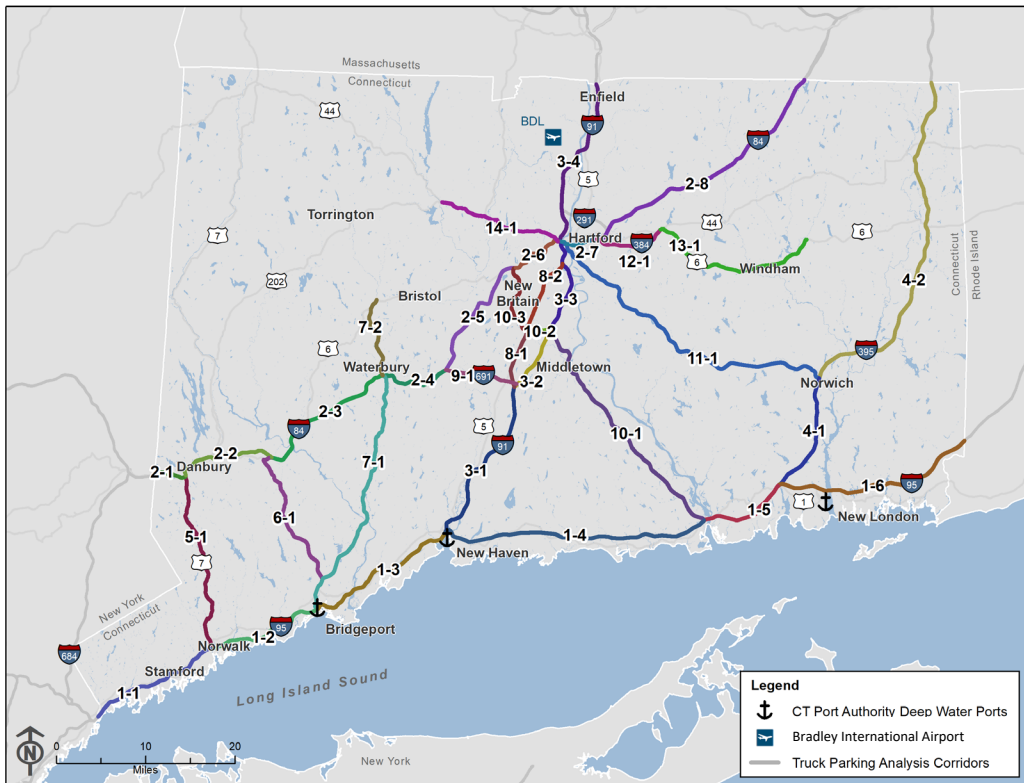
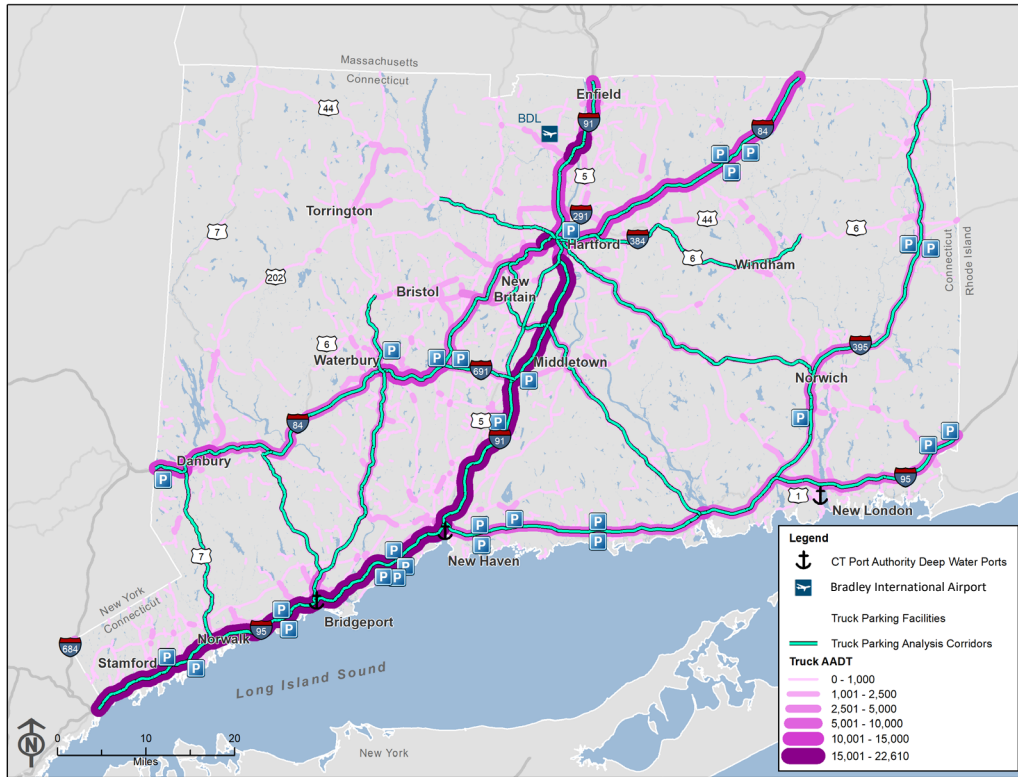
A.3.1 Truck Parking Analysis Corridors and Segments Identification

The methodology identified high truck use state corridors (with over 1,000 trucks per day) for demand assessment as shown in **Figure A-7**. The methodology ensured that the analysis corridors covered all existing truck parking facilities. The corridors were divided into 34 demand analysis segments as listed in **Table A-3**.

¹⁸ Federal Highway Administration (FHWA), Model Development For National Assessment of Commercial Vehicle Parking, March 2002, Available at: <https://www.fhwa.dot.gov/publications/research/safety/01159/01159.pdf> (last accessed on July 15, 2022)

¹⁹ Pennsylvania State Transportation Advisory Committee, Truck Parking in Pennsylvania, December 2007, Available at: <https://talkpatransportation.com/perch/resources/documents/truck-parking-in-pennsylvania-december-2007-final-report.pdf> (last accessed on July 15, 2022)

Figure A-7: Truck Parking Demand Analysis Corridors and Segments



Source: CTDOT Highways GIS Data; CTDOT 2019 HPMS Bi-directional Combination Truck AADTs

Table A-3: Truck Parking Demand Analysis Corridor Segments

Seg. #	Segment Name	Seg. #	Segment Name	Seg. #	Segment Name
1-1	I-95 between NY/CT Border and US 7	2-7	I-84 between I-91/US 44 and I-384	8-1	US 5 between I-691 and SR 9
1-2	I-95 between US 7 and SR 8	2-8	I-84 between I-384 and CT/MA Border	8-2	US 5 between SR 9 and I-91
1-3	I-95 between SR 8 and I-91	3-1	I-91 between I-95 and I-691	9-1	I-691 EB between I-84 and I-91
1-4	I-95 between I-91 and SR 9	3-2	I-91 between I-691 and SR 9	10-1	SR 9 between I-95 and I-91
1-5	I-95 between SR 9 and I-395	3-3	I-91 between SR 9 and US 5/I-84	10-2	SR 9 between I-91 and US 5
1-6	I-95 between I-395 and CT/RI Border	3-4	I-91 between US 5/I-84 and CT/MA Border	10-3	SR 9 between US 5 and I-84
2-1	I-84 between NY/CT Border and US 7	4-1	I-395 between I-95 and SR 2	11-1	SR 2 between I-395 and I-84
2-2	I-84 between US 7 and SR 25	4-2	I-395 between SR 2 and CT/MA Border	12-1	I-384 between I-84 and US 6
2-3	I-84 between SR 25 and SR 8	5-1	US 7 between I-95 and I-84	13-1	US 6 east of I-384
2-4	I-84 between SR 8 and I-691	6-1	SR 25 between SR 8 and I-84	14-1	US 44 WB between I-84/I-91 and US 202
2-5	I-84 between I-691 and SR 9	7-1	SR 8 between I-95 and I-84		
2-6	I-84 between SR 9 and I-91/US 44	7-2	SR 8 north of I-84		

Source: CTDOT Highways GIS Data; CTDOT 2019 HPMS Bi-directional Combination Truck AADTs

A.3.2 Enhanced FHWA Methodology-Based Truck Parking Demand Estimation

The methodology used the 2002 FHWA methodology for corridor level truck parking demand estimation while enhancing the hours-of-service factors using updates made in the 2007 Pennsylvania study. The FHWA methodology estimates short-term and overnight truck parking demand using equations shown in **Figure A-8**.

Figure A-8: Enhanced FHWA Methodology Truck Parking Demand Equations

$$\text{Short-Term Parking Demand} = F_s \times \text{AADT} \times T\% \times L/S \times \text{Pavg (Short-Term)} \times (\text{P-SH} \times \text{PPF-SH} + \text{P-LH} \times \text{PPF-LH}) \quad (\text{Equation 1})$$

Where:

F_s = Seasonal Peak Factor = 1.15

AADT = annual average daily traffic on the roadway segment

T% = percentage of trucks on the roadway segment

L = length of the roadway segment

S = average speed on the roadway segment

Pavg (Short-Term) = average short-term parking duration per hour of travel = 5 minutes / hour

P-SH = Proportion of total truck that are short-haul, assumed as truck trips that are less than or equal to 250 miles (one-way distance)

PPF-SH = Short-haul peak parking factor = 0.02

P-LH = Proportion of total truck that are long-haul, assumed as truck trips that are more than 250 miles (one-way distance)

PPF-LH = Long-haul peak parking factor = 0.09

$$\text{Overnight Parking Demand} = F_s \times \text{AADT} \times T\% \times L/S \times P\% (\text{Long-Term}) \times (\text{P-LH} \times \text{PPF-LH}) \quad (\text{Equation 2})$$

Where:

F_s = Seasonal Peak Factor = 1.15

AADT = annual average daily traffic on the roadway segment

T% = percentage of trucks on the roadway segment

L = length of the roadway segment

S = average speed on the roadway segment

P% (Long-Term) = Fraction of time long-haul truckers must be off-duty and/or parked over 8 consecutive days under the Federal Motor Carrier Safety Administration (FMCSA) regulations (see discussion on *Adjustments to the 2002 FHWA Model*)

P-LH = Proportion of total truck that are long-haul, assumed as truck trips that are more than 250 miles (one-way distance)

PPF-LH = Long-haul peak parking factor = 0.09

Source: *Federal Highway Administration (FHWA), Model Development For National Assessment of Commercial Vehicle Parking, March 2002; Pennsylvania State Transportation Advisory Committee, Truck Parking in Pennsylvania, December 2007.*

To apply the above equations, the methodology prepared several inputs and made assumptions as follows:

- The methodology defined 250 miles one-way (or 500 miles two-way) as the haul distance threshold to classify truck trips as short- and long-haul types. All in-state trips are short-haul, out-of-state trips are a mix of short- and long-haul.
- The CTDOT 2019 HPMS data was used to estimate 2019 corridor level average combination truck AADT.
- The CTDOT Travel Demand Model was used to perform select link analysis under 2016 baseline and 2040 planned conditions and estimate in- state and out-of- state truck travel splits. The model was also used to estimate corridor level average speed and travel time.

- The CTDOT Transearch truck-based commodity flows origin-destination database was used to estimate short- and long-haul splits for out-of- state truck travel and assemble state level truck growth factors by movement type (inbound, outbound, intra, and through).
- Combining the HPMS, TDM, and Transearch data, the analysis estimated future corridor level combination truck AADT and corridor level overall current and future short-haul and long-haul splits.

Current (2019) and future (2040) combination truck AADT and average speed inputs, and percentage short-haul and percentage long-haul assumptions and demand estimates (outputs) for the segments of analysis corridors are summarized in **Table A-4** and **Table A-5**.

Table A-4: 2019 Truck Parking Demand Analysis Input, Assumptions and Outputs by Segment

Seg. #	Segment Name	Combination Truck AADT	Length (miles)	Average Speed (mph)	P-SH (% Short-Haul)	P-LH (% Long-Haul)	Total Truck Parking Demand (truck parking spaces needed during peak hour)	Normalized Truck Parking Demand (truck parking spaces needed during peak hour / mile)
1-1	I-95 between NY/CT Border and US 7	11,110	16	65	81.8%	18.2%	42	2.7
1-2	I-95 between US 7 and SR 8	10,460	14	65	81.8%	18.2%	36	2.6
1-3	I-95 between SR 8 and I-91	10,210	18	61	90.1%	9.9%	30	1.6
1-4	I-95 between I-91 and SR 9	5,000	31	69	90.2%	9.8%	23	0.7
1-5	I-95 between SR 9 and I-395	4,500	10	68	90.3%	9.7%	9	0.9
1-6	I-95 between I-395 and CT/RI Border	4,540	24	69	81.7%	18.3%	26	1.1
2-1	I-84 between NY/CT Border and US 7	8,660	4	65	81.6%	18.4%	10	2.7
2-2	I-84 between US 7 and SR 25	7,010	12	65	81.6%	18.4%	21	1.8
2-3	I-84 between SR 25 and SR 8	5,790	17	65	81.6%	18.4%	26	1.5
2-4	I-84 between SR 8 and I-691	7,760	8	65	90.5%	9.5%	10	1.2
2-5	I-84 between I-691 and SR 9	6,170	16	65	90.2%	9.8%	15	1.0
2-6	I-84 between SR 9 and I-91/US 44	9,290	7	63	90.2%	9.8%	12	1.6
2-7	I-84 between I-91/US 44 and I-384	8,920	4	65	87.8%	12.2%	9	2.3
2-8	I-84 between I-384 and CT/MA Border	9,610	31	68	81.3%	18.7%	70	2.2
3-1	I-91 between I-95 and I-691	9,190	20	69	92.7%	7.3%	20	1.0
3-2	I-91 between I-691 and SR 9	9,430	8	65	92.2%	7.8%	11	1.4
3-3	I-91 between SR 9 and US 5/I-84	9,910	11	65	92.2%	7.8%	15	1.3
3-4	I-91 between US 5/I-84 and CT/MA Border	8,170	20	69	81.8%	18.2%	37	1.9
4-1	I-395 between I-95 and SR 2	2,990	14	68	89.3%	10.7%	8	0.6
4-2	I-395 between SR 2 and CT/MA Border	2,240	41	70	83.9%	16.1%	20	0.5
5-1	US 7 between I-95 and I-84	170	21	39	96.7%	3.3%	4	0.2
6-1	SR 25 between SR 8 and I-84	280	18	44	92.6%	7.4%	4	0.2
7-1	SR 8 between I-95 and I-84	1,120	30	64	93.8%	6.2%	5	0.2
7-2	SR 8 north of I-84	840	10	60	94.8%	5.2%	4	0.4
8-1	US 5 between I-691 and SR 9	370	7	42	97.7%	2.3%	4	0.5
8-2	US 5 between SR 9 and I-91	550	9	35	97.7%	2.3%	4	0.4
9-1	I-691 EB between I-84 and I-91	2,200	8	66	93.5%	6.5%	4	0.5
10-1	SR 9 between I-95 and I-91	660	29	67	93.5%	6.5%	4	0.1
10-2	SR 9 between I-91 and US 5	1,290	3	65	93.5%	6.5%	4	1.3
10-3	SR 9 between US 5 and I-84	750	8	65	93.5%	6.5%	4	0.5
11-1	SR 2 between I-395 and I-84	860	37	61	93.0%	7.0%	5	0.1
12-1	I-384 between I-84 and US 6	770	9	67	97.6%	2.4%	4	0.5
13-1	US 6 east of I-384	320	20	46	97.6%	2.4%	4	0.2
14-1	US 44 WB between I-84/I-91 and US 202	260	15	35	94.8%	5.2%	4	0.3
	TOTAL						508	

Source: CTDOT Highways GIS Data; CTDOT 2019 HPMS Bi-directional Combined Unit Truck AADTs; CTDOT Travel Demand Model (TDM): base year (2016) and forecast year (2040); CTDOT TRANSEARCH truck-based commodity flows origin-destination database.

Table A-5: 2040 Truck Parking Demand Analysis Input, Assumptions and Outputs by Segment

Seg. #	Segment Name	Combination Truck AADT	Length (miles)	Average Speed (mph)	P-SH (% Short-Haul)	P-LH (% Long-Haul)	Total Truck Parking Demand (truck parking spaces needed during peak hour)	Normalized Truck Parking Demand (truck parking spaces needed during peak hour / mile)
1-1	I-95 between NY/CT Border and US 7	13,300	16	65	81.0%	19.0%	52	3.3
1-2	I-95 between US 7 and SR 8	12,520	14	65	81.0%	19.0%	43	3.1
1-3	I-95 between SR 8 and I-91	12,710	18	61	90.6%	9.4%	36	2.0
1-4	I-95 between I-91 and SR 9	6,270	31	69	90.8%	9.2%	25	0.8
1-5	I-95 between SR 9 and I-395	5,620	10	68	90.8%	9.2%	10	1.0
1-6	I-95 between I-395 and CT/RI Border	5,400	24	69	80.8%	19.2%	32	1.3
2-1	I-84 between NY/CT Border and US 7	10,370	4	65	80.8%	19.2%	11	3.0
2-2	I-84 between US 7 and SR 25	8,390	12	65	80.8%	19.2%	26	2.2
2-3	I-84 between SR 25 and SR 8	6,930	17	65	80.8%	19.2%	31	1.8
2-4	I-84 between SR 8 and I-691	9,660	8	65	91.0%	9.0%	12	1.4
2-5	I-84 between I-691 and SR 9	7,690	16	65	90.6%	9.4%	18	1.2
2-6	I-84 between SR 9 and I-91/US 44	11,580	7	63	90.6%	9.4%	13	1.8
2-7	I-84 between I-91/US 44 and I-384	11,030	4	65	88.1%	11.9%	10	2.5
2-8	I-84 between I-384 and CT/MA Border	11,560	31	68	80.5%	19.5%	87	2.8
3-1	I-91 between I-95 and I-691	11,510	20	69	93.0%	7.0%	25	1.3
3-2	I-91 between I-691 and SR 9	11,780	8	65	92.6%	7.4%	12	1.5
3-3	I-91 between SR 9 and US 5/I-84	12,380	11	65	92.6%	7.4%	17	1.5
3-4	I-91 between US 5/I-84 and CT/MA Border	9,690	20	69	80.8%	19.2%	45	2.3
4-1	I-395 between I-95 and SR 2	3,760	14	68	90.3%	9.7%	9	0.7
4-2	I-395 between SR 2 and CT/MA Border	2,730	41	70	83.7%	16.3%	24	0.6
5-1	US 7 between I-95 and I-84	220	21	39	96.9%	3.1%	4	0.2
6-1	SR 25 between SR 8 and I-84	350	18	44	93.2%	6.8%	4	0.2
7-1	SR 8 between I-95 and I-84	1,400	30	64	94.3%	5.7%	6	0.2
7-2	SR 8 north of I-84	1,060	10	60	95.1%	4.9%	4	0.4
8-1	US 5 between I-691 and SR 9	470	7	42	97.8%	2.2%	4	0.5
8-2	US 5 between SR 9 and I-91	700	9	35	97.8%	2.2%	4	0.4
9-1	I-691 EB between I-84 and I-91	2,750	8	66	93.8%	6.2%	5	0.6
10-1	SR 9 between I-95 and I-91	830	29	67	93.8%	6.2%	5	0.2
10-2	SR 9 between I-91 and US 5	1,610	3	65	93.8%	6.2%	4	1.3
10-3	SR 9 between US 5 and I-84	940	8	65	93.8%	6.2%	4	0.5
11-1	SR 2 between I-395 and I-84	1,070	37	61	93.7%	6.3%	7	0.2
12-1	I-384 between I-84 and US 6	980	9	67	97.7%	2.3%	4	0.5
13-1	US 6 east of I-384	410	20	46	97.7%	2.3%	4	0.2
14-1	US 44 WB between I-84/I-91 and US 202	330	15	35	95.1%	4.9%	4	0.3
	TOTAL						601	

Source: CTDOT Highways GIS Data; CTDOT 2019 HPMS Bi-directional Combined Unit Truck AADTs; CTDOT Travel Demand Model (TDM): base year (2016) and forecast year (2040); CTDOT TRANSEARCH truck-based commodity flows origin-destination database.

A.3.3 ATRI Utilization-based Truck Parking Demand Adjustments

The 2019 demand estimate based on the enhanced FHWA methodology was divided by the existing supply inventory-based aggregated truck parking spaces by analysis segment to estimate the expected truck parking utilization in 2019. When a segment had no supply, utilization was noted as not available (N/A). These were compared to the 2019 ATRI data-based actual truck parking utilization also aggregated to the analysis segments. When the actual utilization was higher than the expected utilization, the FHWA methodology-based 2019 truck parking demand estimate was increased so that the utilization reached the actual value. Otherwise, the truck parking demand estimate was left unchanged. The 2040 demand estimate based on the enhanced FHWA methodology was also adjusted upwards by the same adjustment factor (1.0 or greater in value) as that in 2019.

Current (2019) expected to actual utilization comparisons and adjusted current (2019) and future (2040) demand estimates (outputs) for the segments of analysis corridors are summarized in **Table A-6** and **Table A-7**.

Table A-6: 2019 Adjusted Truck Parking Demand Outputs by Segment

Seg. #	Segment Name	Truck Parking Supply (truck parking spaces)	FHWA Methodology-Based Expected Utilization	ATRI Data-Based Actual Utilization	Adjustment Factor	Adjusted Total Truck Parking Demand (truck parking spaces needed during peak hour)	Adjusted Normalized Truck Parking Demand (truck parking spaces needed during peak hour / mile)
1-1	I-95 between NY/CT Border and US 7	40	105.0%	90.0%	1.0	42	2.7
1-2	I-95 between US 7 and SR 8	40	90.0%	50.2%	1.0	36	2.6
1-3	I-95 between SR 8 and I-91	250	12.0%	32.7%	2.7	82	4.4
1-4	I-95 between I-91 and SR 9	125	18.4%	48.3%	2.6	60	2.0
1-5	I-95 between SR 9 and I-395	0	N/A	N/A	N/A	9	0.9
1-6	I-95 between I-395 and CT/RI Border	150	17.3%	17.5%	1.0	26	1.1
2-1	I-84 between NY/CT Border and US 7	20	50.0%	52.9%	1.1	11	2.9
2-2	I-84 between US 7 and SR 25	0	N/A	N/A	N/A	21	1.8
2-3	I-84 between SR 25 and SR 8	0	N/A	N/A	N/A	26	1.5
2-4	I-84 between SR 8 and I-691	0	N/A	N/A	N/A	10	1.2
2-5	I-84 between I-691 and SR 9	165	9.1%	47.5%	5.2	78	5.0
2-6	I-84 between SR 9 and I-91/US 44	0	N/A	N/A	N/A	12	1.6
2-7	I-84 between I-91/US 44 and I-384	0	N/A	N/A	N/A	9	2.3
2-8	I-84 between I-384 and CT/MA Border	258	27.1%	41.8%	1.5	108	3.4
3-1	I-91 between I-95 and I-691	43	46.5%	37.5%	1.0	20	1.0
3-2	I-91 between I-691 and SR 9	25	44.0%	48.0%	1.1	12	1.5
3-3	I-91 between SR 9 and US 5/I-84	10	150.0%	12.5%	1.0	15	1.3
3-4	I-91 between US 5 / I-84 and CT/MA Border	60	61.7%	0.5%	1.0	37	1.9
4-1	I-395 between I-95 and SR 2	10	80.0%	41.6%	1.0	8	0.6
4-2	I-395 between SR 2 and CT/MA Border	20	100.0%	45.5%	1.0	20	0.5
5-1	US 7 between I-95 and I-84	0	N/A	N/A	N/A	4	0.2
6-1	SR 25 between SR 8 and I-84	0	N/A	N/A	N/A	4	0.2
7-1	SR 8 between I-95 and I-84	0	N/A	N/A	N/A	5	0.2
7-2	SR 8 north of I-84	10	40.0%	29.3%	1.0	4	0.4
8-1	US 5 between I-691 and SR 9	0	N/A	N/A	N/A	4	0.5
8-2	US 5 between SR 9 and I-91	0	N/A	N/A	N/A	4	0.4
9-1	I-691 EB between I-84 and I-91	0	N/A	N/A	N/A	4	0.5
10-1	SR 9 between I-95 and I-91	0	N/A	N/A	N/A	4	0.1
10-2	SR 9 between I-91 and US 5	0	N/A	N/A	N/A	4	1.3
10-3	SR 9 between US 5 and I-84	0	N/A	N/A	N/A	4	0.5
11-1	SR 2 between I-395 and I-84	0	N/A	N/A	N/A	5	0.1
12-1	I-384 between I-84 and US 6	0	N/A	N/A	N/A	4	0.5
13-1	US 6 east of I-384	0	N/A	N/A	N/A	4	0.2
14-1	US 44 WVB between I-84/I-91 and US 202	0	N/A	N/A	N/A	4	0.3
	TOTAL	1,226				700	

Source: CTDOT Highways GIS Data; CTDOT 2019 HPMS Bi-directional Combined Unit Truck AADTs; CTDOT Travel Demand Model (TDM): base year (2016) and forecast year (2040); CTDOT TRANSEARCH truck-based commodity flows origin-destination database; ATRI 2019 Truck Parking Events Sample; ATRI 2019 Truck GPS Sample based Truck Flows.

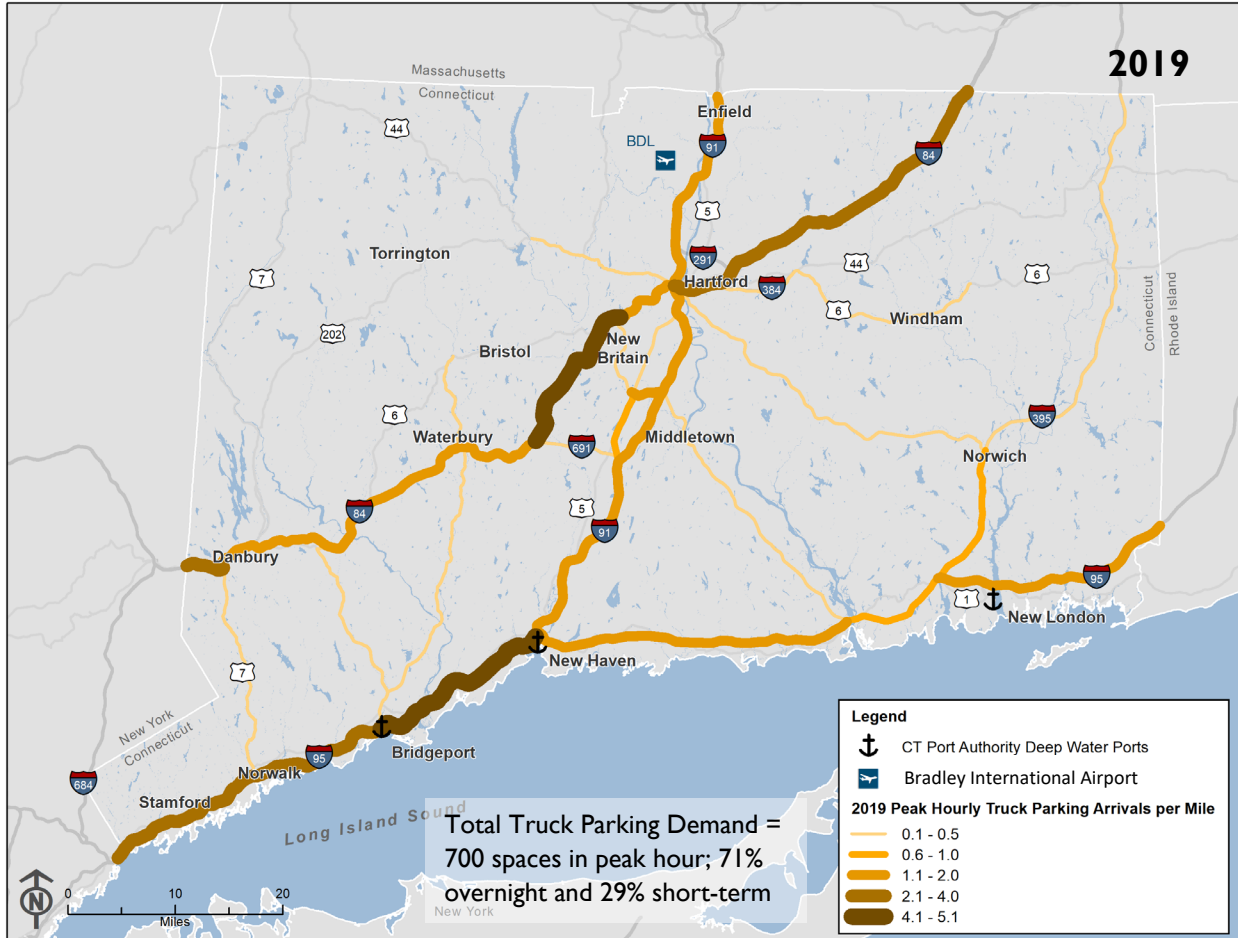
Table A-7: 2040 Adjusted Truck Parking Demand Outputs by Segment

Seg. #	Segment Name	Adjusted Total Truck Parking Demand (truck parking spaces needed during peak hour)	Adjusted Normalized Truck Parking Demand (truck parking spaces needed during peak hour / mile)
I-1	I-95 between NY/CT Border and US 7	52	3.3
I-2	I-95 between US 7 and SR 8	43	3.1
I-3	I-95 between SR 8 and I-91	98	5.3
I-4	I-95 between I-91 and SR 9	66	2.1
I-5	I-95 between SR 9 and I-395	10	1.0
I-6	I-95 between I-395 and CT/RI Border	32	1.3
2-1	I-84 between NY/CT Border and US 7	12	3.2
2-2	I-84 between US 7 and SR 25	26	2.2
2-3	I-84 between SR 25 and SR 8	31	1.8
2-4	I-84 between SR 8 and I-691	12	1.4
2-5	I-84 between I-691 and SR 9	94	6.0
2-6	I-84 between SR 9 and I-91/US 44	13	1.8
2-7	I-84 between I-91/US 44 and I-384	10	2.5
2-8	I-84 between I-384 and CT/MA Border	134	4.3
3-1	I-91 between I-95 and I-691	25	1.3
3-2	I-91 between I-691 and SR 9	13	1.7
3-3	I-91 between SR 9 and US 5 / I-84	17	1.5
3-4	I-91 between US 5/I-84 and CT/MA Border	45	2.3
4-1	I-395 between I-95 and SR 2	9	0.7
4-2	I-395 between SR 2 and CT/MA Border	24	0.6
5-1	US 7 between I-95 and I-84	4	0.2
6-1	SR 25 between SR 8 and I-84	4	0.2
7-1	SR 8 between I-95 and I-84	6	0.2
7-2	SR 8 north of I-84	4	0.4
8-1	US 5 between I-691 and SR 9	4	0.5
8-2	US 5 between SR 9 and I-91	4	0.4
9-1	I-691 EB between I-84 and I-91	5	0.6
10-1	SR 9 between I-95 and I-91	5	0.2
10-2	SR 9 between I-91 and US 5	4	1.3
10-3	SR 9 between US 5 and I-84	4	0.5
11-1	SR 2 between I-395 and I-84	7	0.2
12-1	I-384 between I-84 and US 6	4	0.5
13-1	US 6 east of I-384	4	0.2
14-1	US 44 WB between I-84/I-91 and US 202	4	0.3
	TOTAL	829	

Source: CTDOT Highways GIS Data; CTDOT 2019 HPMS Bi-directional Combined Unit Truck AADTs; CTDOT Travel Demand Model (TDM); base year (2016) and forecast year (2040); CTDOT TRANSEARCH truck-based commodity flows origin-destination database; ATRI 2019 Truck Parking Events Sample; ATRI 2019 Truck GPS Sample based Truck Flows.

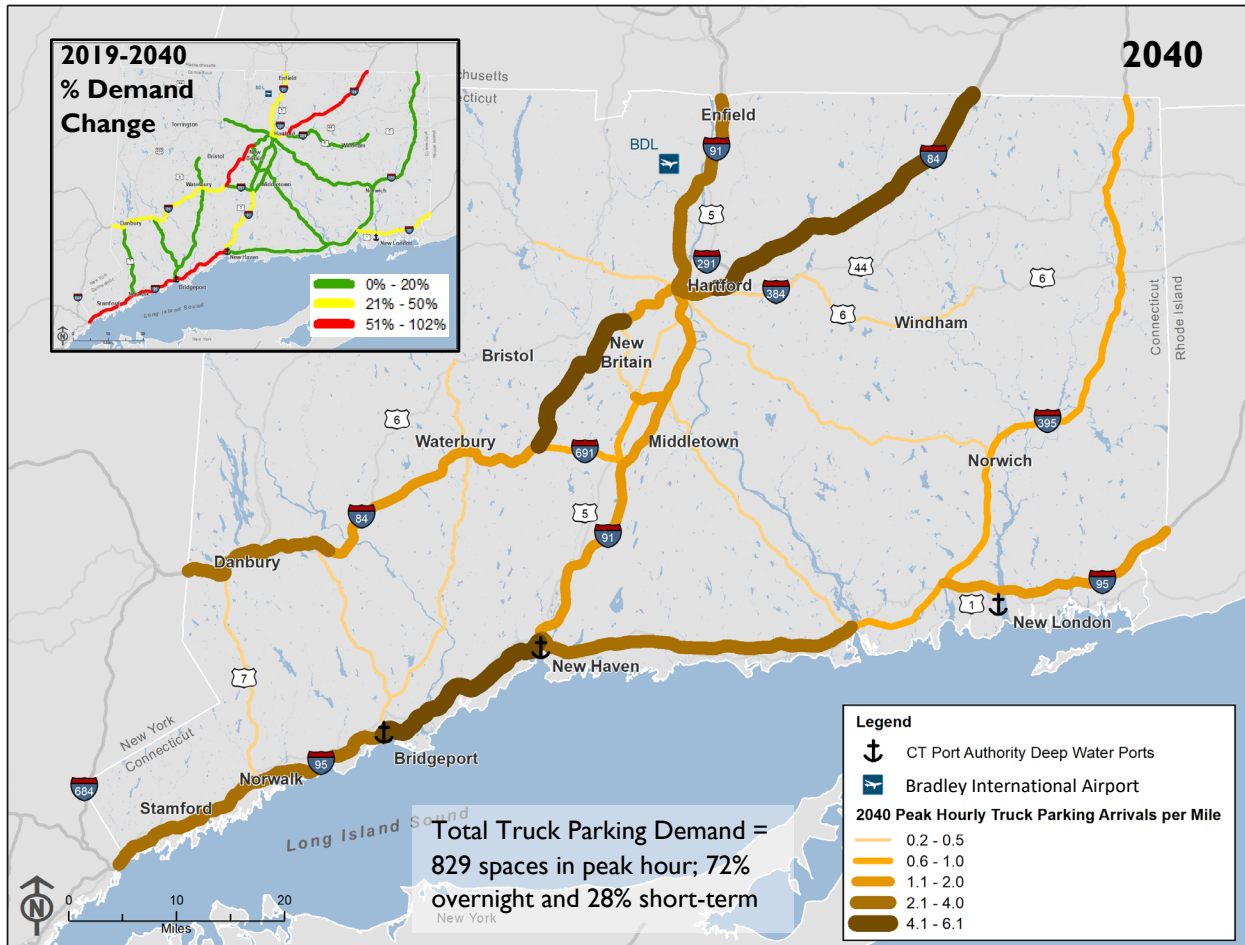
Lastly, the study team developed statewide normalized demand (truck parking spaces needed during peak hour per segment mile) and utilization (segment total demand to total supply ratio) maps under current (2019) and future (2040) conditions (see **Figure A-9** through **Figure A-12**). These maps were used in the comparative analysis of all sites and the truck parking needs identification in the CTDOT Statewide Freight Plan.

Figure A-9: 2019 Truck Parking Demand on Analysis Corridors



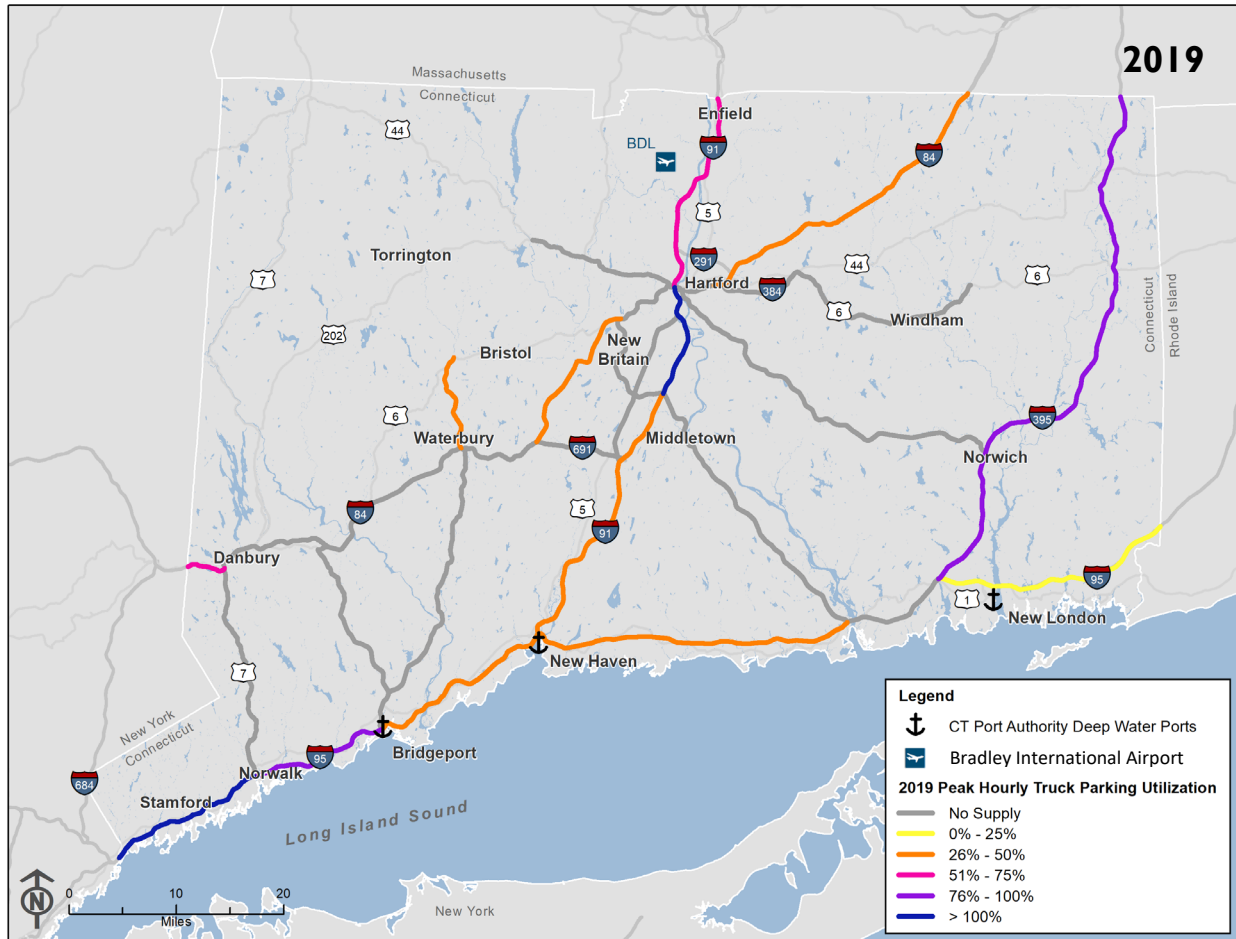
Source: CTDOT Highways GIS Data; CTDOT 2019 HPMS Bi-directional Combined Unit Truck AADTs; CTDOT Travel Demand Model (TDM); base year (2016); CTDOT TRANSEARCH truck-based commodity flows origin-destination database; ATRI 2019 Truck Parking Events Sample; ATRI 2019 Truck GPS Sample based Truck Flows.

Figure A-10: 2040 Truck Parking Demand on Analysis Corridors



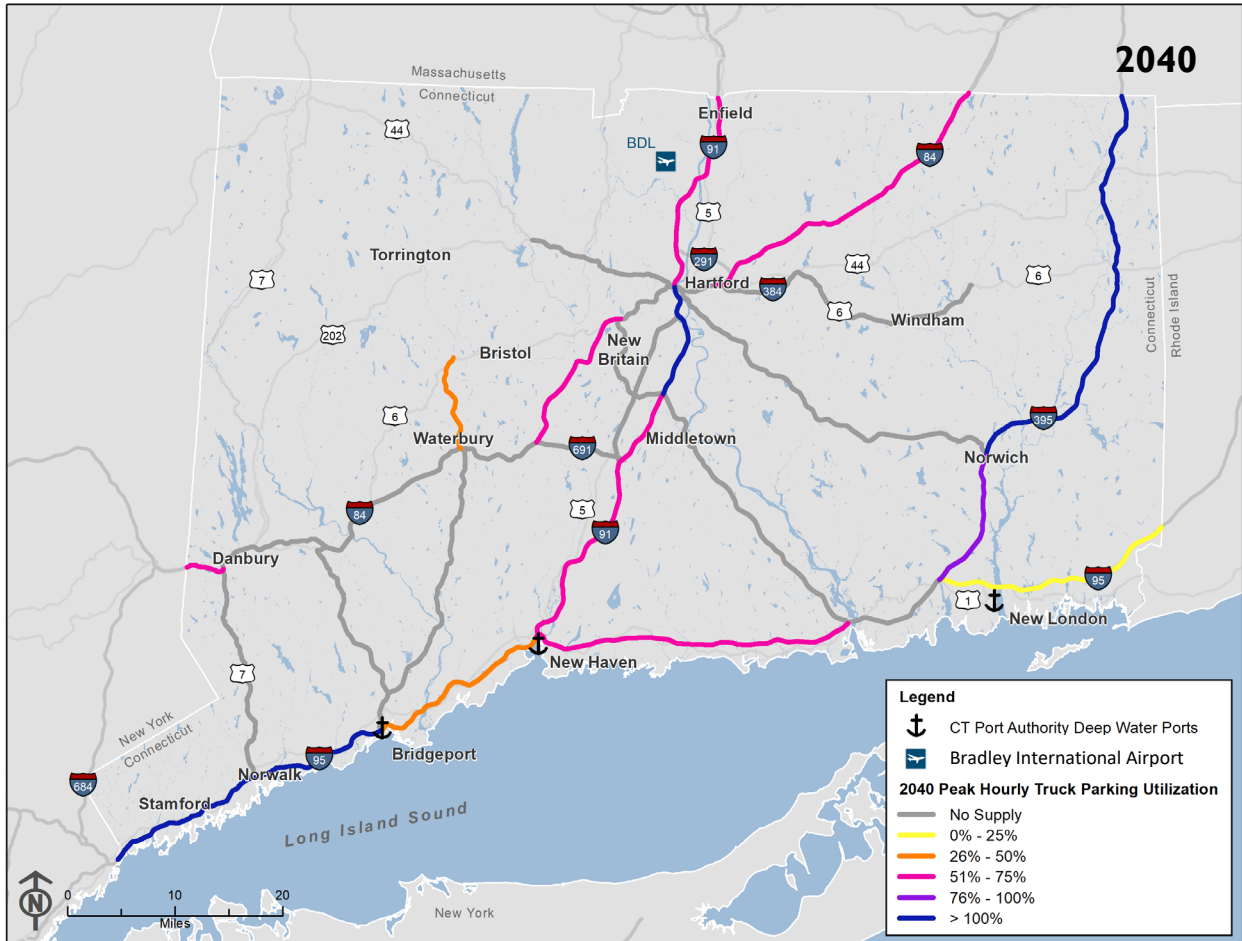
Source: CTDOT Highways GIS Data; CTDOT 2019 HPMS Bi-directional Combined Unit Truck AADTs; CTDOT Travel Demand Model (TDM): base year (2016) and forecast year (2040); CTDOT TRANSEARCH truck-based commodity flows origin-destination database; ATRI 2019 Truck Parking Events Sample; ATRI 2019 Truck GPS Sample based Truck Flows. Note: The inset in 2040 map is showing the percent change in 2019-2040 truck parking demand growth. Red = over 50% change in demand; Yellow = 21-50% change in demand; and Green = Below 20% change in demand.

Figure A-11: 2019 Truck Parking Utilization on Analysis Corridors



Source: CTDOT Highways GIS Data; CTDOT 2019 HPMS Bi-directional Combined Unit Truck AADTs; CTDOT Travel Demand Model (TDM): base year (2016); CTDOT TRANSEARCH truck-based commodity flows origin-destination database; ATRI 2019 Truck Parking Events Sample; ATRI 2019 Truck GPS Sample based Truck Flows

Figure A-12: 2040 Truck Parking Utilization on Analysis Corridors



Source: CTDOT Highways GIS Data; CTDOT 2019 HPMS Bi-directional Combined Unit Truck AADTs; CTDOT Travel Demand Model (TDM); base year (2016) and forecast year (2040); CTDOT TRANSEARCH truck-based commodity flows origin-destination database; ATRI 2019 Truck Parking Events Sample; ATRI 2019 Truck GPS Sample based Truck Flows