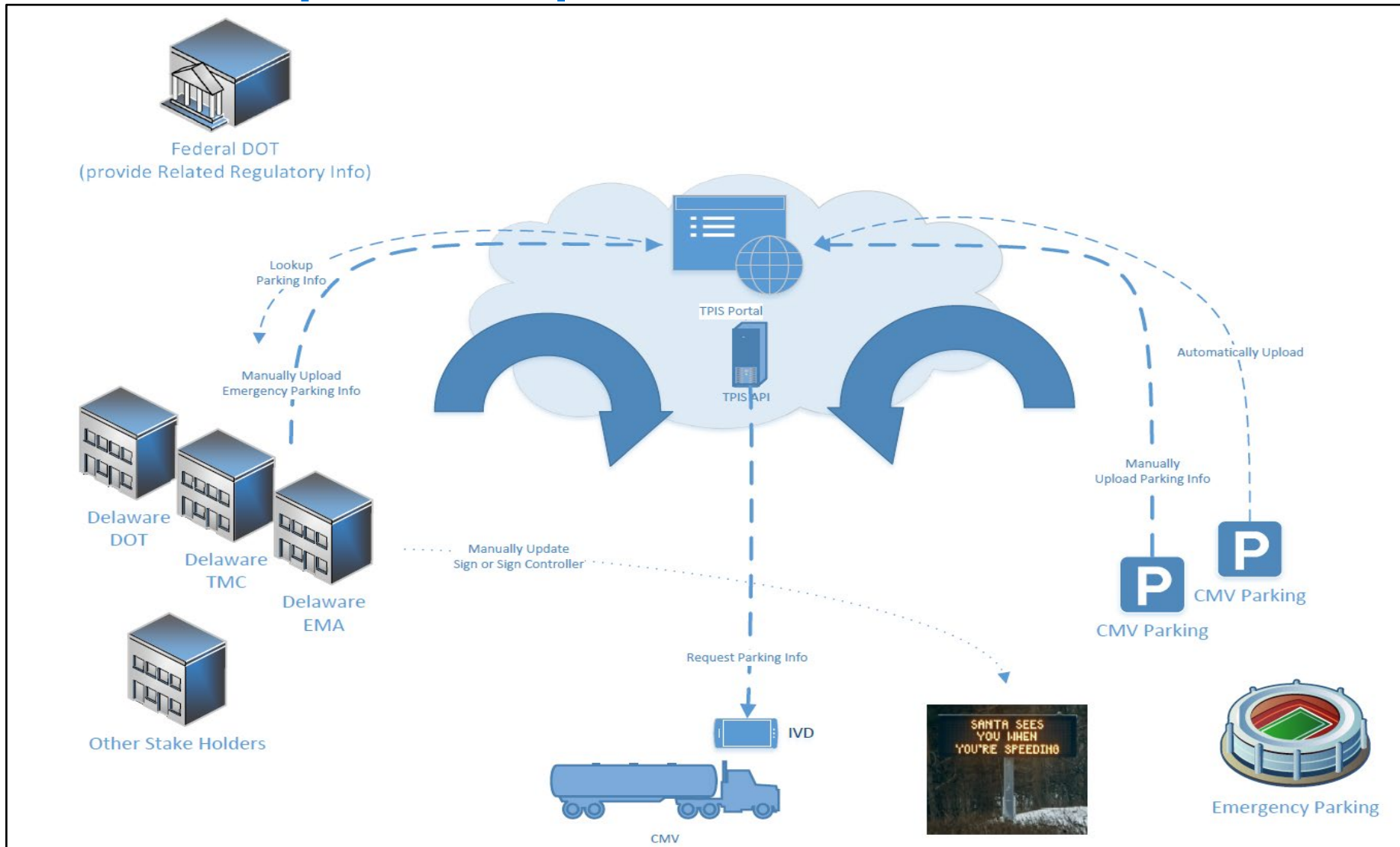# Delaware DOT
Truck Parking Information System (TPIS)

Project Summary

December 7th 2022

Project Background

- In spring 2019, the Volpe Center began working with DelDOT to identify potential truck parking locations in Delaware and to develop a pilot system for providing parking availability information at these location(s) to CMV drivers in a safe and non-intrusive manner.

  - Identify at least two potential truck parking locations in Delaware;

  - Develop a truck parking database system and related capabilities to allow the system to share real-time parking space data with a variety of truck driver accessible systems;

  - Conduct a TPIS demonstration; and

  - Develop recommendations to expand TPIS to be a regional or national parking information system.

TPIS Concept of Operations

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Initial System Overview—Description

- Two potential locations were considered—Delaware House and Smyrna Rest Area.

  - The Smyrna Rest Area (Smyrna) was selected for the pilot TPIS because DelDOT operates Smyrna but does not operate Delaware House.

- The initial pilot TPIS consisted of:

  - A TPIS portal [web application, database, and application programming interface (API)]

  - In-Ground Sensors (company: PNI)

  - Video Sensors (two companies: Uncanny Vision and WiseMoving)

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Initial System Overview—Description

- The TPIS portal was designed to support both manual entry and automated update of parking space information.

- The TPIS API allows DelDOT and third-party applications to pull parking information availability from TPIS.

  - All parking lots—returns the list of all parking lots in the database and their space status, including maximum capacity and available spaces

  - Parking lot by name—returns information on the named parking lot, including maximum capacity and available spaces

  - Parking lot by location within a radius—returns the list of all parking lots within a specified radius of lat-long coordinates along with their space status

TPIS Database System—Example Data

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Video Sensor—Uncanny Vision Screenshot

Video Sensor—WiseMoving Screenshot
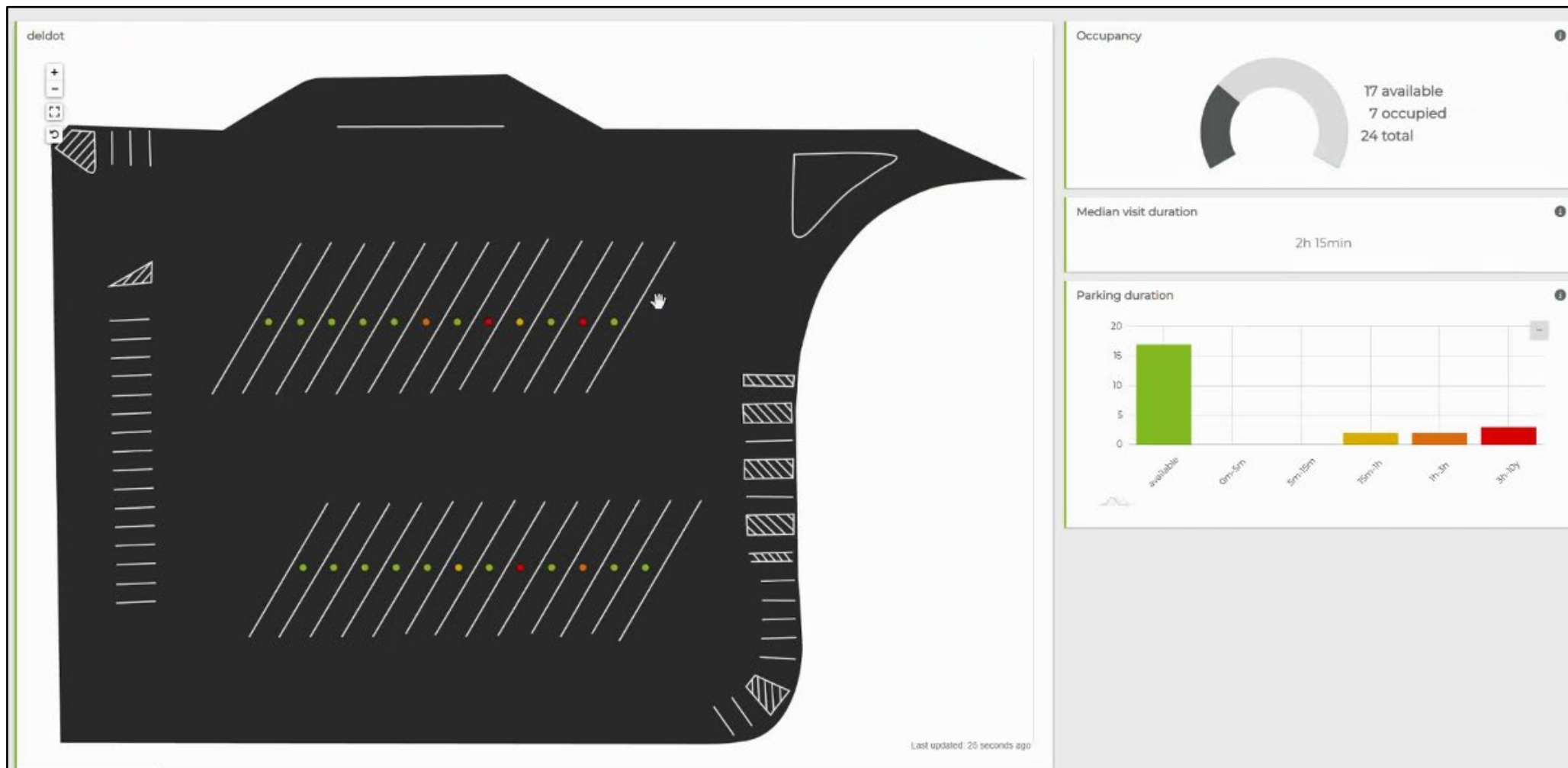
May 2021 Project Progress Meeting

- On May 27, 2021, the Volpe project team presented a TPIS status update to DelDOT.

- Participants discussed the challenges associated with in-ground sensors:

  - Smyrna is mixed use (tractor trailers, personal vehicles, other). At least three sensors per parking space are required to fully determine space occupancy.

  - Calibrating the sensitivity of the sensors is tricky.

  - The sensors are battery powered and need to be replaced every 3-5 years.

May 2021 Project Progress Meeting—Results

- Based on meeting discussions, DelDOT decided to:

  - Discontinue in-ground sensor testing.

  - Continue testing both video-based space counter systems.

  - Explore the options of installing taller poles at Smyrna to improve coverage and accuracy of the video-based counter systems OR adding two more cameras for full coverage of the 24 spaces.

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2022 Project Progress Meetings

- During project meetings in early 2022, DelDOT decided to:

  - Interface directly with source parking information rather than host the TPIS portal and database.

    - DelDOT selected WiseMoving's API for determining the status of parking spaces at Smyrna.

    - The TPIS also allows DelDOT applications to interface with Virginia DOT's API (i95truckparking).

  - Add two additional cameras to Smyrna to provide full coverage of the 24 parking spaces.

  - Bring the four cameras at Smyrna into Delaware's network.

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Summer 2022—TPIS Migration to DelDOT

- Volpe assisted DelDOT in planning the migration of the web portal and database to a DelDOT server.
  - Ultimately, DelDOT chose not to host the TPIS server.

- Volpe worked with DelDOT to develop a plan for bringing the four cameras at Smyrna into Delaware's network by bringing the network to the Smyrna shed housing the sensor station antenna.
  - Ultimately, DelDOT provided a dedicated broadband router for the Smyrna cameras.

- Volpe facilitated discussions between DelDOT and WiseMoving.
  - WiseMoving signed DelDOT's Data Usage Agreement Terms and Conditions (T&C) and Cloud Services T&C in July 2022.
  - WiseMoving provided DelDOT with an annual subscription service and camera maintenance agreement in August 2022.

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Additional Camera Installation

- The installation of two additional cameras at Smyrna in September 2022 provides full coverage of the 24 parking spaces.

- All cameras were updated to secure https in September 2022.

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Existing System Overview—Description

- The major TPIS components are:

  - TPIS web application and database—to be replaced with direct access to sensor API when TPIS transitions to DelDOT on 30 Sept 2022.

    - Static truck parking information (capacity only)
    - Static emergency parking information (capacity and manual availability)
    - Accounts for third-party parking information (capacity and manual availability)
    - API for third-party parking information—dynamic (capacity and manual availability)
    - DelDOT parking sensors—dynamic (capacity and manual availability)
    - API for query

  - Smyrna Parking Space Status System

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Smyrna Parking Space Status System

- The parking space status system at Smyrna includes:

  - TPIS Sensor Station with a broadband router that provides internet access to the four cameras.

  - Four TPIS cameras mounted on lamp posts.

  - Video analytics provided by WiseMoving.

Sensor Station and Camera Boxes

- The sensor station and camera boxes include NetGear switches and Ubiquiti NanoStation range extenders.

- Camera boxes also include Axis cameras.

- The Sierra broadband router provides internet access for the system.
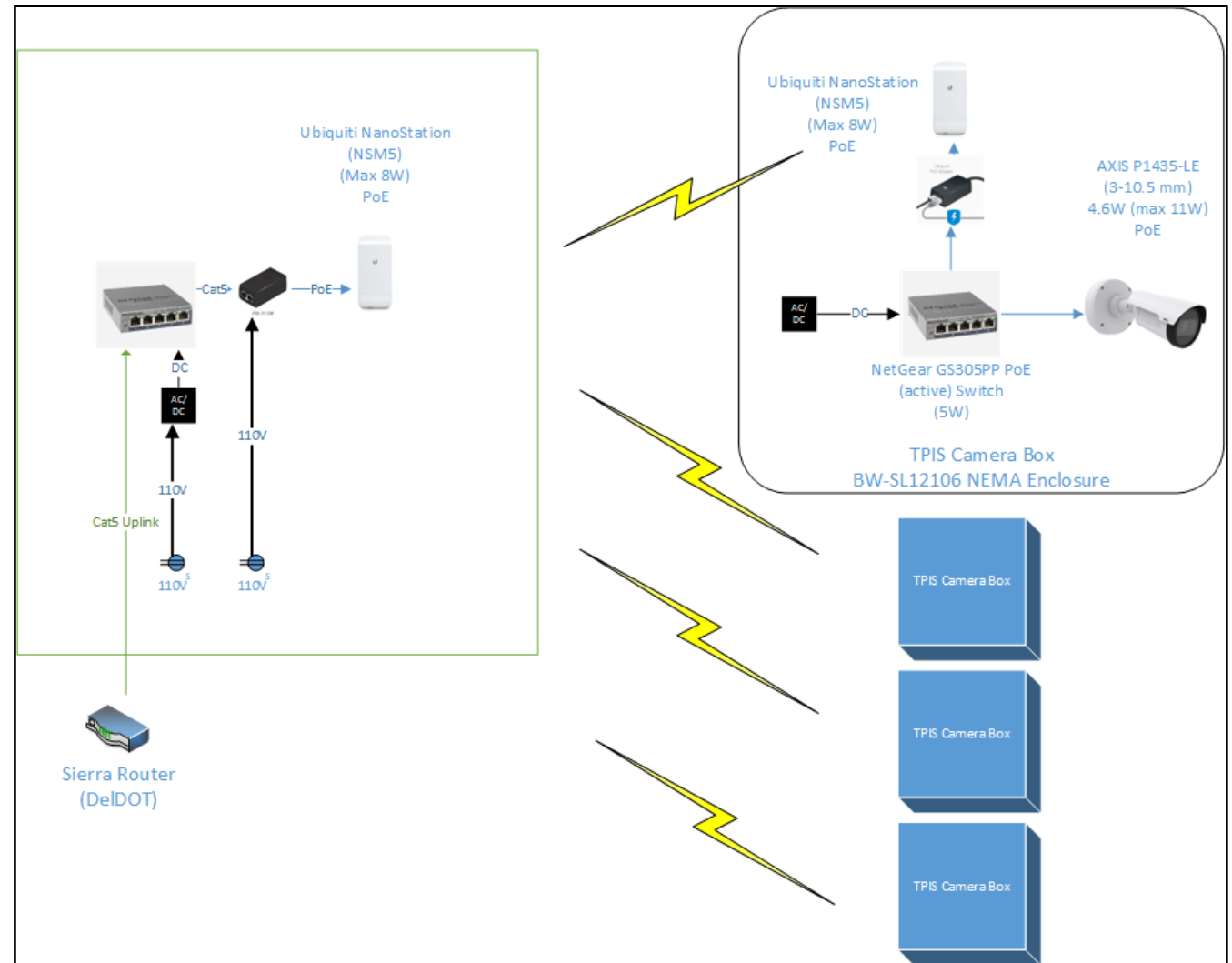
WiseMoving Video Analytics

- The four cameras upload images to WiseMoving.

- The images are analyzed.

- The results are shown on the Administrator Dashboard.

- The results are available via Application Programming Interface (API).

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Administrator Dashboard—Map View

- Green dots depict available spaces.

- Other dot colors depict occupied spaces and the duration of occupation.

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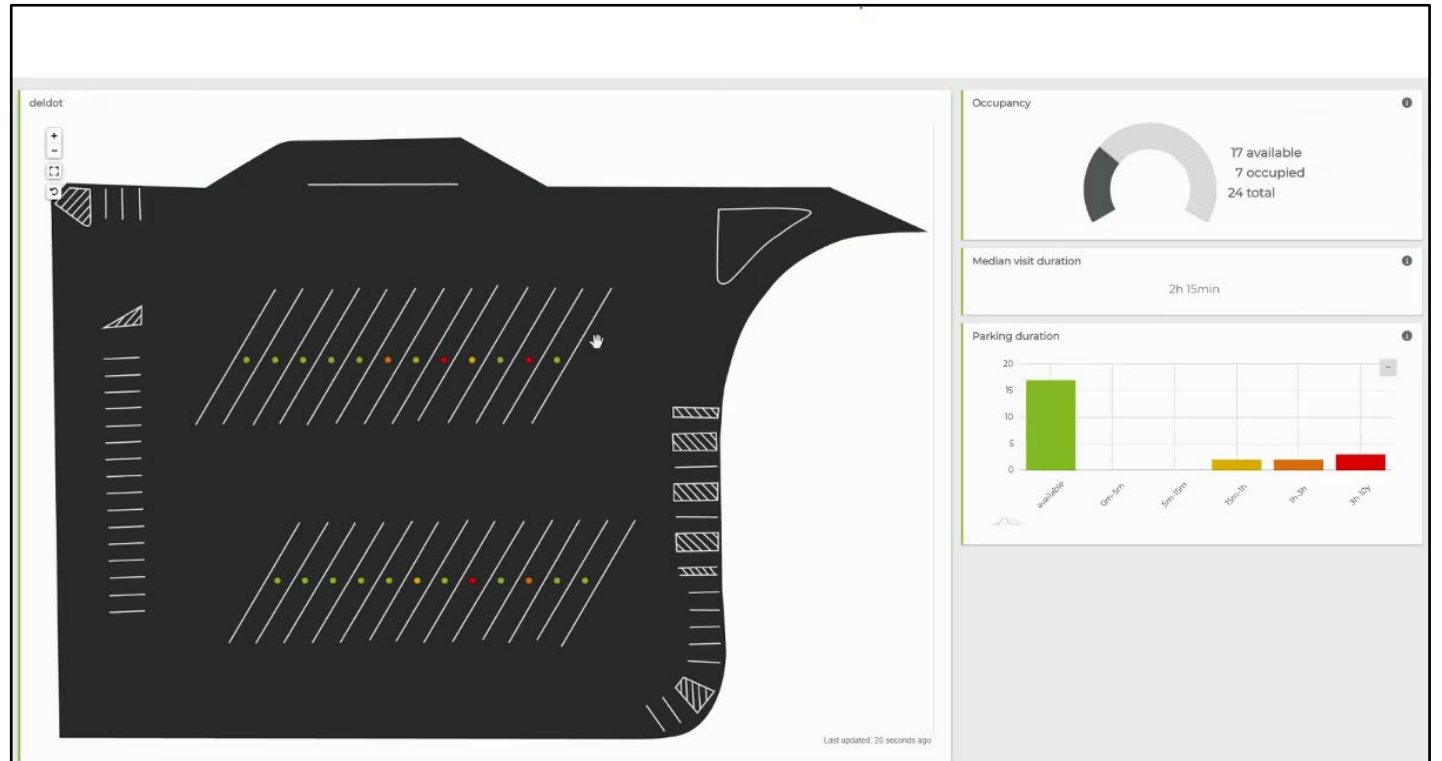
Administrator Dashboard—Stats
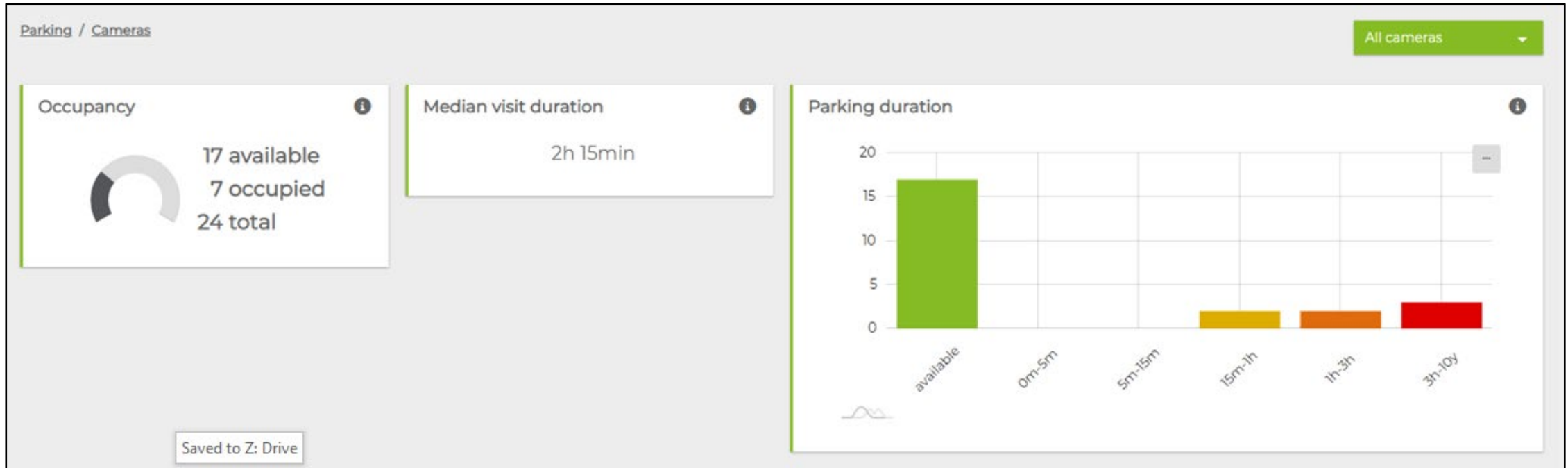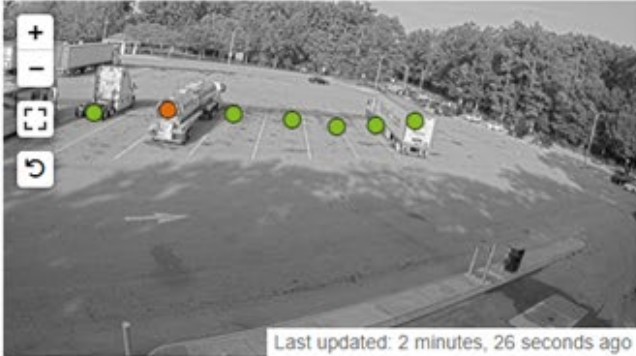
Administrator Dashboard—Camera View

Demonstration Plan

- A tabletop demonstration of the TPIS was conducted on September 22, 2022.

- The objective was to demonstrate the advantages a single or centralized source of parking information has over multiple, separate sources for vehicle operators who need to find an available, safe place to stop driving and rest.

- Three scenarios were tested:
  - Space availability at a specific facility
  - Space availability at multiple facilities
  - Emergency parking spaces activation

Demonstration Results—Space Availability at a Specific Facility

Scenario: Truck operator is familiar with Smyrna and has planned to stop there. Before starting the trip, the operator sets up an app linked to the TPIS database to show space availability at Smyrna. During the trip, the app is periodically updating the screen to show the status at Smyrna.

Driving down Route 1, before the first Route 13 exchange, the operator checks space availability at Smyrna. If spaces are available, the operator will continue on Route 1 to the Smyrna exit. If there are no spaces, the operator will take Route 13 in hopes of finding a space along Route 13.

When the facilitator informed the exercise that the operator was approaching a decision point—the first Route 1/Route 13 exchange—the operator checked the simulated in-vehicle device, noted that there were 10 available spaces at Smyrna, and announced the decision to stay on Route 1 toward Smyrna.

Small screen on simulated in-vehicle device showing 10 available spaces at Smyrna.

Success: The demonstration showed that the TPIS can successfully be used by a truck operator to find a parking space at Smyrna.

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Demonstration Results—Space Availability at Multiple Facilities

Scenario: Truck operator is driving a tractor trailer from MA to Port of VA. Unforeseen traffic delays in the NY/NJ area require the operator to make an overnight stop. Enroute in Philadelphia the operator needs to decide whether to stay on I-95 and stop in MD or VA or turn into DE and stop at Smyrna / other DE location. Before starting the trip, the operator sets up an app linked to the TPIS database to show space availability along the route. During the trip, the app is periodically updating the screen to show space availability.

Facilitator first demonstrated a scenario when the operator does not have access to a single truck parking information source. In this variation, the operator searched different sources. This activity would not be safe for the operator to perform while driving.

As operator approached Philadelphia, the facilitator informed exercise that now would be a good time for the operator to think about where to stop. Operator checked the simulated in-vehicle device as a single truck parking information source, noted limited spaces at VA locations but more available spaces at Smyrna, and decided to exit I-95 and proceed south toward Smyrna.
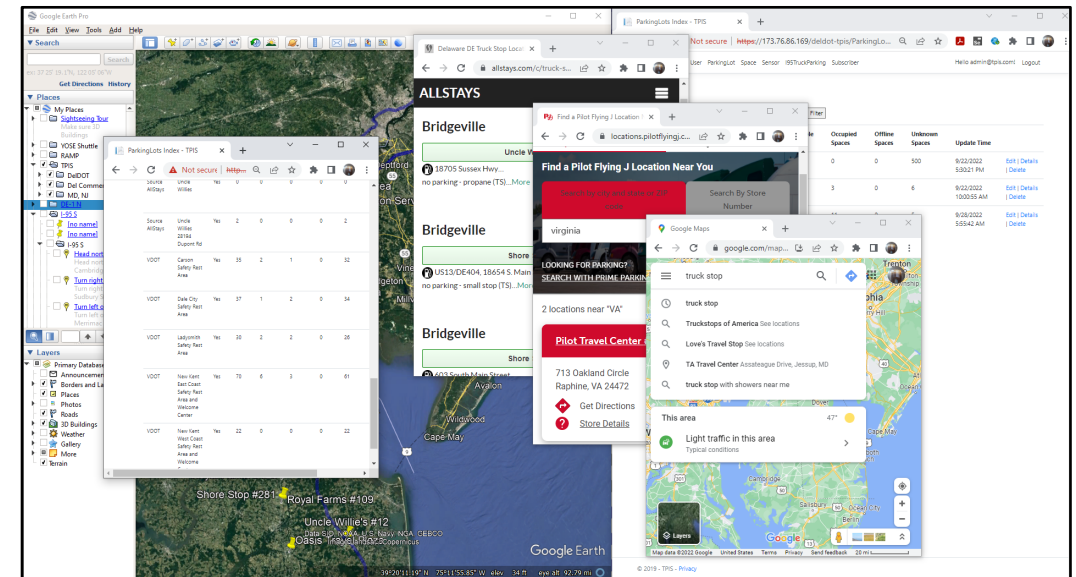
Small screen on simulated in-vehicle device with access to TPIS data as a single source for truck parking information. The three small, layered screens simulate the operator searching across multiple sources of truck parking information.

Success: The demonstration showed that the TPIS can successfully be used by a truck operator to find parking spaces along the Port of VA route.

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Demonstration Results—Activation of Emergency Parking Spaces

Scenario: Truck operator is driving a tractor trailer from MA to Port of VA, with plans to drive through DE. As the operator enters DE, a hurricane that hit SC earlier in the day and originally was moving east to sea unexpectedly turns north, heading towards VA, MD, and DE. All roads are being closed with all drivers directed to shelter. In response, DEMA activates emergency truck parking facilities.

Before starting the trip, operator sets up an app linked to the TPIS database to show space availability in DE in case of traffic delays in NY and NJ. During the trip, the app is periodically updating the screen to show space availability.

Facilitator informed exercise of the hurricane's change in direction and that DEMA is instructing all vehicles in DE to get off the roads.

- DEMA coordinated with the TMC, used the TPIS administrative dashboard to activate the simulated emergency parking area at DE Park Raceway, and updated roadside message boards.

- Operator checked simulated in-vehicle device, noted 500 potential spaces at emergency parking area and only 8 at Smyrna, and decided to proceed to DE Park Raceway.
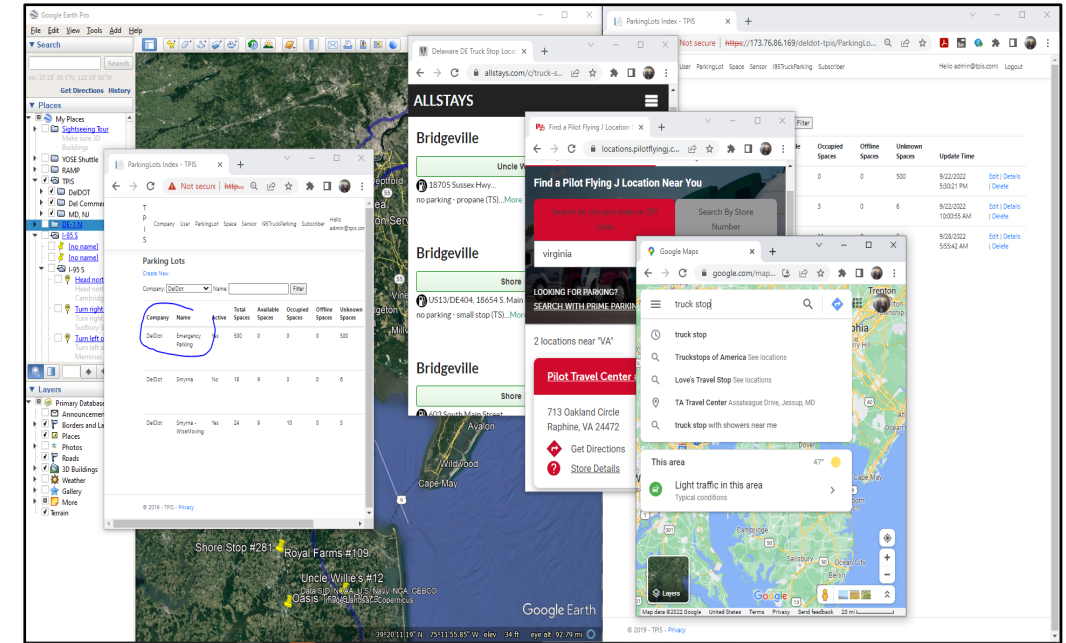

Small screen on simulated in-vehicle device with access to TPIS data showing activation of emergency parking area and available spaces at Smyrna.

Success: The demonstration showed that the TPIS can successfully be used by a truck operator to see parking spaces available at traditional and emergency parking locations.

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Recommendations

- Expand TPIS to be a regional, collection of regional, or a national repository of truck parking information.

- Expand information collected to provide more useful aids to truck operators.
  - Collect specific route and direction information. For example, if parking locations "southbound on I-95" can be selected for the scenario of the operator travelling from MA to the Port of VA.

- Expand sites with automated truck parking sensors.

- Install automated sensors at more parking facilities.

- Maintain historical truck parking space usage / availability data to provide predictive recommendations.
  - For example, in the scenario where the operator leaves MA at 0600, Smyrna had no available spaces. At 1200 when the operator is in NJ and needs to decide which route to take, Smyrna had 20 available spaces. The operator really needs to know how many spaces will likely be available when the truck is due to arrive at Smyrna.

- Develop in-vehicle applications to showcase parking location search capabilities.

- Share data with map and direction service providers.

- Incorporate truck parking locations into DelDOT TMC Maps.

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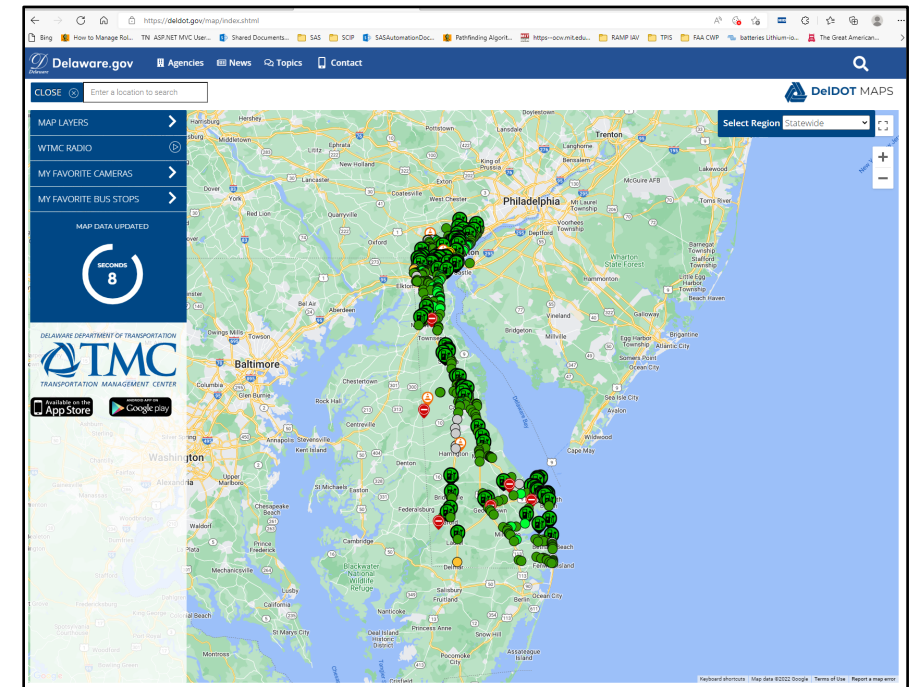
Questions?

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Our Purpose
Advancing transportation innovation for the public good.

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Innovative Solutions

Collaboration and Partnering

Professional Excellence

Employee Well-Being