Planning for Connected Automated Vehicles

MDOT CAV Working Group

August 12, 2019

i **SETTING THE CONTEXT**

ii WHAT HAS HAPPENED IN MARYLAND AND THE REGION

iii RECOMMENDATIONS FOR FUTURE WORK

ACES..OR IS IT CASE?

CONNECTED VEHICLES

CONNECTED VEHICLE TECHNOLOGIES ALLOW VEHICLES TO COMMUNICATE WITH EACH OTHER AND THE WORLD AROUND THEM.

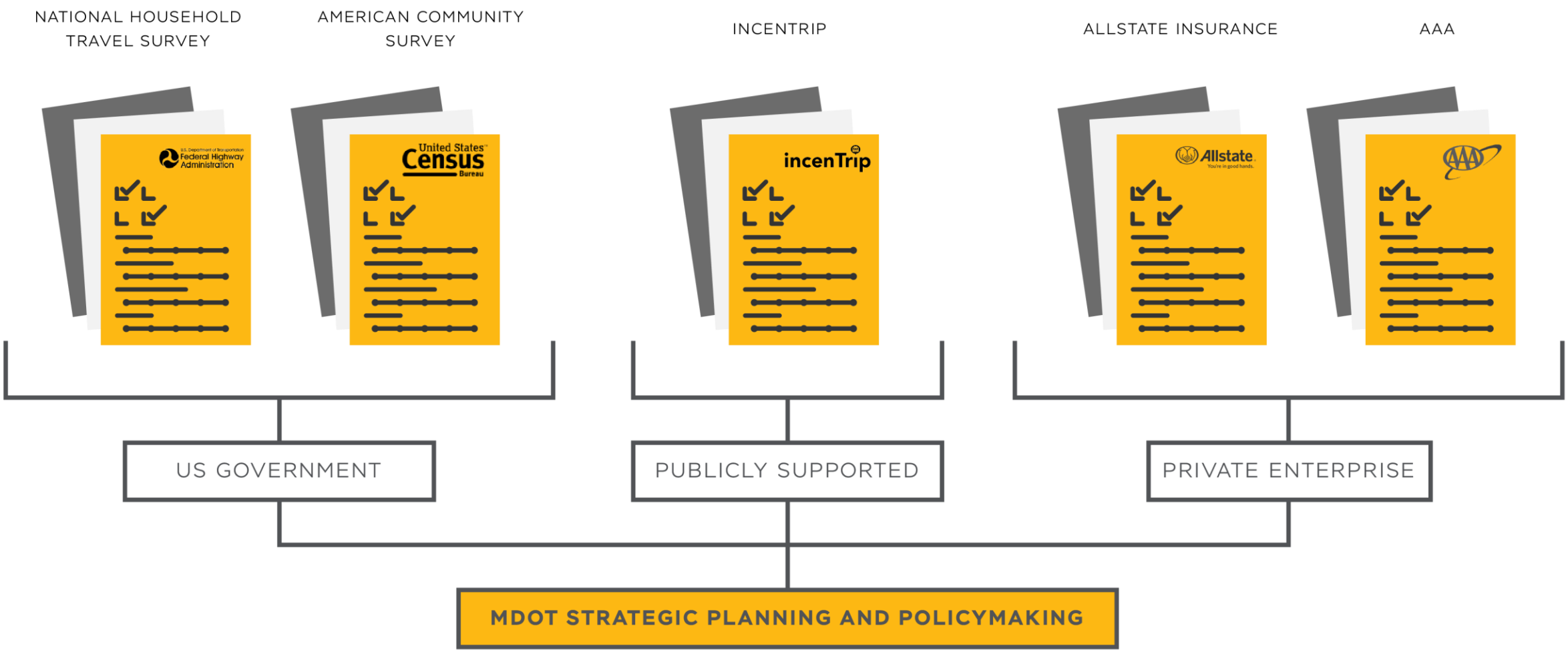
NAVIGATION SYSTEMS + MOBILE APPLICATIONS ENABLING VEHICLE-TO-INFRASTRUCTURE/VEHICLE/BIKE/PED COMMUNICATIONS

AUTOMATED VEHICLES

A FULLY AUTONOMOUS VEHICLE DOES NOT REQUIRE A HUMAN DRIVER, AS IT IS COMPUTER-DRIVEN.

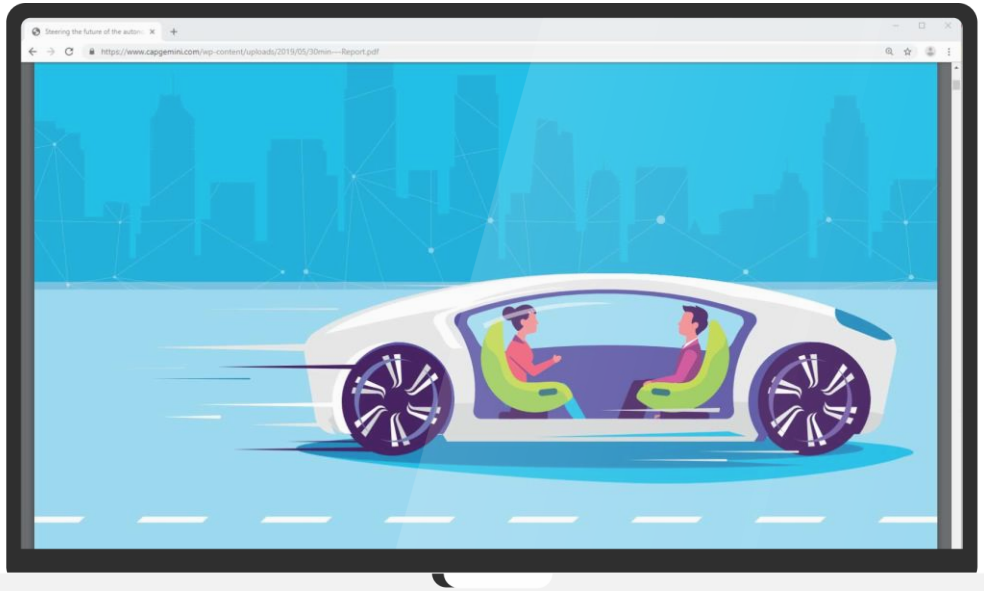
SELF-PARKING & COLLISION AVOIDANCE TECHNOLOGY
VEHICLE PERFORMS ALL SAFETY-CRITICAL DRIVING FUNCTIONS AND MONITORS ROADWAY CONDITIONS

TRAVEL SURVEYS

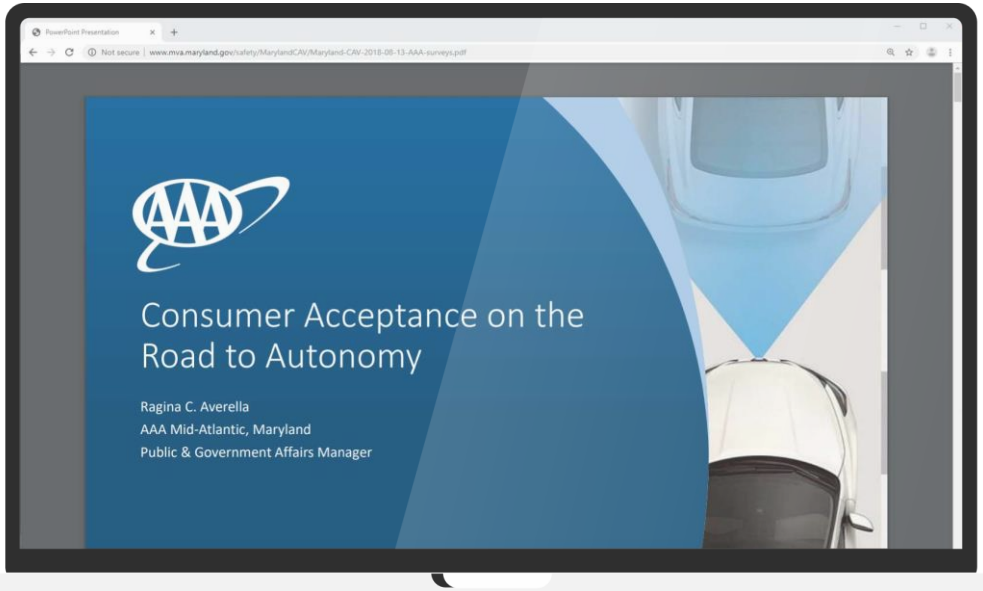


SURVEYS CITED FOR EXAMPLE ONLY

SITUATIONAL SURVEYS

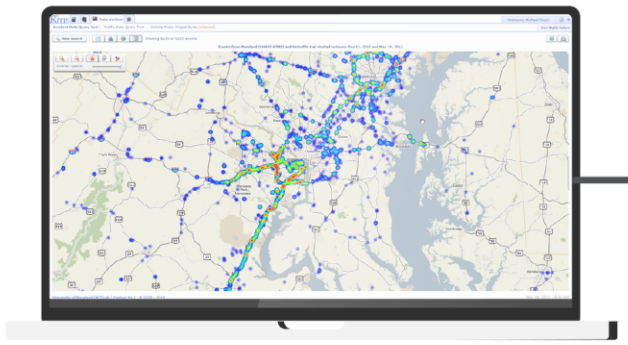


THE AUTONOMOUS CAR
A CONSUMER PERSPECTIVE

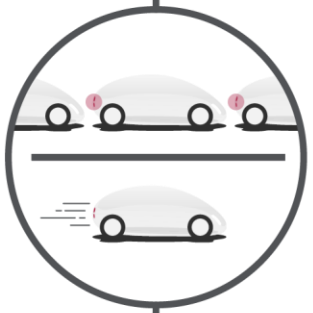


AAA: FEAR OF
SELF-DRIVING CARS

PROBE DATA



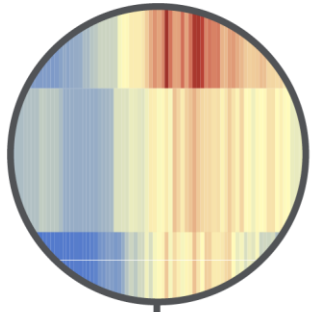
REAL TIME SPEED DATA



TRAVEL TIME (PEAK TRAFFIC)

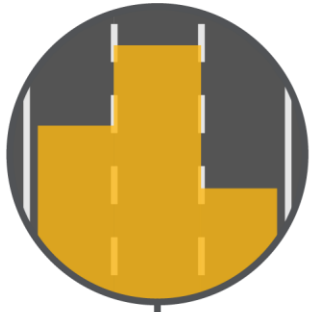
TRAVEL TIME (FREE FLOW)

TRAVEL TIME INDEX



CORRIDOR CONGESTION CHARTS

TRAVEL TIME RELIABILITY

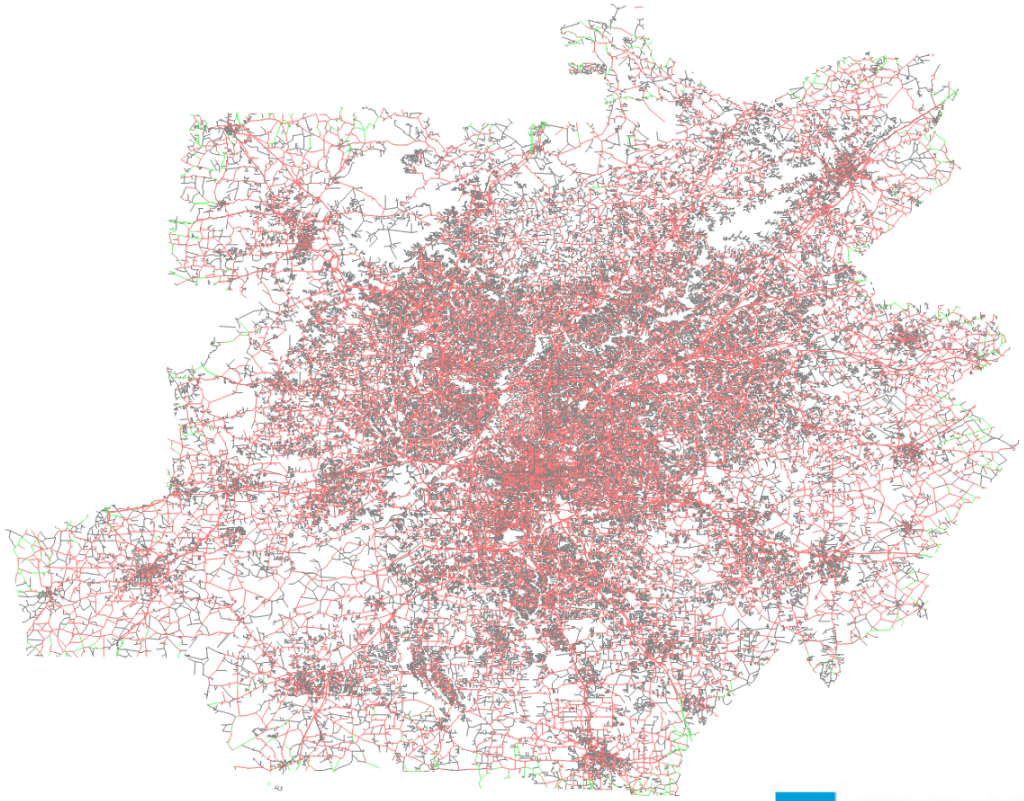


QUEUE MEASUREMENT

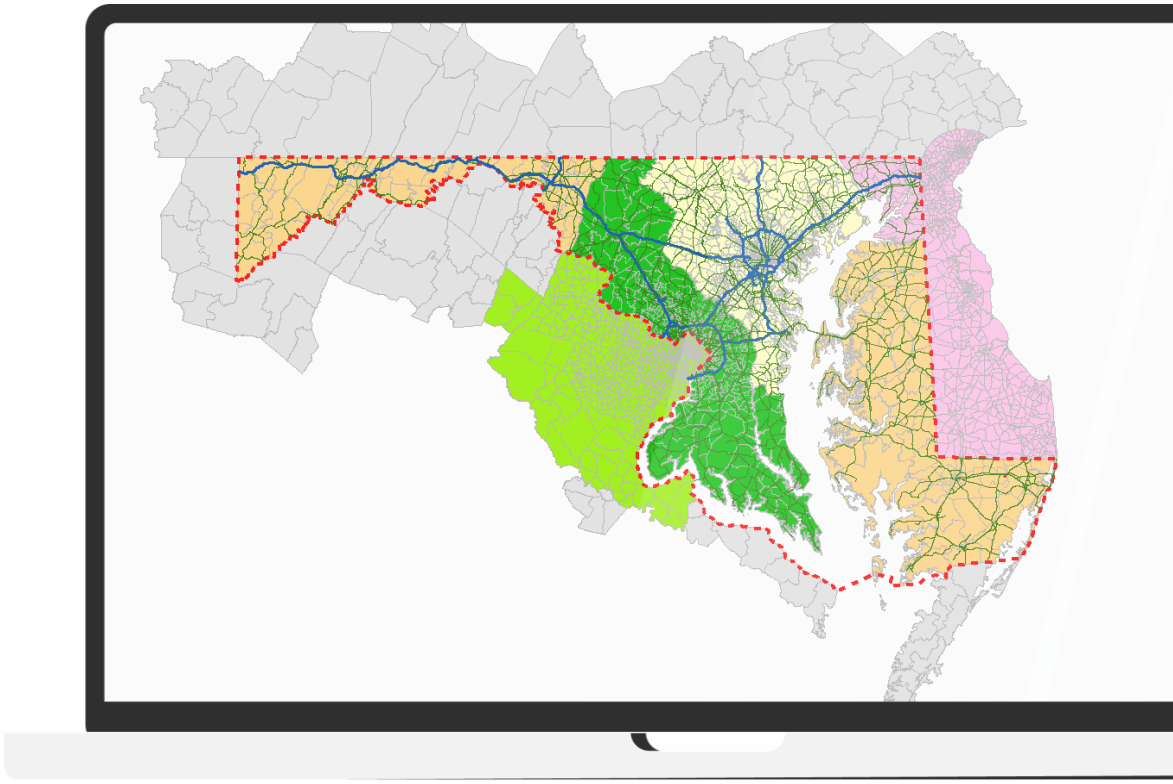
STATE-WIDE BOTTLENECK RANKING

REGIONAL DEMAND MODELS

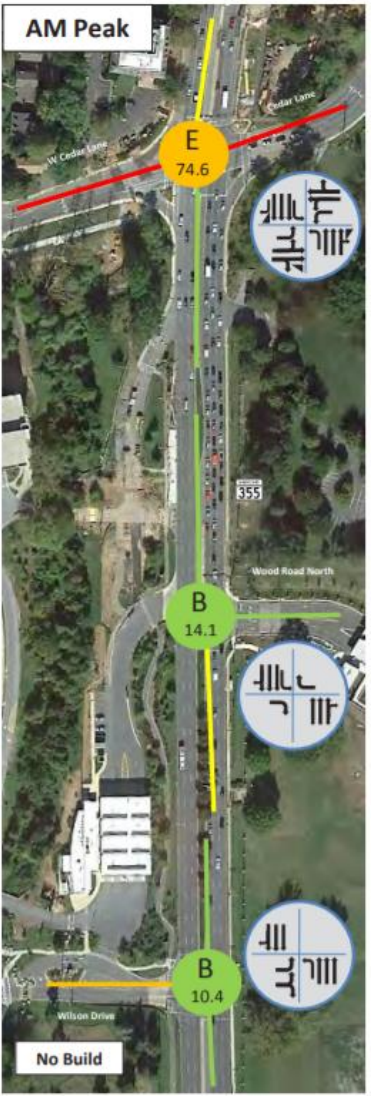
Automated Vehicles Share: 10%

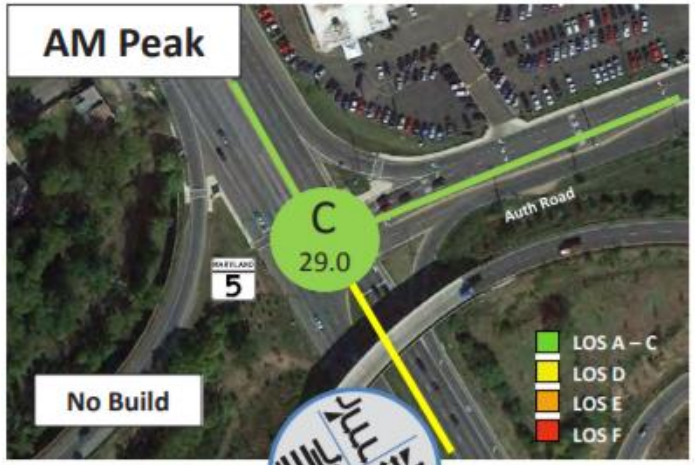


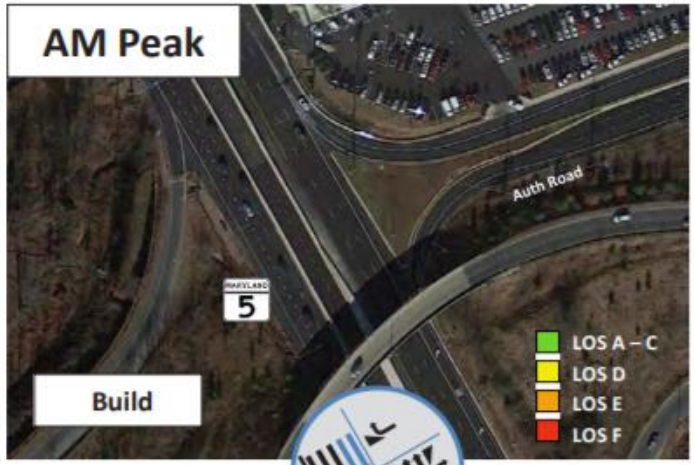
CITILABS

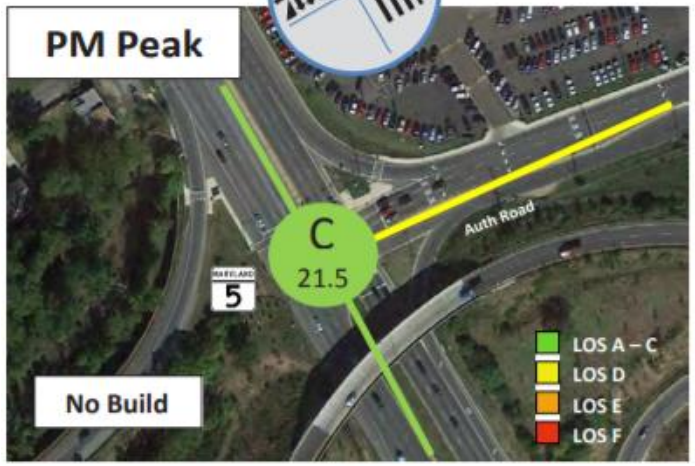


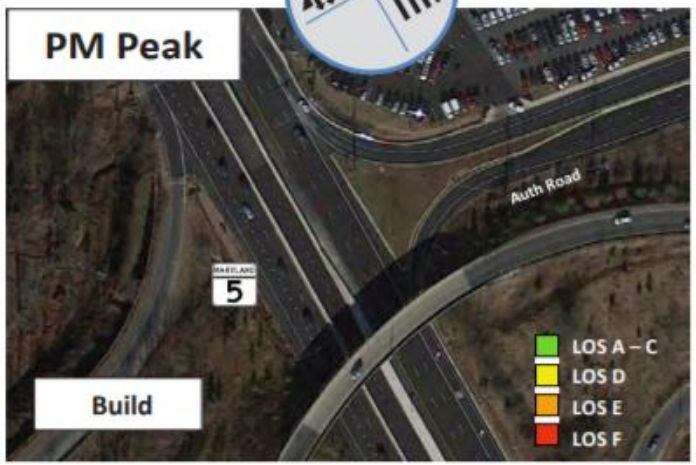
CORRIDOR OR SYSTEM LEVEL ANALYSIS



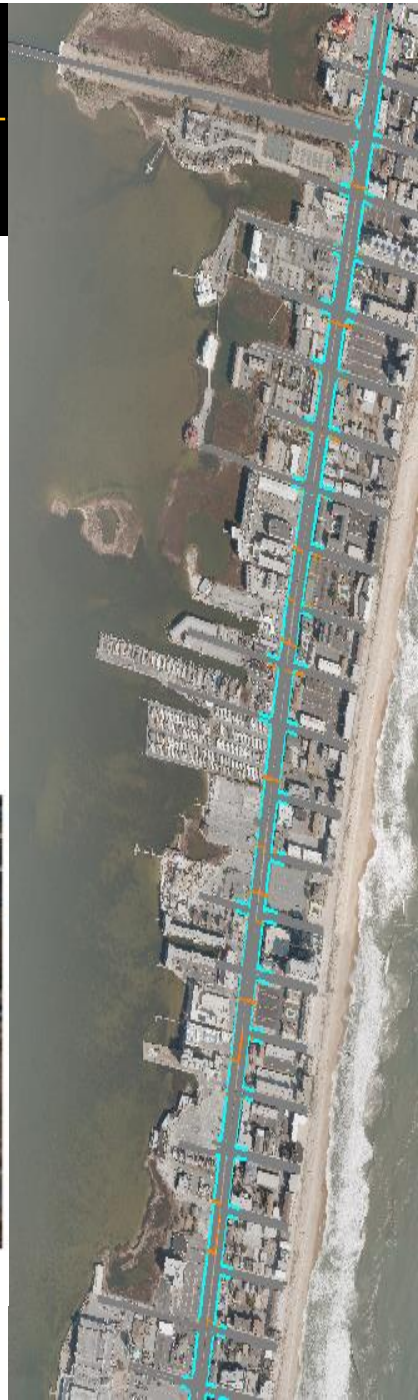




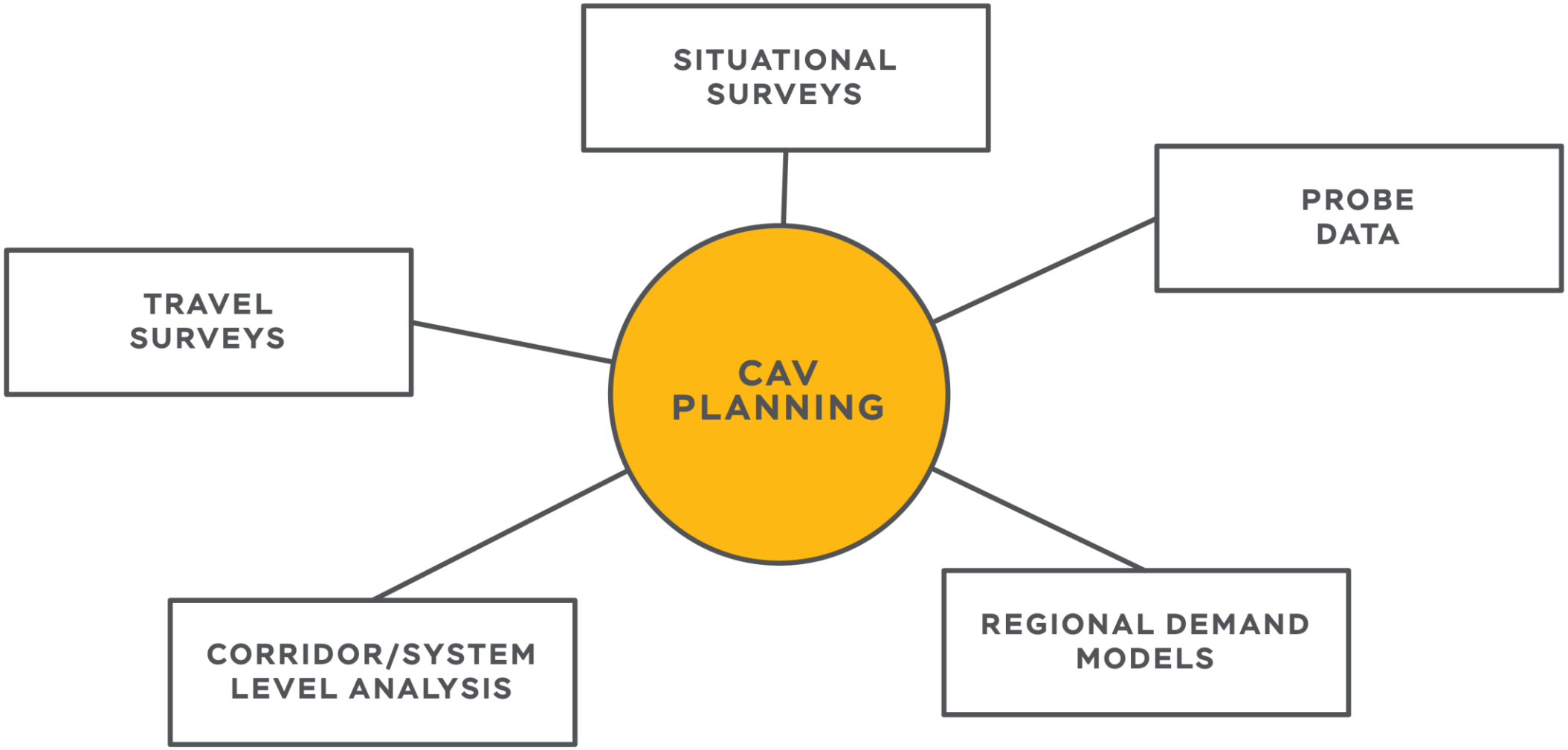




Intersection at MD 5 and Auth Road



HOW IT ALL COMES TOGETHER



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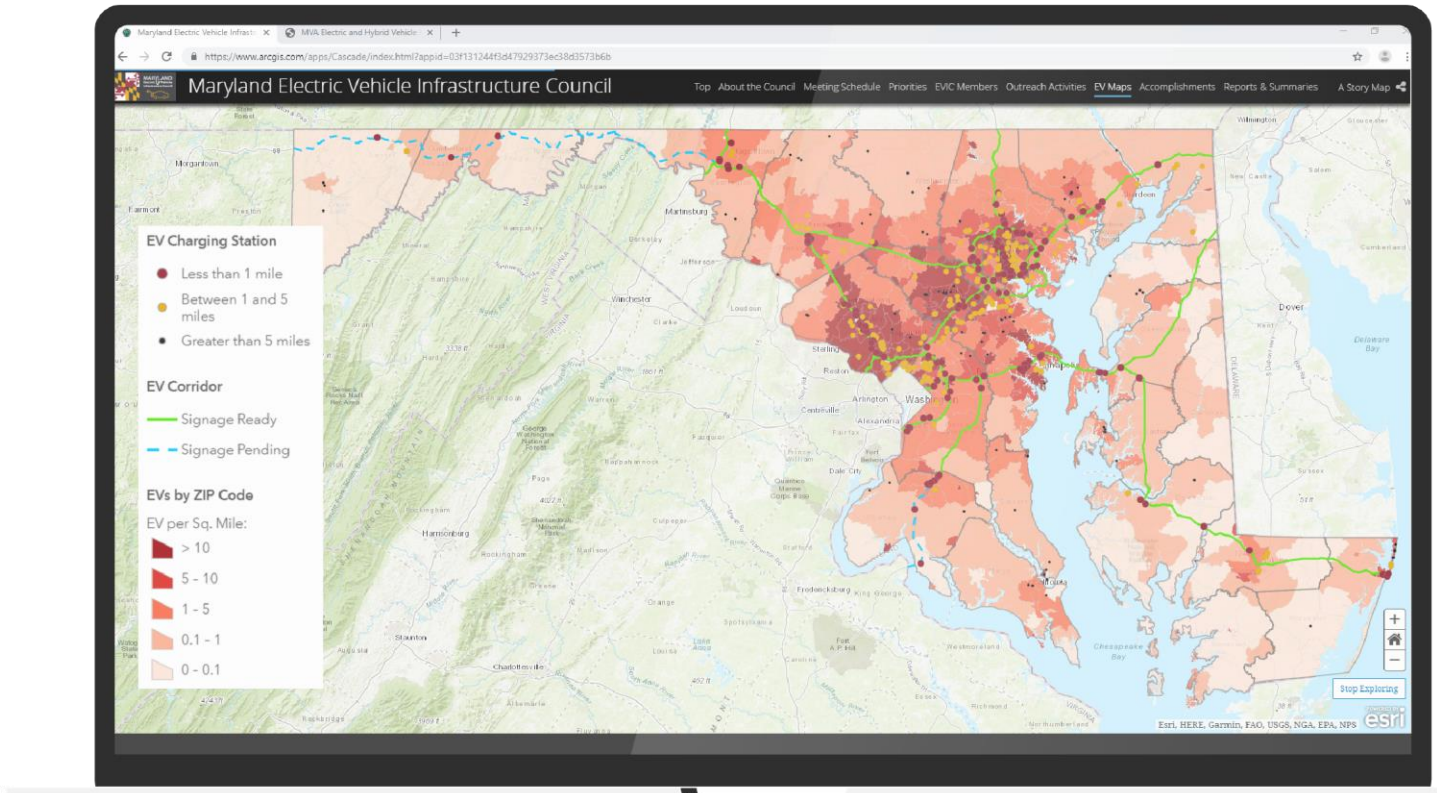
PART II: WHAT HAS HAPPENED IN MARYLAND



EVIC DATA MAP

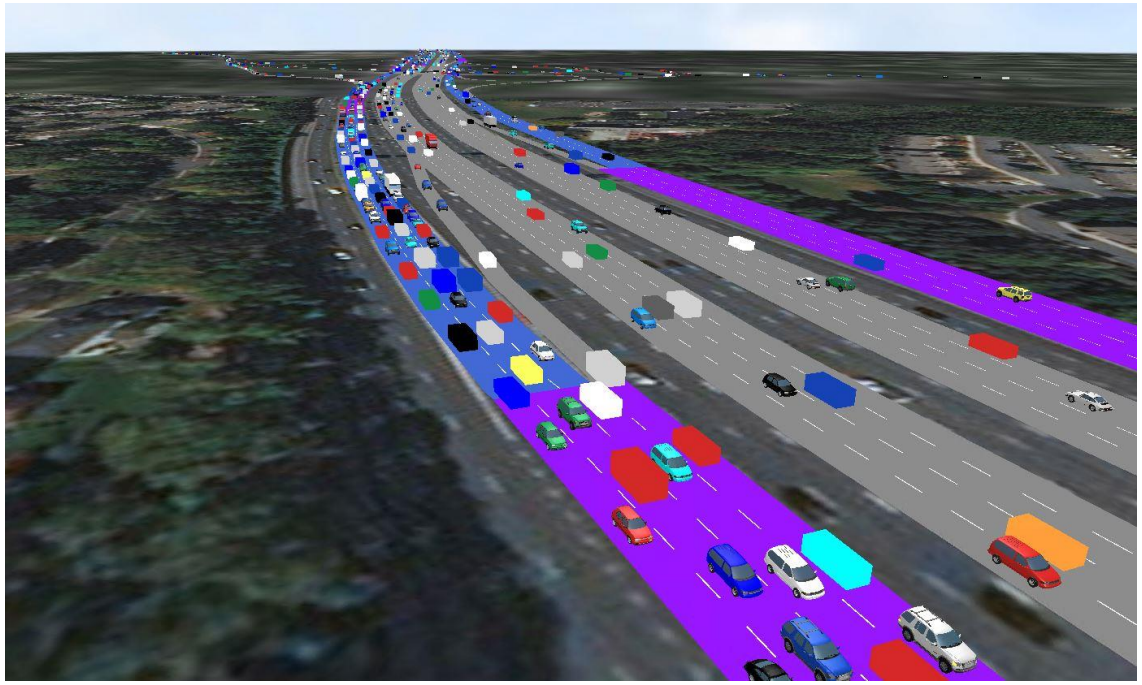
MARYLAND EV REGISTRATION DATA

WHAT ELSE?

BMC is investigating how sensitive their regional demand model might be when changing certain variables

MDOT SHA is also running sensitivity efforts to better understand variation in trip patterns

MDOT SHA is incorporating more detailed corridor analysis in microsimulations as a sensitivity condition to better understand the range of impact to our facilities



WHAT HAS HAPPENED IN MARYLAND: MARYLAND STATEWIDE MODEL

Exploratory Analysis Modeling (EAM): manage uncertainty by testing decisions that cover broad range of future possibilities

	Trip Generation	Trip Distribution	Mode Choice	Time of Day	Traffic Assignment
Disutility of in vehicle time in AVs		X			X
Levels of use of car sharing and ride hailing vs personal vehicle			X		
Parking behavior		X	X		
Household escorting	X		X		
Travel demand induced by young and seniors	X				
Empty vehicle trips	X		X		
Telecommuting and peak spreading	X			X	
Latent demand	X				

MARYLAND STATEWIDE MODEL: VARIABLES CHANGED

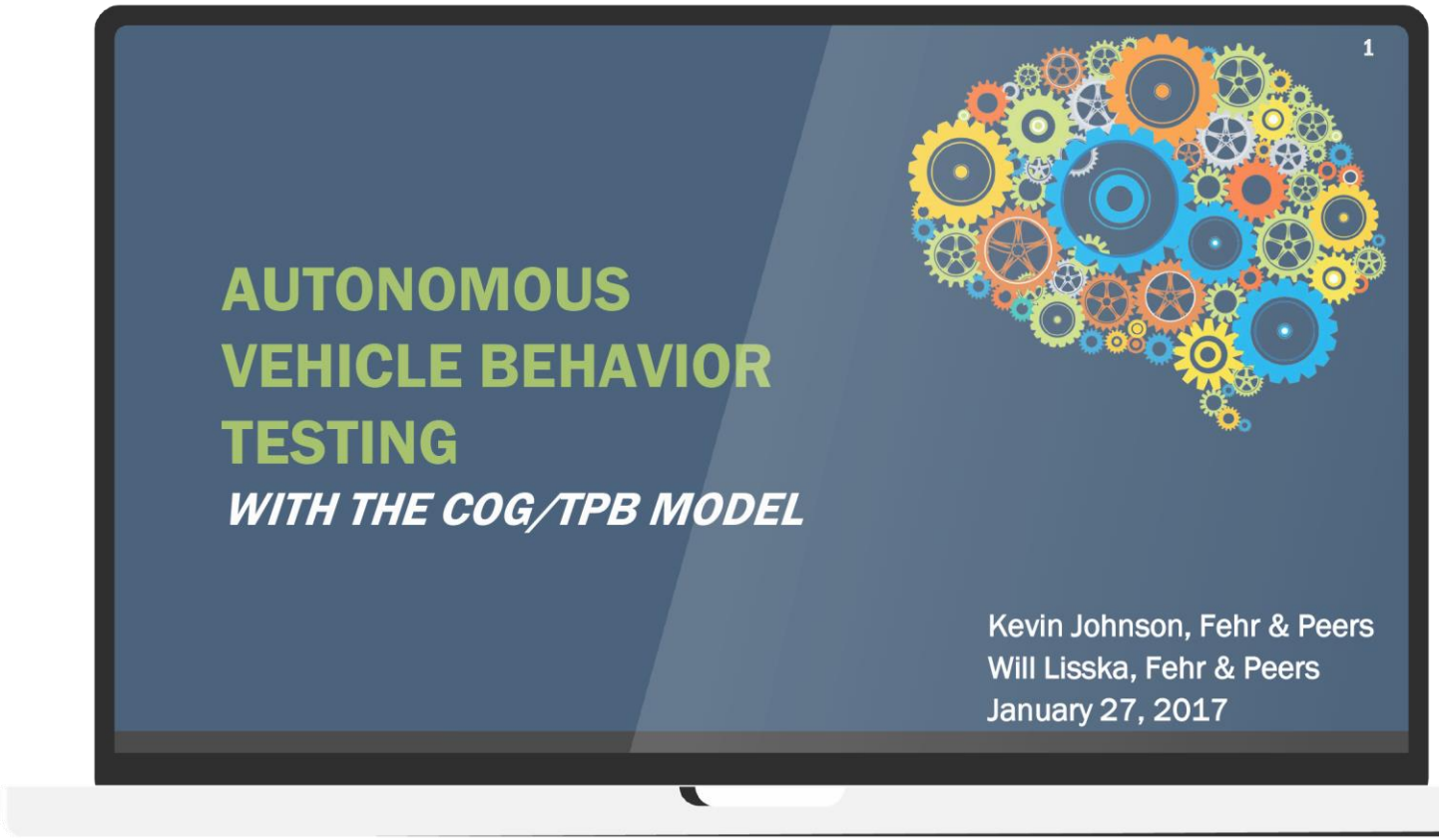
- **Based upon analysis of model parameters defined two scenarios**:
  - *Mid-Range*: Slower adoption rate of autonomous vehicles with expected implementation in larger urban areas
  - *Optimistic*: Faster adoption rate of technologies (autonomous and connected) statewide

- **Focused on range of parameters within Trip Generation, Trip Distribution and Supply**
  - Parameter changes in urban vs non-urban counties
  - Parameter values based on literature and best practice taking into account assumptions related to adoption rates

Factor	Mid-Range		Optimistic	
	Urban	**Non-Urban**	**Urban**	**Non-Urban**
Trip Generation ▪ New Travelers ▪ ZOV ▪ Telework (HBW) ▪ Telework (Other)	+7% +7% – 1% + 1%	No changes applied	+14% +7 – 15% +5%	14% 12% – 15% +5%
Trip Distribution ▪ Parking (in CBD) ▪ Travel Time Shifts	- 1min - 10%	No change - 10%	-2min -20%	-2min -20%
Assignment ▪ Use of capacity ▪ Communications ▪ Signals	Capacity: + 30% Freeway + 15 % Arterial		Capacity: + 75% Freeway + 35 % Arterial	

Ranges used TxDOT (TTP 2050) and FDOT Examples

WHAT HAS HAPPENED NEARBY?



- Fehr and Peers sensitivity model runs using the local MWCOG regional model
- Results:
  - Privately owned vehicles sensitivity run:

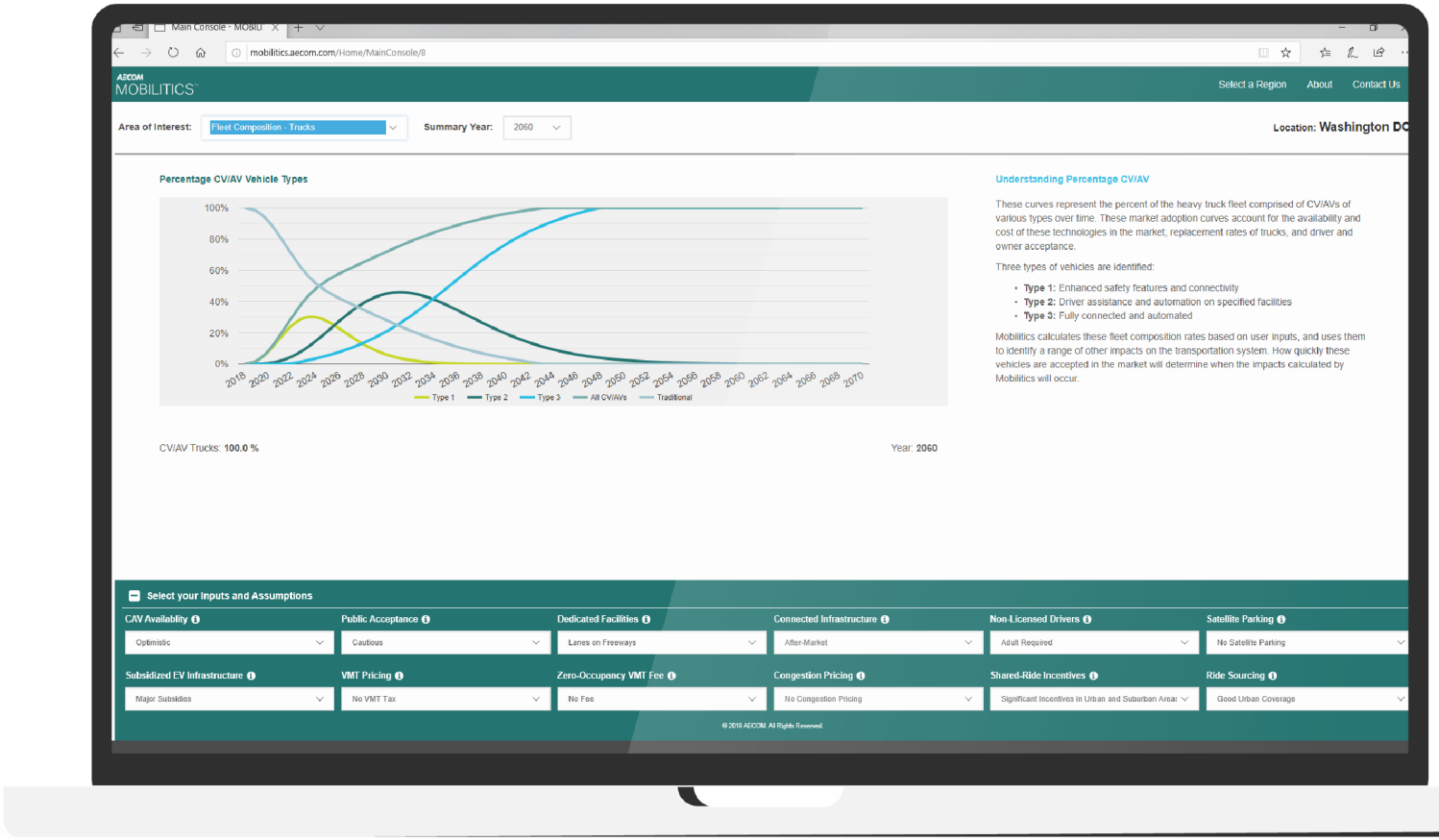
    47% VMT increase with a +25% vehicles trip growth and -26% transit trip growth

  - Shared vehicle sensitivity run:

    27% VMT increase with a +5% vehicle trip growth and -20% transit trip growth

FEHR & PEERS REPORT

WHAT HAS HAPPENED NEARBY?



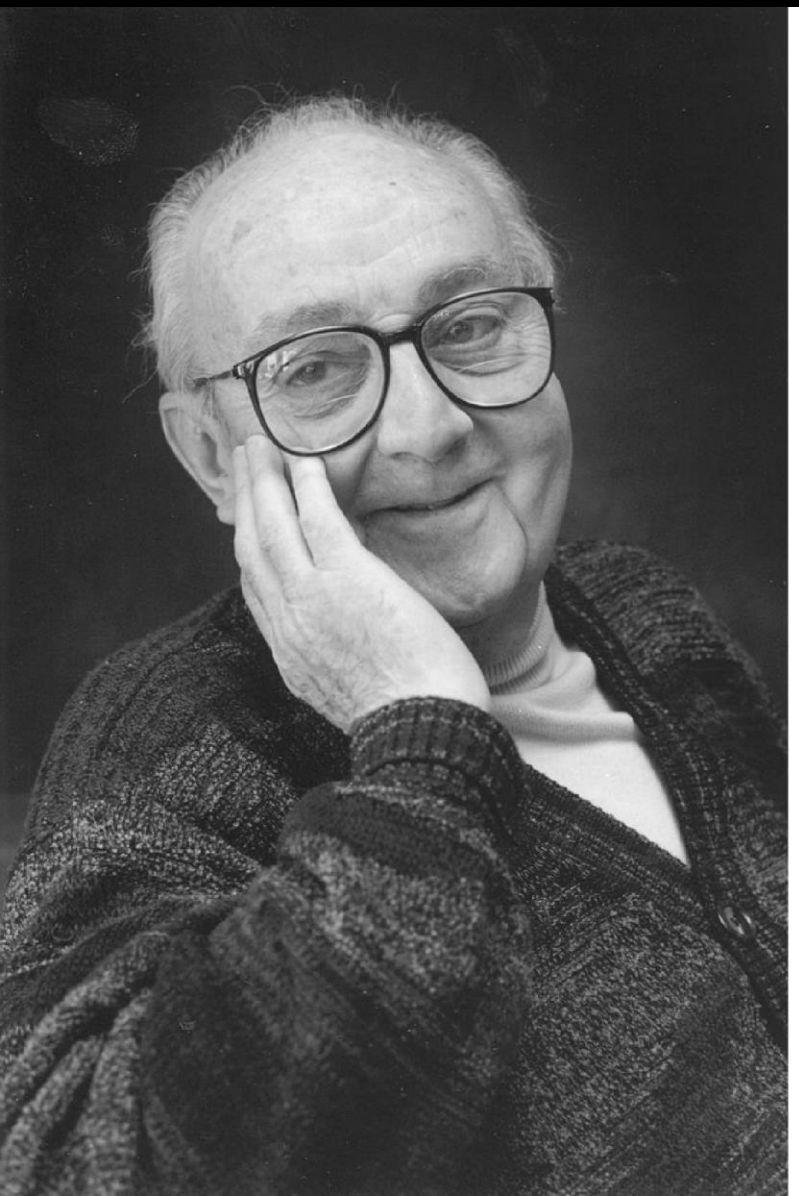
AECOM used the Washington DC regional demand model outputs to generate the VMT, delay, and other potential results using trend analysis to better understand how specific policies could impact our roadways.

MOBILITICS DEMAND MODEL ANALYSIS

WHAT HAS HAPPENED NEARBY?

MICHAEL BAKER
VTRANS 2040
STUDY

HERE'S THE KICKER….



"ALL MODELS ARE WRONG, BUT SOME ARE USEFUL."

GEORGE P. E. BOX, STATISTICIAN

STILL NEEDED: BEHAVIORAL STUDIES

- Currently, there is no publicly available survey data for **Maryland only** drivers that may relate to how they wish to travel given an autonomous, shared, electrified vehicle ecosystem

- The University of Maryland, in partnership with the University of Arizona, was **one of the first public forums in Maryland** where scenarios were posed to the public to better understand their positions on CAV

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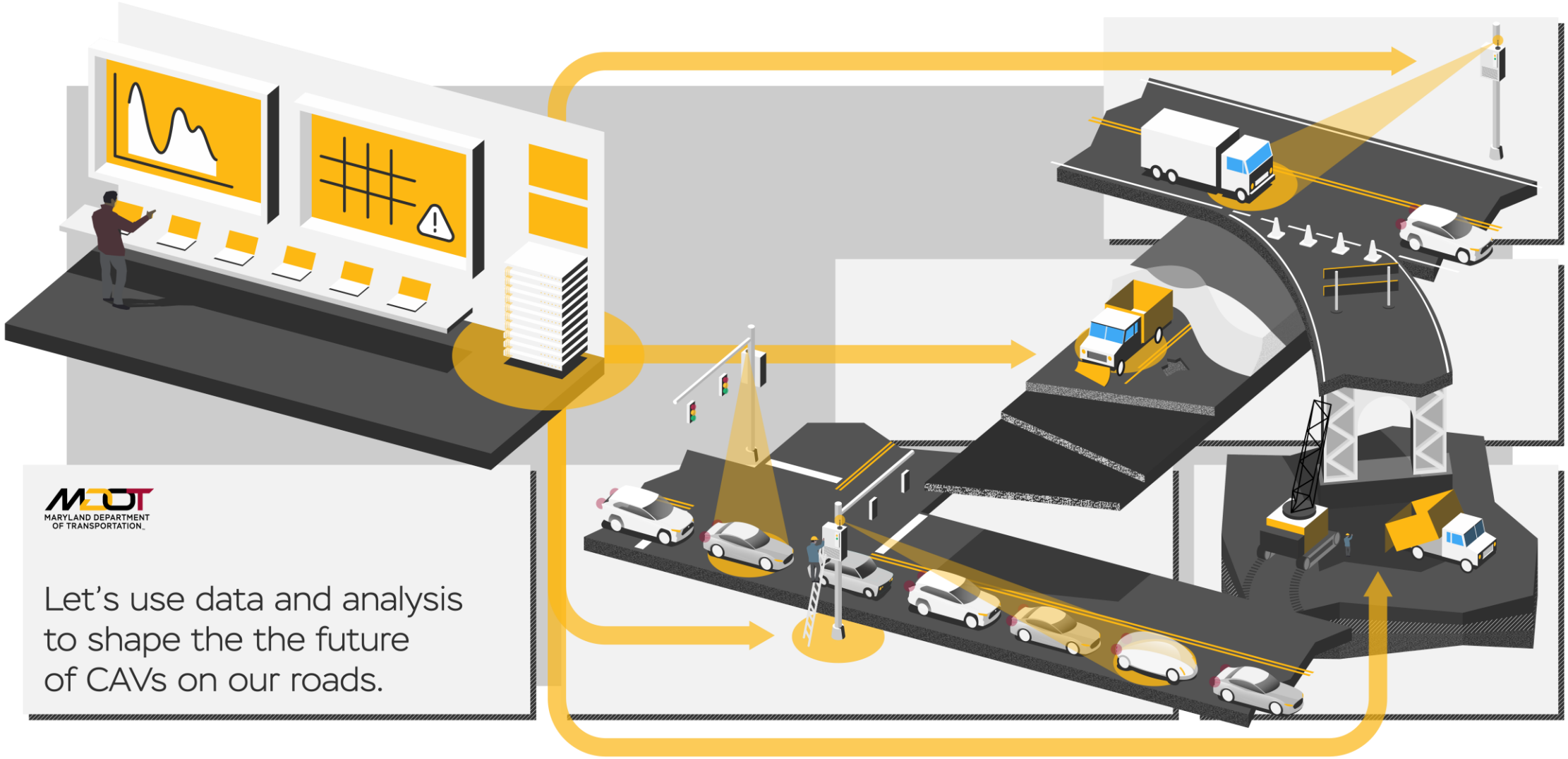
PART III: RECOMMENDATIONS FOR THE FUTURE

- Participation in NHTS to include CAV in future surveys
- Further involvement with partners to perform behavioral surveys
- Invite companies to survey Maryland drivers and bring in the new behavioral piece to how users wish to use the system
- Put forward public workshops to investigate scenarios for MD
- Perform more model sensitivity runs to attempt better representation of impacts that leads to data driven decision making

PART III: THE FUTURE IS ALREADY HERE



QUESTIONS / DISCUSSION

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RESOURCES AND LINKS

- 2017 MARYLAND State Highway Mobility Report
- The Autonomous car - A consumer perspective
- Consumer Acceptance on the Road to Autonomy
- Probe Data Analytics Suite
- MODELING AUTONOMOUS VEHICLES
- Maryland Electric Vehicle Infrastructure Council
- AUTONOMOUS VEHICLE BEHAVIOR TESTING WITH THE COG/TPB MODEL
- MOBILITICS
- VTrans2040 Scenario Analysis