MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

TRAVEL DEMAND MODELING ACTIVITIES AT MDOT-SHA

National Capital Region Transportation Planning Board

Metropolitan Washington Council of Governments

Travel Forecasting Subcommittee

July 22, 2022

PRESENTATION OUTLINE

- Model Objectives at MDOT-SHA *(Mark Radovic)*
- Integration of FHWA Long Distance Passenger Model *(Sabya Mishra)*
- Update to Freight Model and Post-Processors *(Sabya Mishra)*
- Enhancements to Data Inputs *(Jonathan Avner)*
- Research/Other Activities *(Elham Shayanfar)*
- Migration to Cube Catalog *(Roberto Miquel)*
- MDOT-SHAs Travel Monitoring System (TMS) *(Abhay Nigam)*

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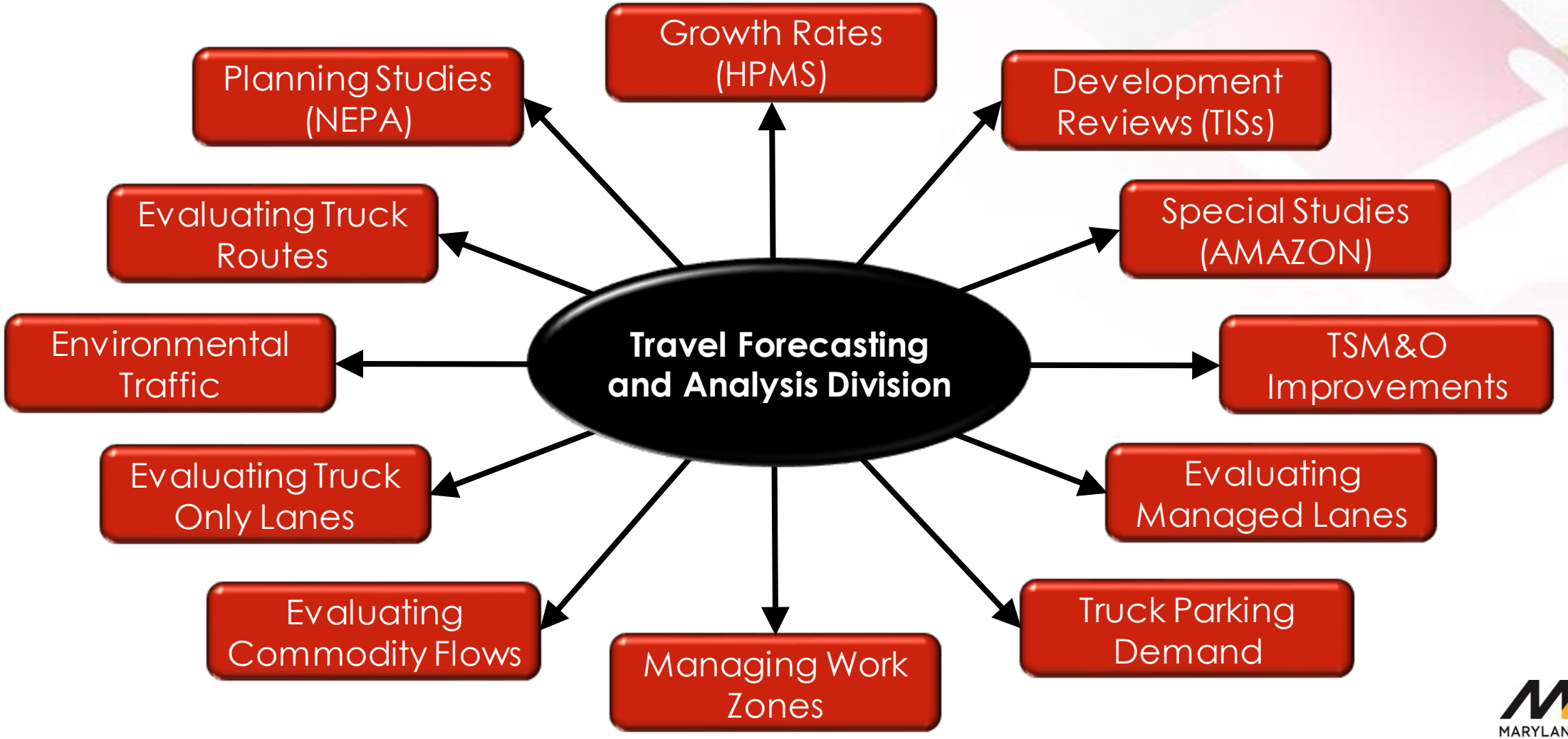
EVOLVING AND DIVERSE TECHNICAL NEEDS



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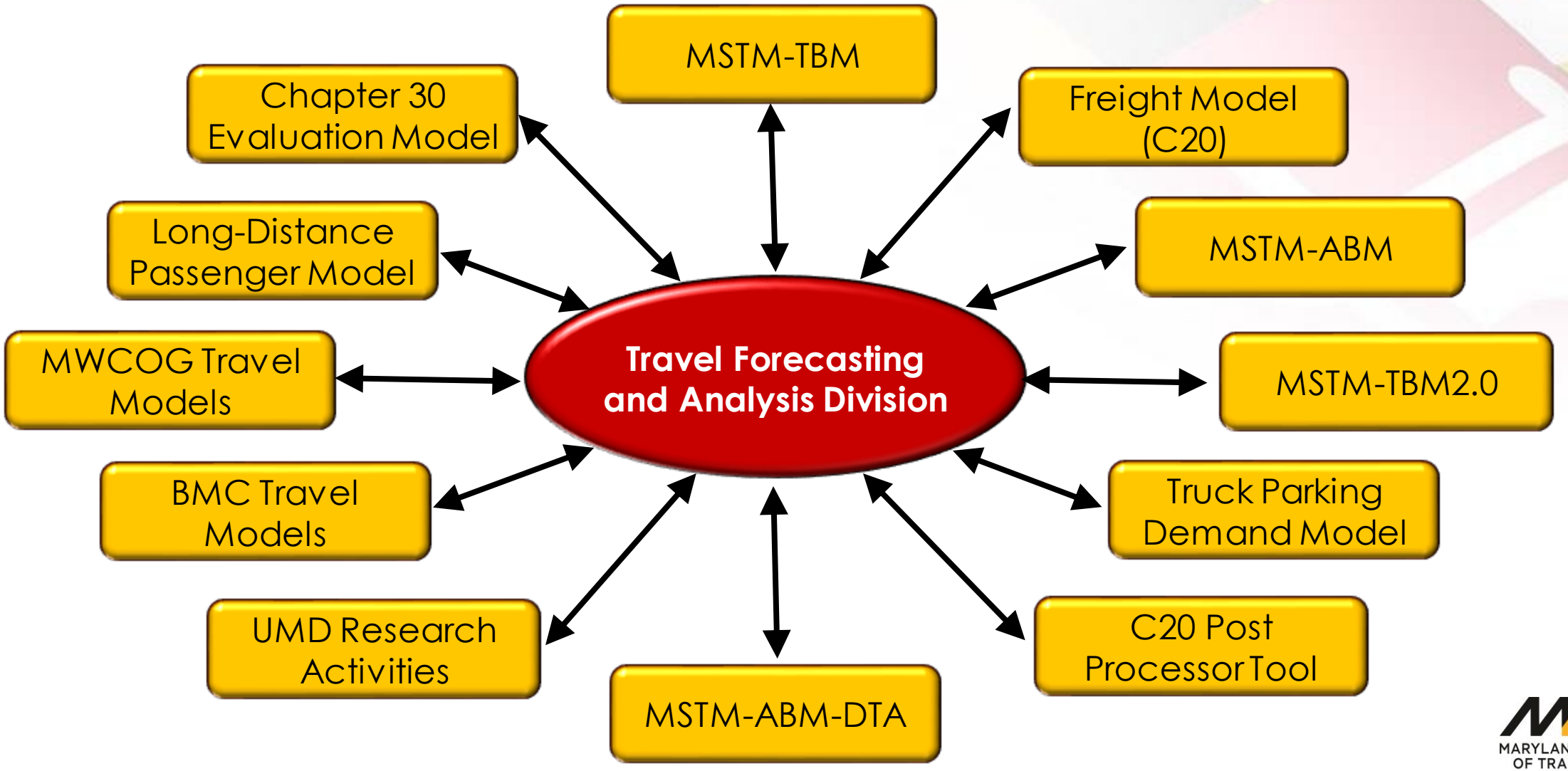
EVOLVING AND DIVERSE TECHNICAL TOOLS



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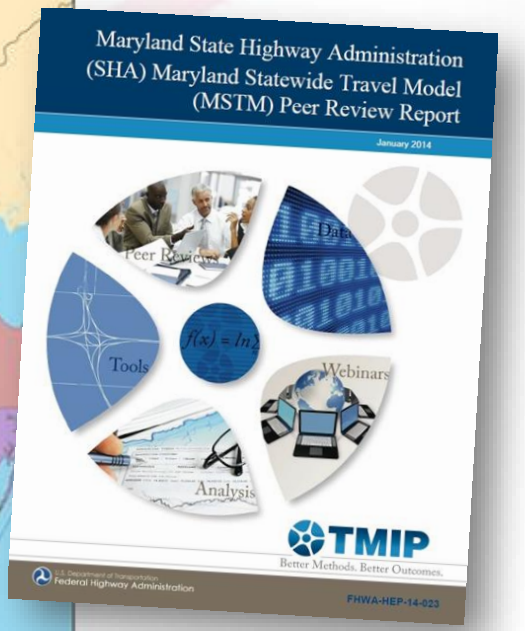
MARYLAND STATEWIDE TRANSPORTATION MODEL (MSTM-TBM)

- Trip-based model with ≈1,500 zones *within* Maryland
- Includes a 'halo' region around the state for a total of ≈1,800 zones
- Traditional 4-step model
- 4 time periods
- Runtimes of ≈16 hrs
- FHWA peer review*
- Active in TRBs Statewide Model Subcommittee
- Participation in Multiple Pooled Fund Studies



* "Maryland State Highway Administration (SHA) Maryland Statewide Travel Model (MSTM) Peer Review Report." Travel Model Improvement Program (TMIP). Washington, D.C.: U.S. Department of Transportation, Federal Highway Administration, January 2014. https://www.fhwa.dot.gov/planning/tmip/resources/peer_review_program/

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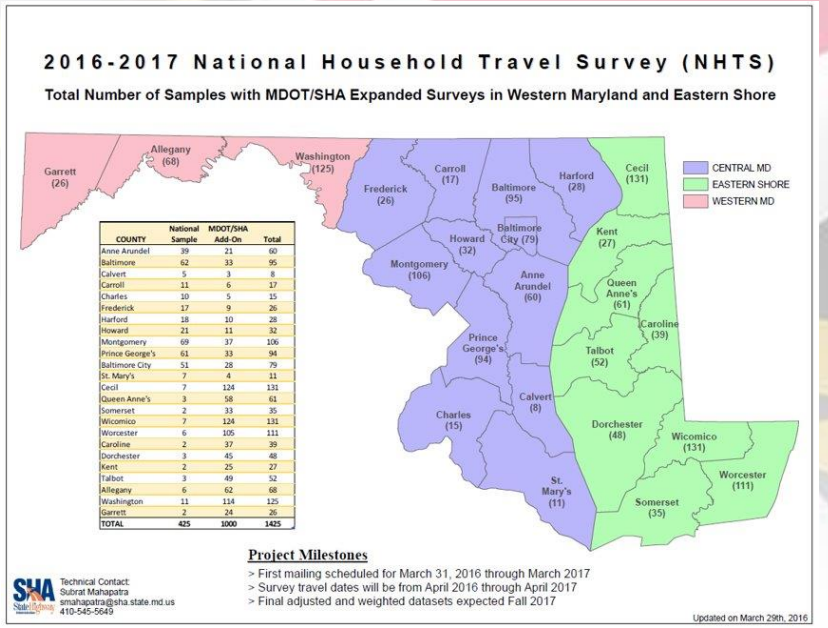
POOLED FUND PARTNERING AND BIG DATA APPLICATIONS



- **National Household Travel Survey** (NHTS/NextGEN)
- Pooled Fund Partner/TAC Member

- **National Accessibility Pooled Fund Study** (Accessibility Observatory)
  - Census Block level detail
  - Phase I (2014-2019)
  - Phase II (2020-2024)
  - Partners include MDOT, VDOT, DCDOT
  - Auto, Transit and Bicycle Modes)

- **Support for Urban Mobility Analyses" (SUMA) Pooled Fund Study**
  - Evaluating mobility datasets such as INRIX, Streetlight, O/D waypoint data)
  - Developing performance measures

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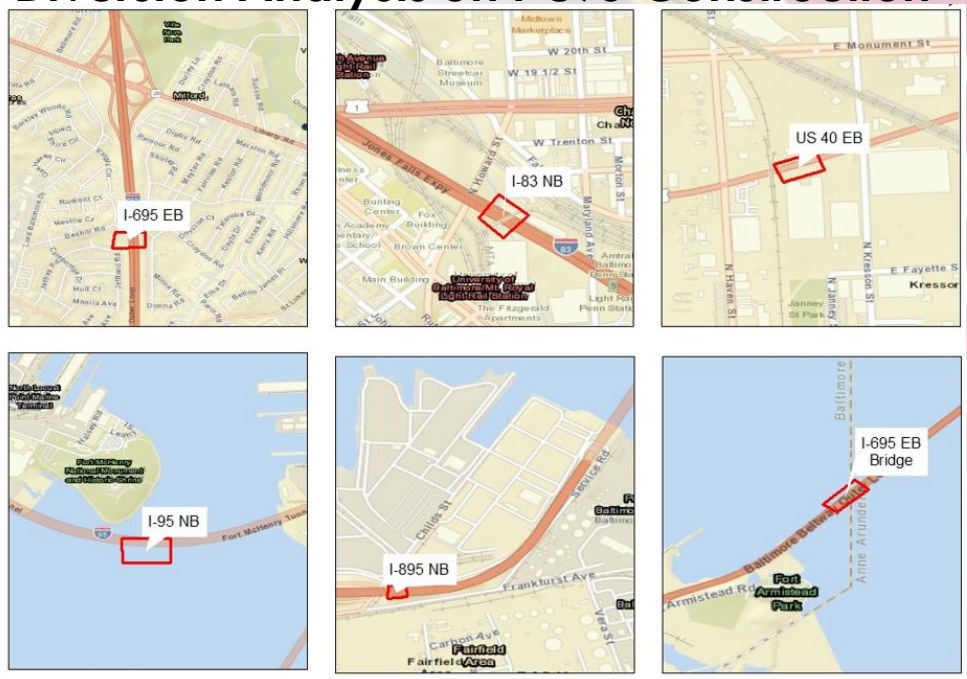
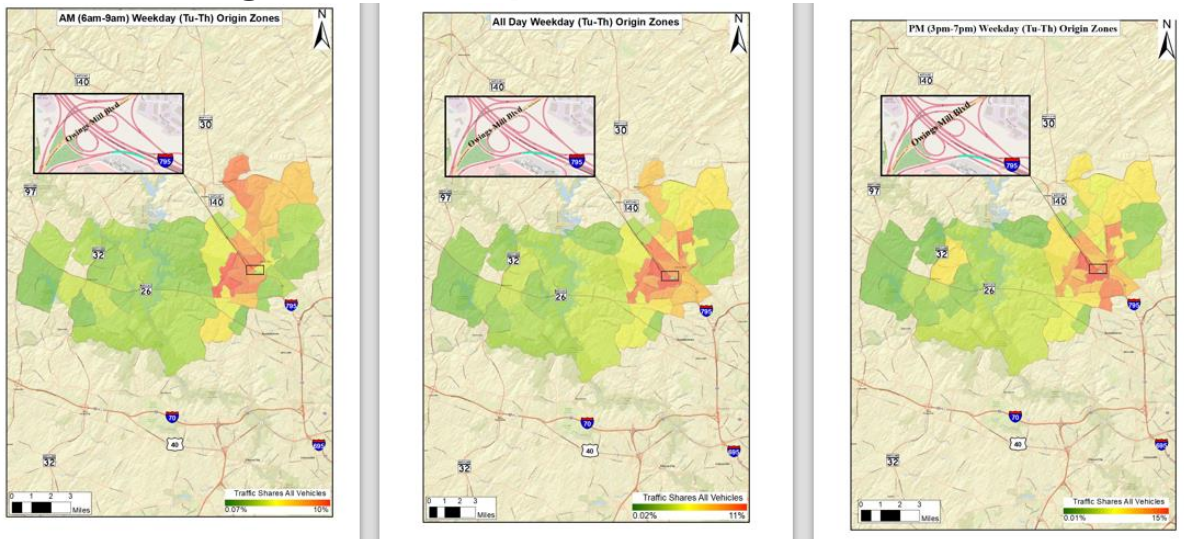
BIG DATA APPLICATIONS: STREETLIGHT DATA

- SMZ ODs
- SMZ Top Routes
- SMZ Long Distance
- Corridor-level ODs
- Corridor-level Routing
- Turning Movements
- AADT Estimation
- I-695 / I-70 Interchange Study Area

Diversion Analysis on I-895 Construction



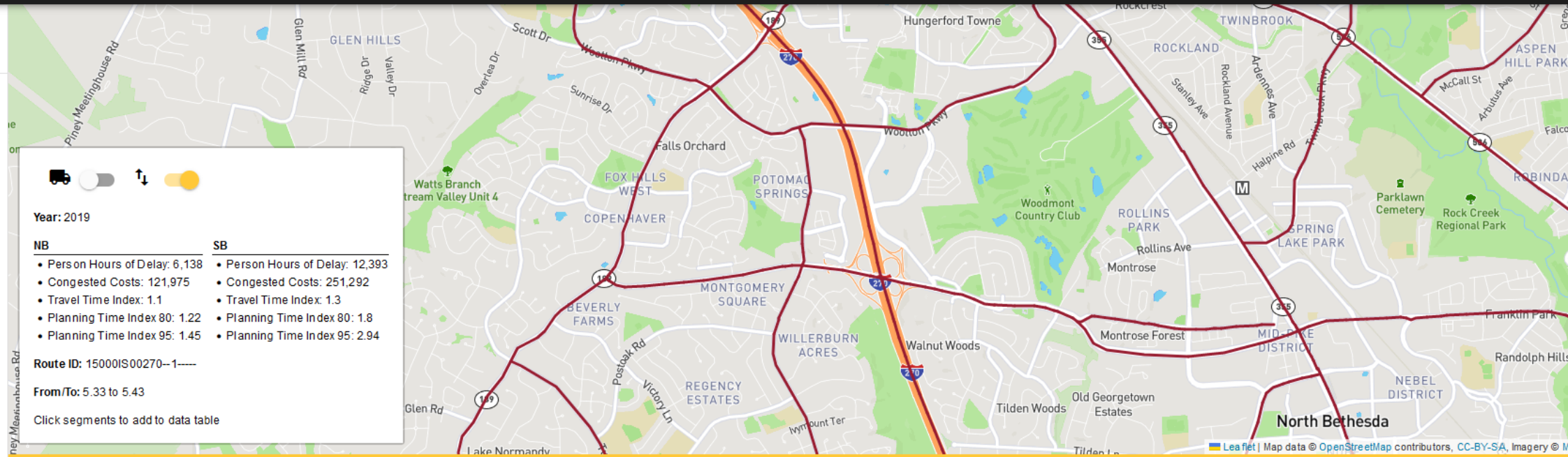
Interchange OD Analysis



Current Layer: DC Metro Area

Select geographic layer:

- Top 100 Bottlenecks
- Regions
- Counties
- Freight Network
- Critical Corridors Freeway
- Critical Corridors Arterial
- Critical Corridors Freight



SETTINGS/FILTERS | ROAD SEGMENTS | SUMMARY

Search

Group By: Route ID

	Route ID	From	To	Person Hours of Delay	Planning Time Index 80	Planning Time Index 95	AADT	Peak Vehicle Miles of Travel	Congested Costs	Congested CO2 Lbs	Normal CO2 Lbs	Reference Speed	Congested Speed	Travel Time Index
Show	10000US00015B-1-----	0	0.19	17,024.259	1.841	2.6	10,992	802.658	357,624.068	72.867	465.317	28.315	19.622	1.451

MARYLAND ROADWAY PERFORMANCE TOOL (MRPAT)

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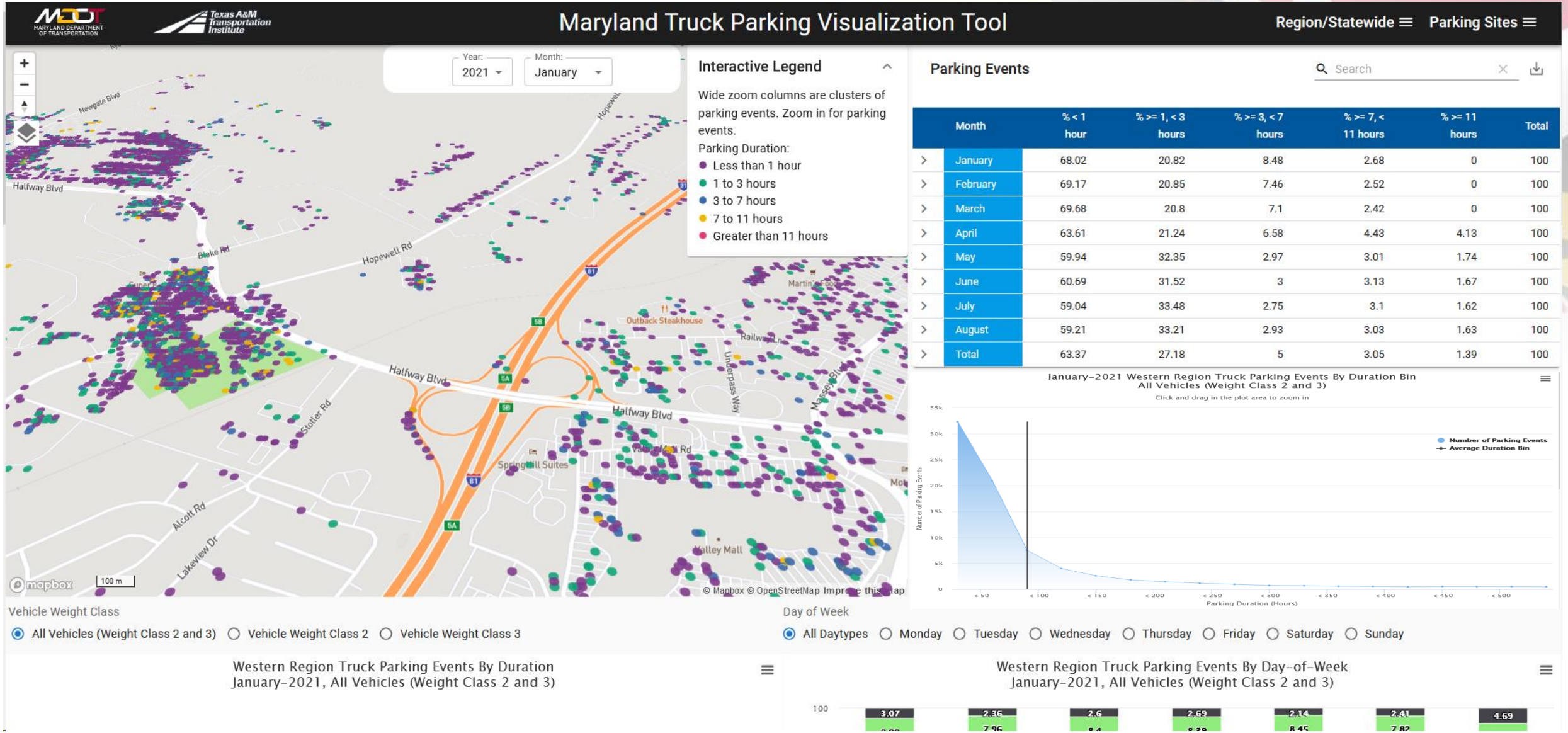

MARYLAND TRUCK PARKING WIDGET

FHWA LONG-DISTANCE PASSENGER MODEL

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FHWA LONG-DISTANCE PASSENGER MODEL

- Derived from FHWA National long-distance model
- Consists of national synthetic population
- Tour-based
- Includes tour party size and part composition
- Multi-modal tours including rail and air passengers
- Open source
- Flexibility in integration
- Standalone package
  - No additional software needed


The Exploratory Advanced Research Program Fact Sheet

Understanding Long-Distance Traveler Behavior

Supporting a Long-Distance Passenger Travel Demand Model

Exploratory Advanced Research . . . Next Generation Transportation Solutions

Long-distance trips in the United States can take 2 days or 2 weeks and may involve cars, buses, planes, or all three. Whether for business, to see family, or visit a national park, such a variety of trip characteristics requires a detailed understanding of traveler needs. Exploring new ways to model long-distance traveler behavior and better identify the required supporting infrastructure is the goal of "Foundational Knowledge to Support a Long-Distance Passenger Travel Demand Modeling Framework," a Federal Highway Administration (FHWA) Exploratory Advanced Research (EAR) Program study awarded to Resource Systems Group (RSG).

Exploring Passenger Travel

Long-distance travel behavior will be explored in several key areas that move beyond traditional methods used for existing statewide models. For example, long-distance trips are scheduled weeks or months in advance of the trip and typically last several days or weeks. There are also significant seasonal effects that can influence long-distance travel, unlike short-distance travel which remains similar day-to-day. Both leisure and business travel are more sensitive to changes in the economy than short-distance travel and leisure activities will often differ from business activities as they are planned and executed with different goals and choices. Party size can also have a significant effect on mode and destination choices.

Current Techniques and Challenges

Several observations have been made based on current modeling techniques. Recreational travel models typically adopt a similar structure to business and other travel, despite broad differences between the two. Business models are generally more time-sensitive and less concerned with party size as a mode choice variable when compared to recreational travel models. For example, a business traveler on a long-distance trip is more likely to fly regardless of expense or the number of colleagues traveling in the party. A family on vacation, however, may decide to drive to save money even if the trip takes longer. Although advanced integrated activity-based models are currently operational, these are limited to an estimate of average weekday travel and do not account for scheduling, influence of other trips, other travelers, or social character.

An additional challenge is that no single dataset offers all the required features for estimating and applying long-distance travel

Long-Distance Modeling

Highway infrastructure planning, high-speed rail development, and airport growth all depend on long-distance travel markets. To ensure infrastructure can meet growing demands in these areas there is a need to model and analyze passenger behavior. Interest in long-distance passenger modeling for statewide models has already been seen in California, Ohio, and Arizona, and high-speed rail studies have been conducted in Florida, California, and the Northeast Corridor; however, these models have been based on traditional travel demand forecasting methods rather than a robust understanding of underlying behavior and how and why long-distance passenger movements differ from other passenger travel.

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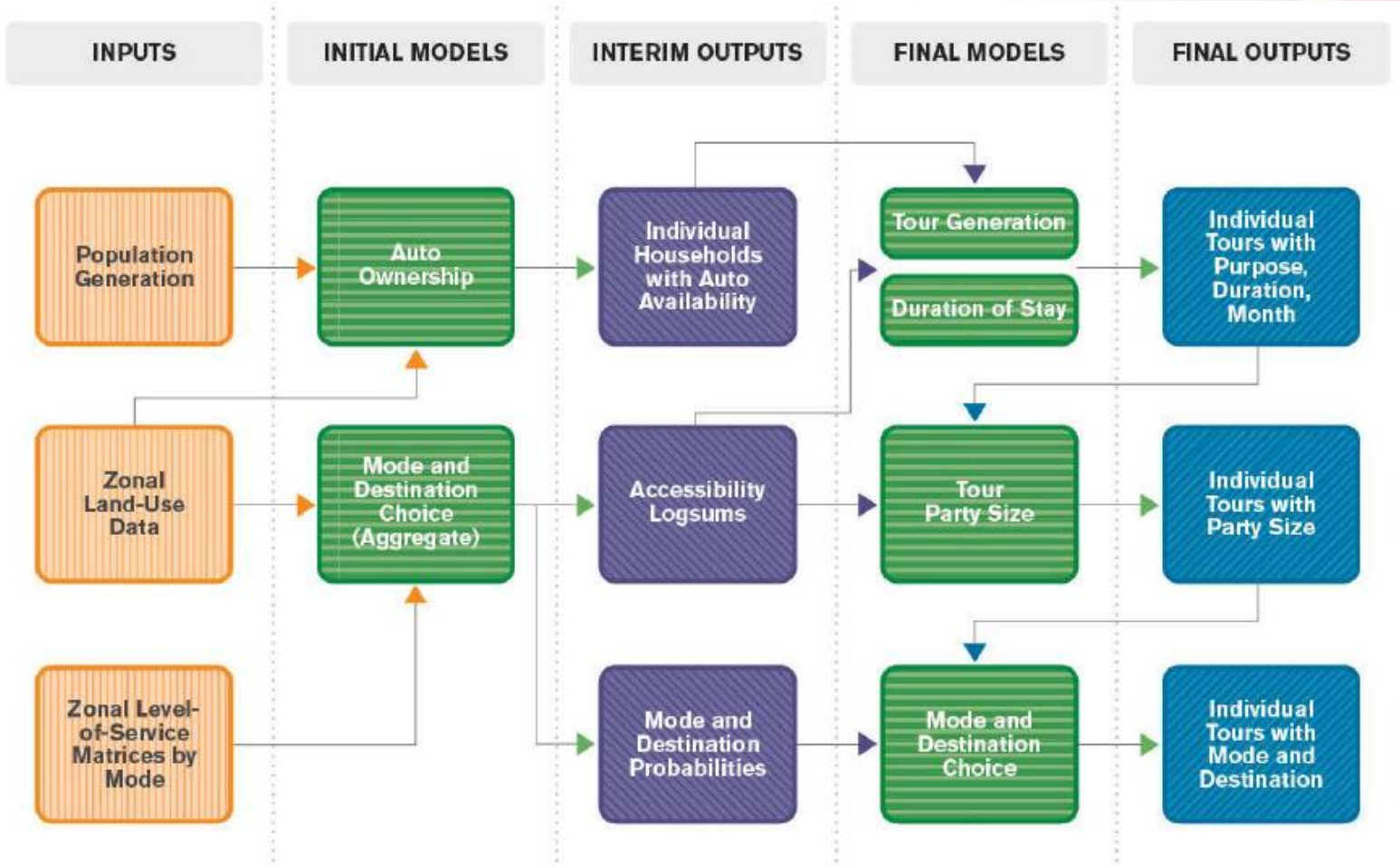
MODEL STRUCTURE



Source: FHWA

FHWA. National Long-Distance Passenger Model: User Guide Exploratory Advanced Research Program DTFH61-11-C-00015, June 2018.

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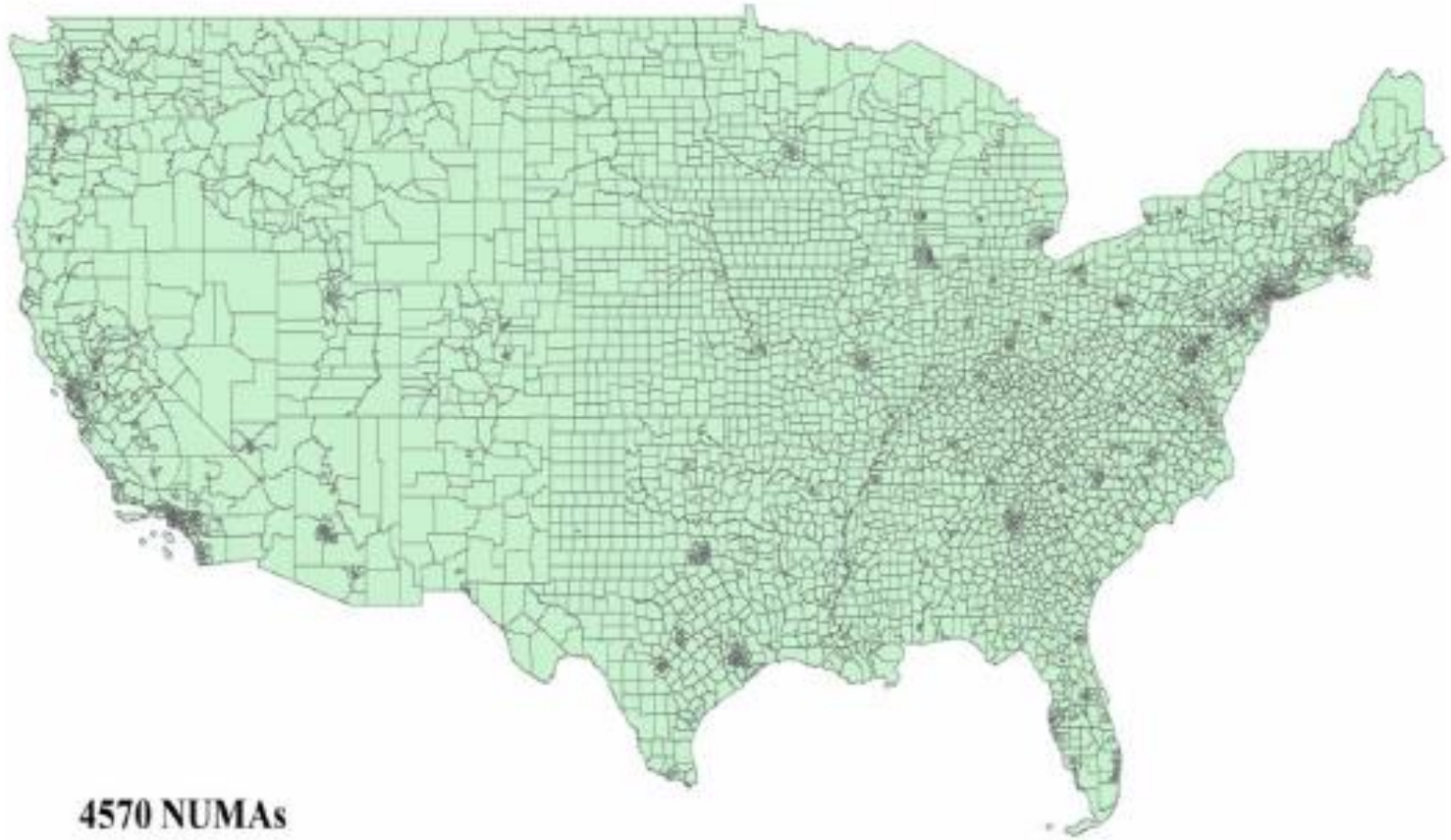
INPUT DATA – ZONE SYSTEM



4570 NUMAs

Source: FHWA

- Total household
- Enrollment
- Park area
- Employment type
- Distance to nearest
  - Bus, rail, airport

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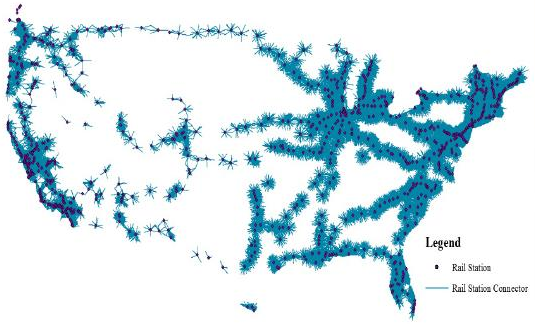
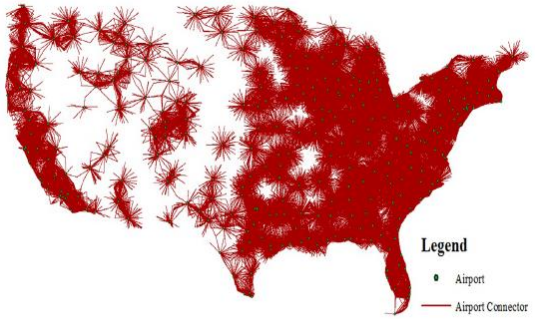
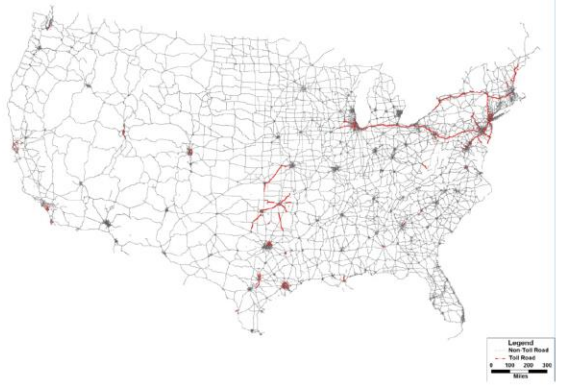
INPUT DATA – NETWORKS

- Highway (with toll)
- Rail
- Bus
- Air

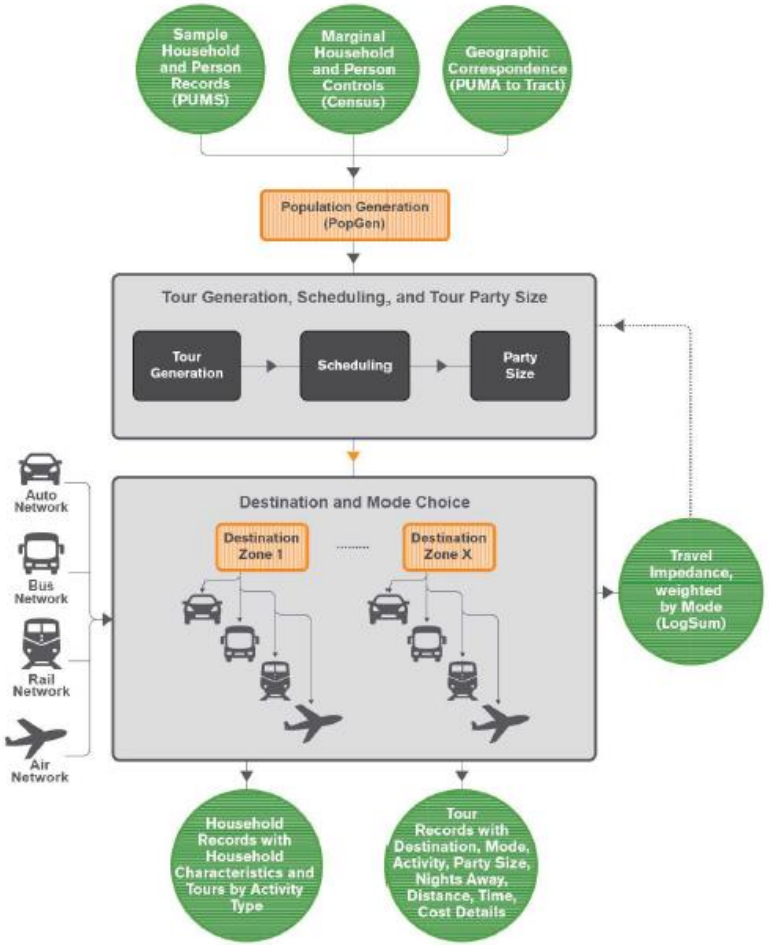


Source: FHWA





Source: FHWA



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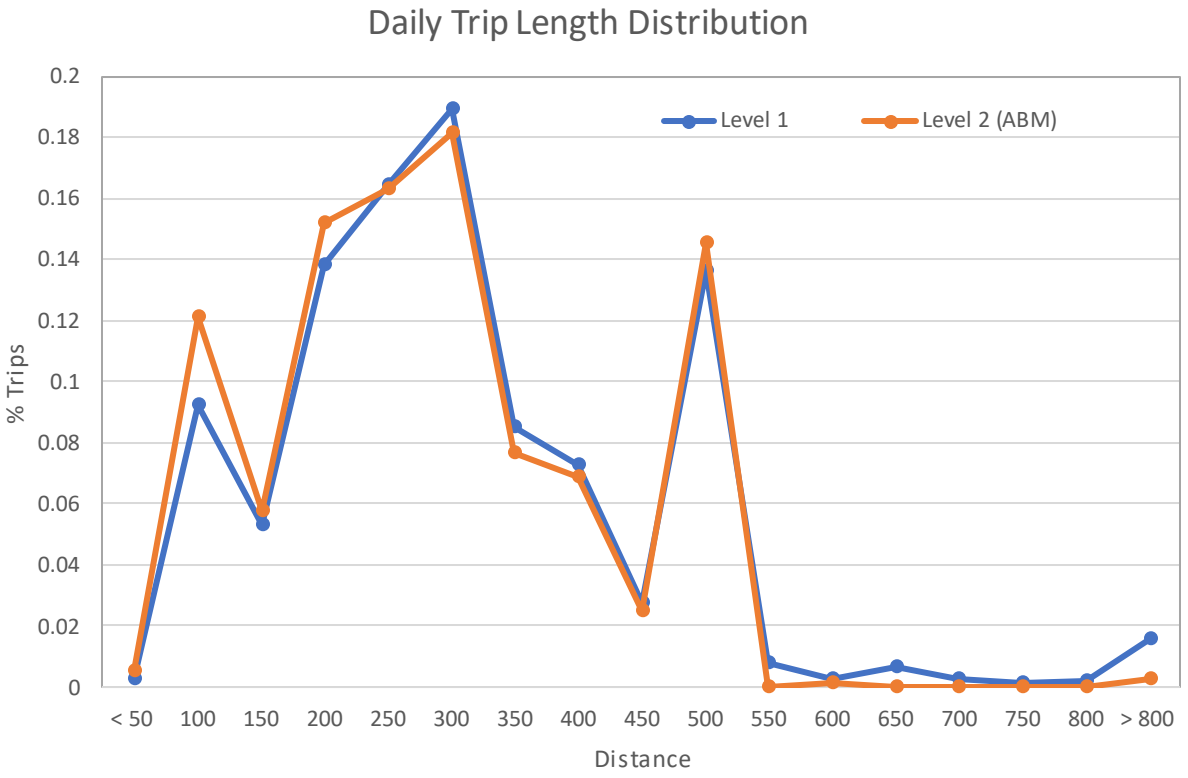
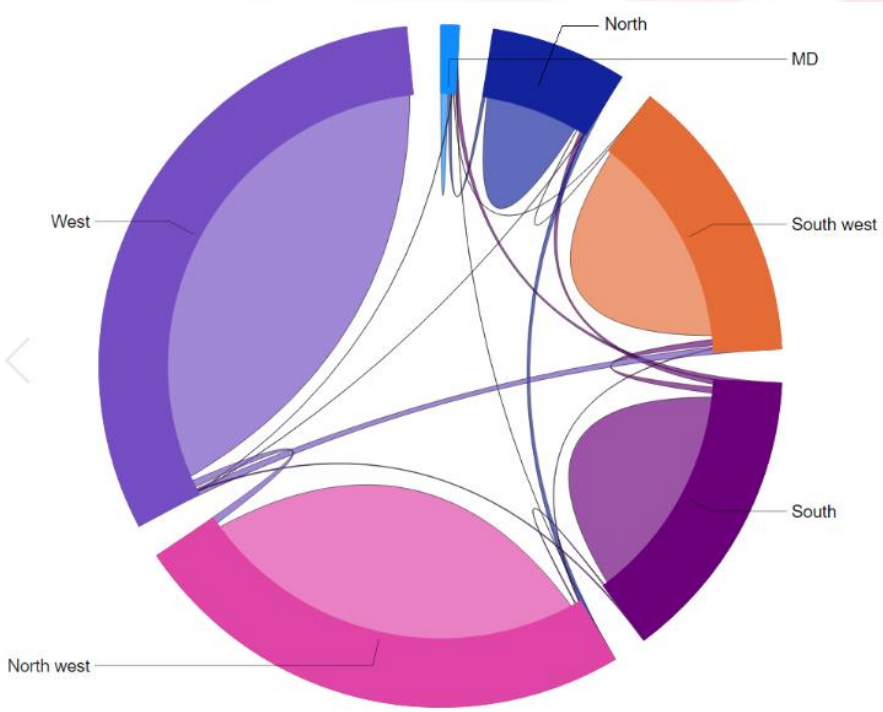
MODEL RESULTS

- Trip length distribution matches well
- Regional flows are reasonable (FHWA study, and other reports)





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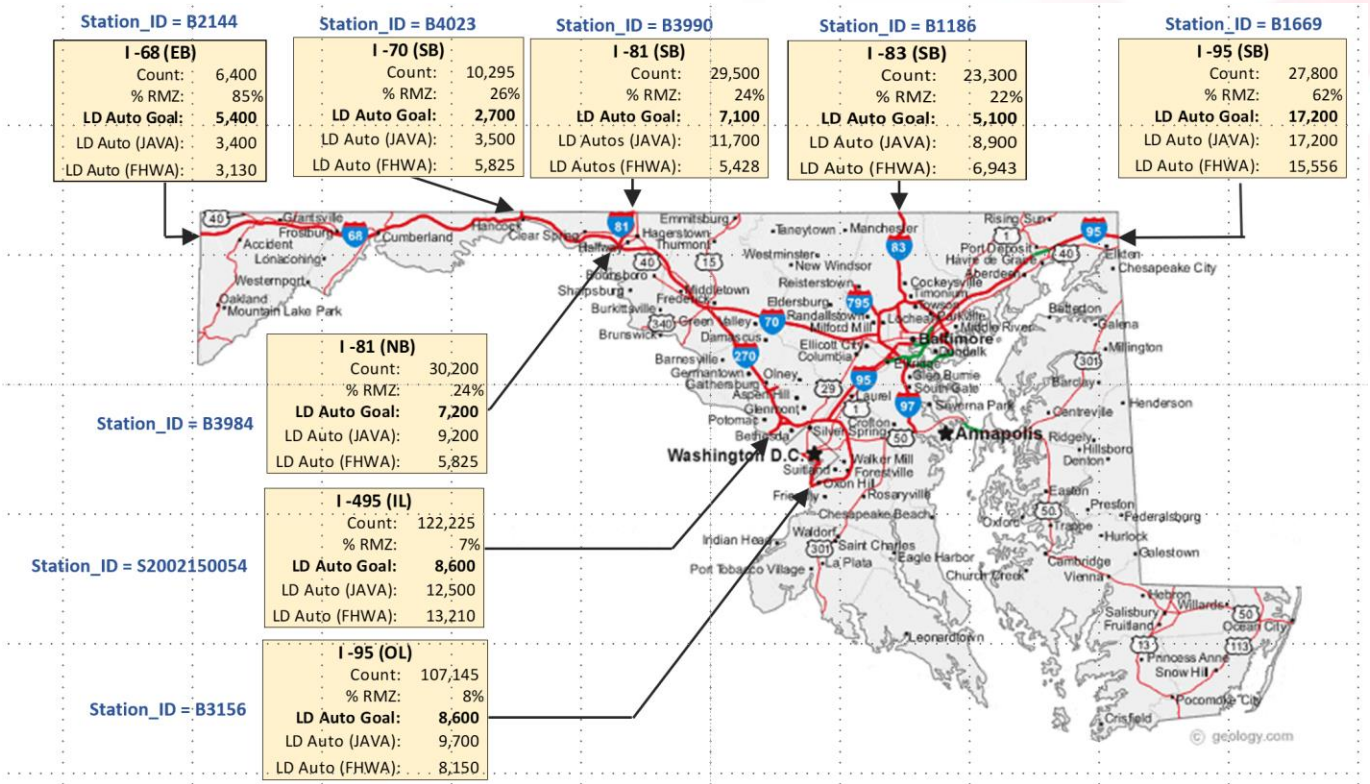
VALIDATION

- INRIX data used



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SHRP2/C20 FREIGHT MODELS

DEVELOPMENT OF BEHAVIOR-BASED FREIGHT MODEL

- Based on SHRP2/C20 research grant
- Includes national supply-chain model, regional truck model, and commercial vehicle truck touring model
- Freight tours available
- O-D's can be based on any time slice (e.g., every 15 minutes)
- Truly multimodal model (not just truck based)
- Freight mode choice can easily be done
- Truck touring model for the entire modeling region
- Open source model structure in R (no installations needed)
- New enhanced dashboard for visualization

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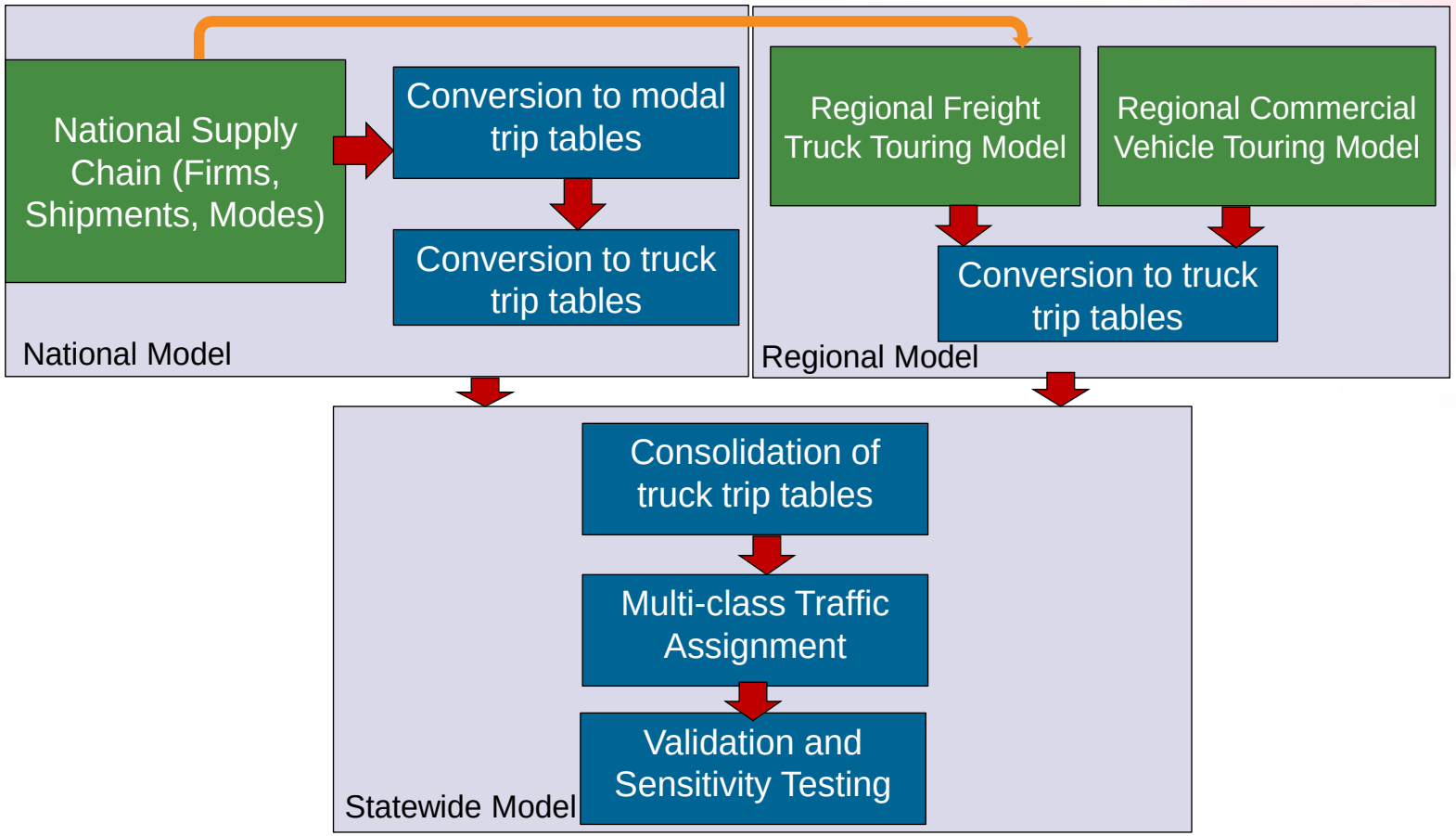
C20 FREIGHT MODEL: APPROACH



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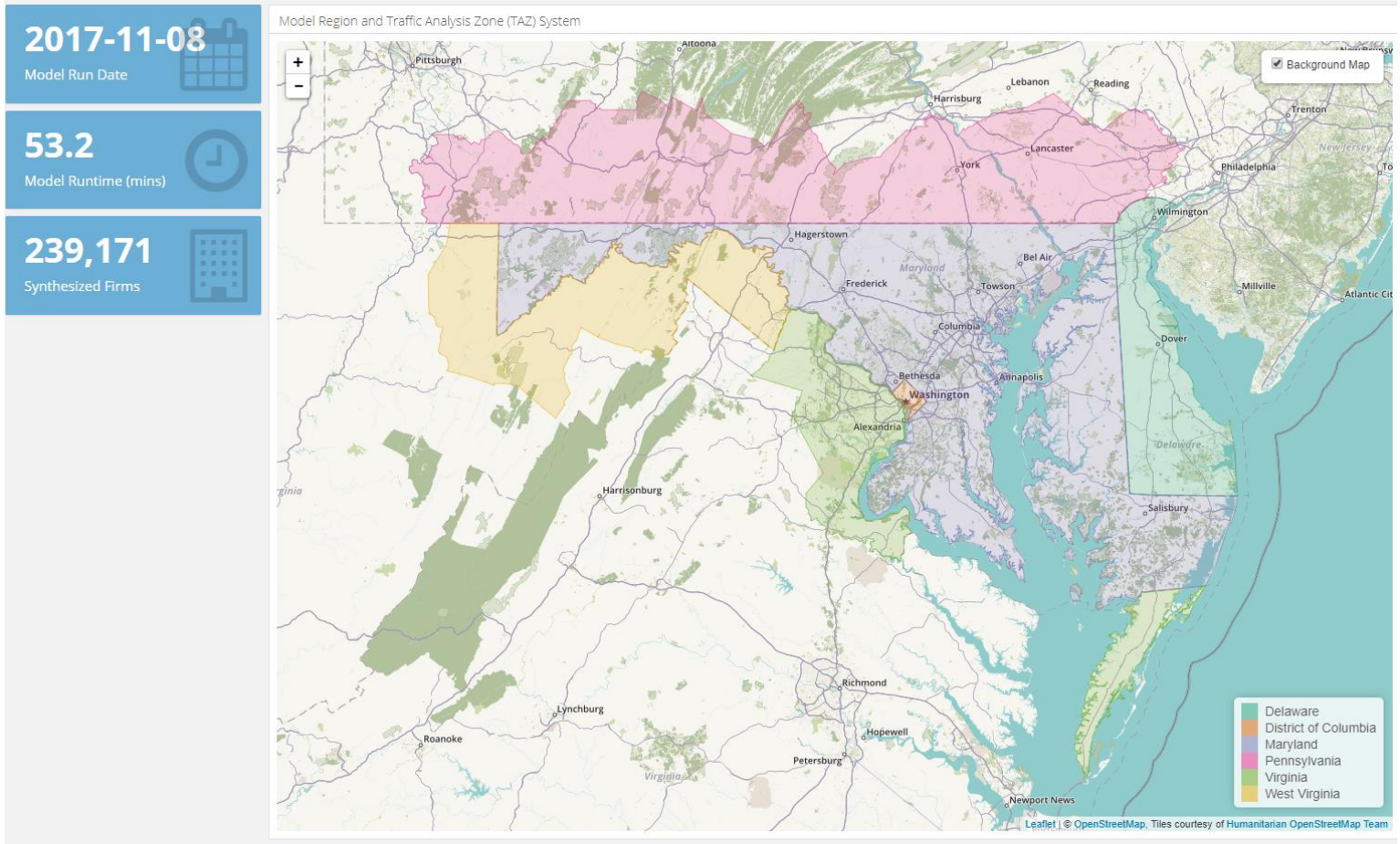
C20 FREIGHT MODEL: DASHBOARD

- Truck touring model includes MD, DE, DC and portions of VA, PA and WV
- 5,281 SMZs and 132 RMZs



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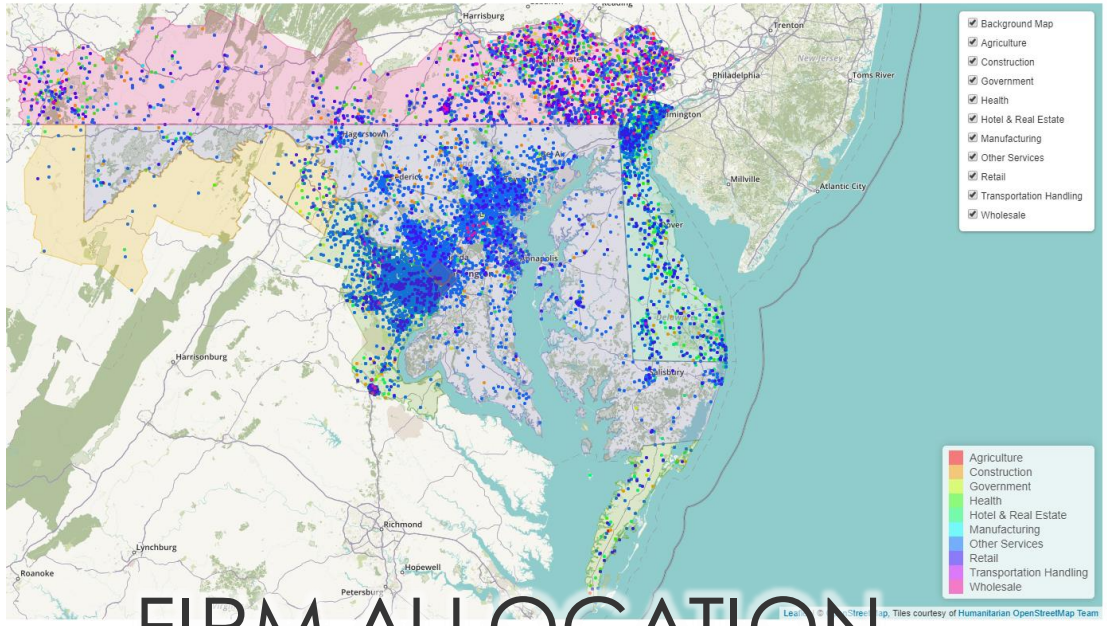
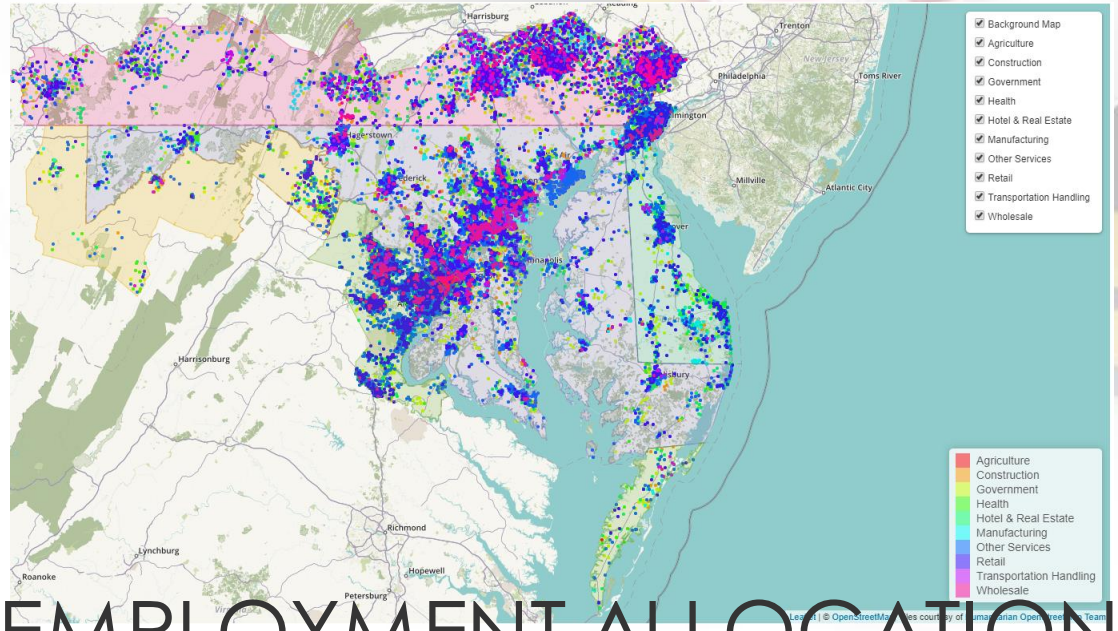
C20 FREIGHT MODEL: FIRM SYNTHESIS

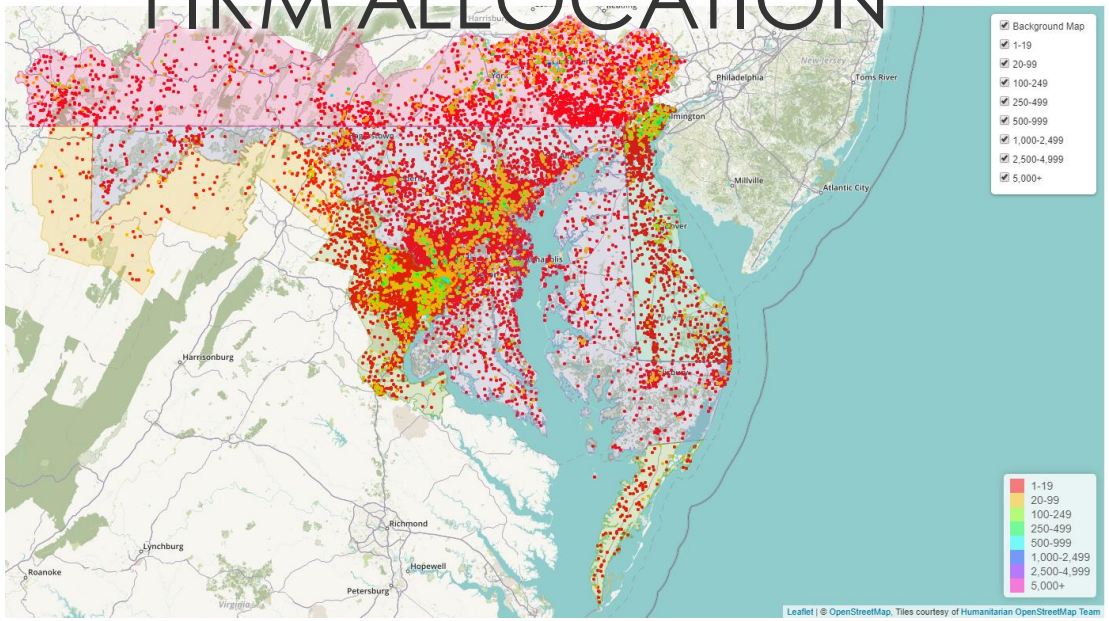


By Industry

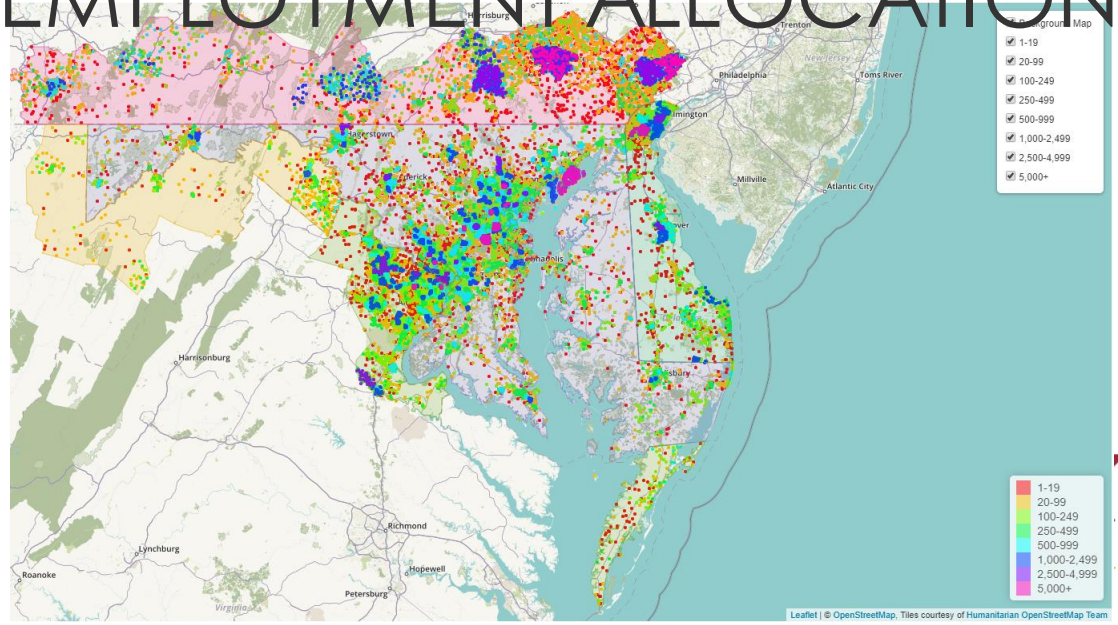


FIRM ALLOCATION

EMPLOYMENT ALLOCATION

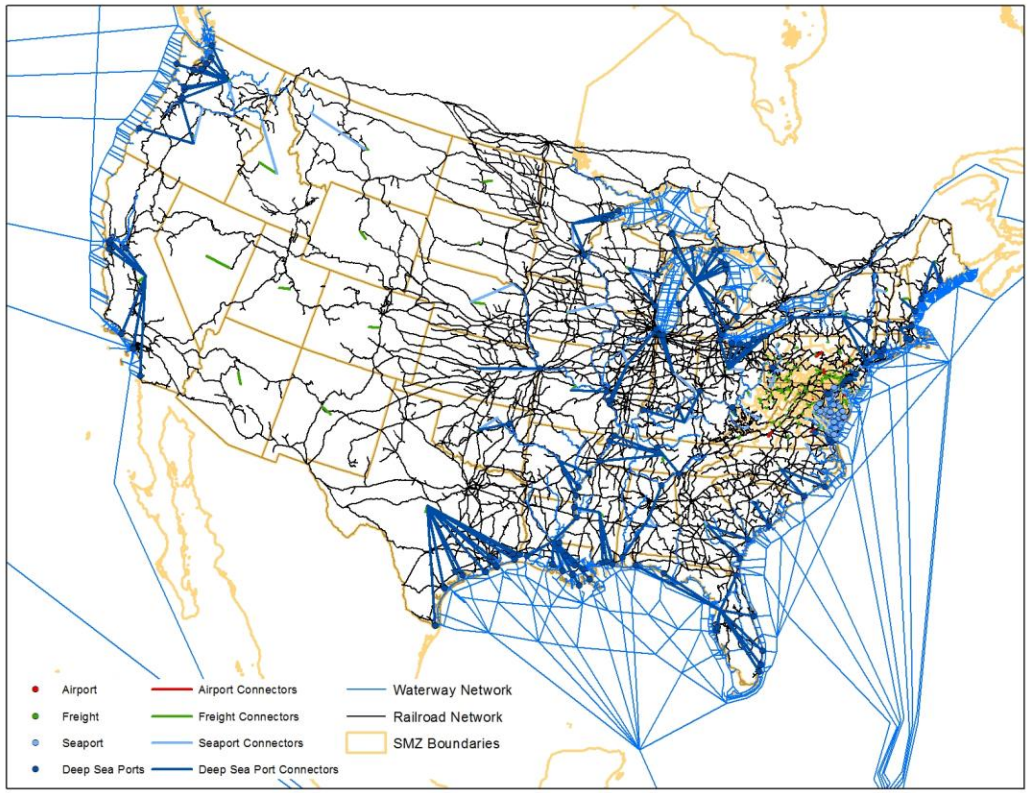


By Size



C20 INPUT DATA

- National multimodal network and properties
  - Road/Rail/Waterway/Pipeline
  - Higher resolution in study area
- Zone system
  - Internal and external
- Network skims
- Desired time of days
  - Eight times of day
    - 3-AM Peak (early, peak, late)
    - 1-Midday
    - 3-PM Peak (early, peak, late)
    - 1-Nightime



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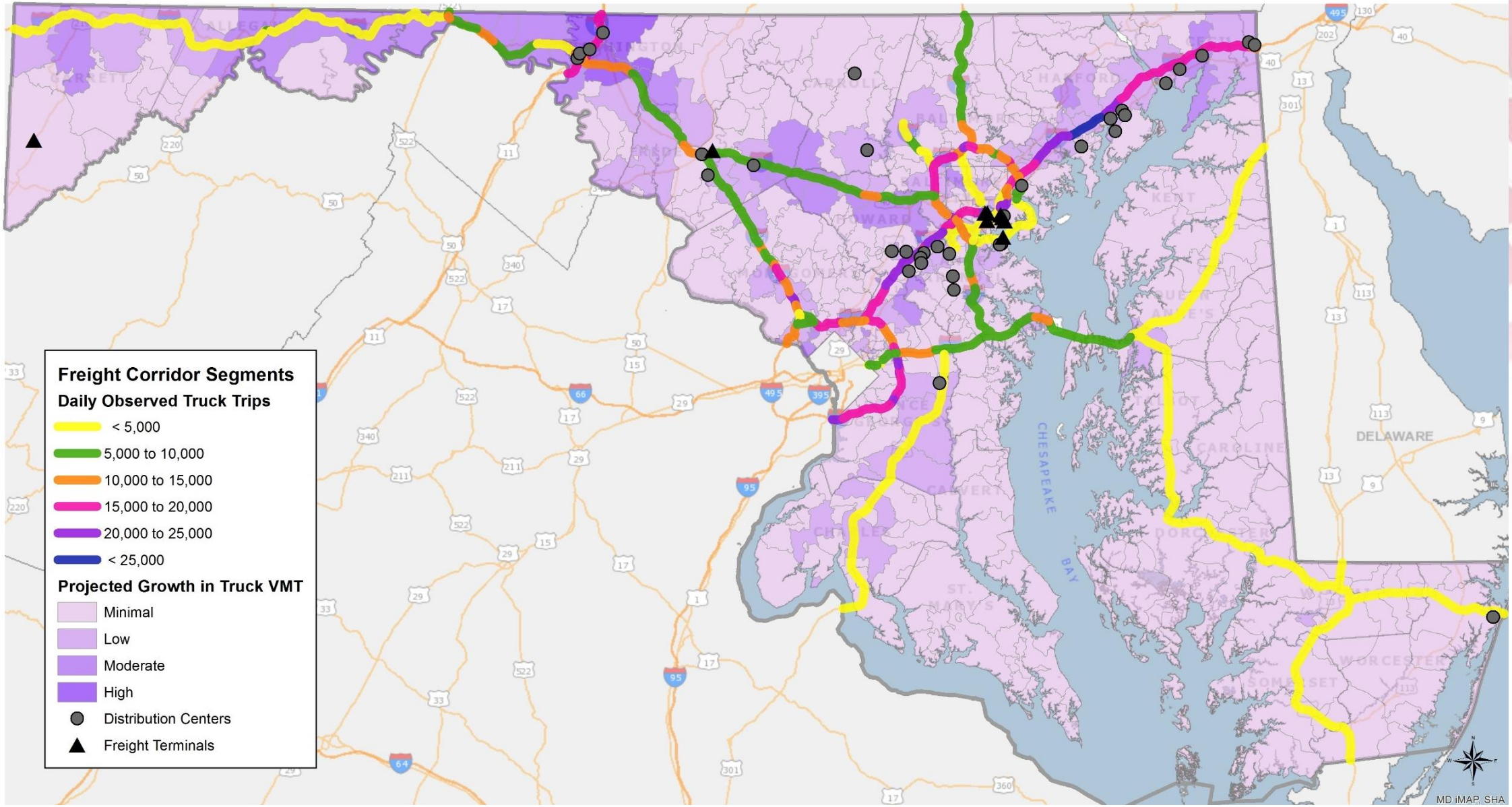

CHANGE IN DAILY TRUCK VMT

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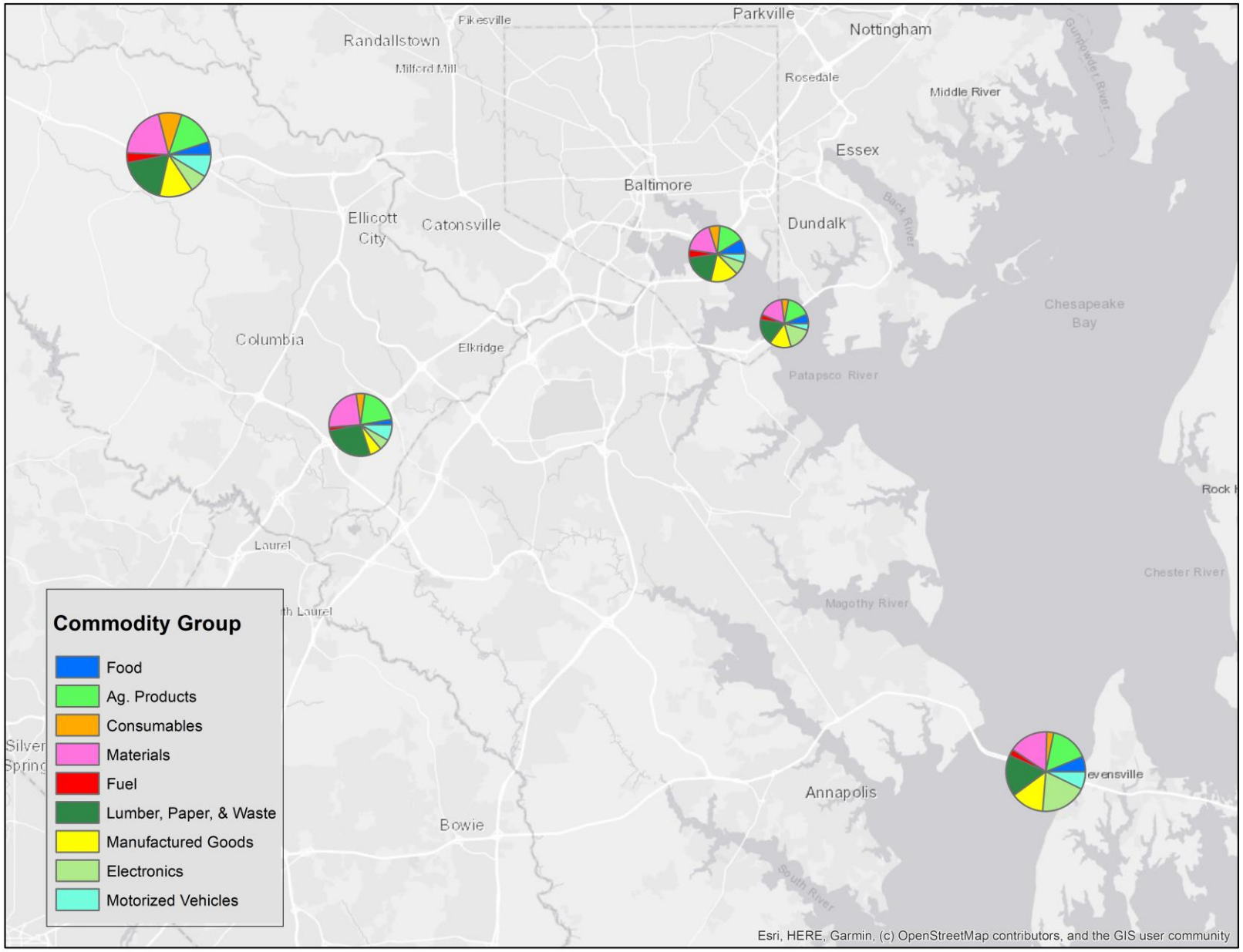
COMMODITY GROUP ASSIGNMENT ON KEY CORRIDORS

- Bay Bridge(US 50)
- Baltimore Harbor Tunnel (I-895)
- Key Bridge(I-695)
- I-70
- I-95



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Maryland Statewide Truck Parking Demand Estimator (2018)
(SHRP2/C20 Freight Model Post-Processor)

Parking Facility/Rest Area	I-95 South Welcome Center	Map it
Freight Corridor	I-95	
Upsteam Rest Area	Adelphi Park and Ride	Map it
Downstream Rest Area	TA Truck stop	Map it
Field Observations	Well marked spots. 49 in south bound, and 27 north bound.	

Current Parking Status	Over-Utilized	
Current Utilixation Factor	4.2	
Current Capacity	76	spaces
Current Utilization	318	spaces
Current Parking Demand	242	spaces (new)
Future Parking Demand	382	spaces (new)

	Existing	2040	
Short-Haul	2,009	2,412	truck trips
Long -Haul	3,572	4,288	truck trips
Total Trucks	5,581	6,700	truck trips
Parking Demand	318	382	total spaces

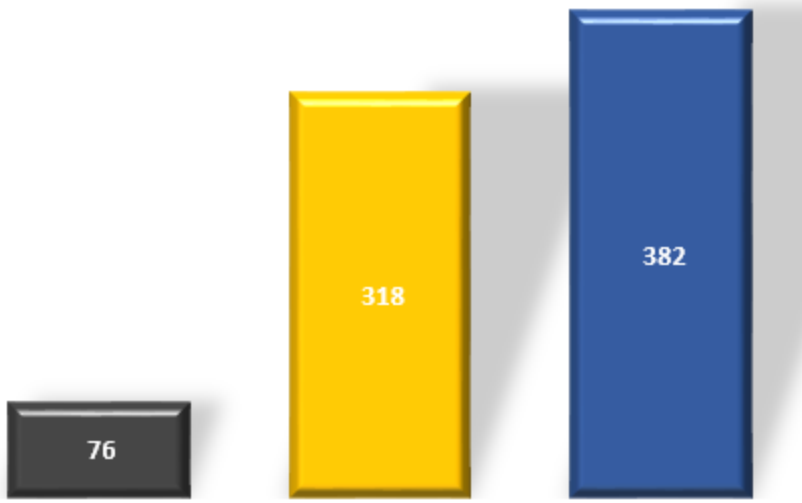
Growth in Truck Trips Along Segment of I-95: 20%

Existing: 5,581

2040: 6,700

Truck Parking Type: Rest Area

Summary of Truck Parking in Maryland: Capacity, Utilization and Demand



Office of Planning and Preliminary Engineering ©2020

MARYLAND TRUCK PARKING DEMAND TOOL

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ENHANCEMENTS/REFINEMENTS TO KEY INPUTS

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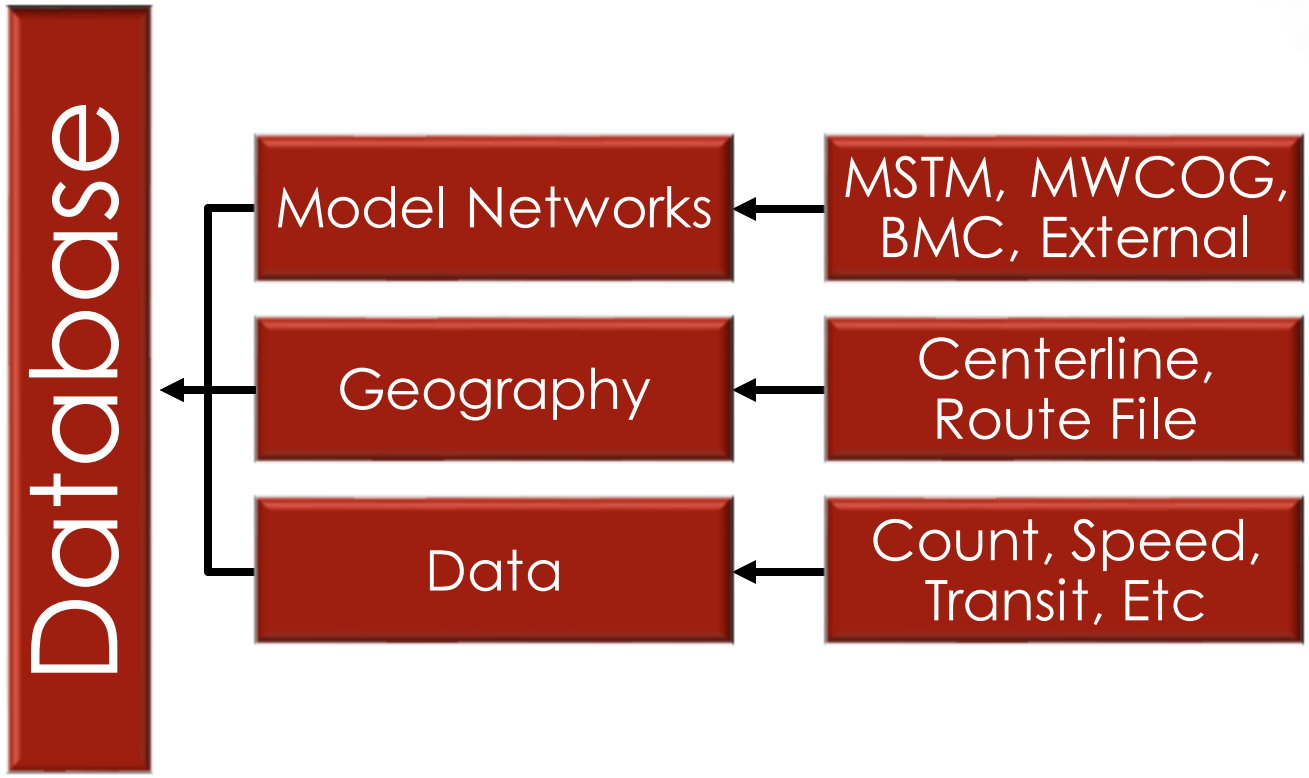
MSTM MDOT-SHA DATA LINKAGES



- Built from Centerline file
  - Association of Route, MSTM (v1) and other source datasets to centerline segmentation.
  - Linkage with SHA asset data
  - Creation of segmentation to support model network requirements
  - Single-Point intersection coding for future junction modeling

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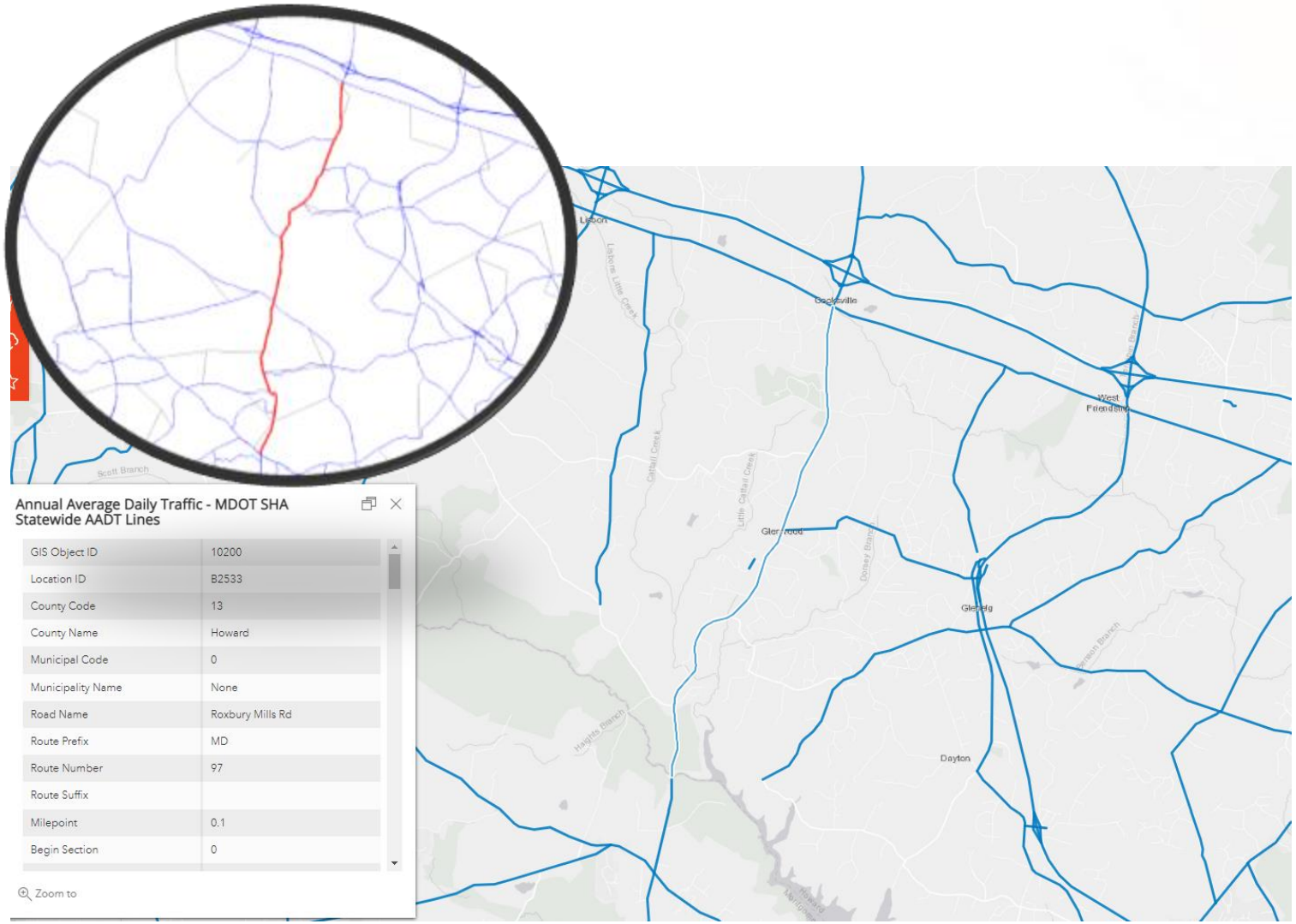
MSTM MDOT-SHA DATA LINKAGES

SHA ADT Segments

MSTM Links



- Linkages to and from MSTM
- Create a linkage TO MSTM:
  - Centerline attribute data (average, max, etc.)
- Create a linkage FROM MSTM:
  - Reporting of model data
  - Performance Measures

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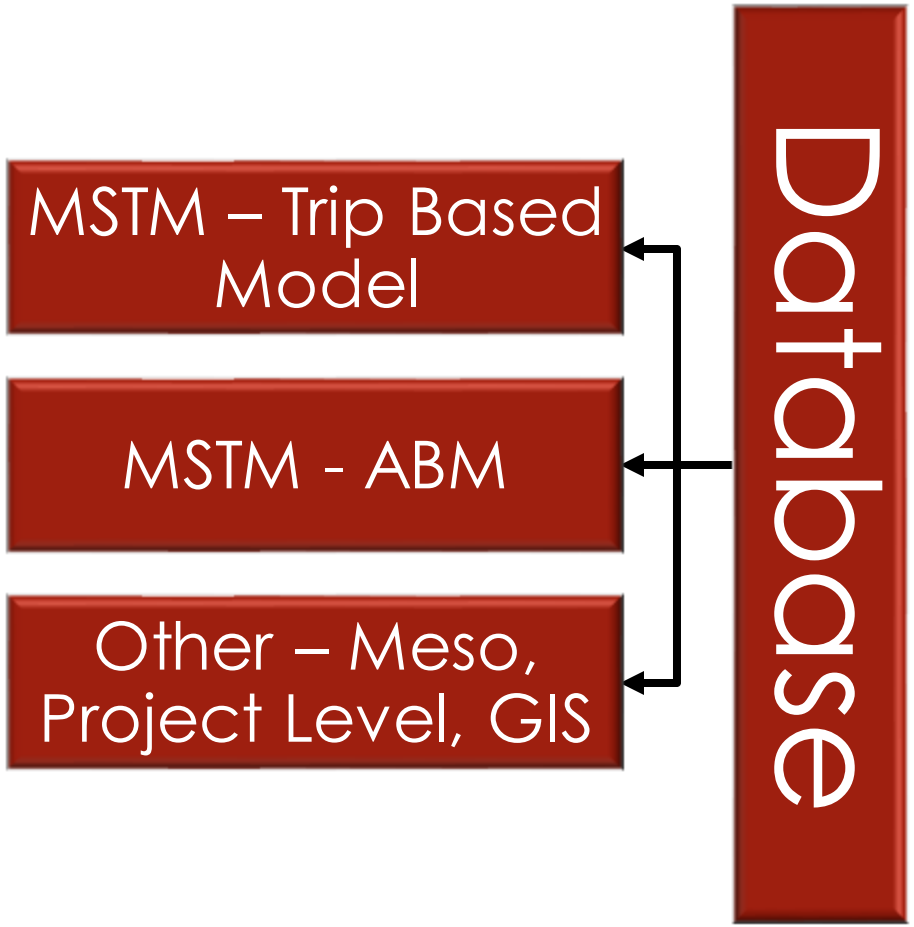
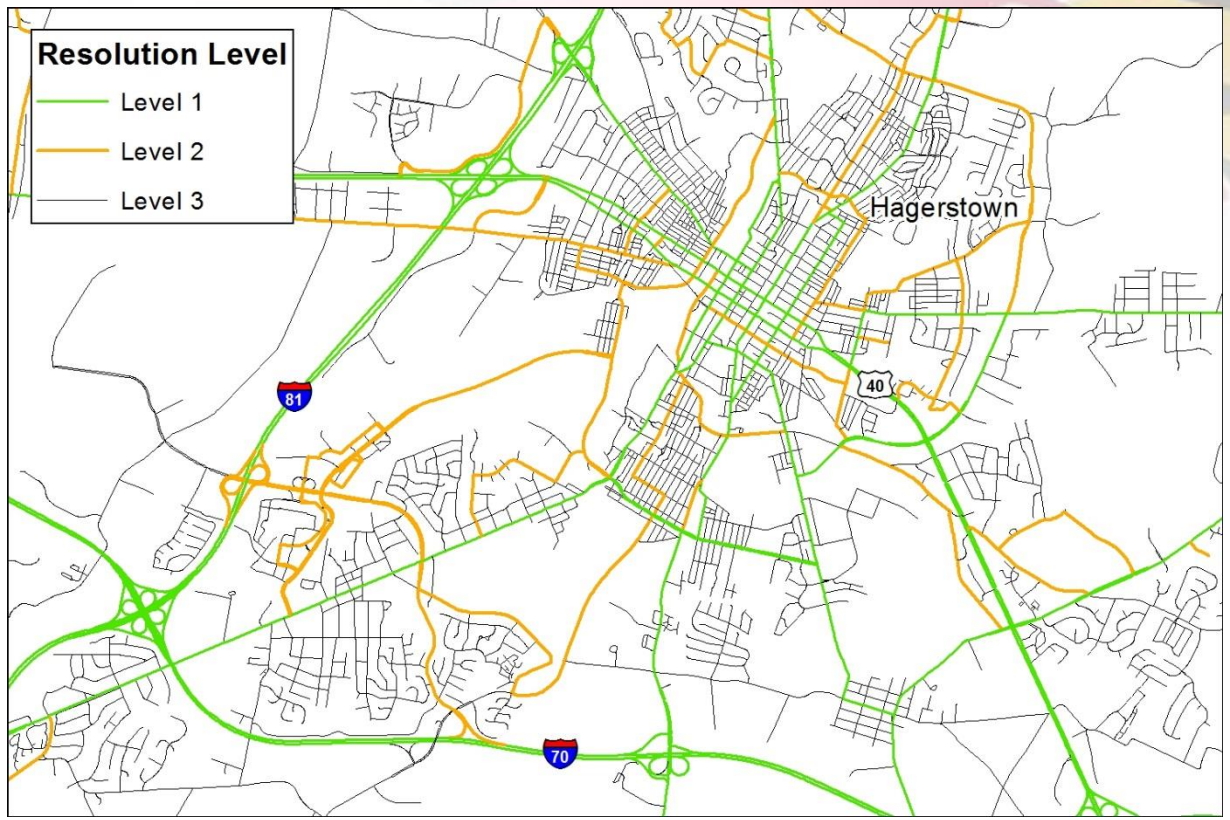
MDOT-SHA MULTI-RESOLUTION DATABASE





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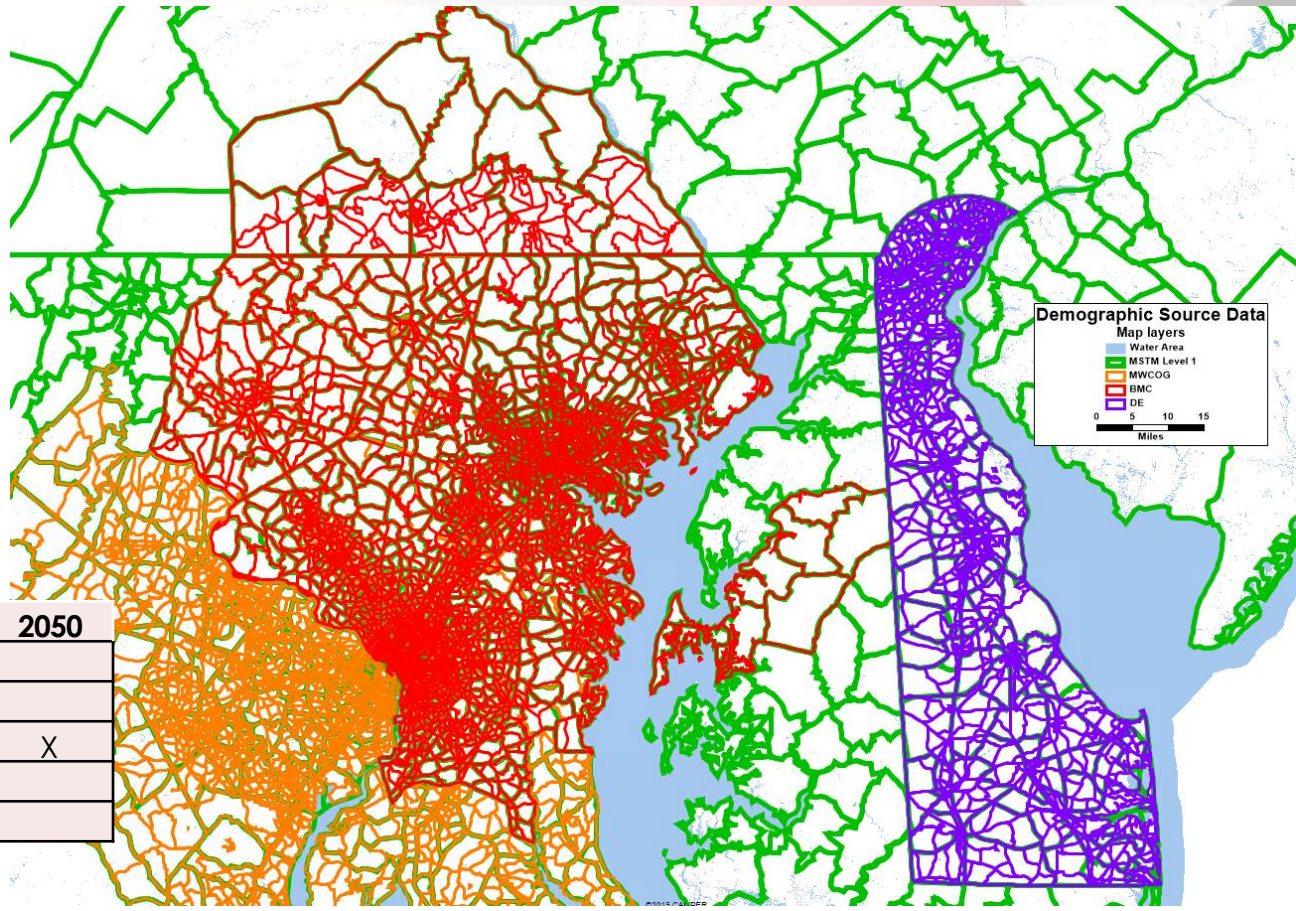
MSTM DATA LINKAGES WITH BMC AND MWCOG

- Build zonal geography and attributes from MPOs for consistency
  - MWCOG = 2.4 Model
  - BMC = 2022 Validation
  - DE = 2022 Zonal Updates



	2015	2019	2020	2025	2030	2035	2040	2045	2050
BMC									
MWCOG		X		X	X		X	X	
DE			X		X		X		X
MDP_EMP	X			X	X		X		
MDP_POP	X		X	X	X	X	X	X	

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RESEARCH ACTIVITIES

MARYLAND DEPARTMENT OF TRANSPORTATION
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COVID-19 IMPACT SCENARIOS ANALYSIS

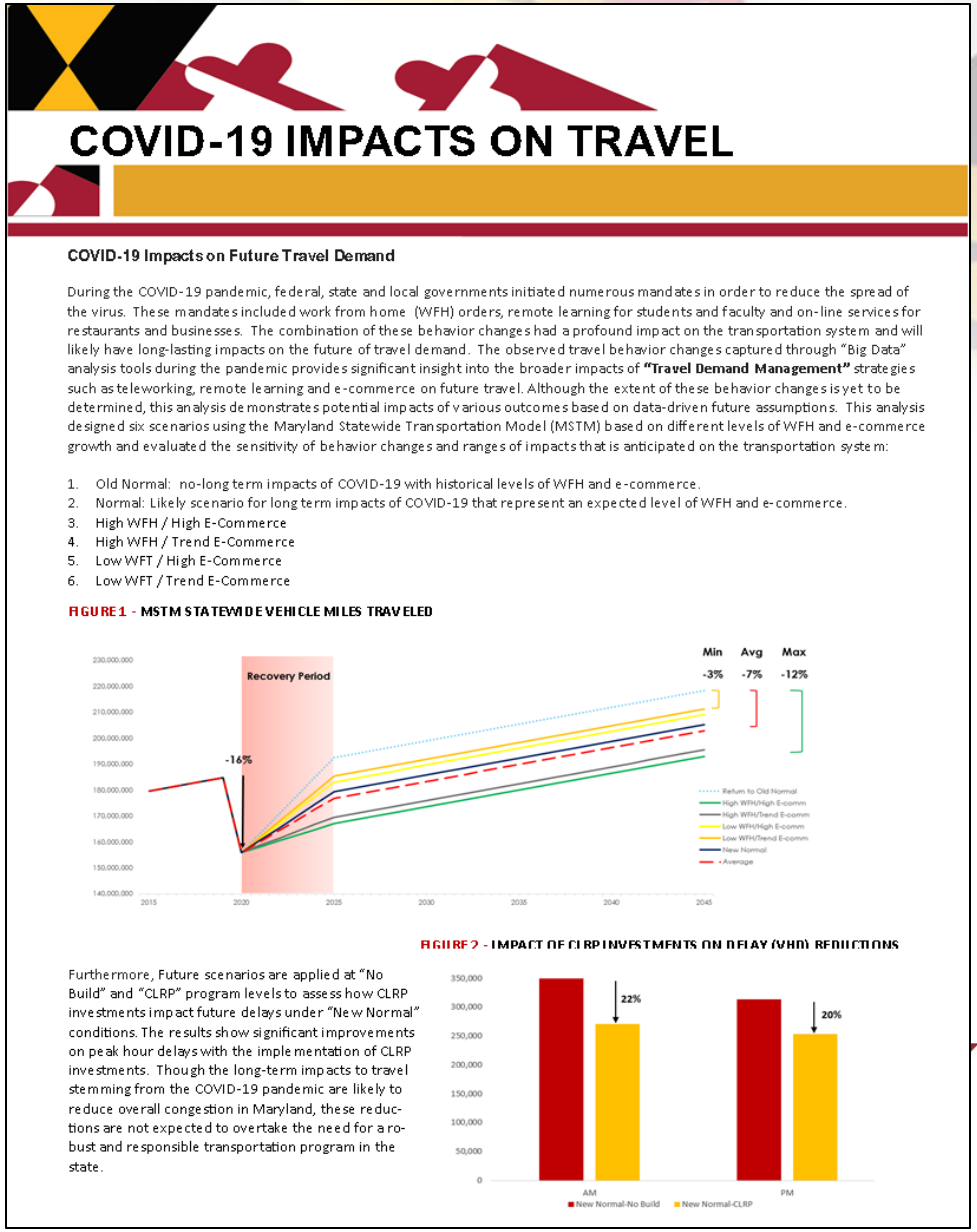
- **Scenario Analysis using the MSTM-TBM**
- **Long-term impacts of the pandemic on travel demand**

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**

Reference: *"COVID-19 Impacts on Mobility and Travel Demand", submitted to "Case Studies on Transport Policy" journal (currently under review)*



COVID-19 IMPACTS ON TRAVEL

COVID-19 Impacts on Future Travel Demand

During the COVID-19 pandemic, federal, state and local governments initiated numerous mandates in order to reduce the spread of the virus. These mandates included work from home (WFH) orders, remote learning for students and faculty and on-line services for restaurants and businesses. The combination of these behavior changes had a profound impact on the transportation system and will likely have long-lasting impacts on the future of travel demand. The observed travel behavior changes captured through "Big Data" analysis tools during the pandemic provides significant insight into the broader impacts of **"Travel Demand Management"** strategies such as teleworking, remote learning and e-commerce on future travel. Although the extent of these behavior changes is yet to be determined, this analysis demonstrates potential impacts of various outcomes based on data-driven future assumptions. This analysis designed six scenarios using the Maryland Statewide Transportation Model (MSTM) based on different levels of WFH and e-commerce growth and evaluated the sensitivity of behavior changes and ranges of impacts that is anticipated on the transportation system:

1. Old Normal: no-long term impacts of COVID-19 with historical levels of WFH and e-commerce.
2. Normal: Likely scenario for long term impacts of COVID-19 that represent an expected level of WFH and e-commerce.
3. High WFH / High E-Commerce
4. High WFH / Trend E-Commerce
5. Low WFT / High E-Commerce
6. Low WFT / Trend E-Commerce

FIGURE 1 - MSTM STATEWIDE VEHICLE MILES TRAVELED

FIGURE 2 - IMPACT OF CLRP INVESTMENTS ON DELAY (VHD) REDUCTIONS

Furthermore, Future scenarios are applied at "No Build" and "CLRP" program levels to assess how CLRP investments impact future delays under "New Normal" conditions. The results show significant improvements on peak hour delays with the implementation of CLRP investments. Though the long-term impacts to travel stemming from the COVID-19 pandemic are likely to reduce overall congestion in Maryland, these reductions are not expected to overtake the need for a robust and responsible transportation program in the state.

SCENARIO FRAMEWORK

			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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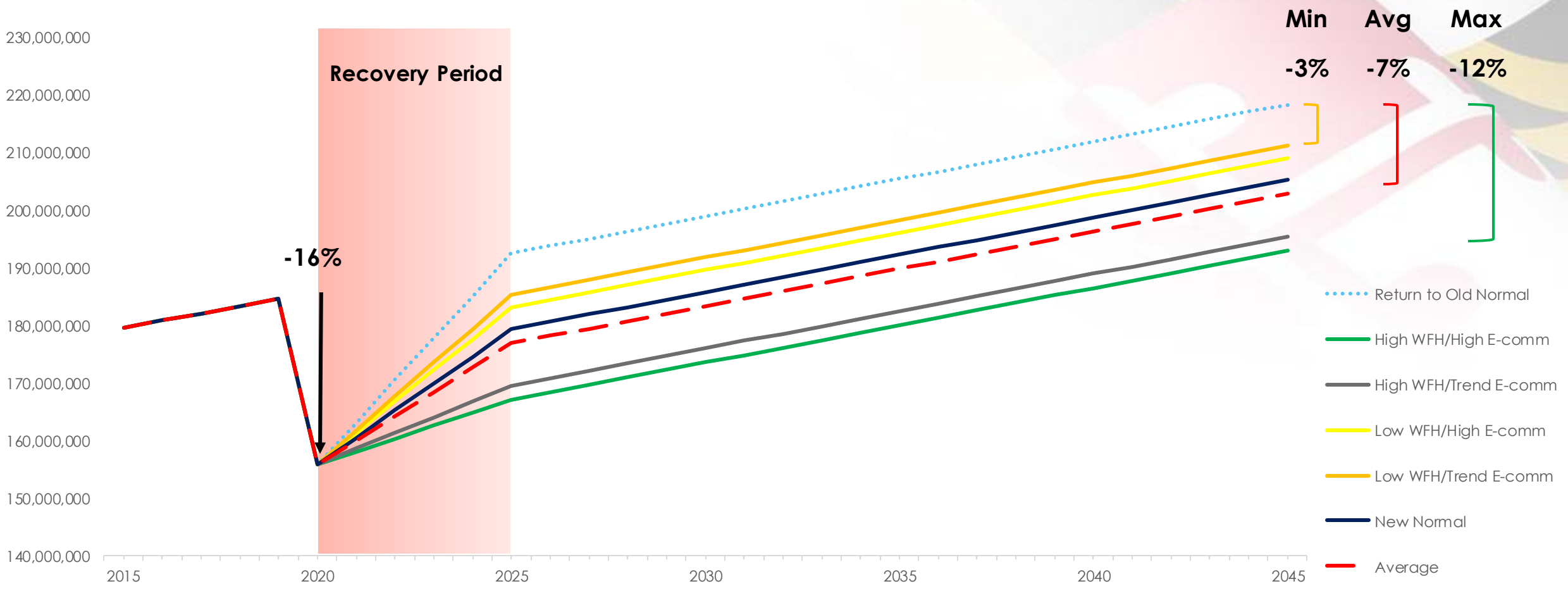
Statewide Vehicle Miles Traveled (MSTM)



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Scenario analysis framework capabilities:

- **CAV Scenario Analysis** as part of the CAV strategic plan.
- MDOT strategies such as **Complete Street**

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COMPLETE STREETS

- MDOT Policy: safety and mobility of all roadway users by developing **context sensitive solutions** that support **pedestrian bicycle**

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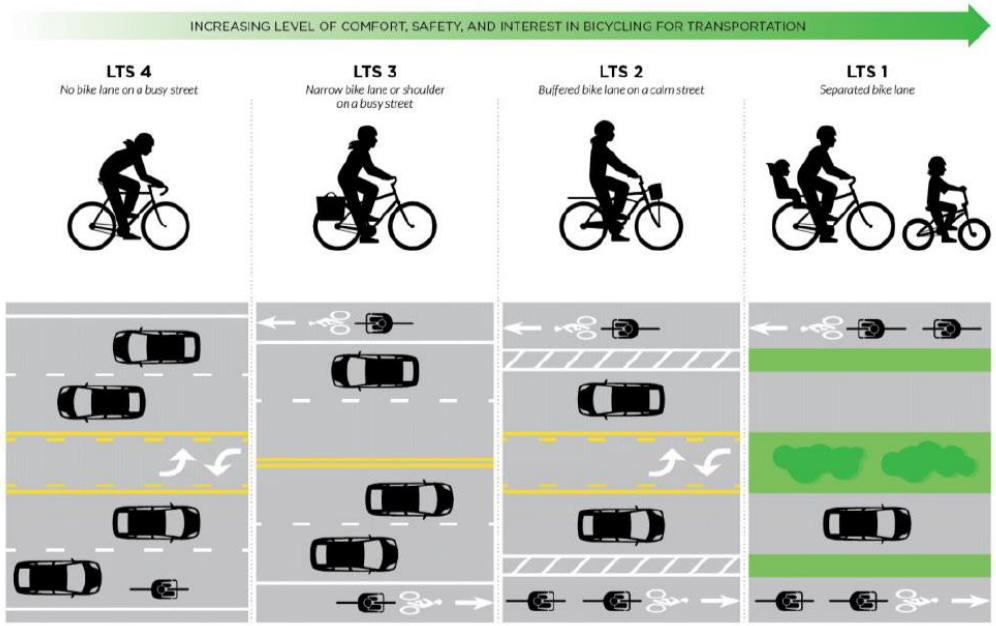
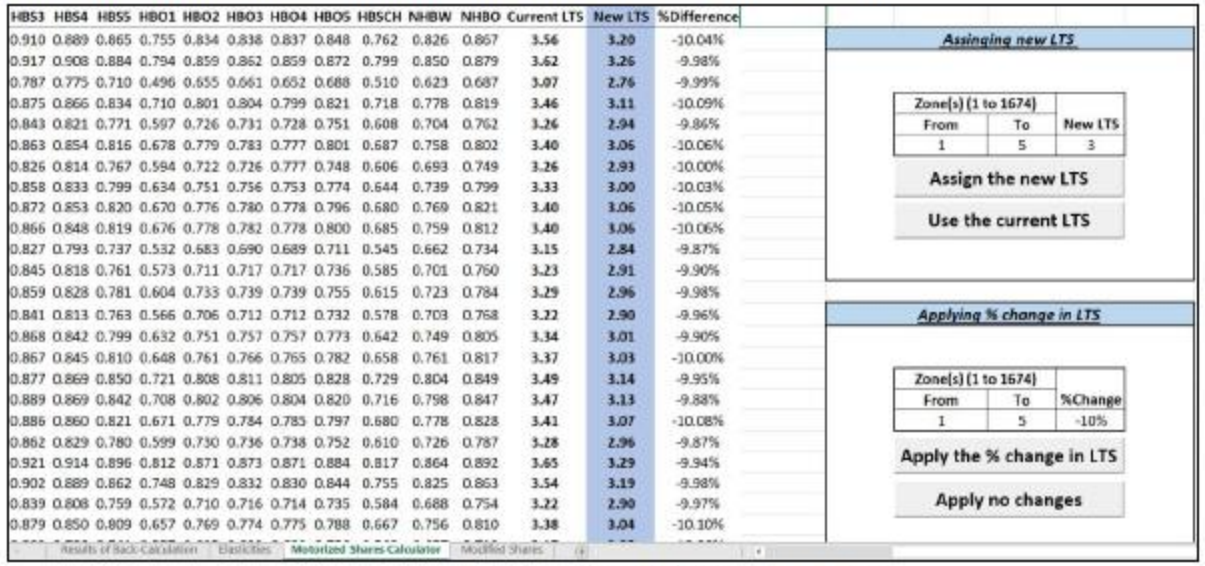
LEVEL OF TRAFFIC STRESS (LTS) (PHASE 1)

- Integration of LTS in estimating non-motorized share.
- UMD research effort to estimate elasticities of LTS to choosing non-motorized modes.



Level of Traffic stress for bicyclists

The calculator includes the following tabs (for details, see the Excel file):



The motorized shares calculator

Direct and cross elasticities resulting from the general model

	Car	Bike	Walk
Travel time Car	-0.0420	0.0597	0.0472
Travel time Bike	0.1309	-0.3852	0.1234
Travel time Walk	0.1630	0.1932	-0.9905
Travel Cost Car	-0.0709	0.1003	0.0810
Parking Cost Car	-0.0404	0.0542	0.0528
LTS Bike	0.1871	-0.5653	0.2021
LTS Walk	0.0958	0.1068	-0.5679

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FUTURE LTS RESEARCH EFFORTS (PHASE 2)

- Integrate LTS attribute in MSTM multi-resolution network.
- Re-estimate mode choice model to include bike and walk modes

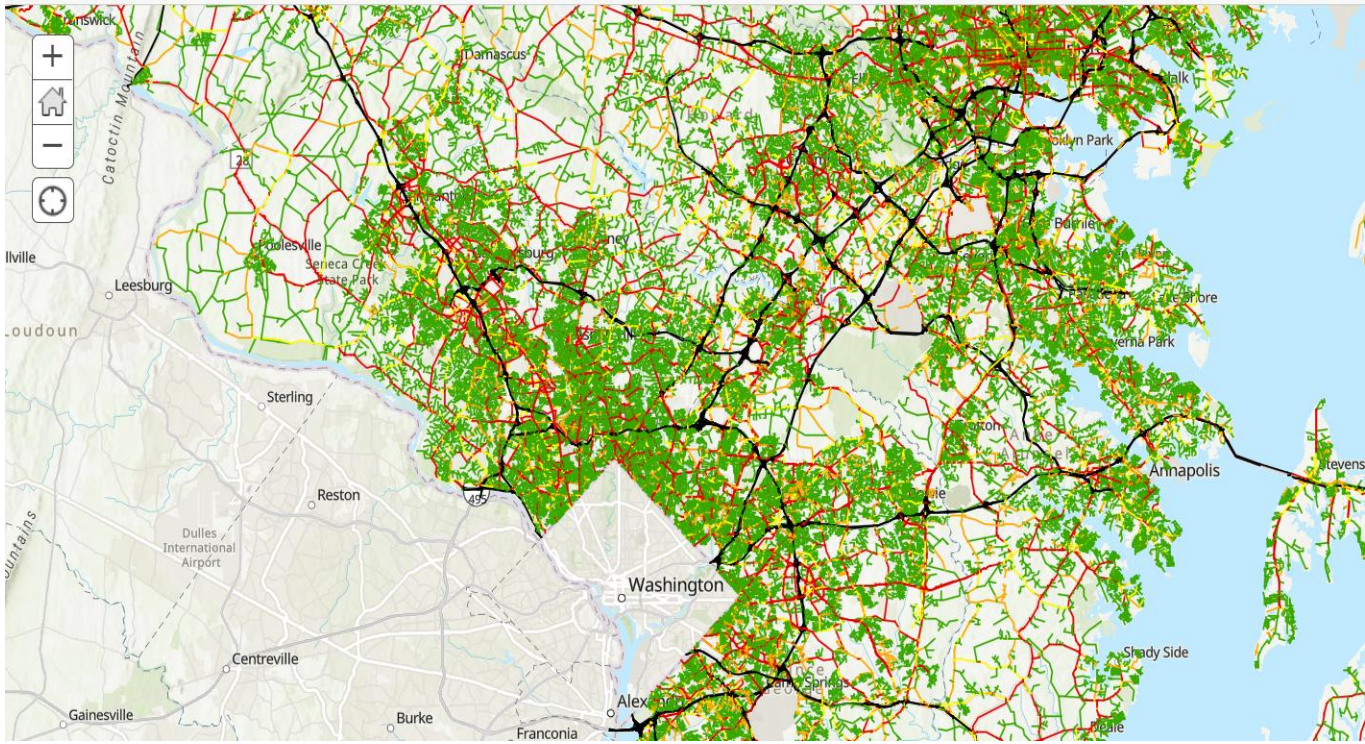
MDOT LTS Methodology

Mixed Traffic Criteria

Number of Lanes	Effective ADT	Prevailing Speed						
		<20mph	25mph	30mph	35mph	40mph	45mph	50+mph
Unlaned 2-way street (No centerline)	0-750	1	1	2	2	3	3	3
	751-1500	1	1	2	3	3	3	4
	1501-3000	2	2	2	3	4	4	4
	3000+	2	3	3	3	4	4	4
1 thru lane per direction (1-way, 1 lane street or 2-way street with centerline	0-750	1	1	2	2	3	3	3
	751-1500	2	2	2	3	3	3	4
	1501-3000	2	3	3	3	4	4	4
	3000+	3	3	3	4	4	4	4
2 thru lanes per direction	0-8000	3	3	3	3	4	4	4
	8001+	3	3	4	4	4	4	4
3+ thru lanes per direction	Any	3	3	4	4	4	4	4

Effective ADT = ADT for two-way roads. Effective ADT – 1.5' ADT for one-way roads

Maryland Bicycle Level of Traffic Stress (LTS)



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CUBE CATALOG MIGRATION

MSTM CUBE CATALOG

- Older versions of the model (pre-v1.5) driven by a batch macro interface.
  - Keystroke interface
  - Limited modularity
  - Hardcoded parameters
  - Difficult to modify on the fly
- Newer versions of the model (v1.5+) implemented in a Cube Catalog.
  - Graphical interface
  - Very modular
  - Parameters keyed to scenario interface
  - Easy to customize

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MSTM CUBE CATALOG

- 2 – 3 months to complete the transition
  - Upfront time to read through the batch file and flowchart the model process
  - Most of the scripting was already in Voyager
  - Included coordination time to make sure that the Catalog setup adequately reflected SHA's desired scenario management approach
- Work was done by consultant with significant experience in setting up Cube Catalogs.
  - Experience with Cube Catalog made it possible to interpret the model scripts and quickly flowchart and layout the catalog.
  - For someone with less Cube Catalog experience, transitioning the model would take more time.

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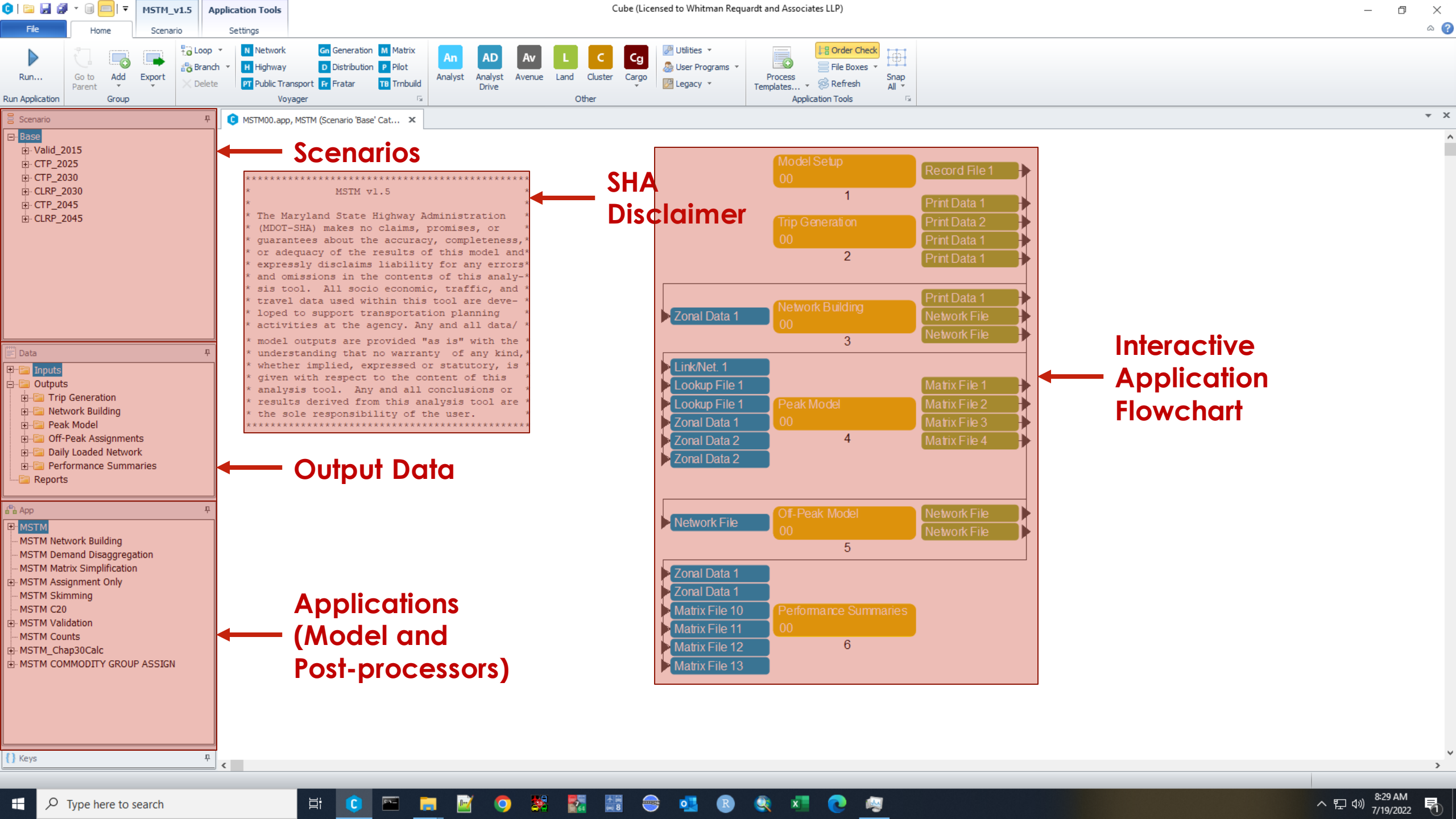

MSTM_v1.5
Application Tools
Cube (Licensed to Whitman Requardt and Associates LLP)
File
Home
Scenario
Settings
Run...
Run Application
Go to Parent
Add
Export
Group
Loop
Branch
Delete
Network
Highway
Public Transport
Generation
Distribution
Fratar
Matrix
Pilot
Trnbuild
Voyager
Analyst
Analyst Drive
Avenue
Land
Cluster
Cargo
Utilities
User Programs
Legacy
Other
Process Templates...
Order Check
File Boxes
Refresh
Snap All
Application Tools
Scenario
Base
Valid_2015
CTP_2025
CTP_2030
CLRP_2030
CTP_2045
CLRP_2045
Data
Inputs
Outputs
Trip Generation
Network Building
Peak Model
Off-Peak Assignments
Daily Loaded Network
Performance Summaries
Reports
App
MSTM
MSTM Network Building
MSTM Demand Disaggregation
MSTM Matrix Simplification
MSTM Assignment Only
MSTM Skimming
MSTM C20
MSTM Validation
MSTM Counts
MSTM_Chap30Calc
MSTM COMMODITY GROUP ASSIGN
Keys
MSTM00.app, MSTM (Scenario 'Base' Cat...
Scenarios
MSTM v1.5
The Maryland State Highway Administration (MDOT-SHA) makes no claims, promises, or guarantees about the accuracy, completeness, or adequacy of the results of this model and expressly disclaims liability for any errors and omissions in the contents of this analysis tool. All socio economic, traffic, and travel data used within this tool are developed to support transportation planning activities at the agency. Any and all data/model outputs are provided "as is" with the understanding that no warranty of any kind, whether implied, expressed or statutory, is given with respect to the content of this analysis tool. Any and all conclusions or results derived from this analysis tool are the sole responsibility of the user.
SHA Disclaimer
Output Data
Applications (Model and Post-processors)
Model Setup 00
Record File 1
1
Trip Generation 00
Print Data 1
Print Data 2
Print Data 1
Print Data 1
2
Zonal Data 1
Network Building 00
Print Data 1
Network File
Network File
3
Link/Net. 1
Lookup File 1
Lookup File 1
Zonal Data 1
Zonal Data 2
Zonal Data 2
Peak Model 00
Matrix File 1
Matrix File 2
Matrix File 3
Matrix File 4
4
Network File
Off-Peak Model 00
Network File
Network File
5
Zonal Data 1
Zonal Data 1
Matrix File 10
Matrix File 11
Matrix File 12
Matrix File 13
Performance Summaries 00
6
Interactive Application Flowchart
Type here to search
8:29 AM
7/19/2022

Scenario
Base
Valid_2015
CTP_2025
CTP_2030
CLRP_2030
CTP_2045
CLRP_2045

Data
Inputs
Outputs
Trip Generation
Network Building
Peak Model
Off-Peak Assignments
Daily Loaded Network
Performance Summaries
Reports

App
MSTM
MSTM Network Building
MSTM Demand Disaggregation
MSTM Matrix Simplification
MSTM Assignment Only
MSTM Skimming
MSTM C20
MSTM Validation
MSTM Counts
MSTM_Chap30Calc
MSTM COMMODITY GROUP ASSIGN

Keys

MSTM00.app, MSTM (Scenario 'Valid_201...
Scenario - Valid_2015 (Application MSTM)...

Long Distance Auto Settings

Run Java Long Distance Auto Model

Long Distance Auto Adjustment Factors:	C:\MSTM_v1.5.20220428.TRN\PARAMETERS\MSTM_LDAuto_AdjFac.mat Browse ... Edit ...
Folder containing Long Distance Auto Matrices if not running Java:	x

Assignment Settings

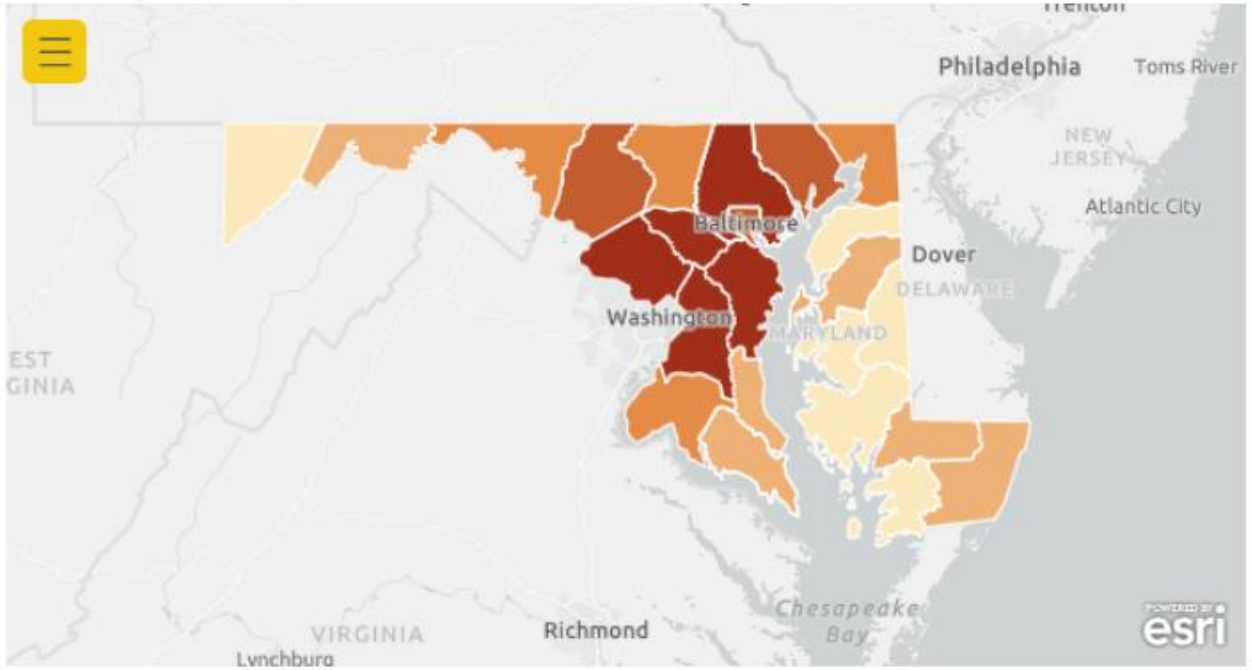
Maximum Number of Equilibrium Assignment Iterations:	100
Relative Gap for Assignment Closure:	0.0001
Alpha and Beta Lookup File	C:\MSTM_v1.5.20220428.TRN\PARAMETERS\MSTM_VDF.dbf Browse ... Edit ...
Value of Time in ¢/Minute for HH Income < $30,000:	8.4
Value of Time in ¢/Minute for HH Income = $30,000 -$59,999:	25
Value of Time in ¢/Minute for HH Income = $60,000 -$99,999	41.7
Value of Time in ¢/Minute for HH Income = $100,000 -$150,000:	50.4
Value of Time in ¢/Minute for HH Income > $150,000 + TRUCKS:	106.4
Passenger Car Equivalents (PCE) - Single Unit Trucks:	1.5
Passenger Car Equivalents (PCE) - Multi Unit Trucks:	2.5
Passenger Car Equivalents (PCE) - Long Distance Trucks:	2

Save | Close | Next... | Back... | Run

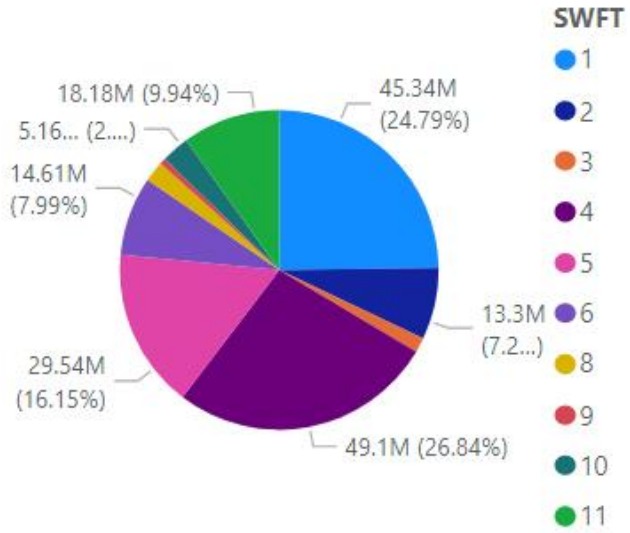
MSTM REPORTING WITH POWER BI

- Current efforts are looking at enhancing model data visualization and analysis using Power BI
  - Current model reports are either text-based or incorporate graphs generated by R
  - Power BI provides tools for data visualization and analysis that are relatively easy to set up
  - Dynamic interactions between visualizations allow the user to quickly focus in on interesting data elements
  - Part of Microsoft suite of products, so is highly accessible to Microsoft users

VMT24 by Counties, State

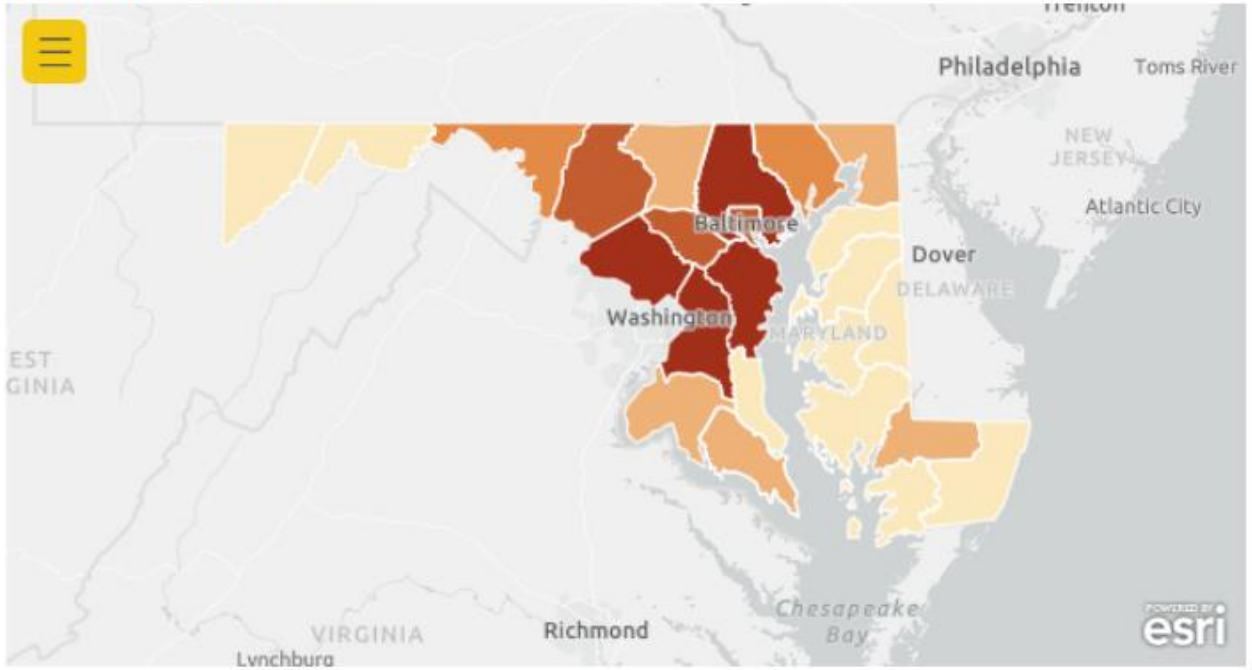


VMT24 by SWFT

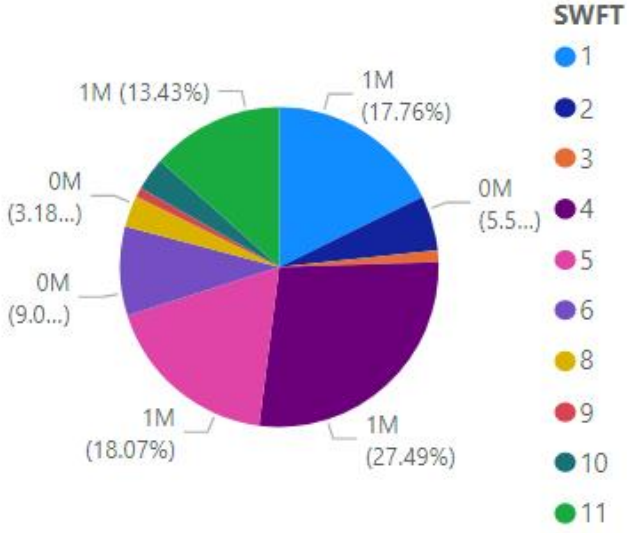


Counties, State	VMT24
Allegany, Maryland	2,541,436.8
Anne Arundel, Maryland	19,024,680.2
Baltimore City, Maryland	11,243,865.9
Baltimore County, Maryland	25,678,635.2
Baltimore, Maryland	25,678,635.2
Calvert, Maryland	2,800,583.8
Caroline, Maryland	1,395,060.2
Carroll, Maryland	4,985,656.5
Cecil, Maryland	4,521,698.1
Charles, Maryland	4,598,746.0
Dorchester, Maryland	1,222,999.3
Frederick, Maryland	10,433,957.2
Garrett, Maryland	2,069,341.2
Harford, Maryland	7,712,192.8
Howard, Maryland	12,453,741.3
Kent, Maryland	766,157.2
Montgomery, Maryland	23,952,731.0
Prince George's, Maryland	25,711,609.5
Queen Annes, Maryland	2,746,219.4
Queen Anne's, Maryland	2,746,219.4
Somerset, Maryland	1,169,556.3
St Marys, Maryland	3,676,177.3
St. Mary's, Maryland	3,676,177.3
Talbot, Maryland	2,031,994.6
Washington, Maryland	6,283,317.3
Wicomico, Maryland	3,504,576.9
Worcester, Maryland	2,369,898.7
	182,894,833.9

VHT24 by Counties, State



VHT24 by SWFT

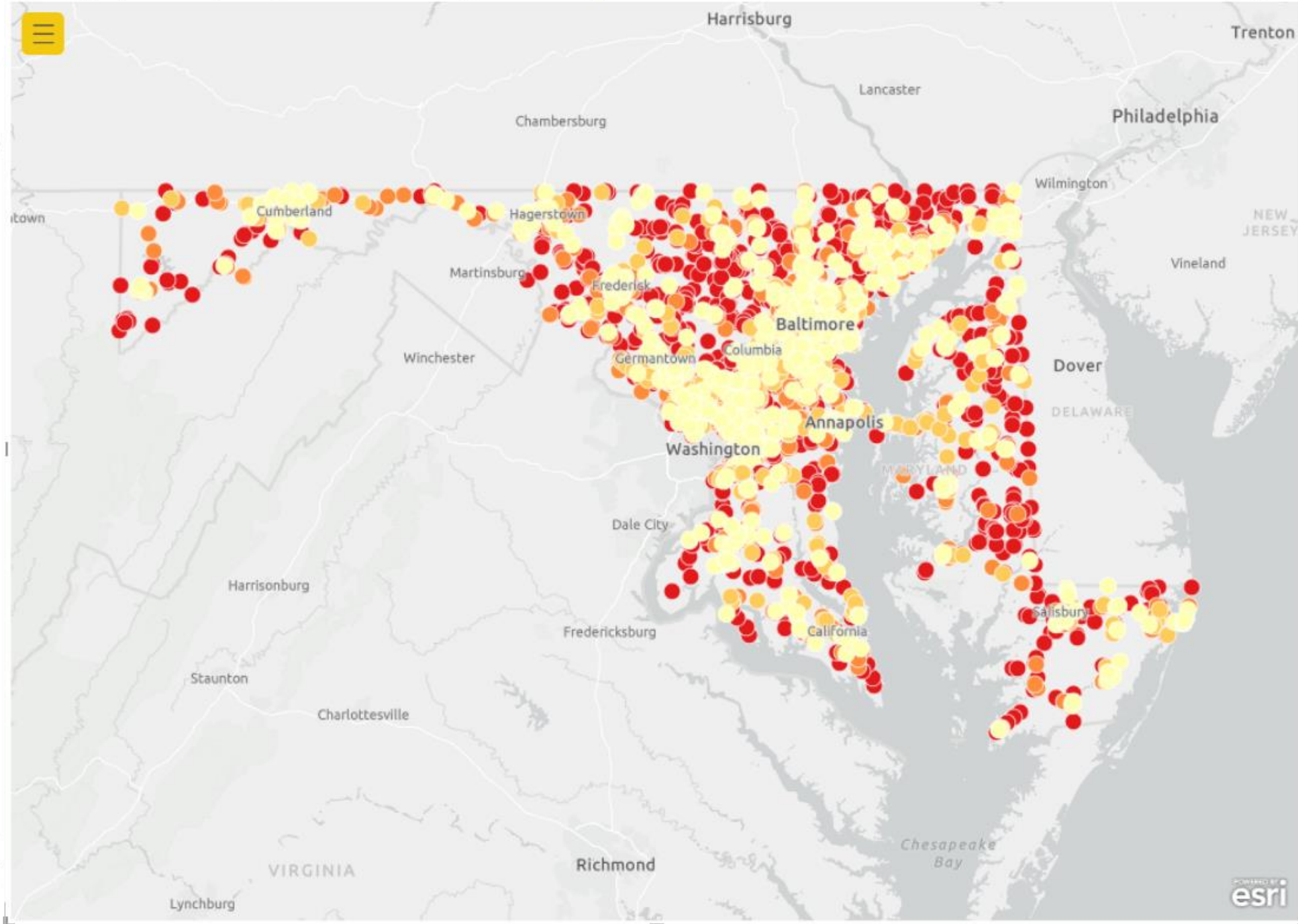


SWFT

1 10

FIPS	Counties, State
24001	Allegany, Maryland
24003	Anne Arundel, Maryland
24510	Baltimore City, Maryland
24005	Baltimore County, Maryland
24005	Baltimore, Maryland
24009	Calvert, Maryland
24011	Caroline, Maryland
24013	Carroll, Maryland
24015	Cecil, Maryland
24017	Charles, Maryland
24019	Dorchester, Maryland
24021	Frederick, Maryland
24023	Garrett, Maryland
24025	Harford, Maryland
24027	Howard, Maryland
24029	Kent, Maryland
24031	Montgomery, Maryland
24033	Montgomery, Maryland
24033	Prince George's, Maryland
24035	Queen Annes, Maryland
24035	Queen Anne's, Maryland
24039	Somerset, Maryland
24037	St Marys, Maryland
24037	St. Mary's, Maryland
24041	Talbot, Maryland
24043	Washington, Maryland
24045	Wicomico, Maryland
24047	Worcester, Maryland

2015L1_VC, VEHS24, AADT_2015 and SWFT by Lat and Long



MDOT-SHA TRAFFIC MONITORING SYSTEM (TMS)

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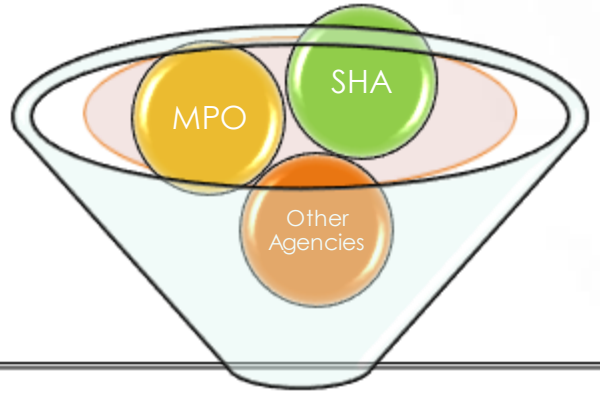

Traffic Monitoring System

Federal Highway
- HPMS
- TMAS

State of Maryland
- State Stat
- Truck Diversion Studies

State Highway
- Planning
- Design
- Freight
- Performance Measures

Metropolitan Planning Organizations
- Data Sharing
- Coordinated Projects

General Public
- AADT
- Traffic Data

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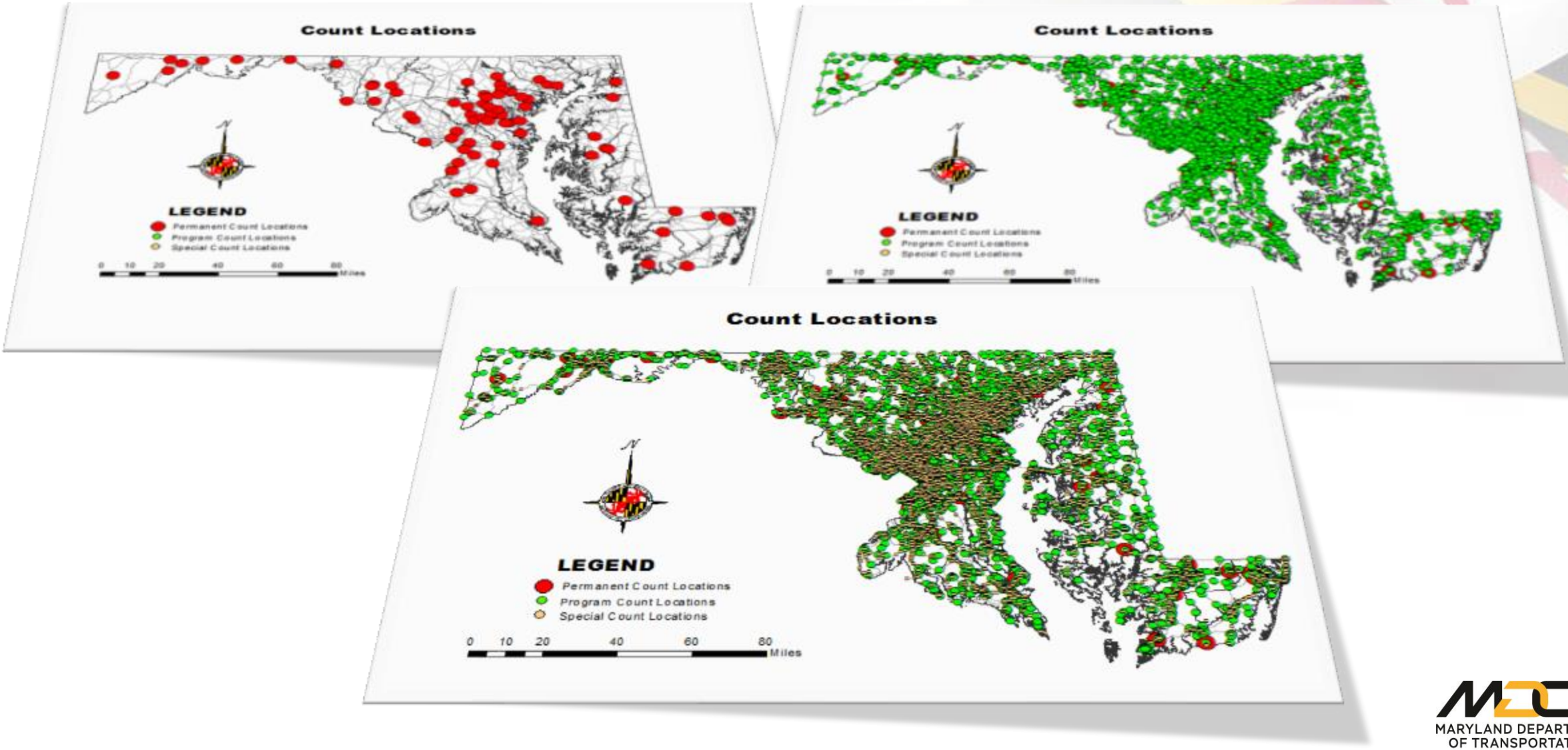

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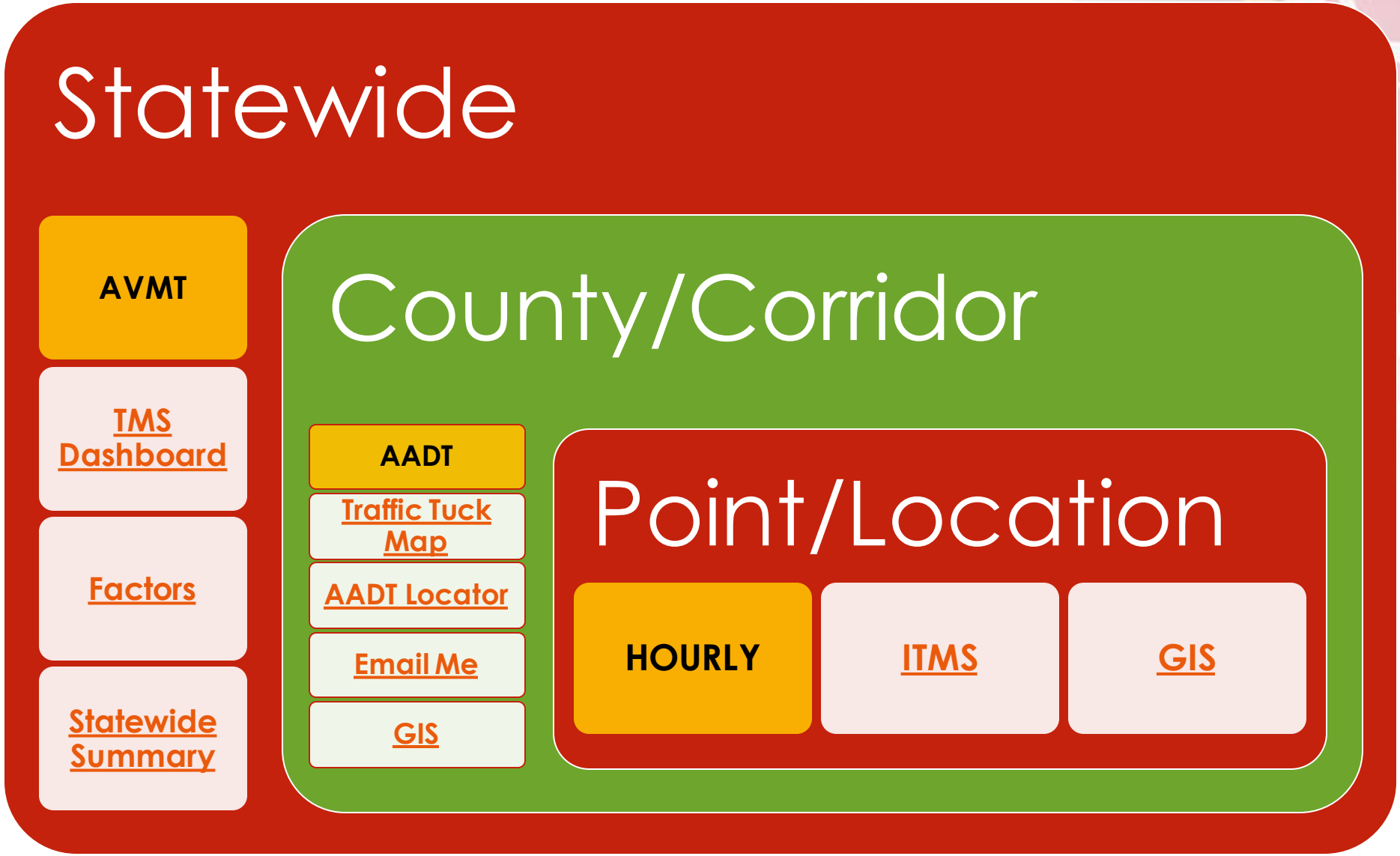

https://www.roads.maryland.gov/mdotsha/pages/index.aspx?PageId=251

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