CONNECTED VEHICLE INFORMATION FOR IMPROVING SAFETY RELATED TO UNKNOWN OR INADEQUATE TRUCK PARKING

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STUDY TEAM

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ABOUT THE PROJECT

Safety issues due to commercial truck parking shortages are a national concern.

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.

This research was developed to help transportation agencies develop solutions to the parking availability problem.

PURPOSE OF STUDY

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. The study involved two main objectives:

- Use big data to understand when and where parking is needed.
- 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.

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).

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.

DEMAND DATA

INRIX truck probe data provided by the Maryland Department of Transportation State Highway Administration (MDOT SHA) from the INRIX Trips dataset for March 2019.

Heavy duty vehicle crash data from 2019-2021 was also provided by MD SHA.

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.

ESTIMATING 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:

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

ALGORITHMS

Step 1

Filter and Slice Data

Step 2

Apply Artificial Intelligence (AI) Algorithms

Step 3

Evaluate Results & Repeat Process

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.

RELIABILITY

Step 1	Step 2	Step 3	Step 4	Step 5	Step 6	Step 7
• Choose study site.	• Geofence research area and define official and unofficial parking area.	• Extract waypoints of trucks parked at this site during a particular month across 2019, 2020, and 2021.	• Compare the number of trucks parked in the official and unofficial areas.	• Compare the ratio of trucks parked in the unofficial areas.	• Compare the number and percentage of trucks parked in official and unofficial areas based on the parking durations.	• Check if these numbers are relatively consistent across years.

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.

ADDITIONAL 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.

IDENTIFYING NEW TRUCK PARKING OPPORTUNITIES

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.

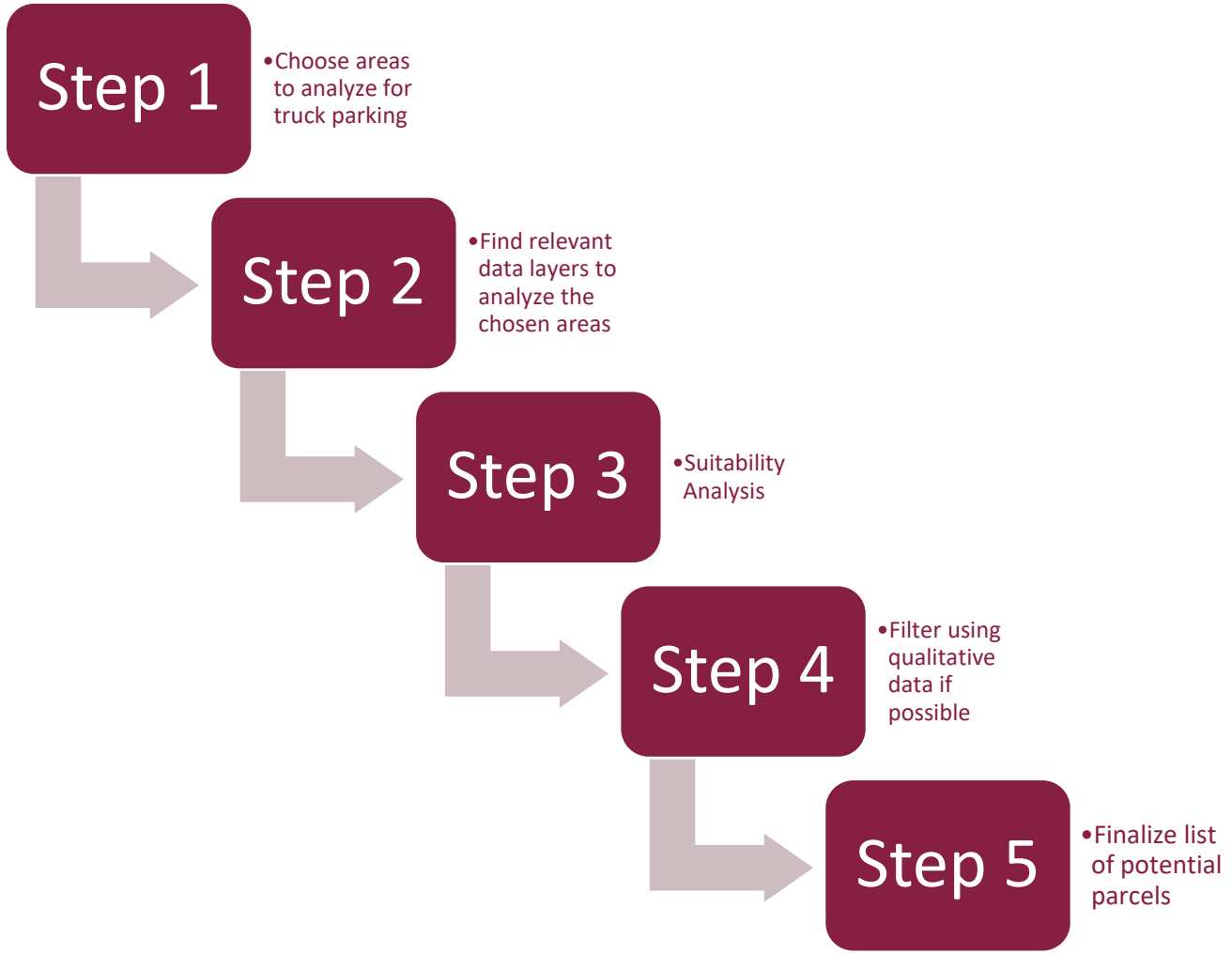
With the projected growth of truck traffic, the demand for adequate truck parking will continue to outpace the supply of public and private parking facilities.

NEW OPPORTUNITIES FOR TRUCK PARKING DATA

The data to identify new opportunities for truck parking was estimated from publicly available data available from Maryland's GIS open portal, the Chesapeake Conservancy, and the U.S. Geological Survey.

The Land Use/Land Cover data was retrieved from Maryland's GIS open portal. The High-Res land cover data was retrieved from the Chesapeake Conservancy. The terrain ruggedness was calculated based on elevation data from the U.S. Geological Survey.

DETERMINING USABILITY OF LAND PARCELS



PROCESS

Suitable Land Parcels

- Unutilized, publicly owned land, can be used as land to create truck parking.
- Underutilized private or public land, currently existing flat paved area that may be a current parking opportunity.

Choose area to analyze – Howard County, MD

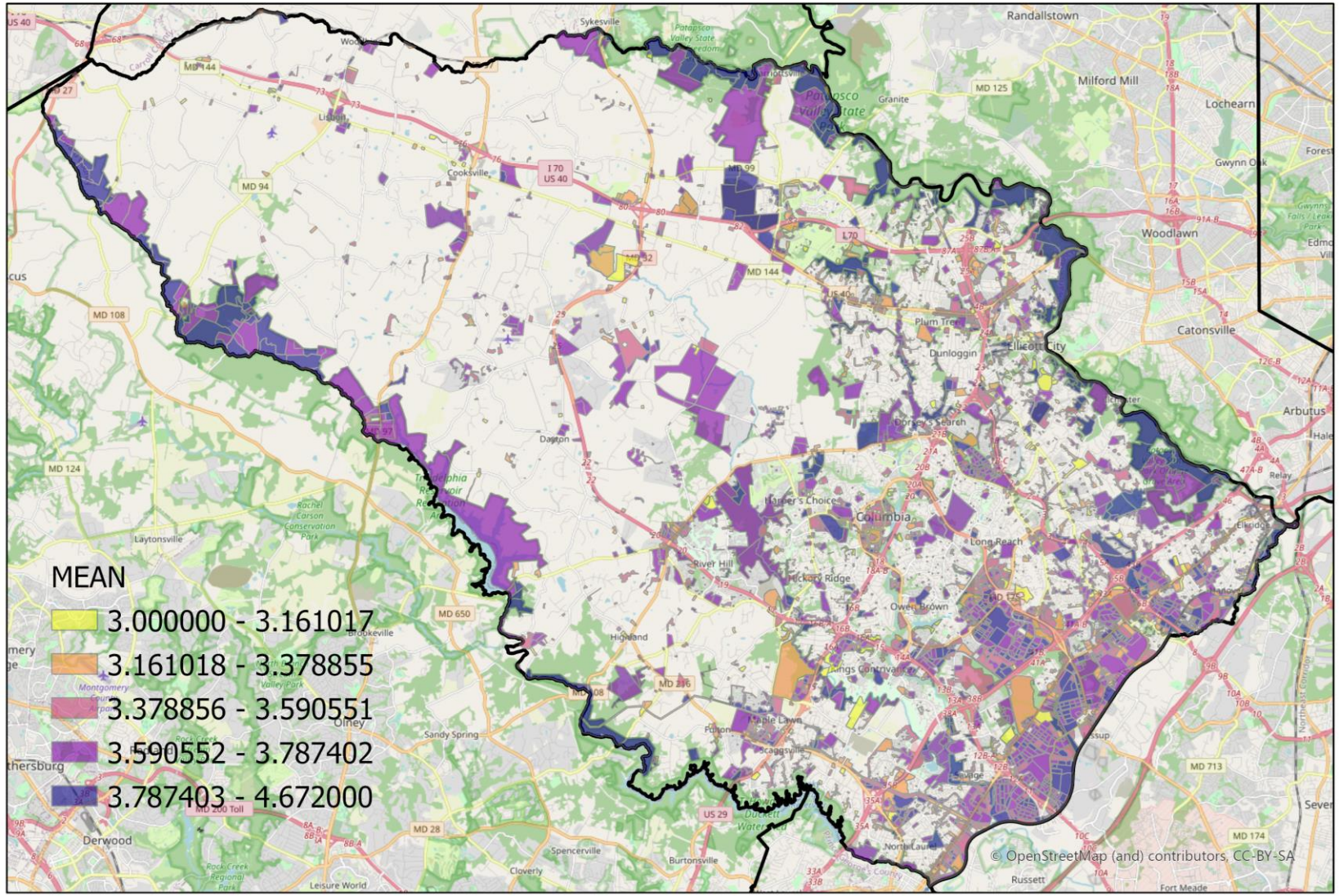
- Publicly Available data:
  - Land Ownership – MDOT GIS Database
  - Land Use / Land Cover – MDOT GIS Database
  - High-Res Land Cover – Chesapeake Conservancy
  - Elevation – USGS

PROCESS, CONT.

Suitability Analysis

- Reclassify qualitative data to be quantifiable
  - e.g., on a scale of 1 to 5
    - Tree cover and buildings are considered a "1," while paved surfaces are a "5."
    - Residential and Agricultural land parcels are a “1”, while Commercial and Exempt land parcels are a "5.”
- Assign a weight to each layer to analyze
  - Land Ownership (40%)
  - Land Use/Land Cover (20%)
  - High-Res Land Cover (20%)
  - Terrain Ruggedness (20%) – created from elevation data

Land Ownership Areas, Avg Land Suitability >= 3

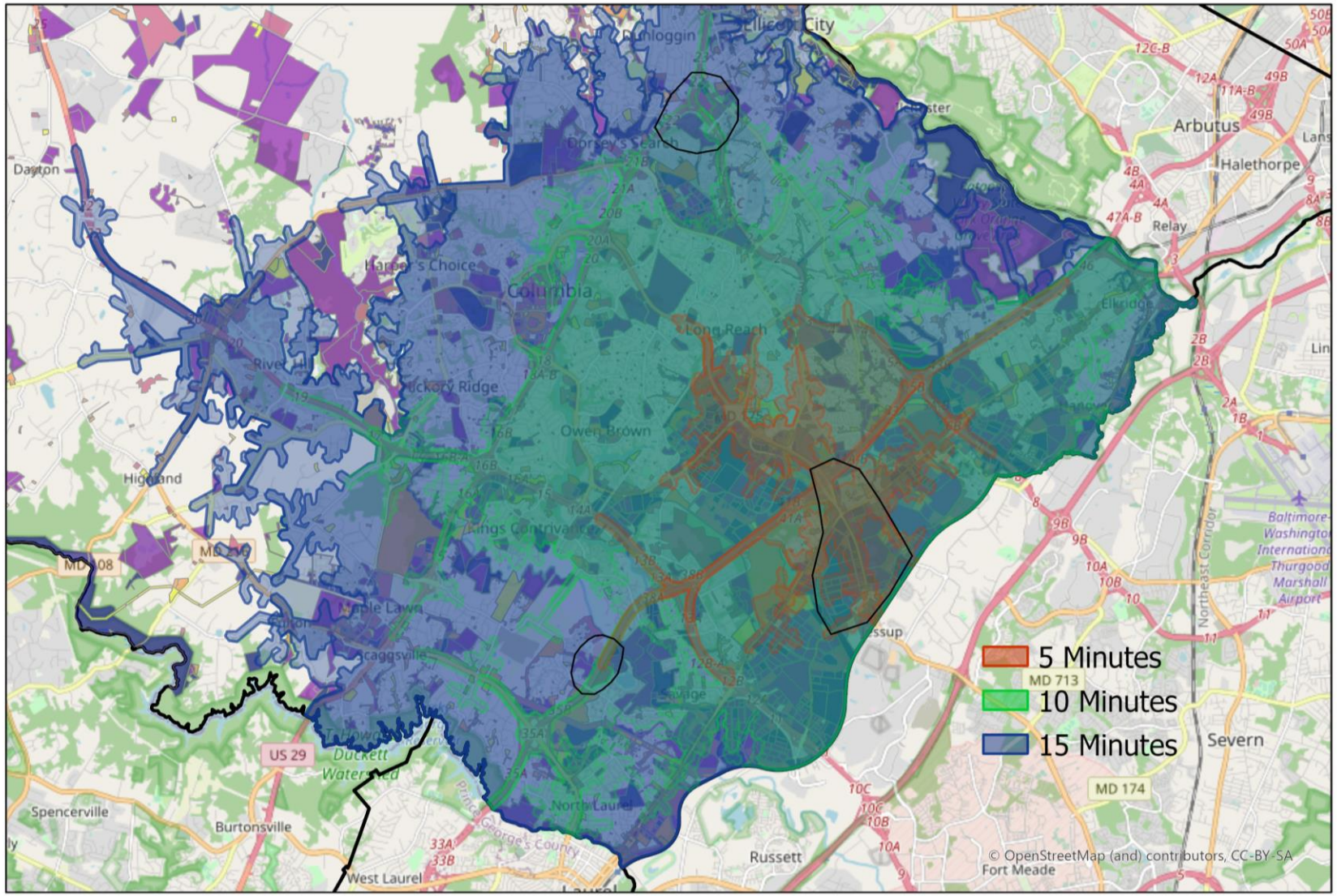


PROCESS, CONT.

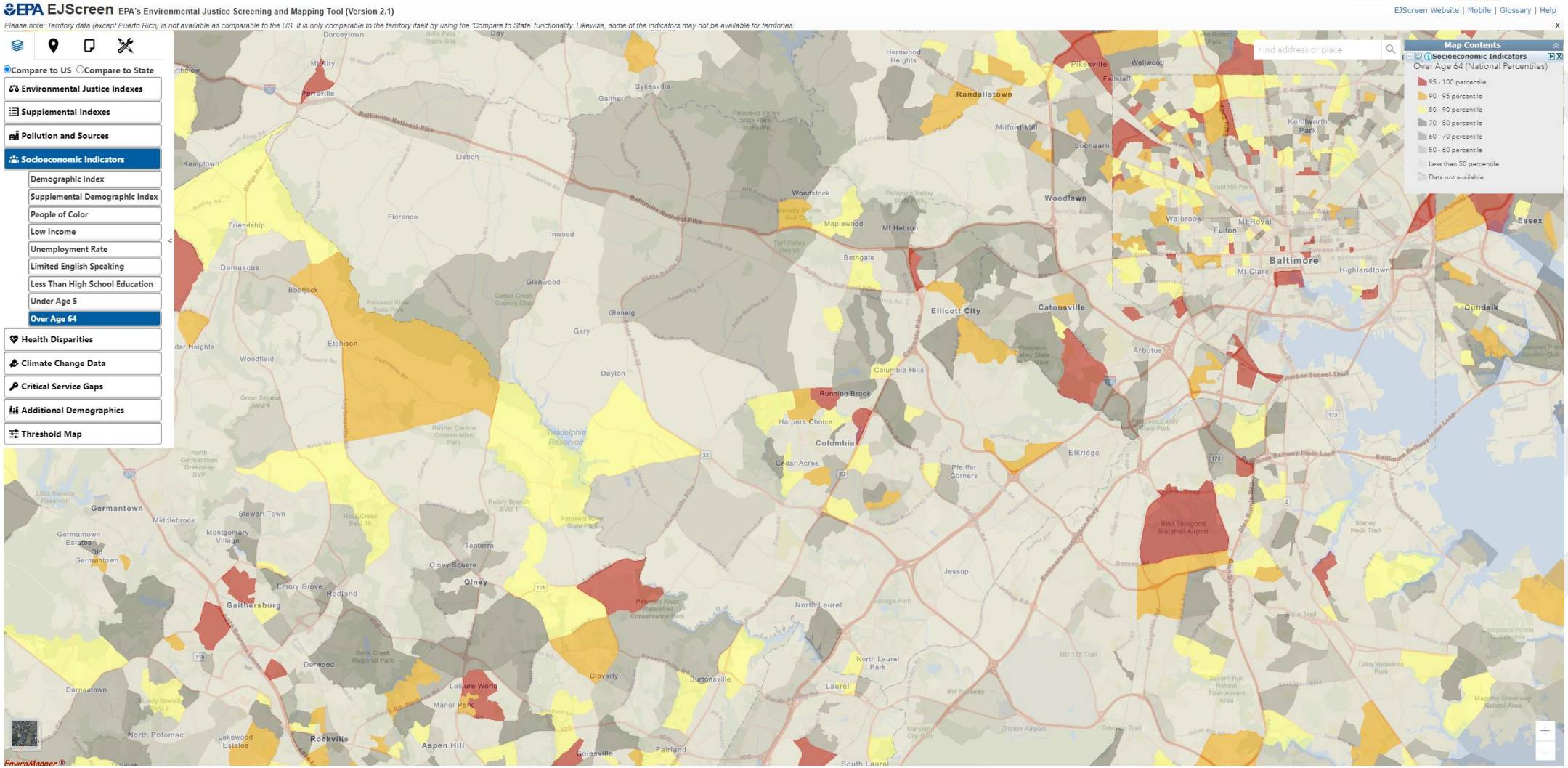
Qualitative and/or subjective data

- This analysis was intended to be a baseline for finding truck parking opportunities.
- Can be refined to reduce unsuitable layers from appearing higher in the list of potential parcels.
- Can add as many or as few different data layers that can be quantified for the analysis.

Example option for analysis - Drive Time Areas



OTHER OPTIONS FOR ANALYSIS – EPA'S EJSCREEN



PROCESS, CONT.

Finalizing list of potential parcels

- Ultimately, each potential parcel will need to be manually determined whether it is suitable for truck parking.

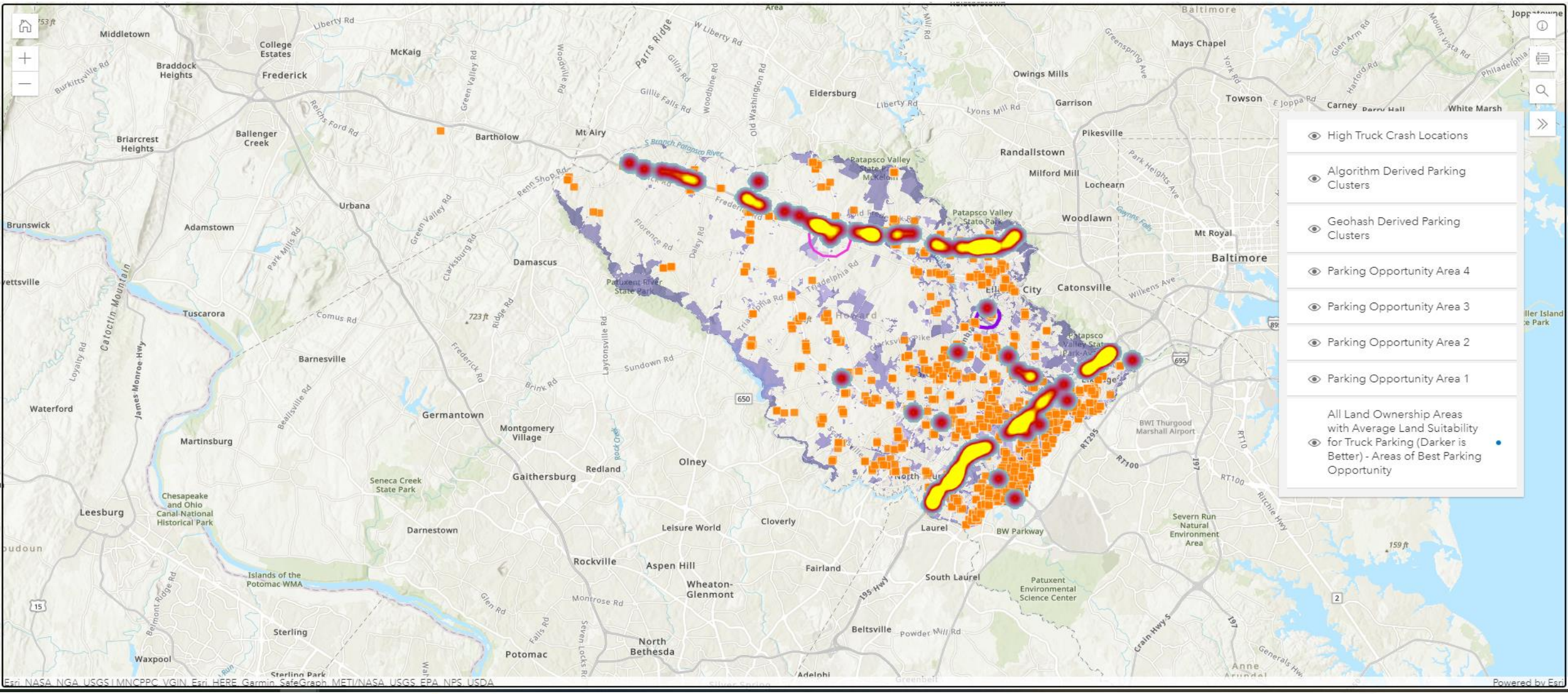
Final Result

- a reduction the scope of manual assessment needed by calculating each parcel's determined value in advance.

FINAL OUTPUT

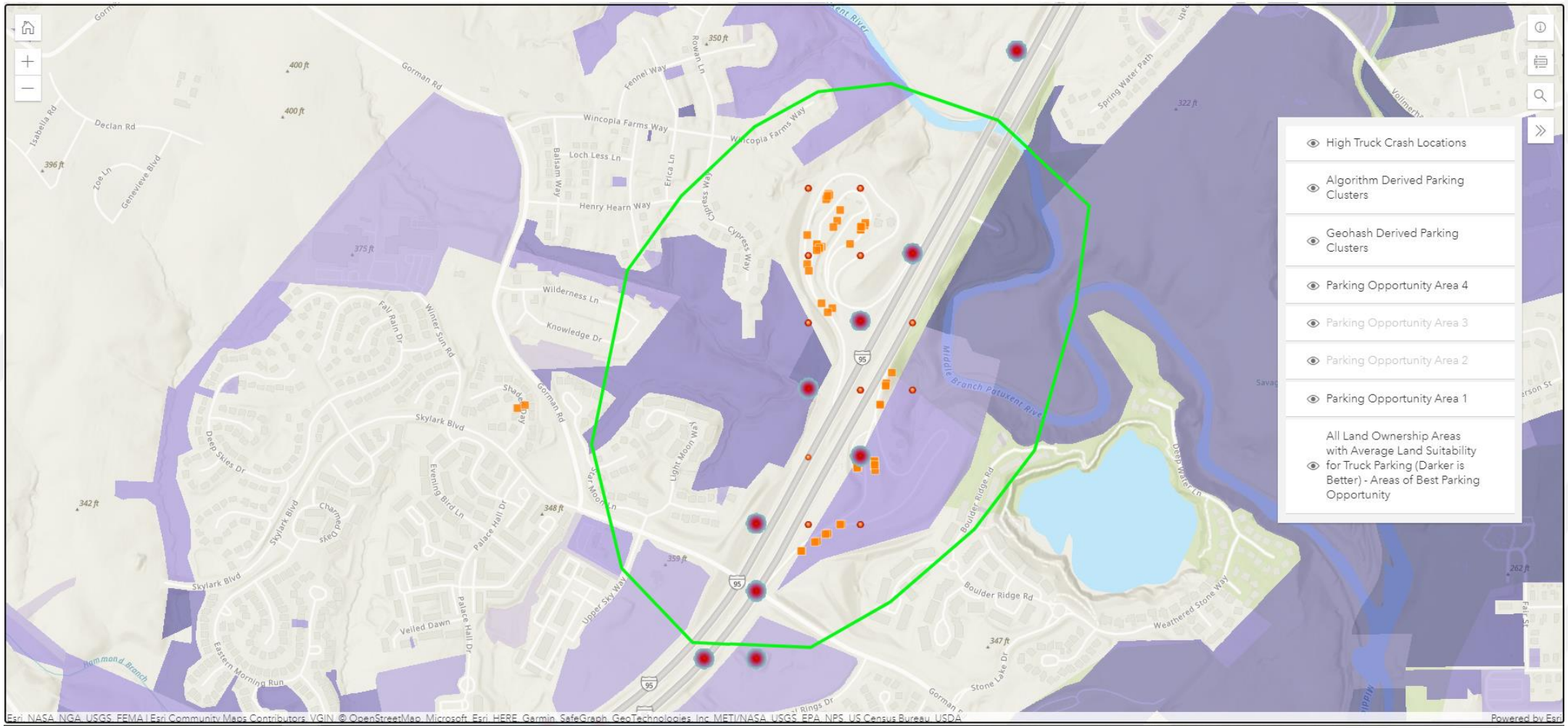
The research team decided that it was important to develop an interactive map of the combined data. Therefore, the team created an ArcGIS online map with all the data layers so that readers of this study and future researchers can explore the data in detail and replicate the analysis. The link for this map is: https://arcg.is/0rHnGH and a screenshot is shown on the next slide.

SAFE-D Parking Assessment (Demand and Opportunity)



AREA 1: LAUREL WELCOME CENTER

SAFE-D Parking Assessment (Demand and Opportunity)

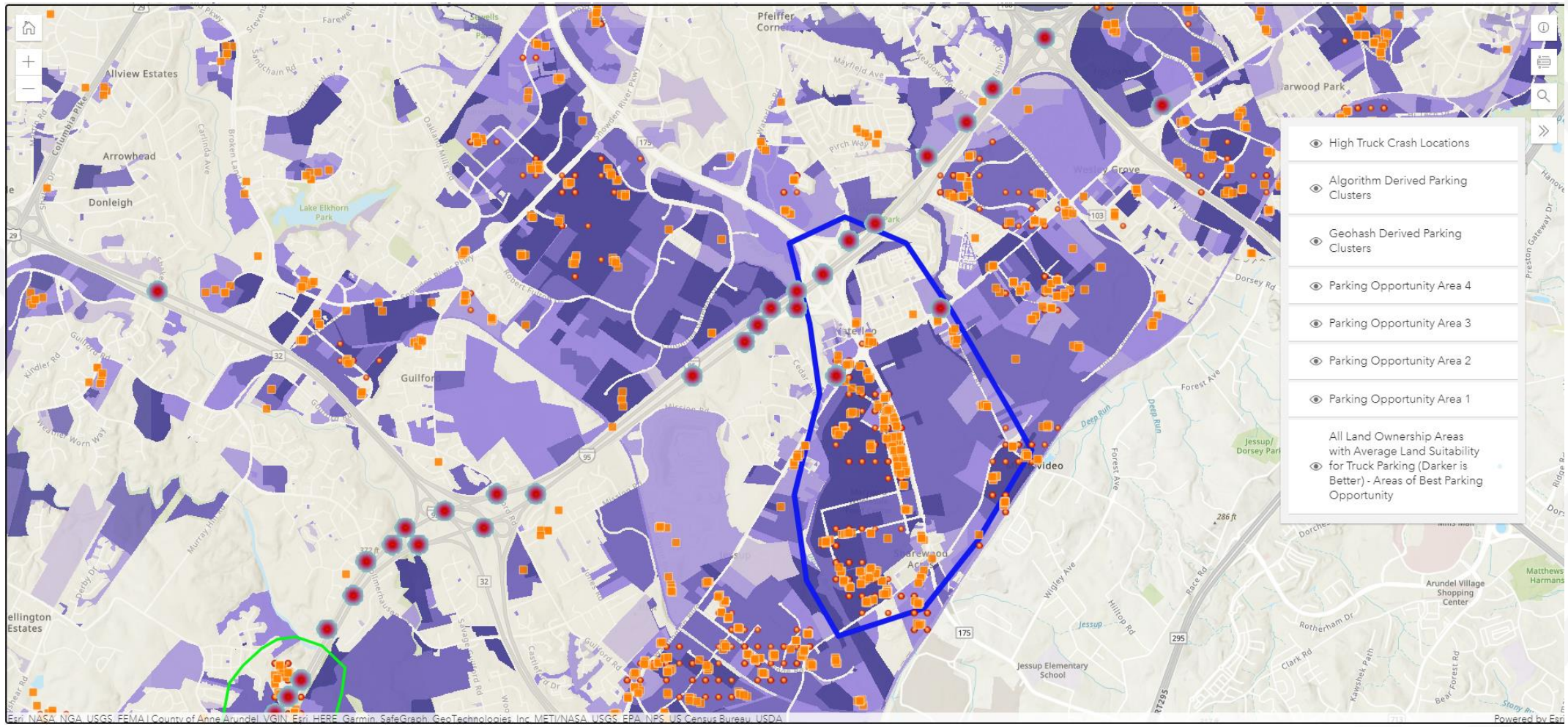


AREA 2: WEST FRIENDSHIP

SAFE-D Parking Assessment (Demand and Opportunity)

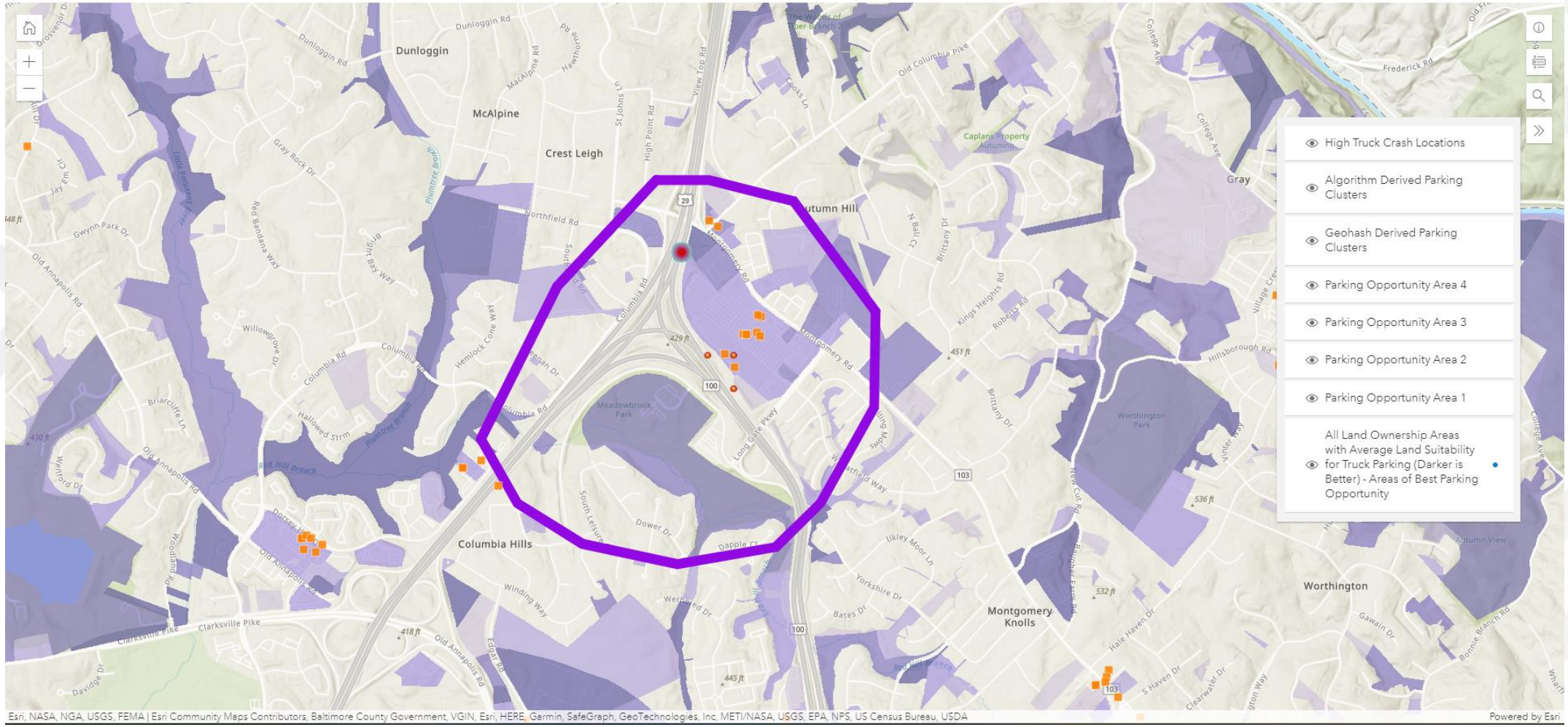
AREA 3: WATERLOO AND JESSUP AREA

SAFE-D Parking Assessment (Demand and Opportunity)



AREA 4: AUTUMN HILL

SAFE-D Parking Assessment (Demand and Opportunity)



STAKEHOLDER INTERVIEWS

Stakeholder interviews were completed in March and April 2022.

- State DOT staff
- Technology providers
- Shipping companies
- Truck drivers

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

- Trucker Path mobile app
- One app that can be used in every state
- Private truck stops are often unwilling to share information

ELECTRONIC LOGGING DEVICE (ELD) SOURCES

- Use of ELDs was supported by truck drivers
- Different ELDs leads to a risk that the information will not get to all truck drivers

CURRENT INFORMATION TECHNOLOGY SYSTEM SOLUTIONS

- Inconsistency from state to state
- Needs to be within 5 miles of a facility

IN-CAB IS BEST

- Simple and minimal information
- Need option to pull over and open a mobile app for more information on facilities and amenities.

ACCURACY IS KEY

- Messaging platforms need to display the correct, reliable information in real-time

PARKING AVAILABILITY

- Need the actual number of spaces available

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 an opportunity in assessing data, like truck probe data, and in disseminating it.

QUESTIONS?


SAFE-D
SAFETY THROUGH DISRUPTION
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