STATE HIGHWAY ADMINISTRATION

Teri Soos, PE

Deputy Administrator

Hanover Operations

Maryland Department of Transportation

State Highway Administration

MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

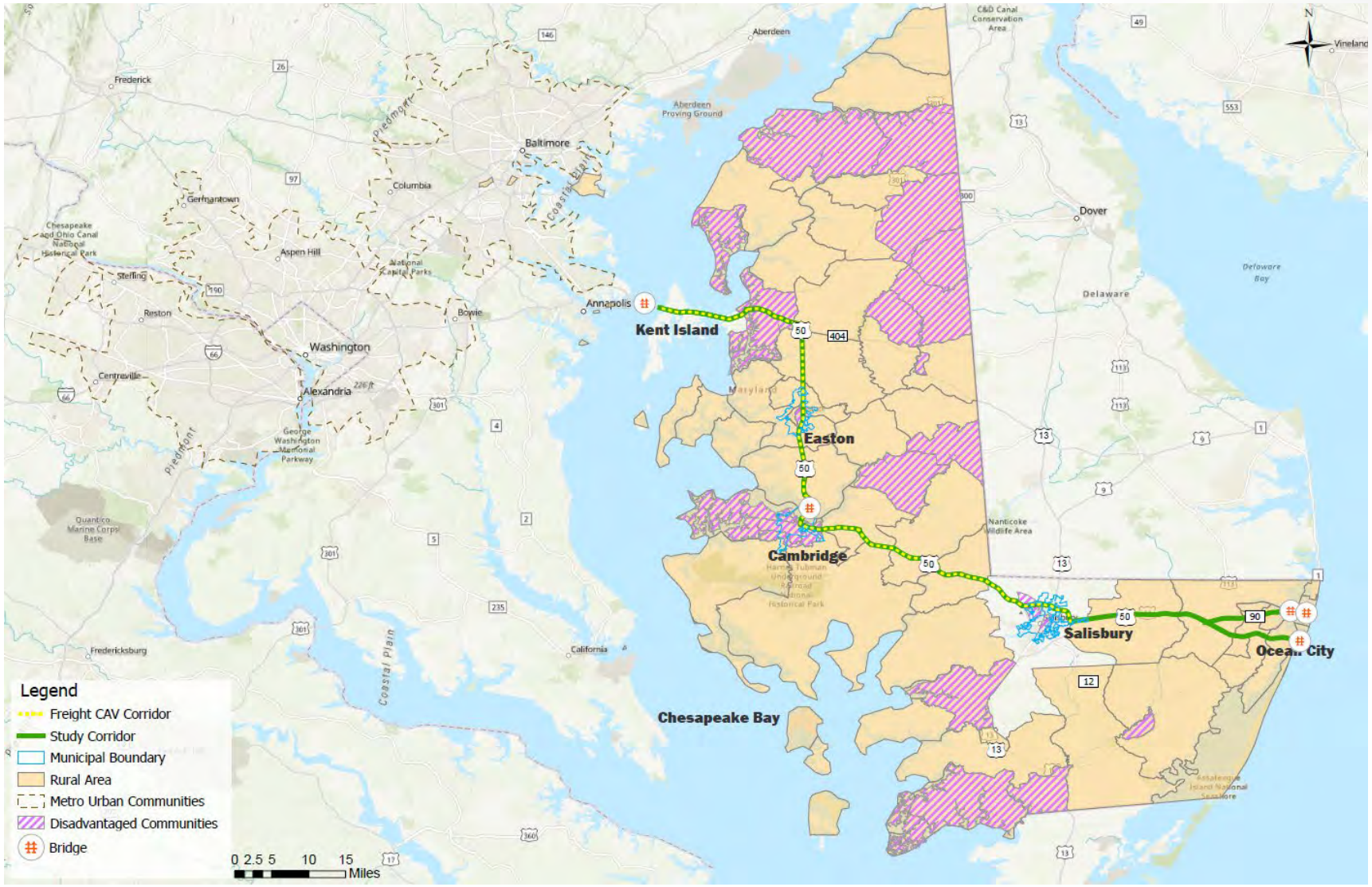
ROUTE 50

"Rural Opportunities to Use Traffic Technology Enhancements (ROUTE) on US 50"

Advanced Transportation Technologies and Innovative Mobility Deployment (ATTIMD) Program

August 29, 2023

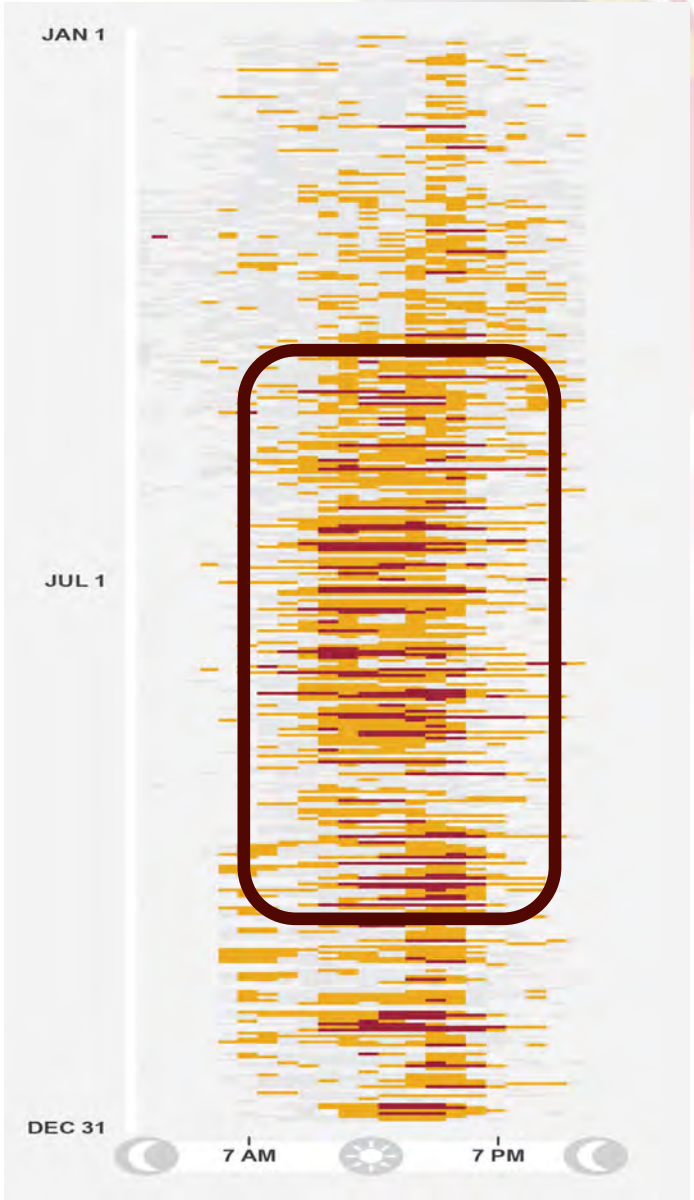
PROJECT AREA



- Maryland's Rural Eastern Shore
- 113-mile corridor
- Connects Baltimore-Washington Metro to Atlantic Beaches
- Seasonal Congestion makes US 50 a barrier
- Disadvantaged Region
- Critical Rural Freight Corridor
- High fatality rate

CONGESTION IMPACTS

- $78 Million Annual Cost
- Seasonal + Holiday is 50% of the annual cost but only 7% of the hours in a year.
- Rear-End Crashes - 30% of the 1,500 annual crashes.
- Local Gridlock due to diversions from US 50
- Freight delays > 100,000 hours per year.
- Access to Jobs. 20-50% of the workforce travels out of the county they live in
- Agricultural impacts during summer harvest



2019 Hourly Cost of Congestion
Red = Severe
Yellow = Heavy
No Color = Moderate to None

TECHNOLOGIES

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Incident & Event Management

- Q2 Inverse Traffic Responsive Pattern Selection (TRPS) Signal System
- Machine Learning Traffic Prediction
- Incident Signal Timing Plans
- Freeway Incident Traffic Management (FITM) Plans

Traffic Management

- Adaptive Signal Control Technology (ASCT)
- Connected Vehicle Systems: Curve Warning & Signal Timing Phasing & Timing (SPaT)

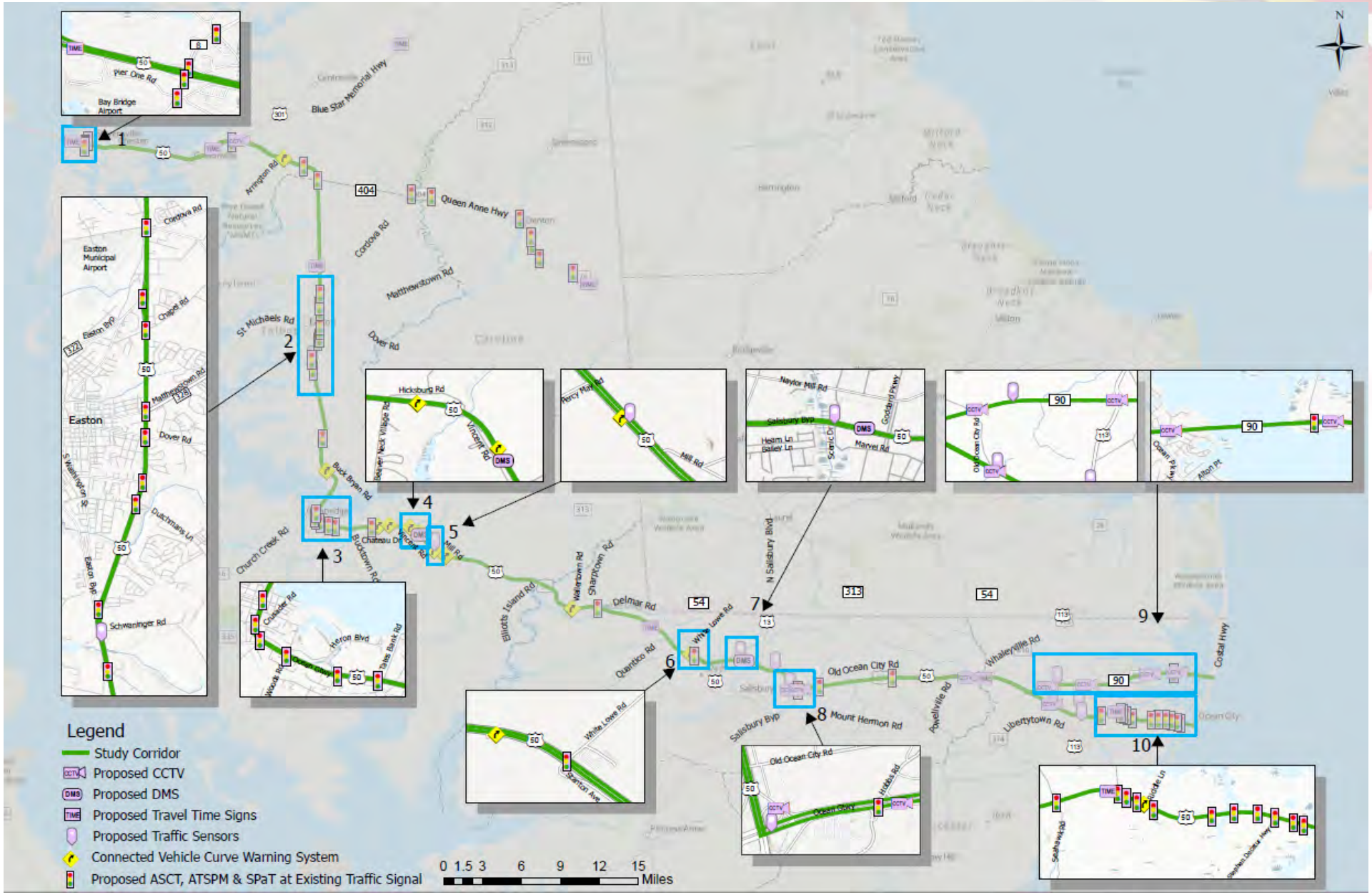
Traffic Monitoring & Performance

- Automated Traffic Signal Performance Measures (ATSPM)
- Traffic Sensors: CCTV, Volume & Speed Detectors, Origin-Destination & Travel Time Detectors TMC & ATMS Integration

Traveler Information

- Alternative Route Travel Time Signs
- Dynamic Message Signs (DMS)
- Travel Information Via Web Sites
- Push Notifications for Hotel & popular online Vacation Rental Platform Apps

TECHNOLOGIES

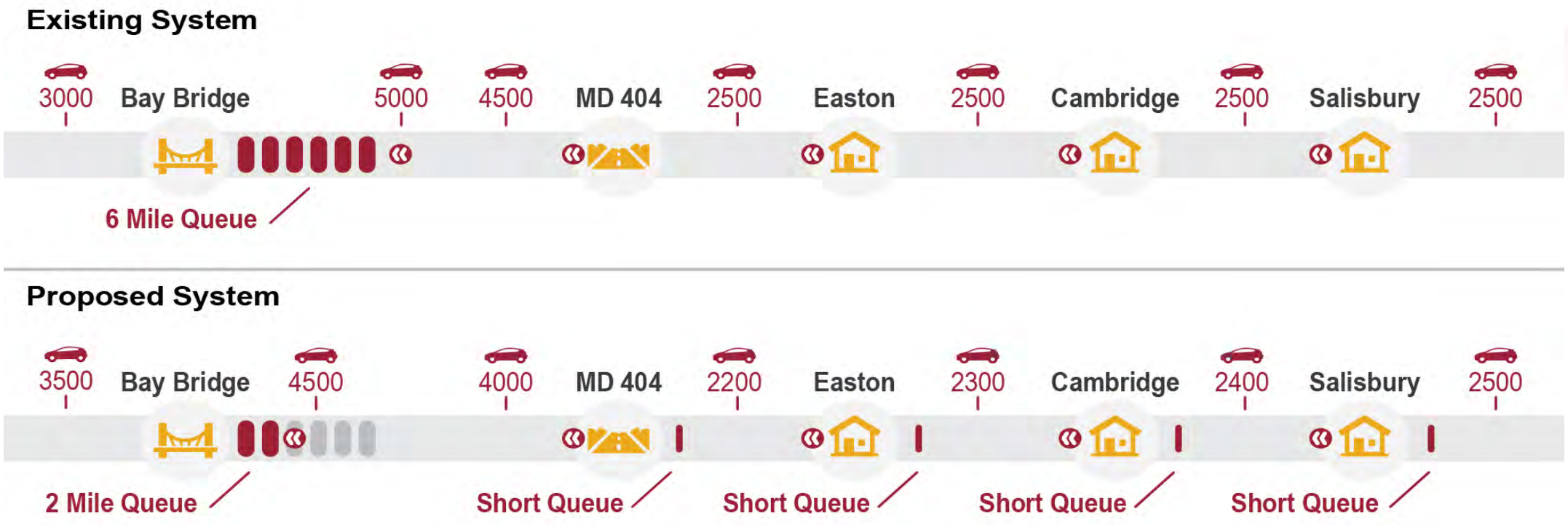


CONNECTED VEHICLE INFRASTRUCTURE

- Signal Phasing & Timing (SPaT)
  - 48 traffic signals
  - Enable future applications:
    - Intelligent Traffic Signal System (I-SIG)
    - Eco-Approach & Departure at Signals
    - Red Light Violation Warning
    - Freight Signal Priority
- Curve Speed Warning
  - 8 horizontal curves on US 50
  - Concentrated in the Cambridge area
- No V2X for VRUs
  - No opportunities due to rural corridor

Q^2 INVERSE TRAFFIC RESPONSIVE (TR)

- **Q**uality of Life & **Q**ueue Management = Q^2
- Inverse signal timing strategy to meters traffic and reduce throughput
- Reduce queues at the Bay Bridge to improve mobility in Kent Island
- Keep long queues out of Easton, Cambridge and Salisbury

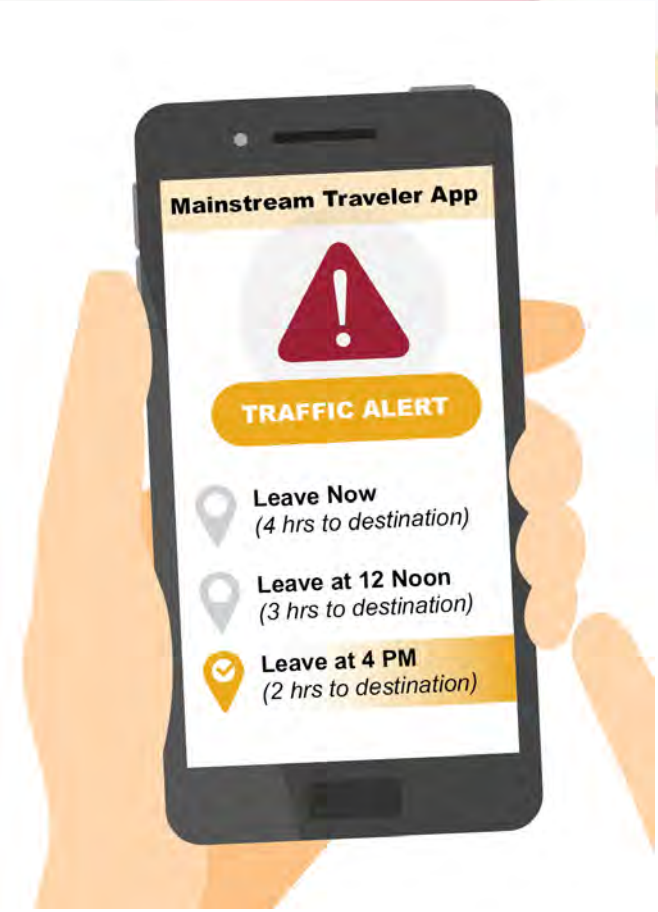


TRAVELER INFORMATION

- Real-time and predicted travel times
- Push notifications to smart phones apps (VRBO, Airbnb, Bonvoy, etc.)
- Dynamic Message Signs
- Web Site Route Planning

Alternative Route Travel Time Sign

Dynamic Message Sign

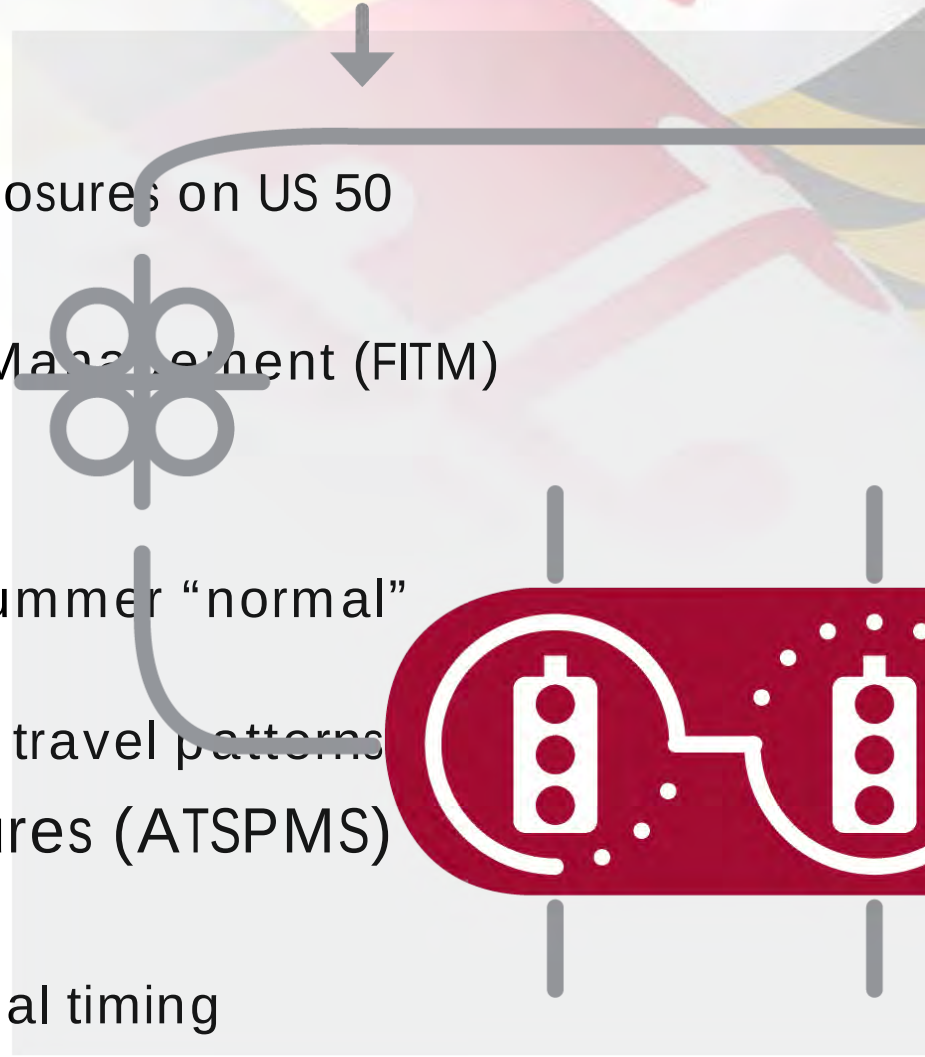


Push Notification on App of Predicted Travel Time

TRAFFIC SIGNAL OPERATIONS

The area we need to see, a Decision Support System

- Incident Signal Timing Plans
  - 100+ different timing plans for the 113-mile corridor
  - Change signal timings due to major crashes and closures on US 50
  - Case-based rules Decision Support System
  - Integrated with updated Freeway Incident Traffic Management (FITM) Plan
- Adaptive Signal Control Technology
  - Used to optimize signal timings for weekday, non-summer “normal” traffic
  - Q2 Inverse TR will be used for seasonal and holiday travel patterns
- Automated Traffic Signal Performance Measures (ATSPMS)
  - 48 signals
  - Upgrade detection & use big data to optimize signal timing



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FREIGHT AV FEASIBILITY ASSESSMENT (FAVFA)

A Closer Look at the "Readiness" of MD Corridors to Support Freight AV Operations

August 29, 2023

OVERVIEW

- Purpose of the FAVFA Project
  - Part of SHA's connected and automated vehicle (CAV) implementation efforts and supports the broader MDOT CAV program
  - Feasibility study on the deployment of automated freight vehicles that operate within or through the state
  - Sought to understand the challenges and opportunities for the deployment of AVs involved in moving goods on MD roads
  - Included both long-haul and last-/middle-mile use cases

- Approach
  - Stakeholder/Industry outreach & data collection
  - Compiled physical and digital infrastructure needs and desires identified by AV developers and the AV freight industry.
  - Also identified impacts on SHA of meeting those needs/desires, and the benefits and challenges associated with them.
  - Used the AV-Readi™ digital tool to analyze corridor "readiness" for AVs (17)

OVERVIEW (CONT'D)

- Outcome
  - Ranked 17 candidate corridors for complexity and attributes that enable or hinder AV deployment
  - The top ten (10) corridors were then selected and ranked using complexity and readiness indices, respectively
  - Final Report completed in February 2023 – available upon request

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Corridor AV-Readi™ Numerical Results

Readiness Index 5 (best) to 0 (worst)

Overall Description	From	To	Ratio Complexity Index 0 (best) to 10 (worst)	Communications	Machine Vision	AV Navigation
Port of Baltimore to Tradepoint Atlantic	Seagirt Marine Terminal (Broening Highway)	MD 157/MD 158 Intersection, via Broening Highway and I-695	3.51	1.60	2.85	3.24
I-70 (Part of TSMO Master Plan System 14)	PA Border	I-695	4.44	2.46	2.81	2.99
I-95 North (JFK)	Baltimore City Limit (North)	DE Border	4.73	2.33	2.71	3.11
I-68 (Part of TSMO Master Plan System 14)	I-70	WV Border	4.94	2.38	3.27	3.27
I-95 South of Baltimore	I-95/I-495	I-695 @ Halethorpe	6.06	2.33	2.71	3.09
I-81 (TSMO Master Plan System 15)	WV Border	PA Border	6.34	2.22	2.81	3.09
US 1/MD 175 Howard County	Maryland Food Center Authority/TA Travel Center	Montgomery Road	7.77	3.45	3.13	2.77
US 50 (TSMO Master Plan System 16)	Queenstown	Ocean City	7.93	2.24	2.90	3.08
US 13 (TSMO Master Plan System 16)	VA Border	DE Border	8.09	2.15	3.12	3.32
US 301 (TSMO Master Plan System 17)	DE Border	US 50	8.11	2.03	2.67	3.13