




Travel Decisions Powered by Data

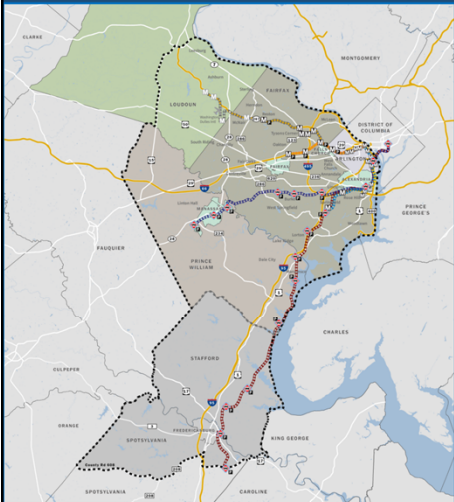
Northern Virginia's AI-Based Decision Support System

**MCDITE 2025 Annual Meeting
April 24, 2025**

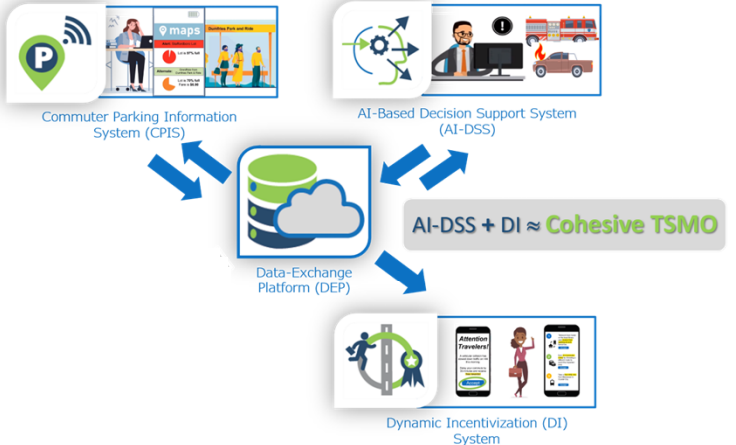




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Virginia Regional Multi-Modal Mobility Program (RM3P)






The area shown for Fredericksburg is not yet final



Optimization, Reliability, Traveler's Choice

Amy T. McElwain
Program Manager
VDOT Office of Strategic Innovation
Visit us at: RM3PVirginia.org


Partners:   

CONCEPT

- ❖ Empowering Commuters
- ❖ Real-Time Information Sharing
- ❖ Rapid Response to Changing Conditions
- ❖ Structured Decision-Making
- ❖ Multi-Modalism
- ❖ Innovative Technology
- ❖ Incentivizing Positive Traveler Behavior
- ❖ Agile Development

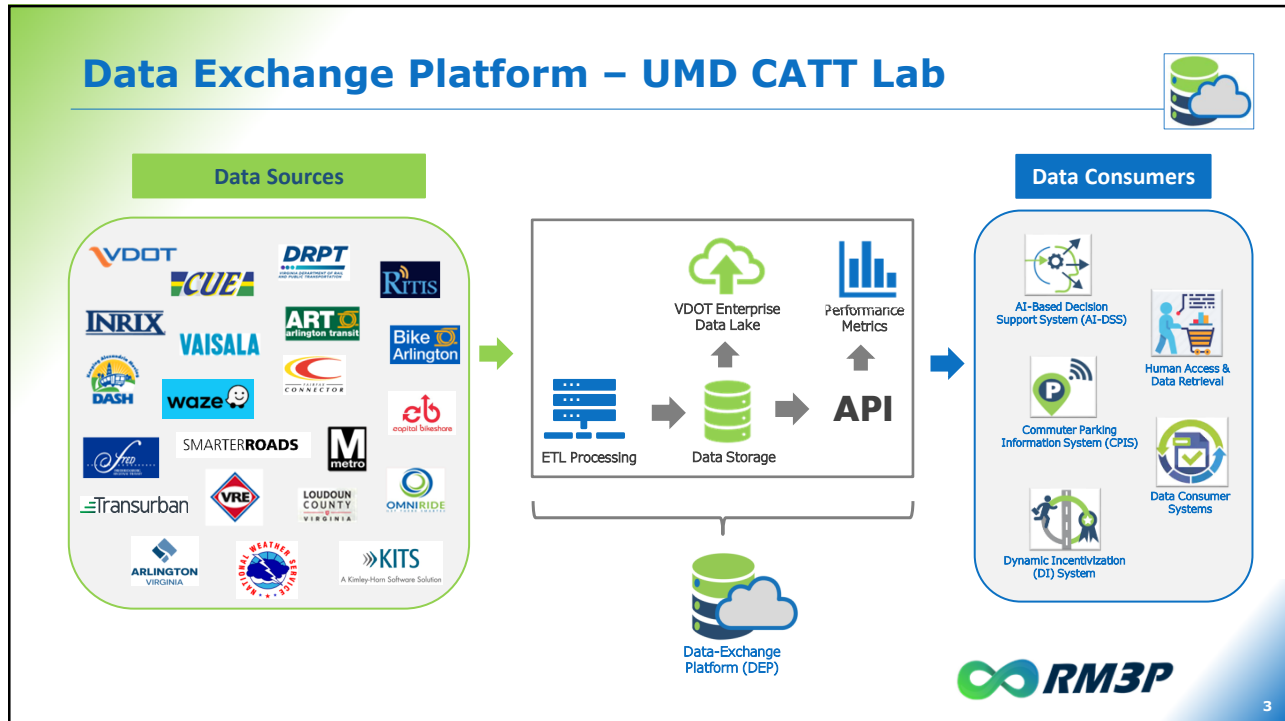
MISSION

Collaborative use of real-time data to improve travel safety, reliability, and mobility



Travel Decisions Powered by Data

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Commuter Parking Information System (CPIS)

What is CPIS?

- Collect parking data to support driver choice behavior
- Help commuters choose among options to park and transfer
- Goals to support reduction in SOV trips and increase multi-modal trips

Lot Occupancy Status

- **Occupancy Categories** – Users will be provided categorized information on occupancy.

Available

Limited

Full

Infrastructure Free

- **Mobile App** – Crowdsources parking occupancy data from users running the app.
- **App Integration** – Can integrate with other apps like the VRE App to collect lot occupancy data.

Phased Approach

- 6-month Proof-of-Concept (POC)
- 3-month Mobilization
- 27-month Extended Deployment

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Dynamic Incentivization



Provides alternatives, options, and incentives to travelers to change travel behavior – don't drive, use transit, carpool, vanpool, bike, travel later



<https://www.gomywayva.com/>

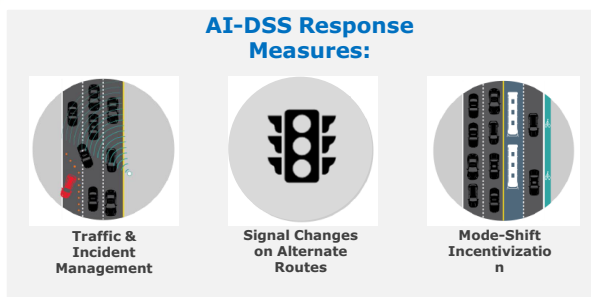


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AI-Based Decision Support System (AI-DSS)



The AI-DSS is a tool for transportation operators that will use travel data to monitor emerging conditions and recommend plans for coordinated, multi-agency multi-modal responses to congestion, incidents, and events.



The AI-DSS will help predict disruptions to the transportation network and provide coordinated response options to agencies.



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AI-DSS Stakeholders and System Users

- VDOT
 - Northern Virginia/Fredericksburg TOC
 - Northern Virginia Signals Team
 - Fredericksburg Signals Team
- MATOC - Regional Partner
- Transit Partners:
 - WMATA
 - Fairfax Connector
 - VRE
 - PRTC/OmniRide
 - DASH
 - Fairfax CUE
- Loudon County
- Prince William County
- City of Alexandria
- City of Arlington
- Local Jurisdictions (i.e. Town of Vienna)
- Express/Tolling Partners
 - Transurban
 - I-66 EMP
 - Dulles Toll Road
 - Dulles Greenway



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AI-DSS Subsystems

Response Plans	Cross-agency strategies and tactics to support event management
Rules Engine	Rules and logic to select multi-modal response plans based on current and future incident and congestion conditions.
Modeling Engine	Real-time simulation for predicting near-term conditions and comparing the benefits of response plans
Prediction Engine	Predict near-term incident risk, congestion, commuter parking availability, and transit next bus arrivals.
Graphical User Interface	Interactive map-centric application to obtain situational awareness of the transportation system and notifications of impactful events requiring cross-agency collaboration



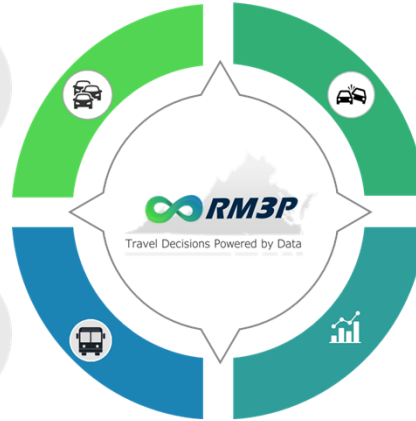
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AI-DSS Prediction Engines

An **AI-Based Traffic Congestion Prediction Engine** leverages advanced machine learning models to predict traffic congestion on highways and arterials.

An **AI-Based Transit Next Stop Prediction** predicts the next stop arrival time of public transit vehicles (such as buses) using artificial intelligence and machine learning models.



An **Incident Hotspot AI-Prediction Engine** leverages machine learning models to predict areas prone to traffic incidents such as accidents, congestion spikes, or road hazards.

AI-Prediction Parking Model designed to predict the availability of parking spaces aiming to support mode shifts for drivers..



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Cross-Agency Cooperation

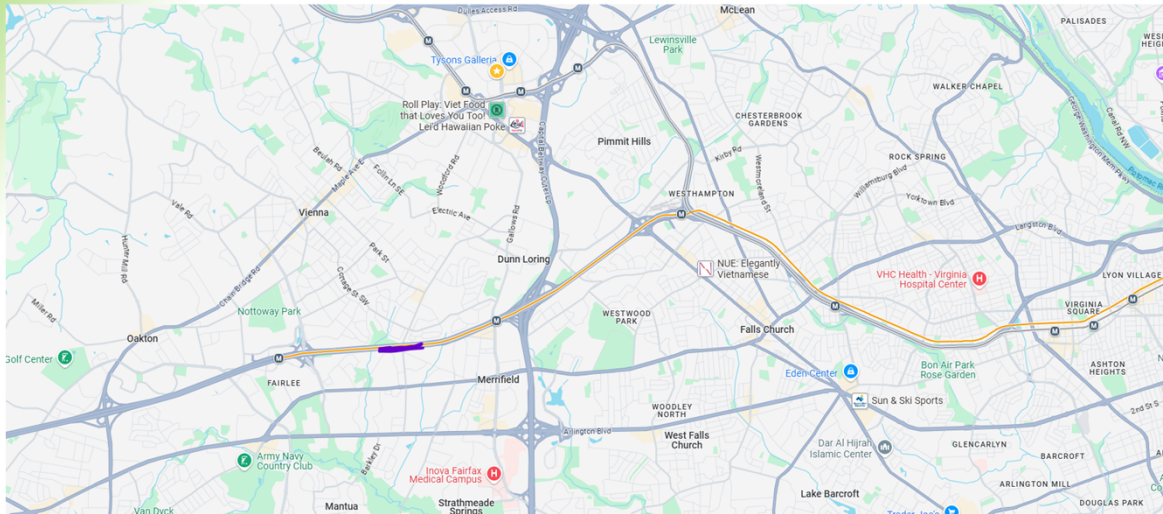
- How can other agencies help me when I have an incident?
- How can I help other agencies when they have an incident?
 - When should transit agencies be involved with roadway events?
 - When should VDOT be involved with transit events?
 - When should Express Lane partners be involved?
 - When is Dynamic Incentivization warranted?



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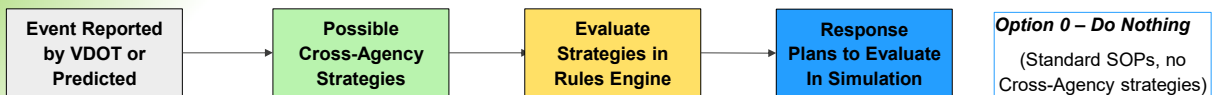
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Freeway Accident I-66 EB – Morning Commute



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Event Response Approach



Accident on I-66 EB
Just past Vienna
Metro Station
Expect 1-2 hour delay

- Agency Notifications
- Traveler Notifications
- DMS to Inform drivers about transit options
- Identify possible alternate corridors for signal timing changes
- Incentivize drivers to change behavior
- Open Express lanes for GP use

Option 1 – Few Alternate Corridors, Light Signal Timing

- Agency Notifications
- Traveler Notifications
- VDOT DMS for Vienna Parking
- Small set of alternate routes
- Light signal timing changes
- Reduce demand via DI

Option 2 – Few Alternate Corridors, Heavy Signal Timing

- Agency Notifications
- Traveler Notifications
- VDOT DMS for Vienna Parking
- Small set of alternate routes
- Heavy signal timing changes
- Reduce demand via DI

Option 3 – More Alternate Corridors, Light Signal Timing

- Agency Notifications
- Traveler Notifications
- VDOT DMS for Vienna Parking
- Large set of alternate routes
- Light signal timing changes
- Reduce demand via DI

Option 4 – More Alternate Corridors, Heavy Signal Timing

- Agency Notifications
- Traveler Notifications
- VDOT DMS for Vienna Parking
- Large set of alternate routes
- Heavy signal timing changes
- Reduce demand via DI



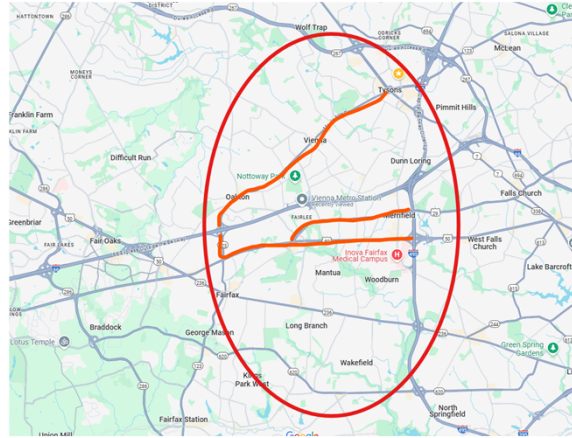
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Scoring Response Plans

- Option 2 – 8.5 -- Recommended
- Option 4 – 7.6
- Option 0 – 5.0 – Do Nothing
- Option 1 – 4.6
- Option 3 – 4.2

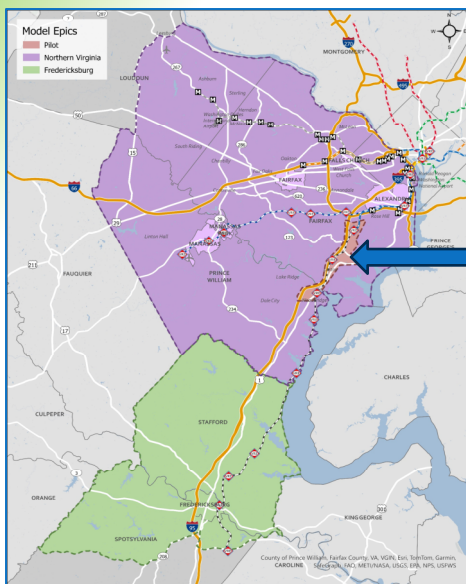
Option 2 – Few Alternate Corridors, Heavy Signal Timing

- AI-DSS
 - Send Agency Notifications about event
 - Send Notifications to 511
- VDOT TOC:
 - Recommend posting message on DMS upstream of Vienna Metro
- VDOT Signal Team
 - Look to change signals on RTEs 123, 29, 50
 - Consider Heavy signal timing changes
- Dynamic Incentivization
 - Reduce demand by 5% over next 90 minutes in the vicinity of event



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Phased Deployment

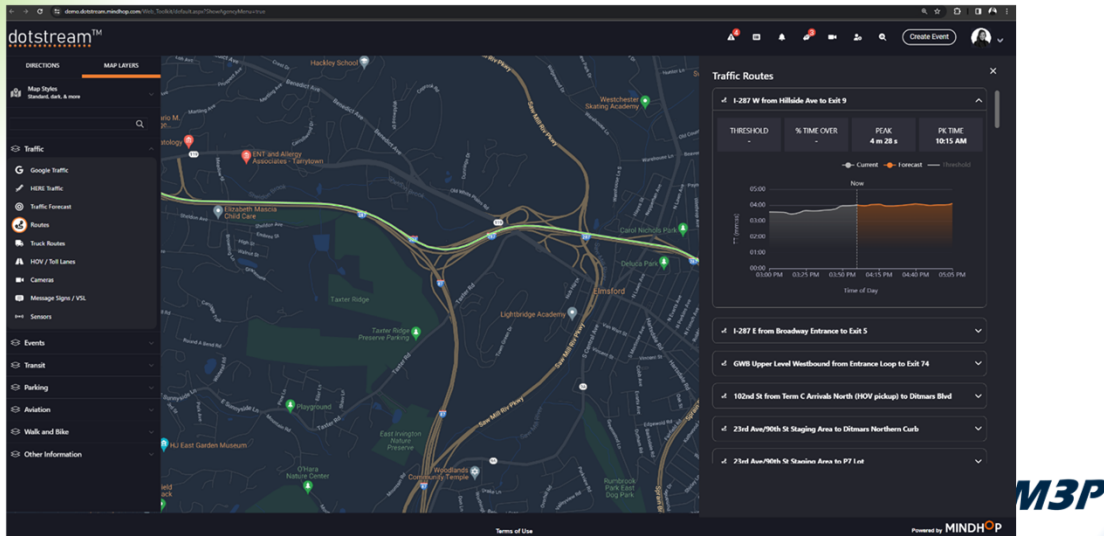


I-95 Pilot Area
 South of Springfield Interchange through Lorton, Occoquan, and Woodbridge extending from I-95 Exits 158 to 169A.



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Operational Interface - Placeholder (New Screen shots to be provided by Mindhop)



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Lessons Learned and Recommendations

- Agency AI guidelines are evolving and require attention
 - New rules for AI Systems were established during the project; required retroactive compliance evaluation
 - Rules that govern quality, bias, correctness, accuracy, timeliness of the data and the systems
- Agency personnel hesitant to trust prediction or change operations
 - Traffic management requires event verification before response
 - Hard to separate vision of future strategy from today's standard operating procedures
 - Signal team preferred starting with identifying alternate routes instead of recommending timing plan
- Accuracy targets hard to establish
 - Should we expect AI/ML models be 95% accurate?
 - Very few real-world deployments
 - Accuracy is data driven; data quality and availability will impact accuracy

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Lessons Learned and Recommendations

- Predictions are data driven; critical that the data inputs are correct and complete
 - Verify a priori that key data sets are available, accurate, and without gaps
 - Ensure data is easily accessible through standard APIs
- Prediction may require types of data or data fields that are not anticipated
 - Problems with event data where location does not easily snap to roadway segments
 - Parking data not readily available
- Testing a MVP on a small part of the network
 - Consider a more incremental and iterative implementation approach
 - Make sure MVP small enough yet still big enough to cover all approaches/strategies
- Early Adopter Program
 - Onboarded a selected few agency staff to serve as early adopters and test drive the AI-DSS
 - Identify and work out issues before full deployment
 - Engage early adopters on a frequent basis
 - Serve as champions for their agencies



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