MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

COVID-19 IMPACTS ON MOBILITY AND TRAVEL DEMAND

July 2021

Project Goal:

Scenario based **approach rooted in** ***data driven*** **assumptions**

1. **Identify and model impacts on mobility and travel behavior during the pandemic.**
2. **Estimate potential long-term travel impacts of the pandemic on future forecasts.**

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OUTLINE

Observed Data	Multiple data sources are used to identify impacts of Covid-19 on mobility and travel demand.
2020 Pandemic Scenario	Define pandemic scenario based on observed traffic conditions in the Fall of 2020.
MSTM Calibration and Validation	Calibrate model parameters and validate outputs based on observed conditions in the "Pandemic" Scenario.
Design 2045 Scenarios	Define post-pandemic scenarios based on potential long-term impacts of COVID-19.
2045 Forecasts	Evaluate impacts on future travel demand and forecasts.

Observed Data Sources

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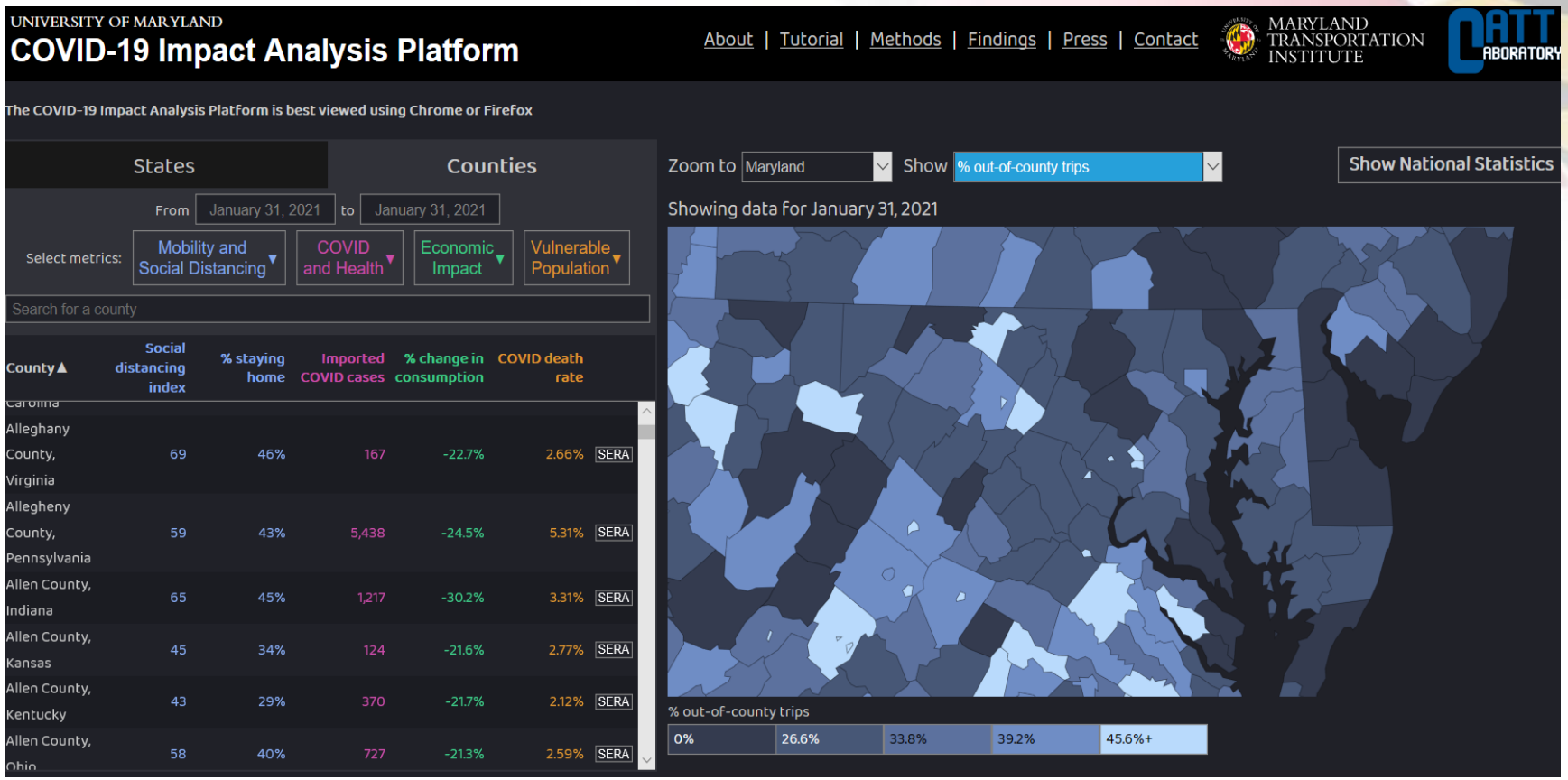
COVID -19 IMPACT ANALYSIS PLATFORM

HTTPS://DATA.COVID.UMD.EDU/

- Published by **UMD CATT Lab** through **RITIS**.
- **COVID-19's impacts** on mobility, health, economy, and society for all states and counties.



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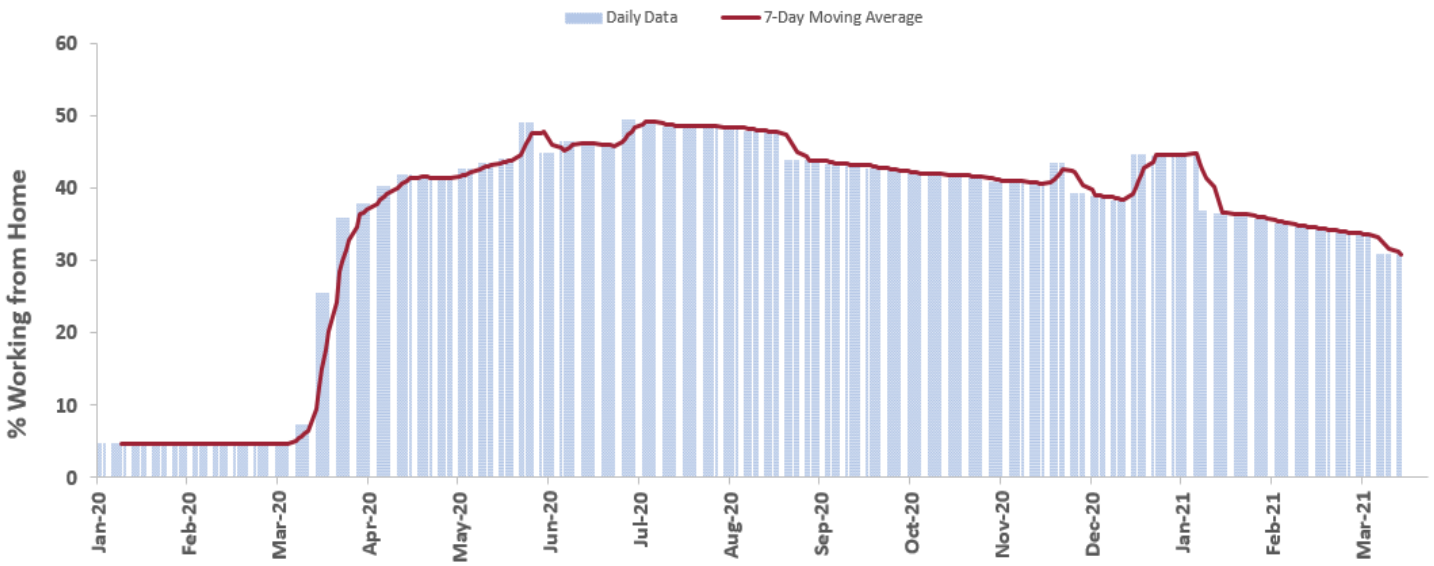
Work from Home

Observed Data:



Source: COVID -19 Impact Analysis Platform- RITIS

Model:

- Reduction in **home-based work production**
- Reduction in **non home-based work** trips

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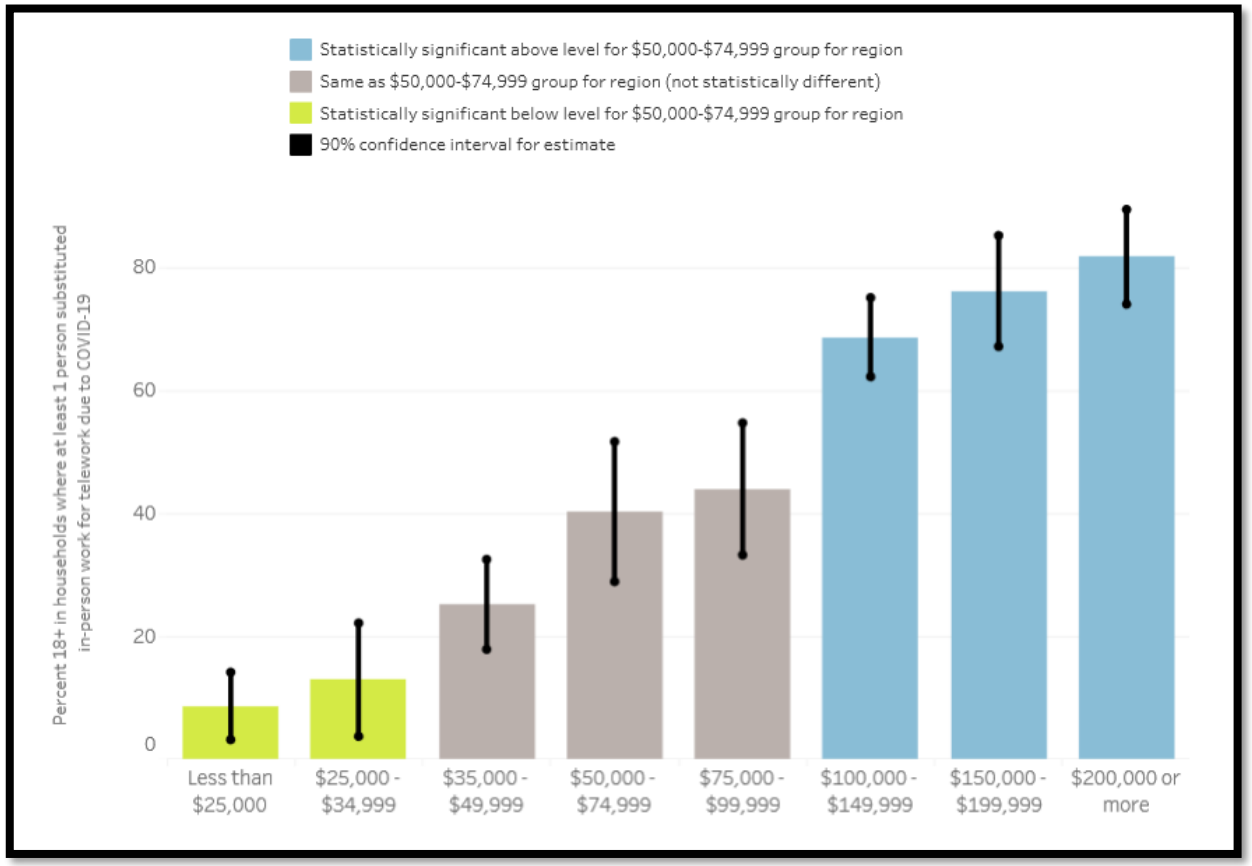
Work from Home by Income

Observed Data:



Source: Bureau of Transportation Statistics

Model:

- Reduction factors in **home-based work by income**

Income level	HBW production change
<20k	-16%
20k-40k	-22%
40k-60k	-34%
60k-100k	-48%
>100k	-70%

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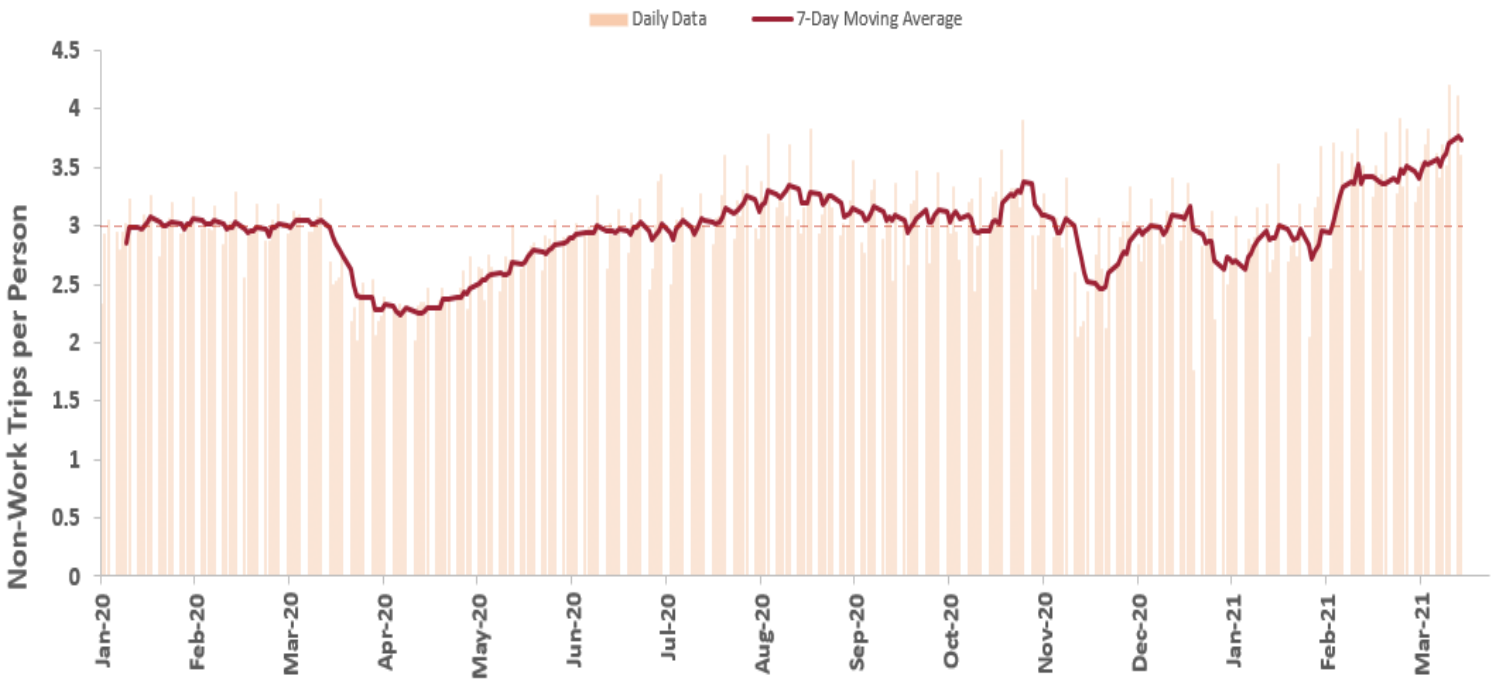
Discretionary Travel

Observed Data:



Source: COVID -19 Impact Analysis Platform- RITIS

Model:

- 3% Increase in **home-based other** trip purpose

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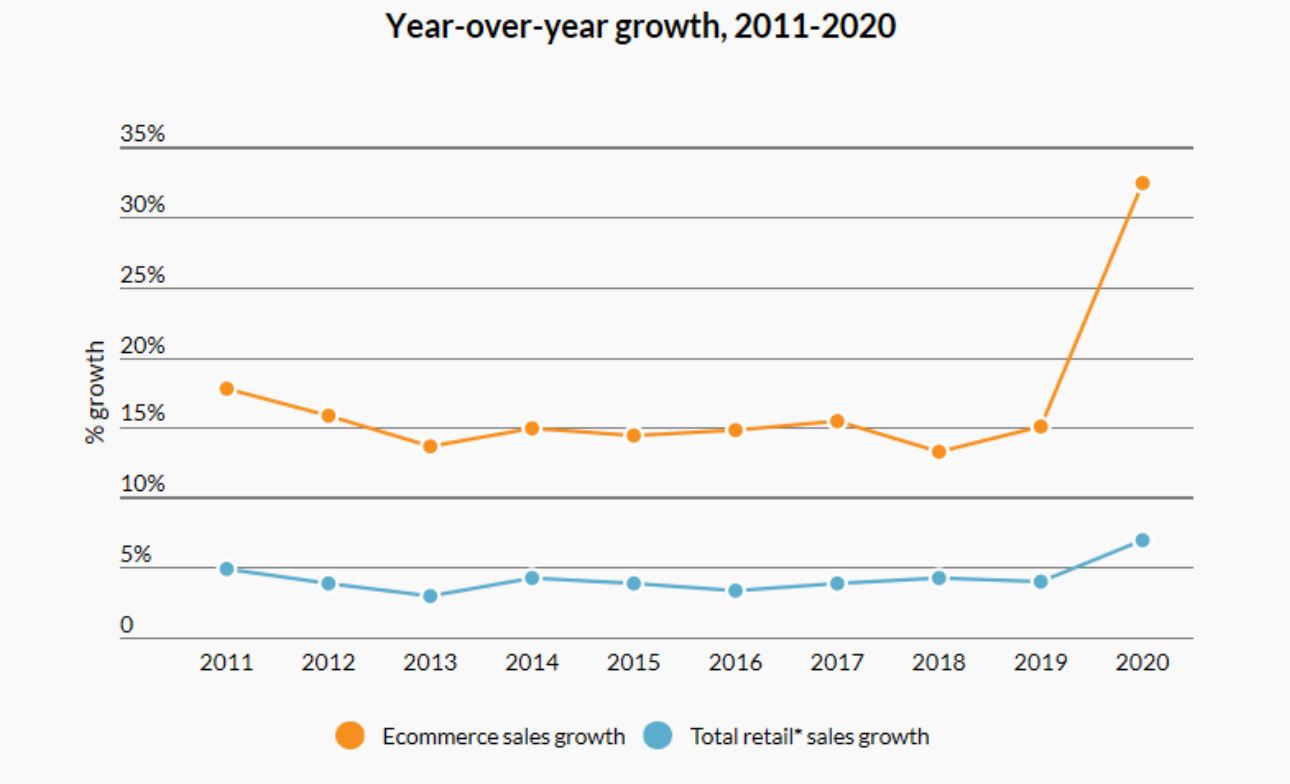
Shopping Trips and Truck/Commercial Vehicles

Observed Data:



Source: Department of Commerce

Model:

- Increase in **truck and commercial vehicles**
- Reduction in **home-based shopping** trips

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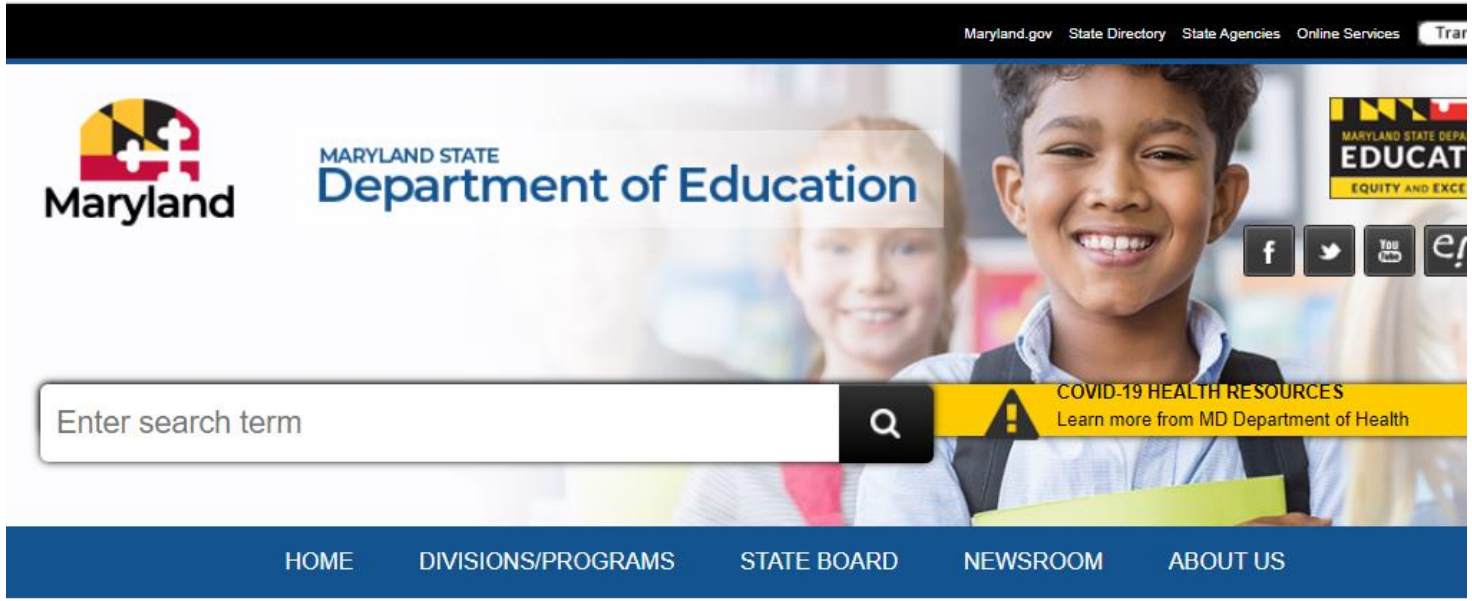
Remote Learning

Observed Data:



Source: ***http://marylandpublicschools.org/Pages/default.aspx***

Model:

- 75% reduction in **Home-based School** Trips

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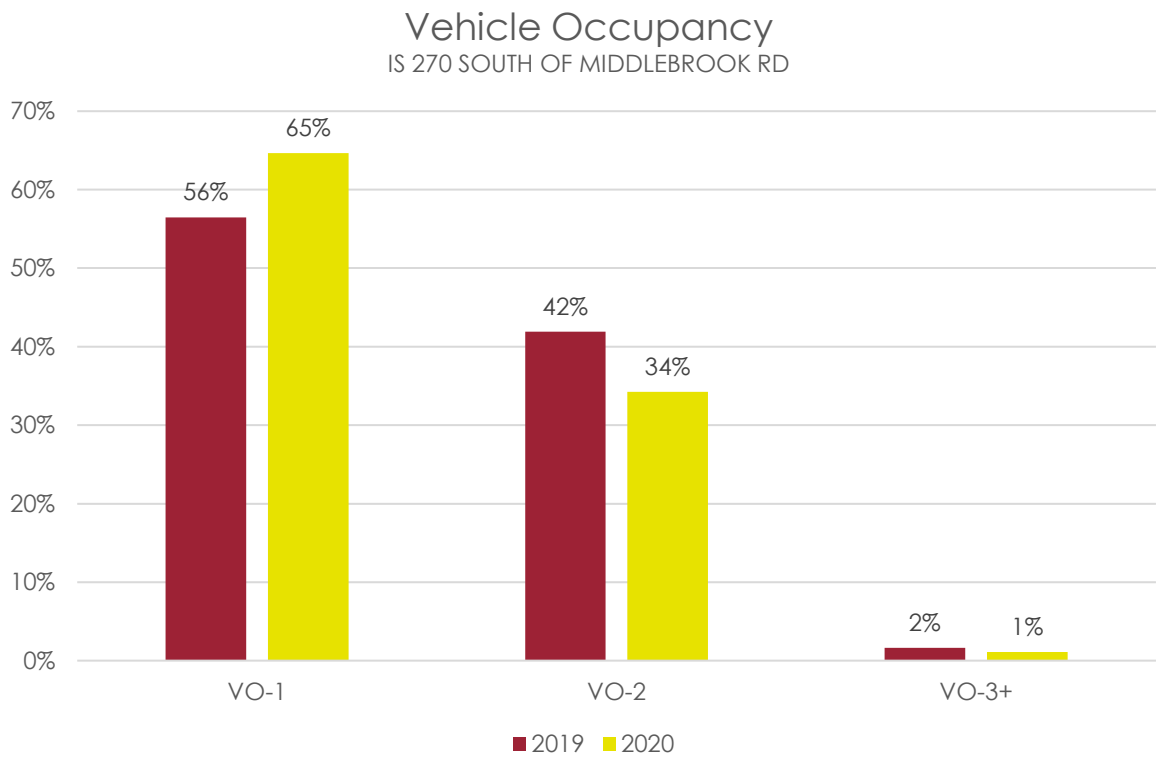
Vehicle Occupancy

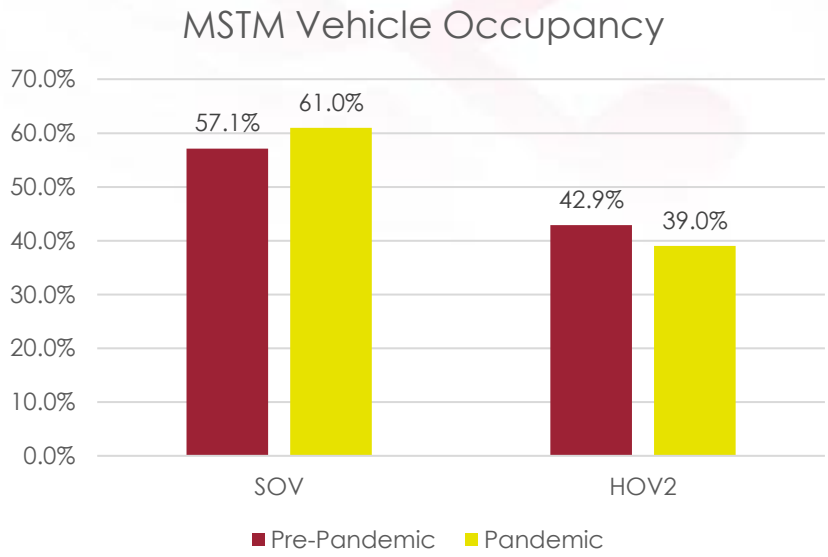
Observed Data:



Source: MDOT-SHA

Model:

- Shift from **HOV to SOV**



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Pandemic Scenario (Fall 2020)

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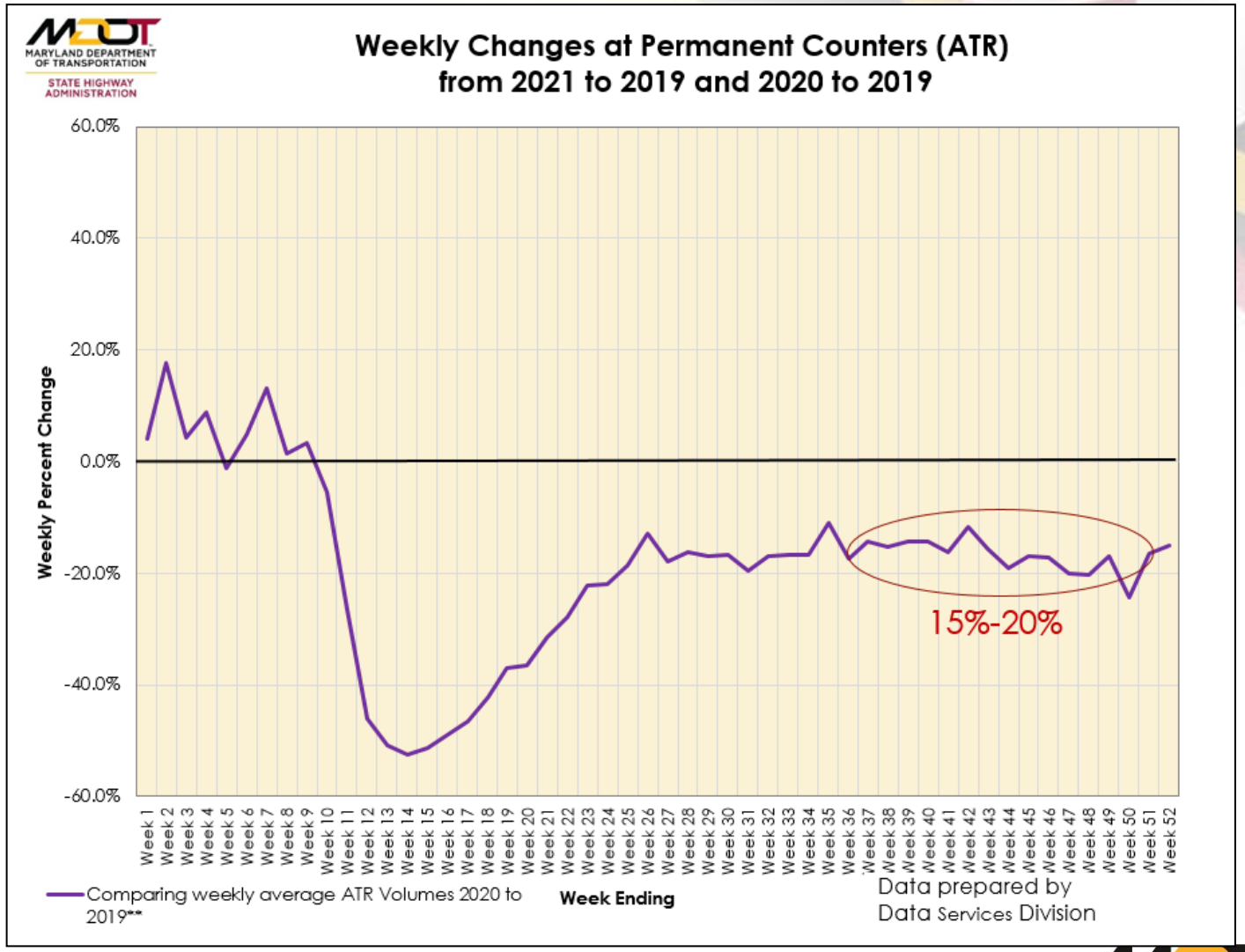
- Calibration goal:

  <u>15%-20%</u> reduction in VMT as observed in Fall 2020



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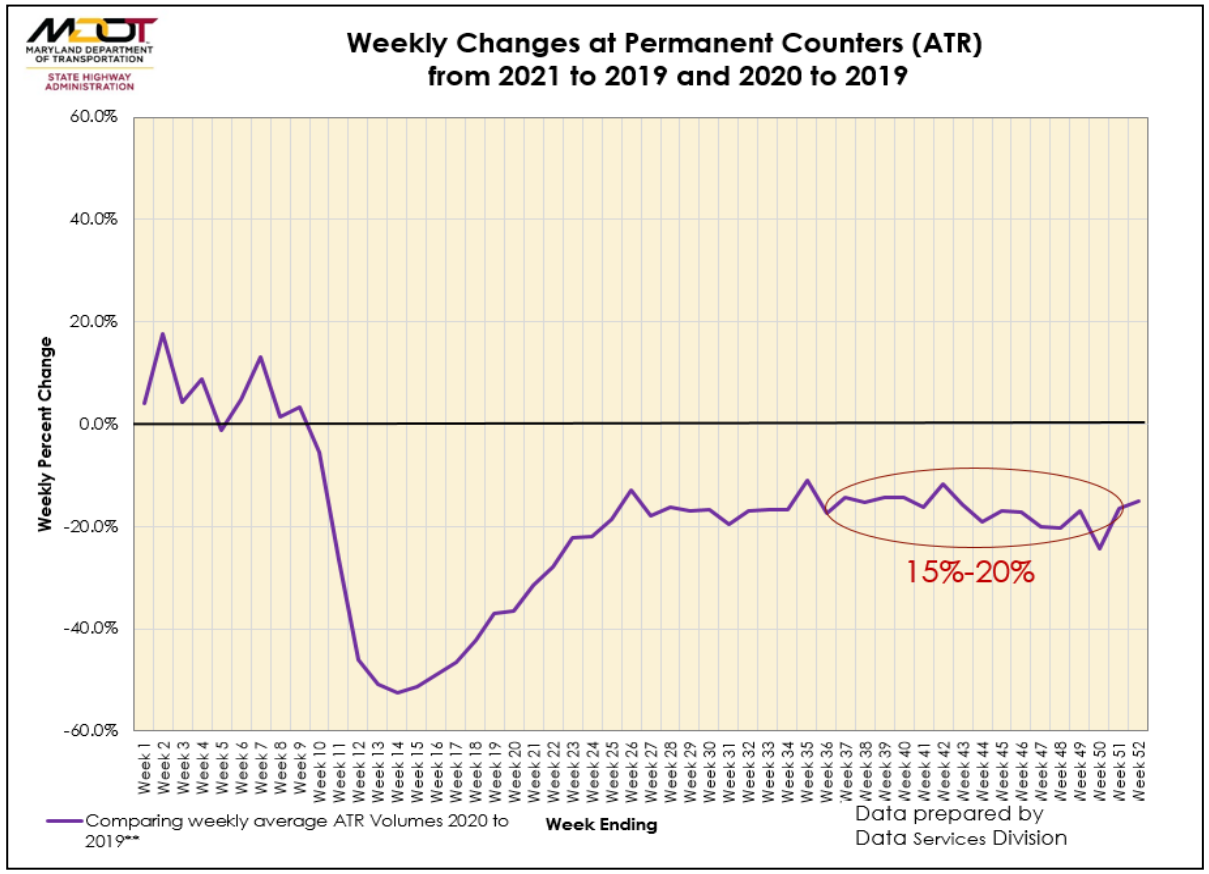
IMPACTS	Model Parameter
Person Travel	
Work from Home (WFH)-Production	HBW Production Rates by income level
Work from Home (WFH)-Attraction	HBW Attraction Rates by job type and income level
Change in Work Related Travel	Decrease in Non Home-Based Work models as a function of the WFH impacts on HBW rates
Remote Learning	Adjustment of home-based school trips.
Vehicle Occupancy	Manual shift of HOV2 and HOV3 trips to SOV as well as reduction of transit trips estimated by model.
Discretionary Travel (Non-Shopping)	Increase in home based other trip purposes
E-Commerce-Shopping	Change in home-based shopping trip production rates
Discretionary Non Home-Based Trips	Reduction in Non Home-Based trips accounting for 2nd and 3rd stops in tours
Truck/Commercial Travel	
E-Commerce deliveries	Factoring of the commercial vehicle trip tables that account for delivery and distribution movements
Increased demand for goods	Factoring of the long and short distance single unit and multi truck trip tables.

OUTPUT: Vehicle Miles Traveled

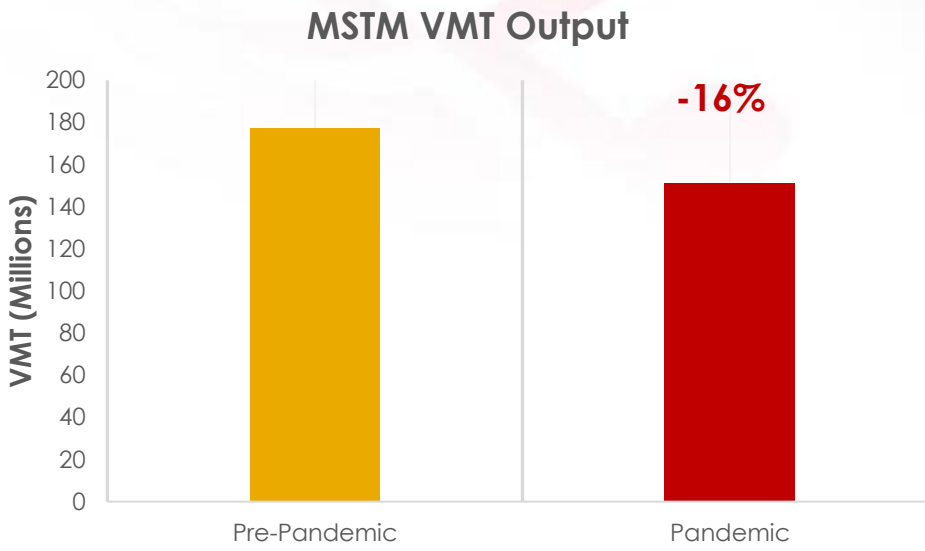
Observed Data:



Source: MDOT-SHA Data Services Division

Model:

- 16% Reduction in VMT



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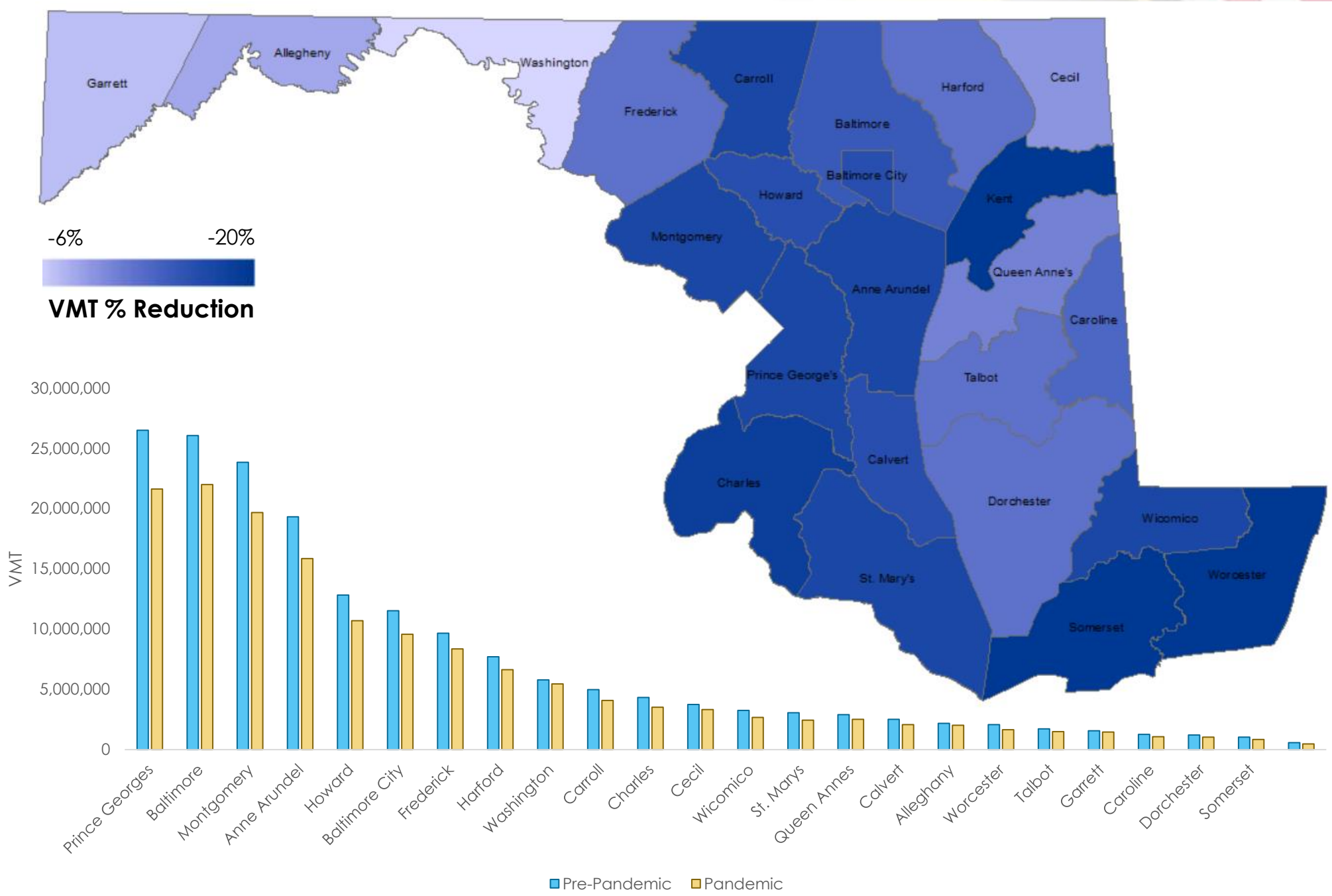

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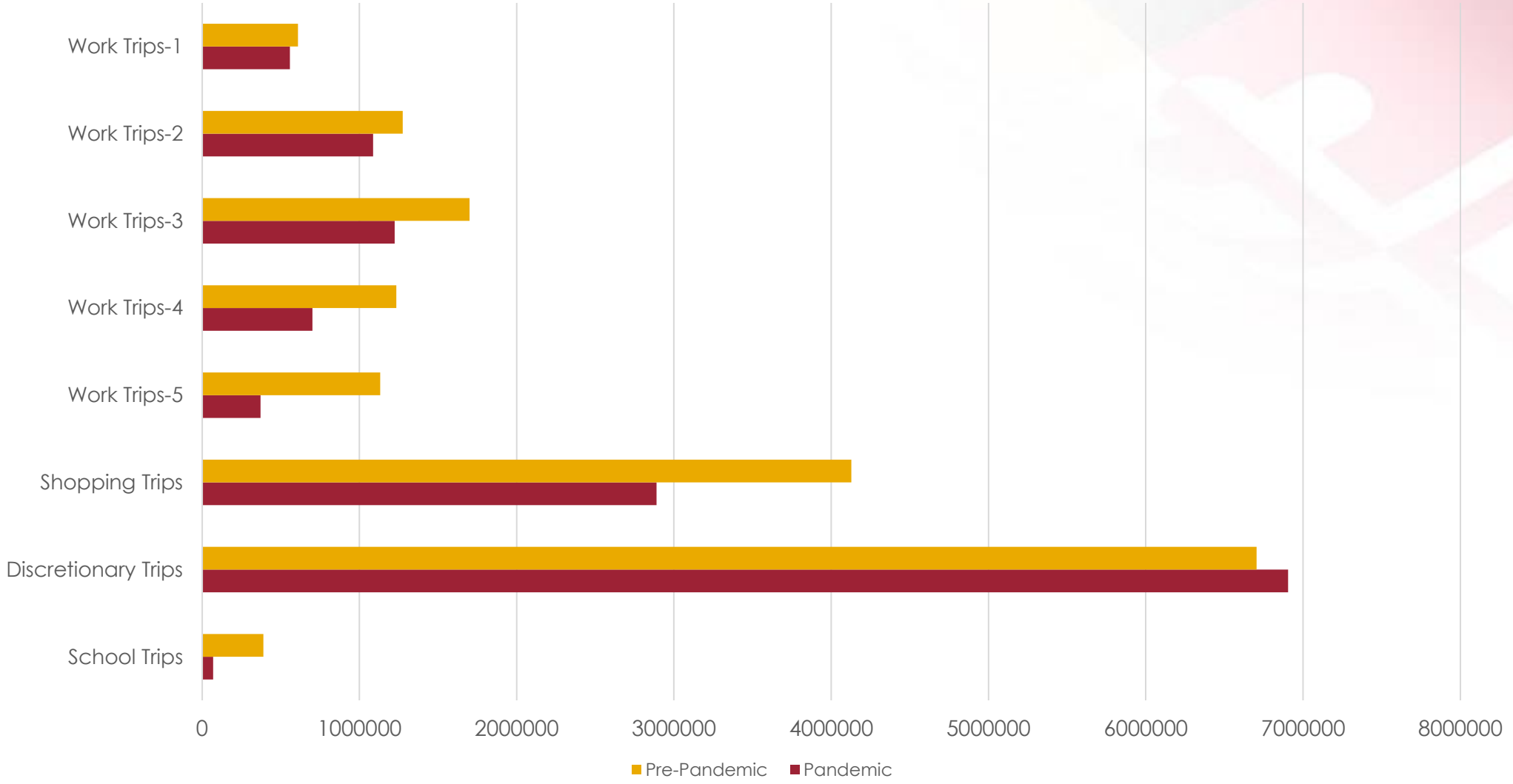
MSTM Trips by Purpose



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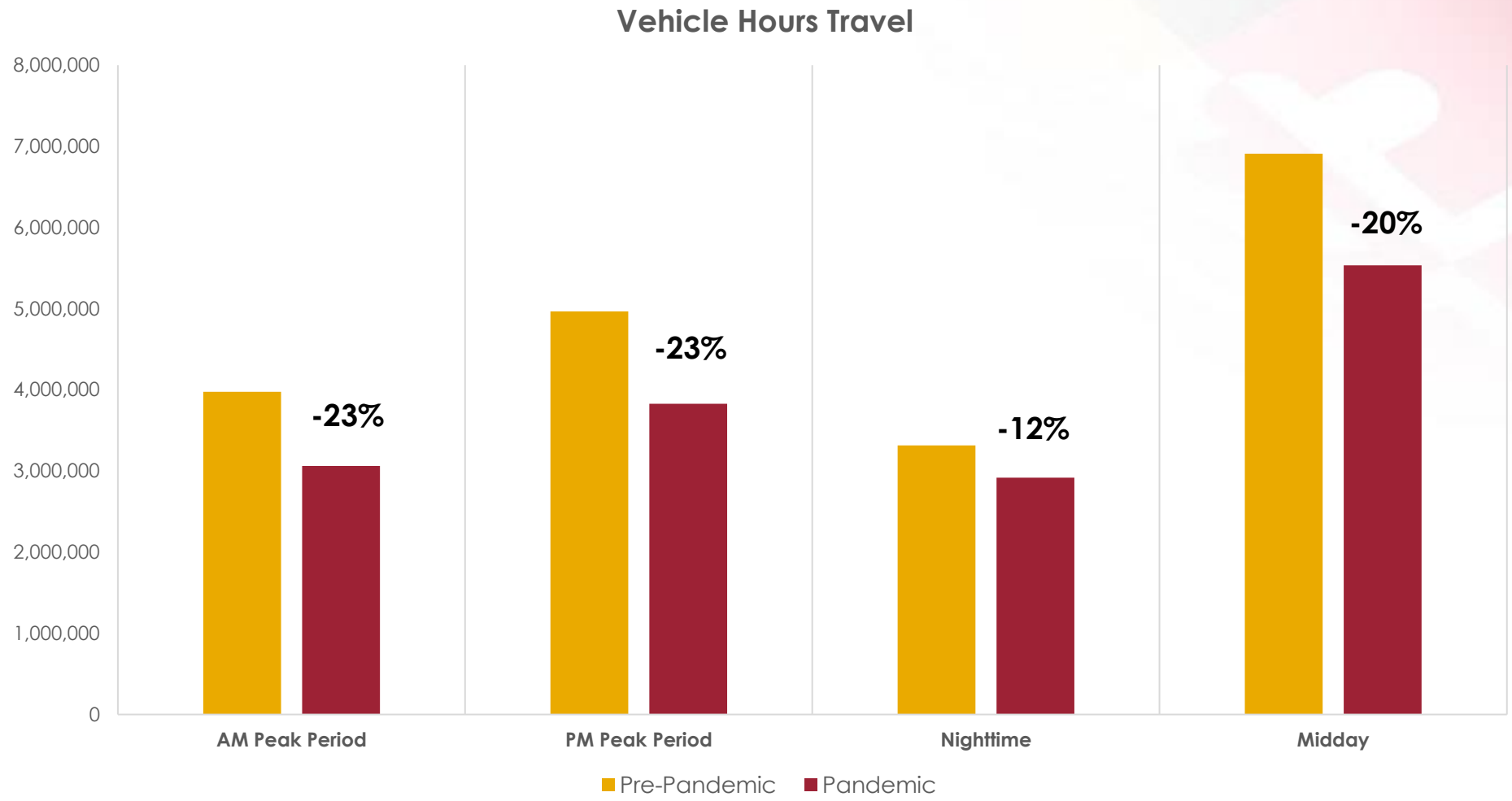
Vehicle Hours Travel by Time of Day



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Future Year Scenarios (2045)

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FUTURE COVID-19 IMPACT SCENARIOS

Work from Home

Rise of E-Commerce

1. **Old Normal**
2. **High WFH/ High E-com**
3. **High WFH/ Trend E-com**
4. **Low WFH/ High E-com**
5. **Low WFH/ Trend E-com**
6. **New Normal**

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Impacts	Assumption
Person Travel	
Work from Home (WFH)-Production	Increased WFH by higher income workers
Work from Home (WFH)-Attraction	Increased WFH would be related to job sites associated with higher income types of jobs (service and professional)
Change in Work Related Travel	Because of increased WFH, lower levels of work-related travel from work sites through the day
Remote Learning	Some level of hybrid education model that would include in person and online teaching
Vehicle Occupancy	Shift of preference to SOV with reduction of HOV2 and HOV3 trips as well as shift away from transit.
Discretionary Travel (Non-Shopping)	Increased free time for discretionary travel from home.
E-Commerce-Shopping	Increased rate of adoption of e-commerce including direct delivery of goods and services without need for travel.
Discretionary Non Home-Based Trips	With a greater focus on "home", more trips shifting to home based and fewer trips made while away from home
Truck/Commercial Travel	
E-Commerce deliveries	Increased levels of delivery and distribution movements consistent with the increased adoption of e-commerce
Increased demand for goods	Related to e-commerce and increased demand for consumer products, higher levels of long and short distance truck movements

FUTURE SCENARIOS

			Scenario					
Impacts	**Level**	**Parameter Change**	**1**	**2**	**3**	**4**	**5**	**6**
WFH (Work Trips)	High	Increased - all possible			X	X		
	Med	Increased - some		X			X	X
	Low	Calibrated	X					
Remote Learning	High	Near all remote			X			
	Med	Some (Hybrid)				X	X	X
	Low	Calibrated	X	X				
Long Distance Truck	High	Increase # of long-distance trucks			X		X	
	M/H	Moderate Increase		X		X		X
	Med	Calibrated	X					
Vehicle Occupancy	High	Shift to SOV						
	M/H				X	X	X	X
	Med	Calibrated	X	X				
	Low	Shift to higher HOV						
Commercial Vehicle	High	Increase #			X		X	
	M/H	Moderate Increase		X		X		X
	Med	Calibrated	X					
Discretionary Travel (non-shopping)	High	Increased			X	X		
	M/H						X	
	Med	Calibrated	X	X				X
	Low	Decrease						
Non Home Based Work (Tied to WFH)	High	Decreased - all			X	X		
	Med	Decreased - some		X			X	X
	Low	Calibrated	X					
Non Home Based Other	High	Increased						
	Med	Calibrated	X	X			X	X
	Low	Lower			X	X		
Home Based Shopping	High	Higher						
	Med	Calibrated	X	X		X		X
	Low	Lower			X		X	

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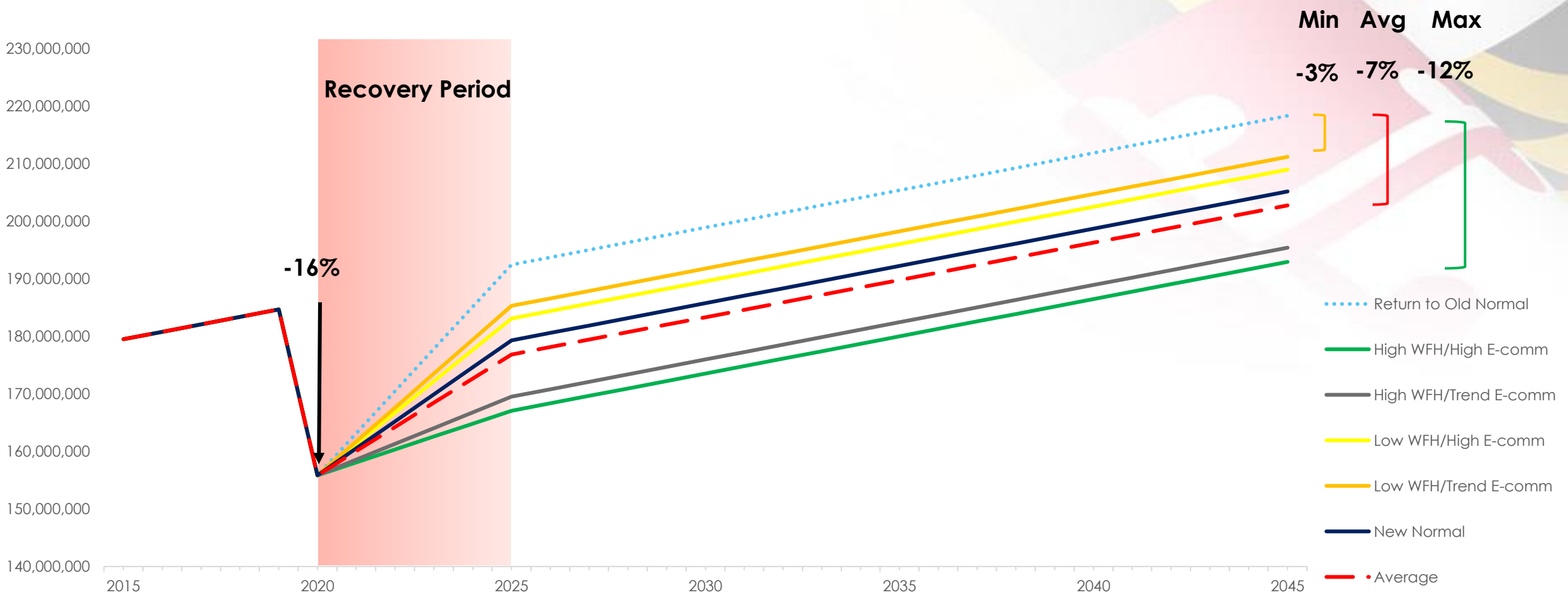
Statewide Vehicle Miles Traveled (MSTM)



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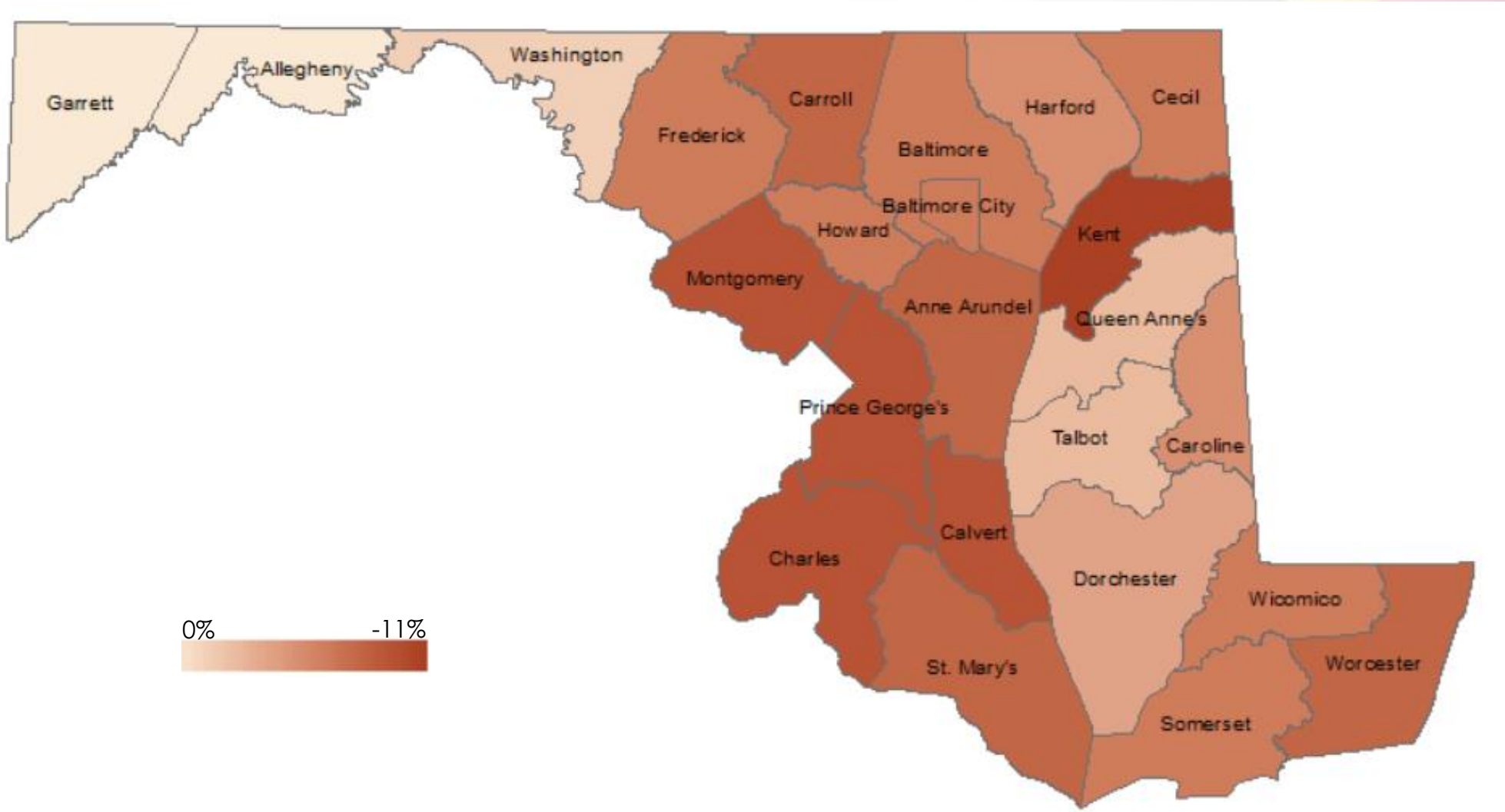
2045 VMT Changes (MSTM Average Scenario)



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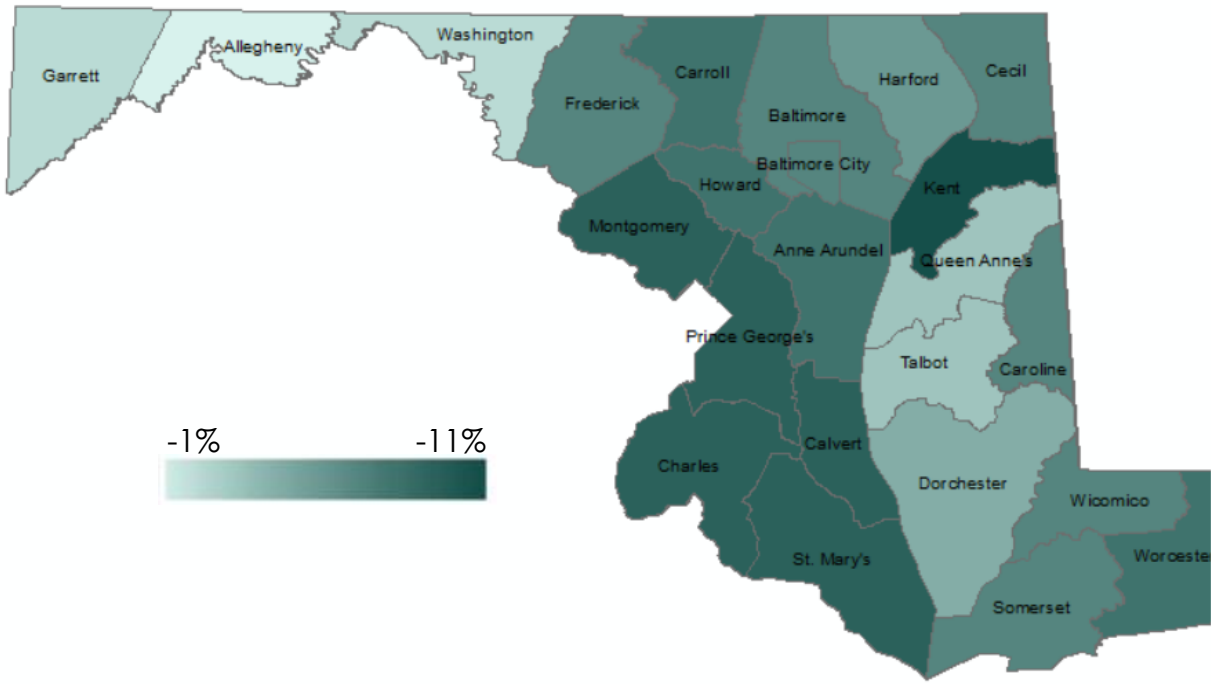
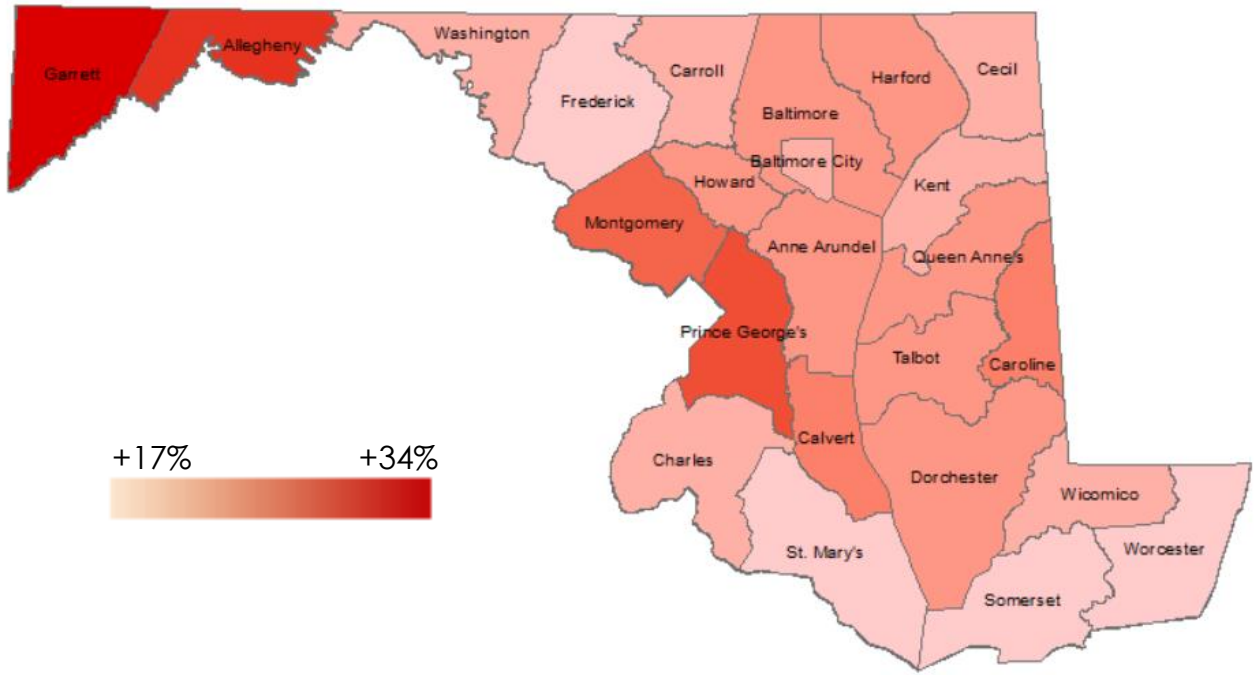
2045 Truck vs. Auto VMT (MSTM)

2045 Auto VMT Change



2045 Truck VMT Change



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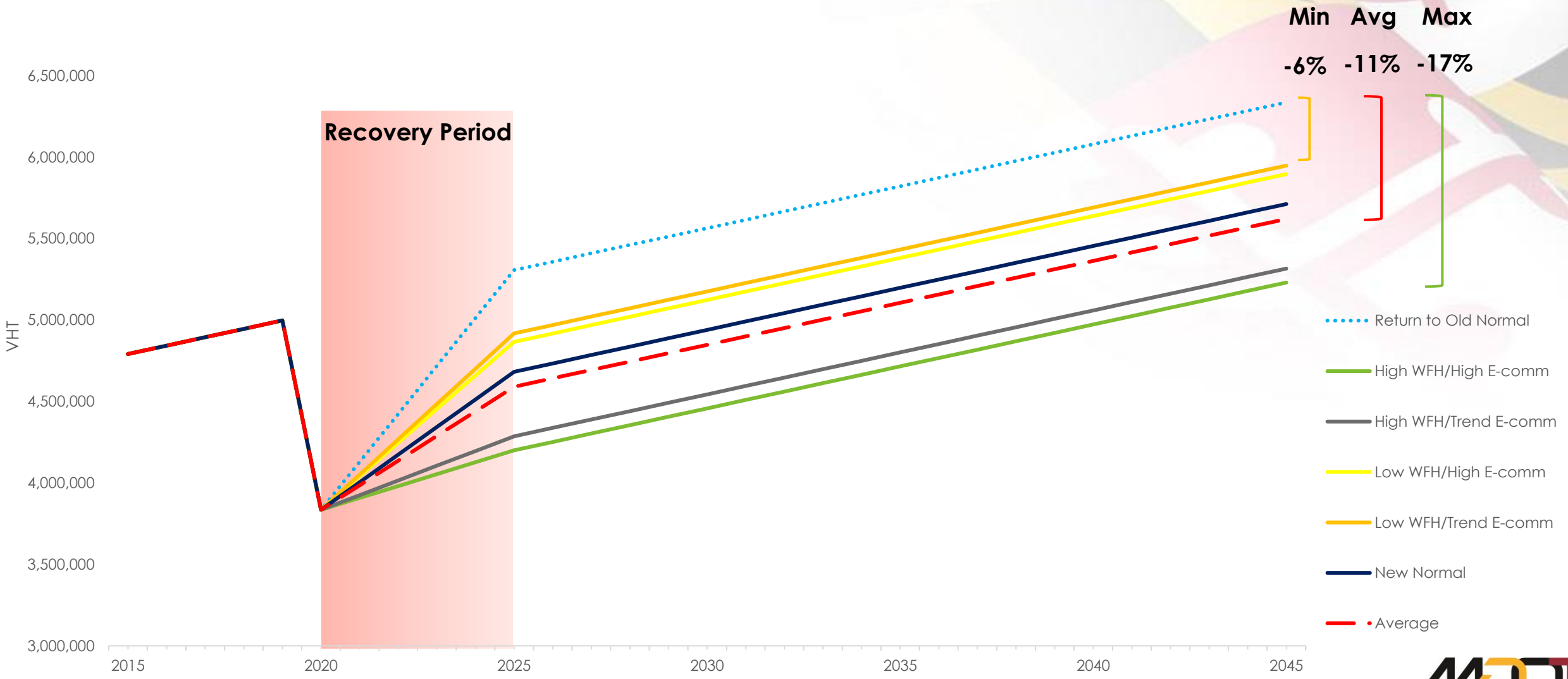
Statewide Vehicle Hours Traveled (MSTM)



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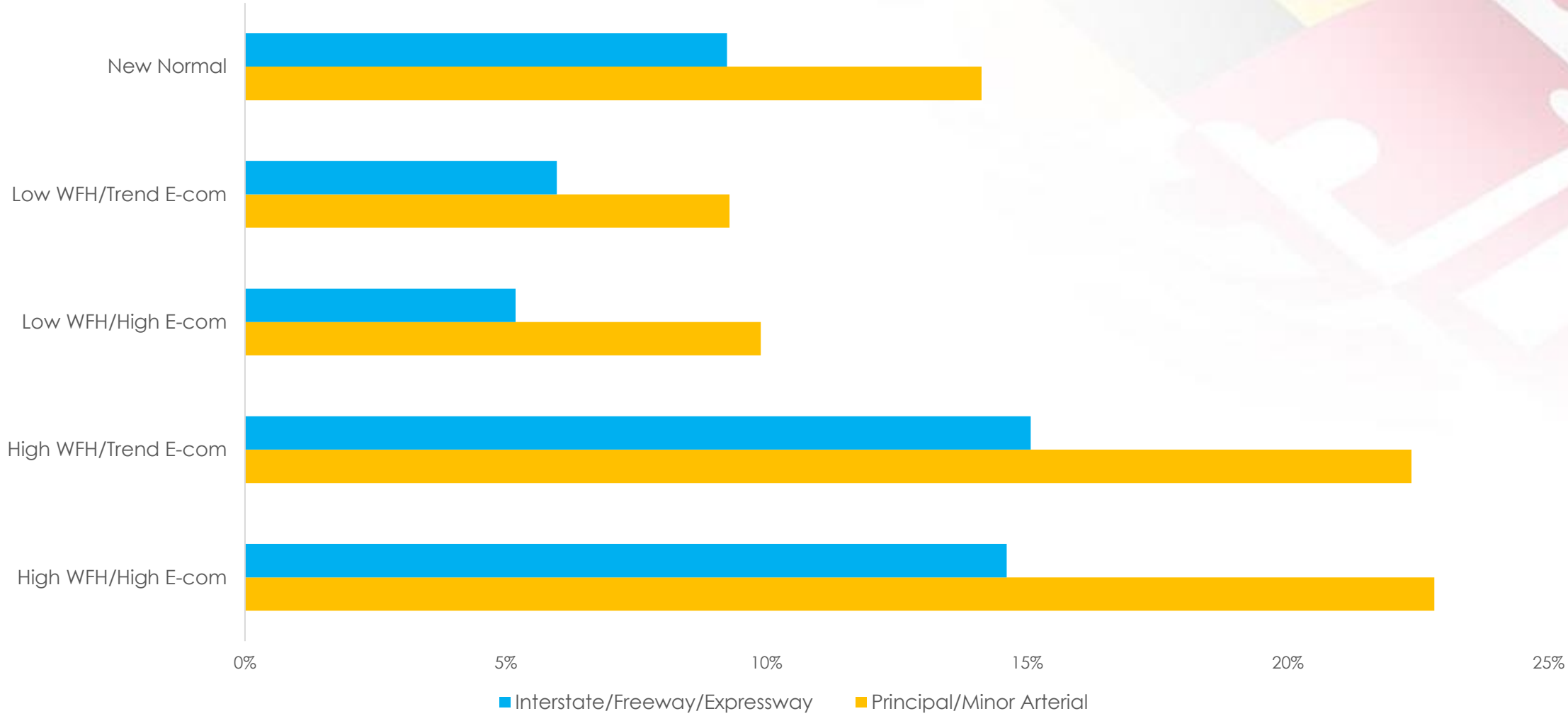
2045 VHT Reductions by Roadway Functional Class



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SUBMITTED FOR THE TRANSPORTATION RESEARCH BOARD 101ST ANNUAL MEETING.

COVID-19 Impacts on Mobility and Travel Demand

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ABSTRACT

Since the beginning of the COVID-19 pandemic, many drastic measures were taken to restrict travel to reduce further spread of the virus. These measures significantly affected travel demand to levels which could not have been anticipated by most planners in transportation agencies. As the pandemic has proven to have significant short-term impacts, it is anticipated that some of these impacts may translate to longer-term impacts on overall travel behavior and the movement of people and goods. Moving forward, it is necessary to re-evaluate travel demand forecasts and hence funding decisions under uncertain future conditions. Maryland Department of Transportation-State Highway Administration (MDOT-SHA) identified multiple strategic scenarios and the impacts they would have on the transportation system, and using the Maryland Statewide Transportation Model (MSTM), a combination of refinements in parameter values were implemented to capture potential long-term travel impacts of the pandemic. Model parameters associated with working from home, household income, changes in discretionary travel, distance learning, increased e-commerce, vehicle occupancy and mode choice were identified. Parameter values were assigned under the various scenarios using employer surveys on workforce teleworking and observed data on e-commerce growth and shopping behavior. Using a range of performance measures, the difference in systemwide vehicle miles travel, and vehicle hours travel were compared to the baseline to assess the potential long-term impacts of COVID-19 on future travel demand.

Keywords: COVID-19, long-term impact, travel forecasting, work from home, e-commerce

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Highlights of Potential Long-term Impacts

- 2045 VMT reduction is between **3% to 12%** with average of **7%**.
- 2045 VHT reduction is between **6% to 17%** with average of **11%**.
- **VHT (delay)** is more sensitive than VMT due to existing levels of congestion.
- Future VMT/VHT reductions occurs mostly in **Urban areas**.
- Delay reductions impact **Arterials** more than **Interstates/Freeways**.
- The highest VMT and delay reduction occurs during **AM peak period**.
- **Truck VMT** is expected to **grow considerably** due to rise in E-commerce.

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Next Steps

- TFAD will develop a **one pager summarizing** these results for distribution to management or inclusion in an appropriate report/location.
- Further investigation into impacts on **freight movement** and **truck parking** demand.
- Continue monitoring changes in travel behavior as COVID restrictions are lifted.
- This COVID scenario analysis is an example of how MSTM can effectively evaluate future **travel demand management policies** such as **TSMO**, **CAV**, **Teleworking**, **etc.**
- TFAD is currently planning to utilize MSTM for **CAV Scenario Analysis** as part of the CAV strategic plan.

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Next Steps

- Continue ongoing coordination with other **TBU partners** and **MDOT policy initiatives to provide**:
  - AMO/TSMO technical support
  - MDOT Statewide Goods Movement Plan
  - MDOT/MTA Statewide Transit Plan
  - MDOT/TSO Statewide Rail Plan
  - MDOT/MDTA technical support
- Initiate second **FHWA Peer Review of MSTM**.

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Thank You!

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