

Safety through Disruption (Safe-D) National University Transportation Center (UTC)

TTI-06-01 Connected Vehicle Information for
Improving Safety Related to Unknown or Inadequate
Truck Parking

Summary of Findings
October 2022



Safe-D National UTC



PURPOSE

To maximize the potential safety benefits of disruptive technologies through targeted research that addresses the most pressing transportation safety questions.

PARTNERSHIP

The largest collection of transportation safety researchers in the nation, encompassing:

- VTTI
- TTI
- SDSU

FOCUS AREA

- Cutting-edge research
- Education and workforce development with programs for all levels
- Fully supported technology transfer



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ABOUT THE PROJECT

Safety issues due to commercial truck parking shortages are a national concern. National hours-of-service (HOS) regulations limit drivers' time on the road to increase safety by limiting fatigue. This requires drivers to locate safe, secure, and legal parking wherever they are when or before they hit their limits. If drive time is exhausted with no nearby truck parking, drivers may park in unsafe or unauthorized locations to meet HOS requirements, or they may continue to drive while fatigued.

There are intrinsic safety implications to all highway users due to large trucks parking in unsafe locations or truck drivers driving past their allotted hours. With the projected growth of truck traffic, the demand for adequate truck parking will continue to outpace the supply of public and private parking facilities.

This research was developed to help transportation agencies develop solutions to the parking availability problem by identifying effective methods for using data to estimate truck parking demand and areas of parking opportunity, assessing available data sources for estimating truck parking, and determining the safest solutions for distributing information on parking availability directly to drivers.

HOW WILL THIS STUDY HELP TRANSPORTATION AGENCIES?

ESTIMATING DEMAND

Finding the total number of trucks that want to park in a given location or geographic area

SAFETY

Identifying legal, safe, and secure parking opportunities in that same location or geographic area

COMMUNICATION

Disseminating information on parking opportunities to drivers when they need it and how they want it



Purpose of Study

This Summary is intended to provide a high-level overview of how State DOT planners and data analysts can estimate truck parking demand and identify truck parking supply in their respective regions.

If additional information is needed, please reach out to the research team directly by contacting Nicole Katsikides at n-katsikides@tti.tamu.edu or Brittany Gick at b-gick@tti.tamu.edu.

The purpose of this study was to derive insights that will help State DOTs and other transportation agencies mitigate the presumed negative safety impacts of inadequate truck parking. It builds on prior work by the Texas A&M Transportation Institute (TTI) and the Virginia Tech Transportation Institute (VTTI) in mitigating the negative safety impacts of inadequate truck parking. The study involved two main objectives:

- Use big data to understand when and where parking is needed along major corridors and support local and regional planning efforts for better options.
- Push information via technology to truck drivers to enable them to locate available, safe, and legal parking in messaging formats that they will use and heed.

Study Process



Step 1

Knowledge Synthesis



Step 2

Estimate Demand



Step 3

Identify Supply



Step 4

Assess Quality Issues and Biases in Data



Step 5

Stakeholder Interviews



Knowledge Synthesis

More than 50 relevant journal articles, truck parking studies, technical reports, and other relevant literature resources were reviewed for this project and the following slides will summarize the relevant findings.

Ultimately, the literature review indicates that there is anecdotal evidence that there is a safety problem related to truck parking, there is not enough research that specifically illustrates the connection or cause and effect between inadequate parking and safety.

Key Findings from Knowledge Synthesis

Driver Safety

Numerous studies reference the death of Jason Rivenburg and concerns about driver safety while parking are a notable concern in the literature.

HOS Violations

Lack of truck parking can lead drivers to continue driving to find safe and adequate parking or be forced to park in unsafe and unauthorized locations.

Issues with Unofficial & Unauthorized Parking

Not only is there an issue with drivers being unable to find parking, but there are also perception issues that truck parking is not available in locations, which can impact driver behavior (e.g., drivers passing by available parking because they are unaware spaces are available or the location is inconvenient).

Loss of Parking

The development of parkways and scenic routes has further reduced truck parking availability by not allowing truck parking.

Fatigued Drivers

Fatigued drivers are not only a risk to themselves, but to all roadway users and studies have documented how the proximity of truck parking locations can impact fatigue-related truck crashes.

Hesitant to Use Weigh Stations

While several states have opened weigh stations during off-peak hours, several studies indicate that drivers are hesitant to park there, however more research is needed to understand why this is occurring.



Project Data

Demand was estimated using a sample of INRIX truck probe data provided by the Maryland Department of Transportation State Highway Administration (MDOT SHA) from the INRIX Trips dataset for March 2019 and May 2019. The study was limited to Howard County, Maryland, an area along the I-95 Corridor between Baltimore and the District of Columbia and home to significant freight movements, truck parking, and intermodal facilities. Additional information on how the data was analyzed can be found in the accompanying Guidebook or full paper.



Estimate Demand

To estimate demand, there were three different methods tested using a sample of INRIX truck probe data. The study was limited to the area of Howard County, Maryland. The three different ways the data were assessed to estimate demand include:

1. Developing a mathematical algorithm to assess clusters of truck parking.
2. Geohashing the location of the points within the data to identify clusters of parking.
3. Testing the reliability of the information in the parking information it provided.

Truck Parking Demand: Algorithms



Step 1

Filter and Slice Data



Step 2

Apply Artificial Intelligence
(AI) Algorithms



Step 3

Evaluate Results & Repeat
Process

Truck Parking Demand: Geohashing

Step 1

Using GIS software (ArcGIS), the data points inside the boundaries of Howard County were identified and extracted.

Step 2

Using the “vehicle weight class” information, the resulting data table from Step 1 was further filtered to extract only heavy-duty vehicles’ trips (vehicle weight class = 3).

Step 3

Using coordinates of the start point for each stop trip, a 7-digit geohash was assigned to the stop trip. This information was stored in a new column. The research team also extracted the center point coordinates of all the geohashes with at least one observation assigned to them.

Step 4

The research team then identified and marked the day-of-week and hour-of-day that each event started in (Monday to Sunday, hours 0 to 23). This information was stored in new columns.

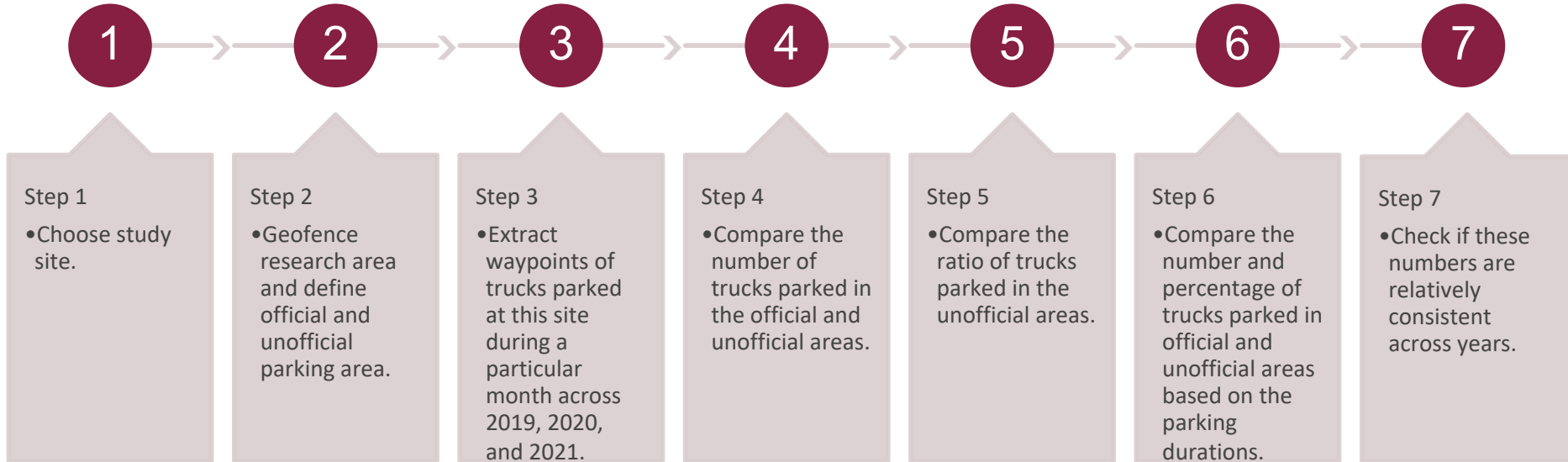
Step 5

The research team developed a summary table by calculating the total number of stop trips happening in each 7-digit geohash on a specific day-of-week; (e.g., Monday in geohash dqcp1mt).

Step 6

The resulting summary table was imported into GIS software and visualized along with geohashed truck crash information and other relevant data.

Truck Parking Demand: Reliability





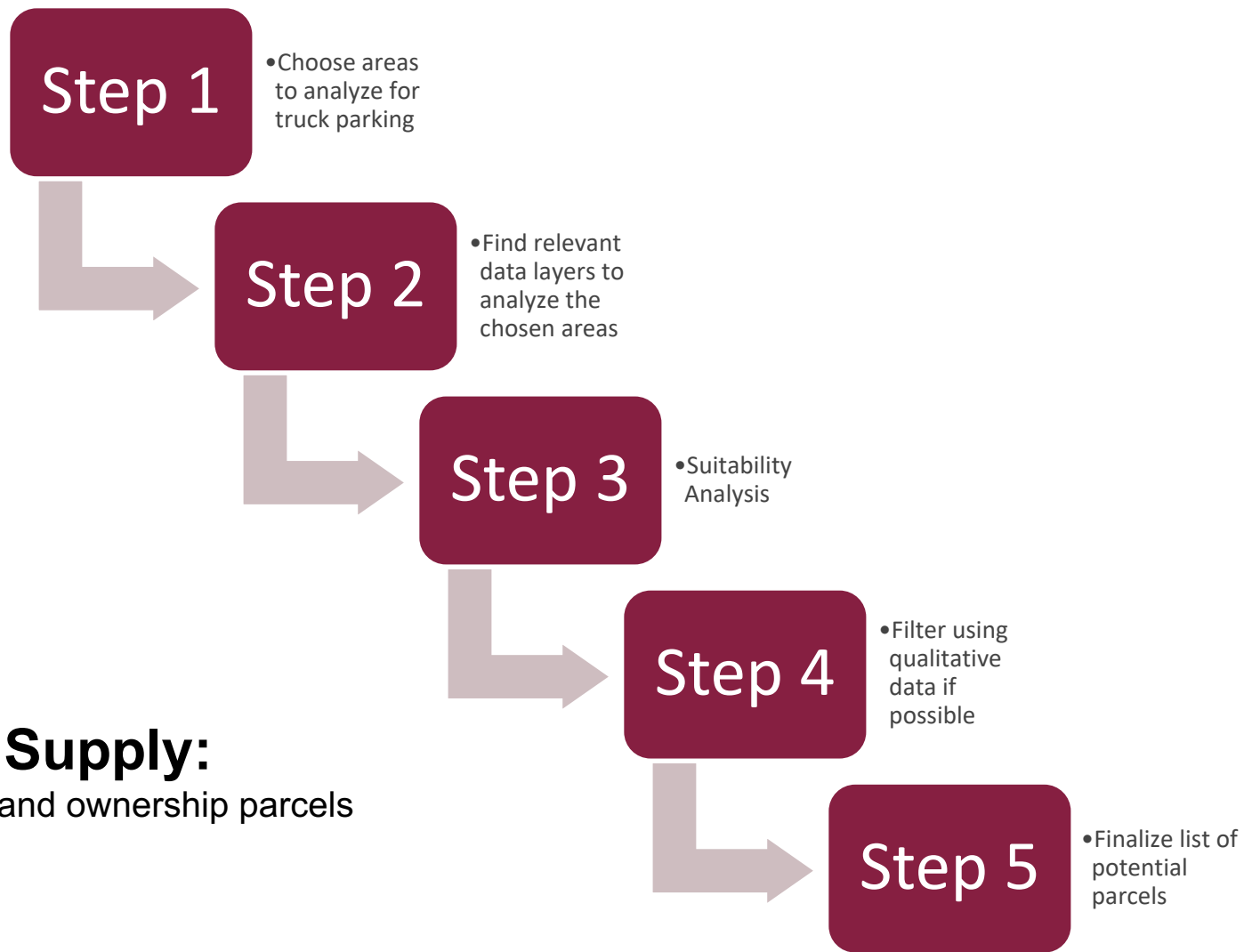
Identify Supply

There are intrinsic safety impacts to all highway users due to large trucks parking in unsafe locations or truck drivers driving past their allotted hours.

With the projected growth of truck traffic, the demand for adequate truck parking will continue to outpace the supply of public and private parking facilities.

Truck Parking Supply:

Determining usability of land ownership parcels

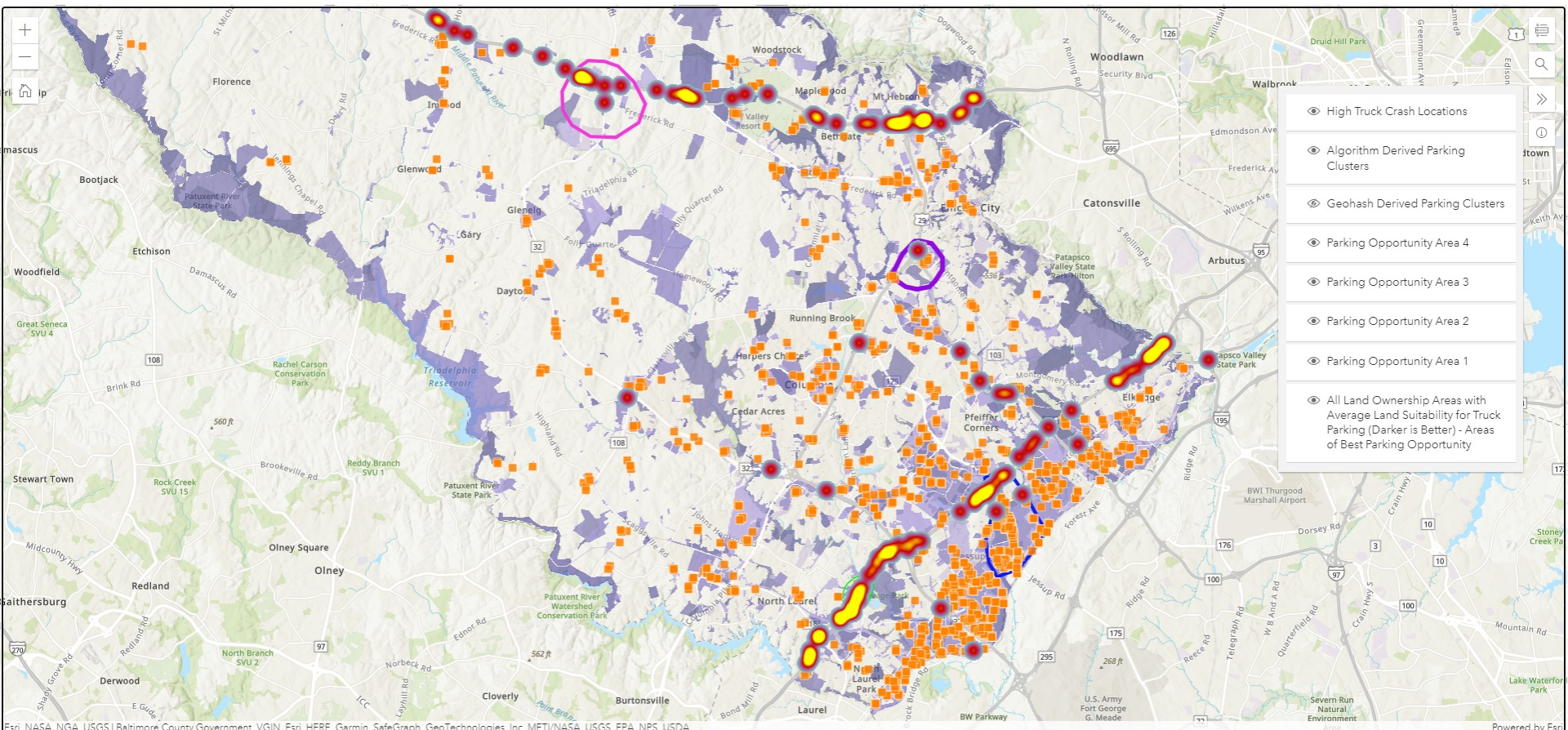




Final Output

The research team decided that it was important to develop an interactive map of the combined data. Therefore, the team created an ArcGIS online map with all the data layers so that readers of this study and future researchers can explore the data in detail and replicate the analysis. The link for this map is: <https://arcg.is/OrHnGH> and a screenshot is shown on the next slide.

SAFE-D Parking Assessment (Demand and Opportunity)





Quality Issues and Biases in Big Data

This study also sought to assess quality issues and biases in big data. While there are several methods to analyze data, each has its own limitations. It is important for researchers and practitioners to be aware of these limitations before using the data to analyze truck parking.

Key Findings from Big Data Assessment

Coverage

- Probe data is merely a sample of trucks, so the data will have a range of coverage and not all trucks are included.

Bias and Characteristics

- There is a lack of transparency and different data methodologies among data sources which can lead to inconsistency.
- Truck probe data lack information about the vehicle (e.g., type of cabin, single unit vs. combination), which if provided could aid in understanding truck parking behavior.

Cumbersome Analytics

- Processing big data is cumbersome, time-consuming, and requires data analysis expertise.

Key Findings from Big Data Assessment

Parking Detection Errors

- Cameras and sensors do not always accurately detect vehicles parking in spaces.
- There can be sensor failures and often sensors cannot detect the type of vehicle in the space leading to reporting errors.

Inconsistent Reporting

- State reporting standards differ which can lead to inconsistent reporting of parking citations and crash information.

Observational Data

- Manual counts can be time-consuming and costly.
- Crowdsourced information for use in smartphone and web applications is subjective and may not always be accurate.



Stakeholder Interviews

Twenty stakeholder interviews were completed in March and April 2022. Stakeholders included State DOT staff, technology providers, shipping companies, and truck drivers and sought to gain insight about current truck parking detection processes and perspectives on information dissemination.

Feedback on Demand and Supply Information

- Stakeholders supported traffic, volume, and parking concentration information that could help truckers understand routing and parking options and potential availability.
- When it comes to parking location opportunities, it is important to filter opportunities for parking that the public sector can control, buy, or sell, and that it is important to screen property carefully for opportunities before moving forward in any planning process.
- It is necessary to consider corridors, fuel, and amenity locations and or density, and feasibility factors not only relying on land area such as locations not next to residential or incompatible uses, paved locations, and other aspects that would make it work.
- Accurate, reliable information can support the trucking community.
- Getting parking information out to drivers is an important element of for solving for the truck parking problem.



Feedback on the Best Ways to Disseminate Information

Preferred Applications

- The crowdsourced Trucker Path mobile app is currently the preferred means by which truck drivers locate information about truck parking availability.
- Truck drivers prefer to have information in one app that can be used in every state, as opposed to having an app that works only in specific states or areas.
- Private truck stops are often unwilling to share information about available truck parking out of concern that truck drivers will not make fuel, food, and other purchases at their locations.

Electronic Logging Device (ELD) Sources

- Providing truck parking information on ELDs was supported by the truck drivers, especially if the notifications could provide information on upcoming truck stops, how many spaces are available at those locations, and traffic updates.
- There are different ELDs available, so there is a risk that the information will not get to all truck drivers.

Current Information Technology System Solutions

- Each state agency determines the threshold for identifying the number of spaces available using truck parking information management systems, so there can be inconsistency from state to state.
- Truck drivers typically only rely on dynamic messaging signs when they are within 5 miles of a facility, otherwise they are concerned the spaces would no longer be available when they arrive.

Feedback on the Desired Content of Messaging

Parking Availability

- The truck drivers who were interviewed for this project preferred that mobile apps, signs, and other messaging technologies communicate how much parking is available at exits/rest areas that are relatively nearby.
- Several truck drivers expressed frustration at dynamic message signage that did not show the actual number of spaces, as they felt this signage was less reliable.

In-cab is Best

- Simple and minimal information in the messaging works best.
- Having an option to pull over and open a mobile app for more information on facilities and amenities.

Accuracy is Key

- Messaging platforms whether in-cab or outside the cab need to display the correct, reliable information in real-time.



Conclusions and Recommendations

The process for evaluating truck parking demand produced a precise analysis of where trucks are parking, which is important for transportation decision-makers as they attempt to address inadequate truck parking. State DOTs and other transportation decision-makers can also use, as demonstrated, geospatial layers at their fingertips to enhance the demand analysis and understand supply opportunities. There seems to be opportunity in assessing data, like truck probe data, and in disseminating it. More research is needed to evaluate how truck parking scarcity contributes to safety issues such as crashes.

QUESTIONS?

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