MARYLAND DEPARTMENT OF TRANSPORTATION

STATE HIGHWAY ADMINISTRATION

RELIABILITY FORECASTING

FOR PM3 TARGET SETTING

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Presented to: Baltimore Metropolitan Council

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Acknowledgments

High Street Consulting

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- Erin Dean
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UMD

- MAP-21 Tool Team

MPO Partners

BMC, MWCOG, WILMAPCO

Image Source: Craig Fildes, Flikr

PM3 BASELINE SCORES

Interstate Reliability	Non-Interstate NHS Reliability
Metric: Level of Travel Time Reliability $\frac{80th\ Percentile\ TT}{50th\ Percentile\ TT} < 1.5\ = Reliable$ Measure: Traveler-weighted Portion of Interstate NHS Segments that are Reliable	Metric: Level of Travel Time Reliability $\frac{80th\ Percentile\ TT}{50th\ Percentile\ TT} < 1.5\ = Reliable$ Measure: Traveler–weighted Portion of Non–Interstate NHS Segments that are Reliable

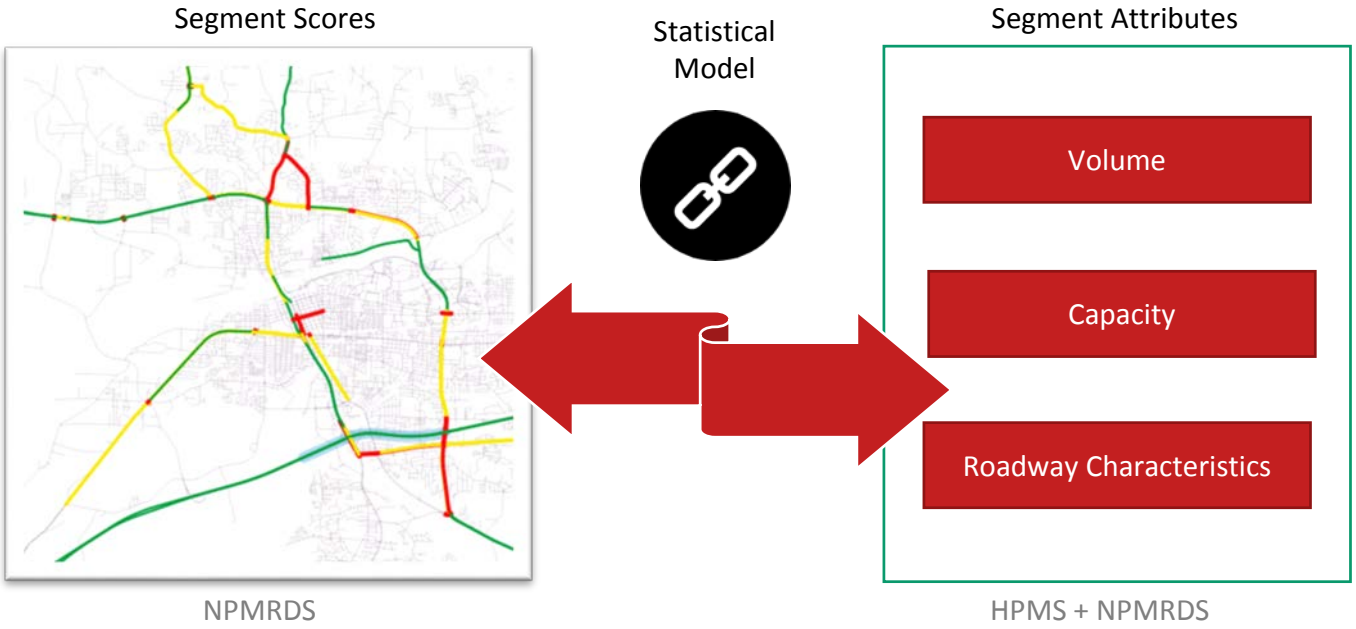
Freight Movement

Metric: Truck Travel Time Reliability

$$\frac{95th\ Percentile\ TT}{50th\ Percentile\ TT}$$

Measure: Distanced-weighted Average of All Interstate Segments

FORECASTING FUTURE RELIABILITY PERFORMANCE



FORECASTING METHODOLOGY

1. SETUP

Calculate current volume and capacity (based on best available data)

2. MODEL FITTING

Fit statistical model, associating LOTTR / TTTR with volume, capacity, and roadway attributes

3. UPDATES

- Forecast future volume based on growth rates
- Update future capacity based on planned projects

4. FORECASTING

Forecast future LOTTR / TTTR using updated volume and capacity

DATA TRANSFORMATION AND MODELING

- LOTTR / TTTR Data is left-bounded at 1 and right-skewed
  - Subtract 1 from LOTTR / TTTR and Log Transform
- Models have limited overall explanatory power (~25% of total variation in segment level scores), but highly significant coefficient estimates (used for forecasting)

LOTTR Model (Log LOTTR)

Coefficients	Estimate	Std. Error
(Intercept)	-0.623	0.022
cars (thousands)	0.028	0.000
capacity (thousands)	-0.017	0.000

All estimates statistically significant at $p < 0.001$, R^2 0.23

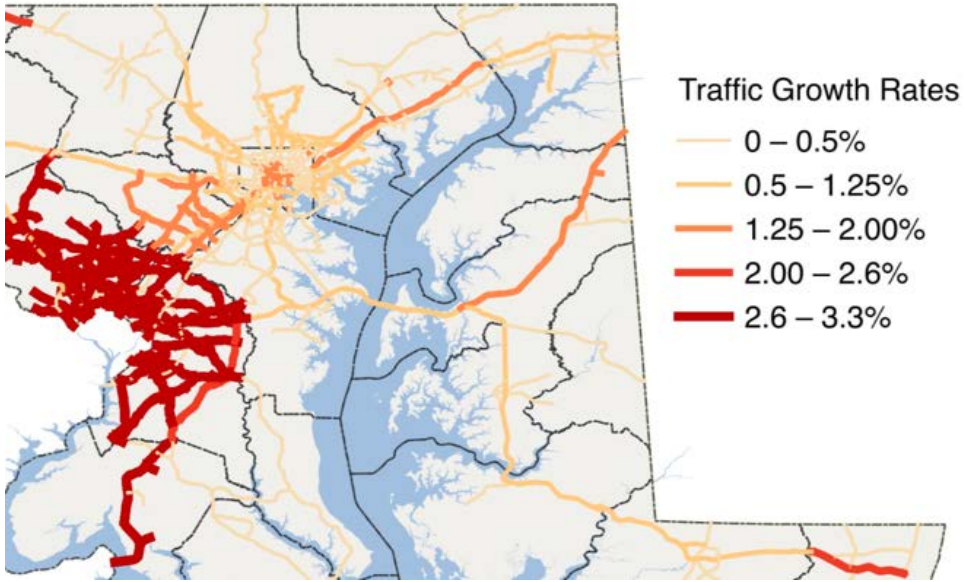
TTTR Model (Log TTTR)

Coefficients	Estimate	Std. Error
(Intercept)	-2.02	0.089
Volume / Capacity Ratio	2.82	0.221
Location: Urban	0.67	0.093

All estimates statistically significant at $p < 0.001$, R^2 0.26

UPDATE FUTURE VOLUME

- Grow Traffic Volume by Geometric Growth Rates

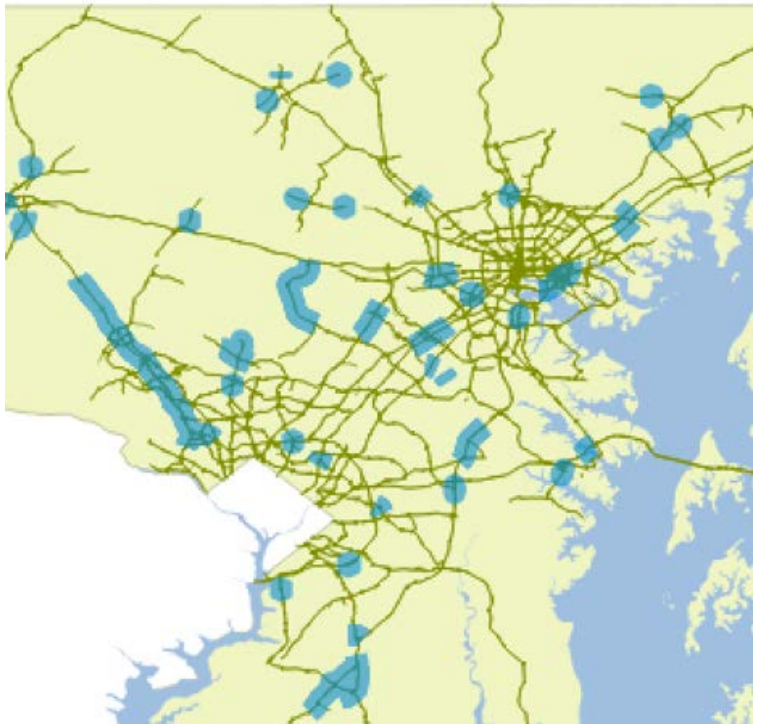


Growth Rate	Directional Miles (Statewide)	Percent of System (Statewide)
0 – 1%	1927	37%
1 – 2%	1377	28%
2 – 3%	909	18%
3 – 4%	918	18%

UPDATE FUTURE CAPACITY

1) Identify Capacity Enhancing Projects
2) Conflate project boundaries to TMC segments
3) Add+1 Lane within Project Boundaries After Project Completion Date

- Capacity Projects (Statewide): 48
  - Lane-Miles (2017): 10,966
  - Lane-Miles (2021): 11,127
- Signal Upgrade Locations: 14
  - ITS Affected Directional Miles: 61.5 (LOTTR reduction of 0.15)



Capacity Project Boundaries

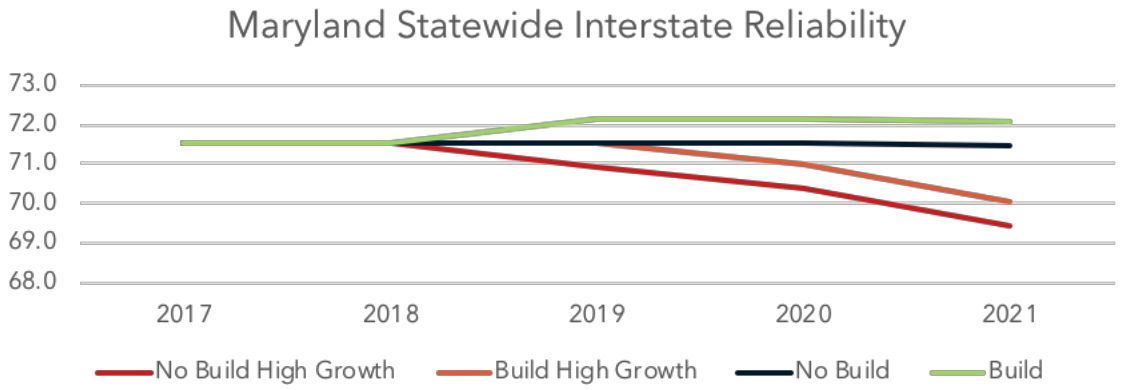
APPLY STATISTICAL MODEL

Using our previously fit LOTTR and TTTR models:

1. Predict Current Performance
2. Predict Future Performance Based On Future Volume, Future Capacity
3. Update Current Observed Metric Value by Predicted *Difference*
4. Aggregate to Performance Measure Score

INTERSTATE RELIABILITY

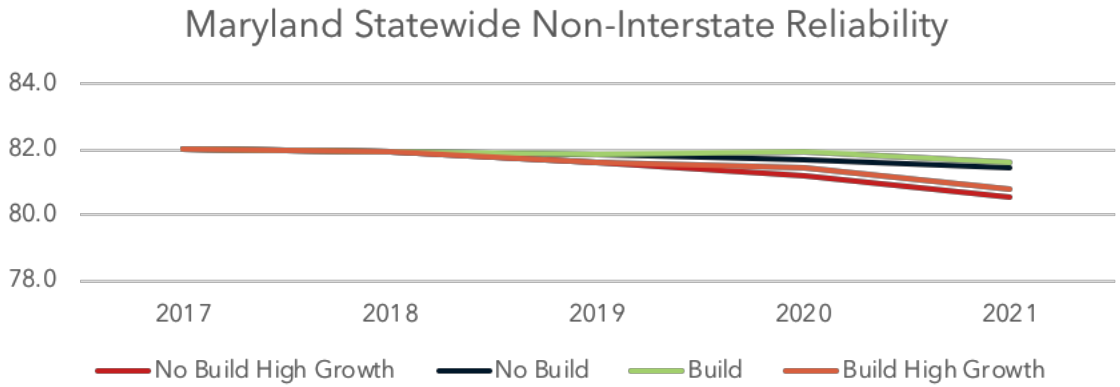
Higher → More Reliable



	Baseline (2017)	2018	Two Year Performance (2019)	2020	Four Year Performance (2021)
No Build High Growth	**71.5**	71.5	**70.9**	70.4	**69.4**
Build High Growth	**71.5**	71.5	**71.5**	71.0	**70.0**
No Build	**71.5**	71.5	**71.5**	71.5	**71.5**
Build	**71.5**	71.5	**72.1**	72.1	**72.1**

NON-INTERSTATE RELIABILITY

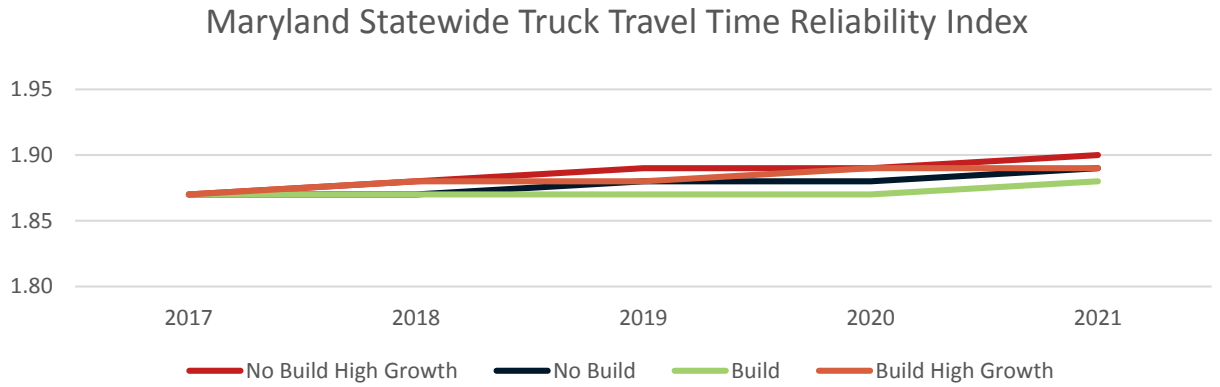
Higher → More Reliable



	Baseline (2017)	2018	Two Year Performance (2019)	2020	Four Year Performance (2021)
No Build High Growth	**82.0**	81.9	**81.6**	81.2	**80.6**
Build High Growth	**82.0**	81.9	**81.6**	81.4	**80.8**
No Build	**82.0**	82.0	**81.9**	81.7	**81.4**
Build	**82.0**	82.0	**81.9**	81.9	**81.7**

TRUCK TRAVEL TIME RELIABILITY

Higher → Less Reliable



	Baseline (2017)	2018	Two Year Performance (2019)	2020	Four Year Performance (2021)
No Build High Growth	**1.87**	1.88	**1.89**	1.89	**1.90**
Build High Growth	**1.87**	1.88	**1.88**	1.89	**1.89**
No Build	**1.87**	1.87	**1.88**	1.88	**1.89**
Build	**1.87**	1.87	**1.87**	1.87	**1.88**

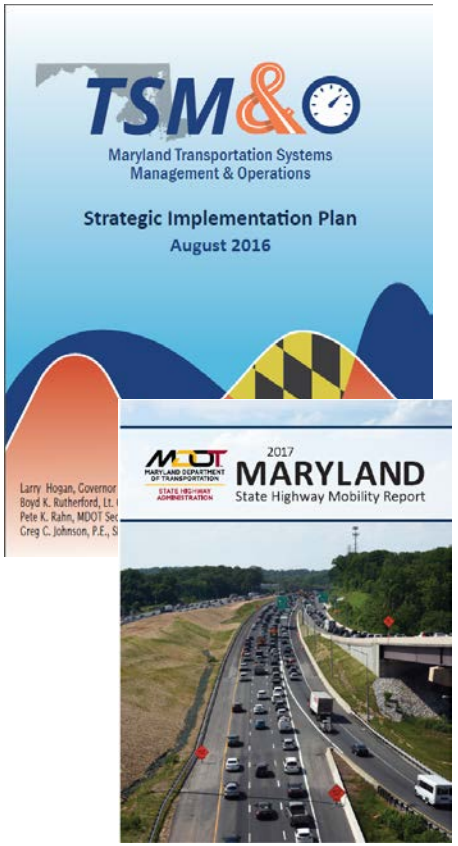
RELATED ONGOING/ UPCOMING EFFORTS AT MDOT SHA

MDOT TRAFFIC RELIEF PLAN (TRP) INITIATIVES

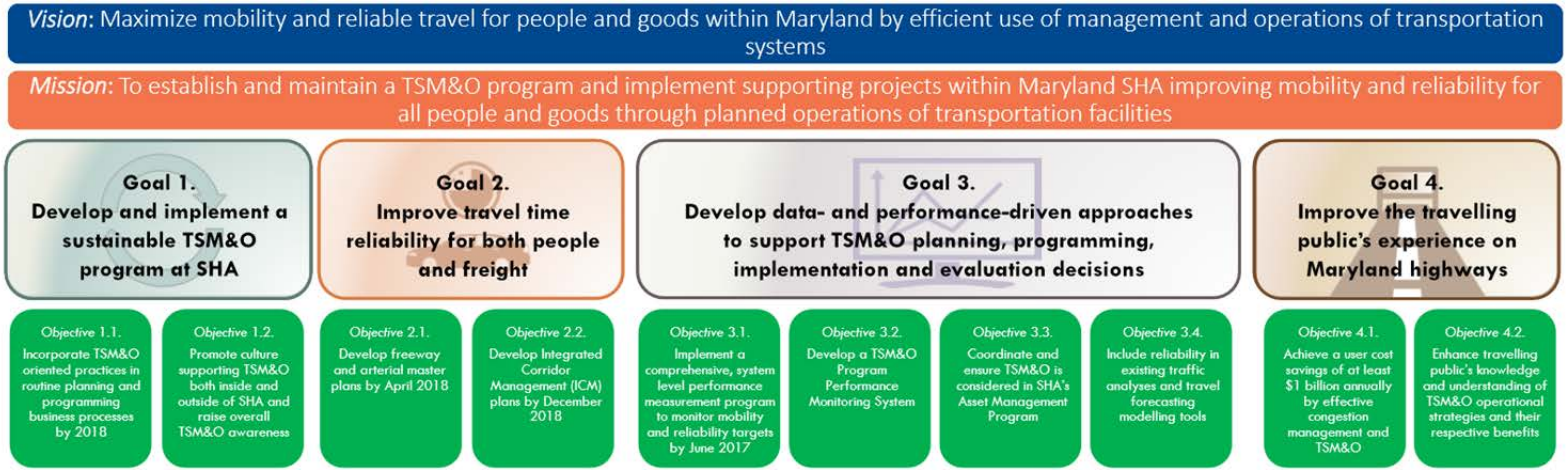
- I-695 TSMO PROJECT
- SMART SIGNAL CORRIDORS
- TSM&O EFFORTS

MDOT SHA TSM&O Strategic Plan

Integrated approach for planning, operations, and maintenance to improve the security, safety, and reliability of our transportation system.



TSM&O Strategic Plan Highlights



- Summarizes a business case for TSM&O
- Establishes mission, vision, goals, objectives and performance measures for TSM&O within MDOT/SHA
- Identifies strategies and projects required to implement TSM&O
- Recommends resource needs to carry out plan

Ongoing TSM&O Initiatives

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2016 Annual User Savings

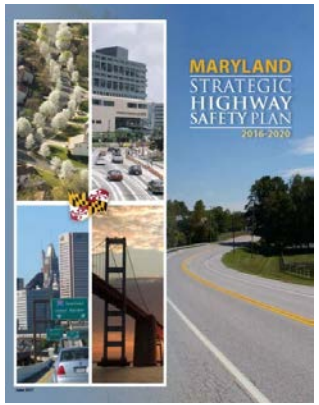
$1.6+ Billion

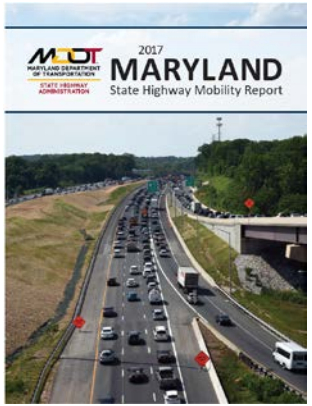
CHART/ TSM&O
$1500 Million

Capital Projects
$29 Million

Signals & Multimodal Strategies
$84 Million

TSM&O Master Plan





- Incidents
- Closures

- Crashes

- AADT
- PTI/TTI
- Bottlenecks

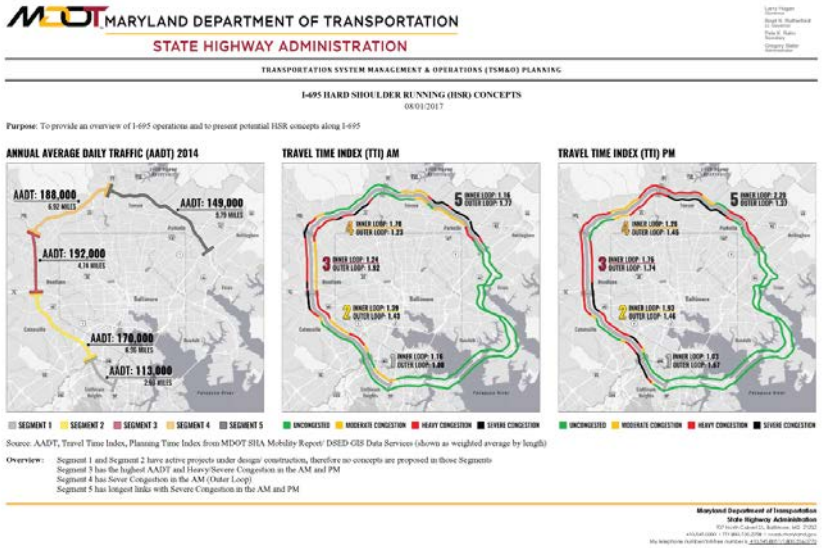
- Existing Project Lists
- Funded – CTP/ TIP
- Unfunded – CLRP/ HNI

Identify Needs
- Safety/ Mobility
- Asset Conditions

Screening
- Concepts, Traffic Analysis/ BCA

Design/ Implementation
- OHD/ CHART/ OOTS/ OPPE/ Districts

TSM&O Project Planning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TRANSPORTATION SYSTEM MANAGEMENT & OPERATIONS (TSM&O) PLANNING

I-695 HARD SHOULDER RUNNING (HSR) CONCEPTS
08/01/2017

Purpose: To provide an overview of I-695 operations and to present potential HSR concepts along I-695

ANNUAL AVERAGE DAILY TRAFFIC (AADT) 2014

TRAVEL TIME INDEX (TTI) AM

TRAVEL TIME INDEX (TTI) PM

Source: AADT, Travel Time Index, Planning Time Index from MDOT SHA Mobility Report/ DSED GIS Data Services (shown as weighted average by length)

Overview: Segment 1 and Segment 2 have active projects under design/ construction, therefore no concepts are proposed in those Segments
Segment 3 has the highest AADT and Heavy/Severe Congestion in the AM and PM
Segment 4 has Sever Congestion in the AM (Outer Loop)
Segment 5 has longest links with Severe Congestion in the AM and PM

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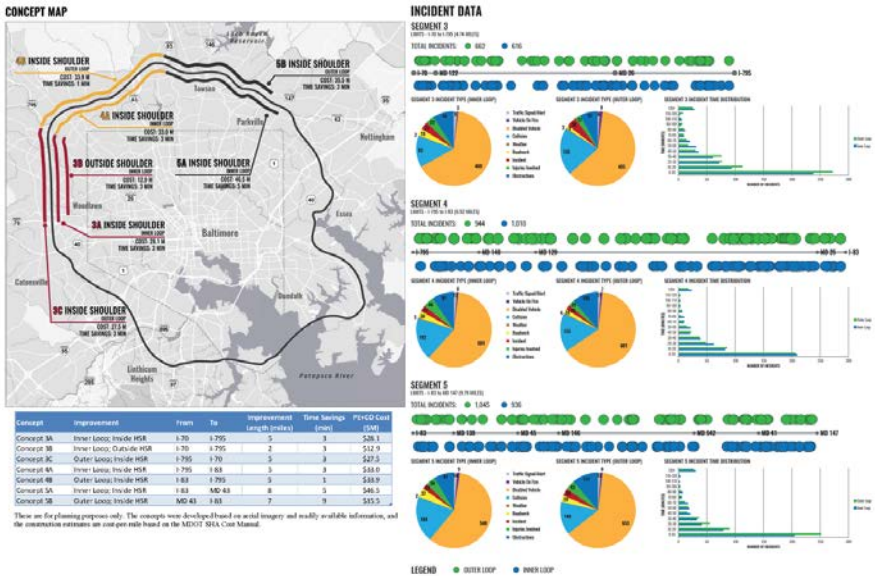
State Highway Administration

- Logical Segments
- Existing Conditions
- Purpose & Needs
- Feasible Concepts
- Traffic Analysis/ Benefits
- Planning level Costs



Concept	Improvement	From	To	Improvement Length (miles)	Time Savings (min)	PE/CO Cost ($M)
Concept 3A	Inner Loop; Inside HSR	I-70	I-795	5	3	$28.1
Concept 3B	Inner Loop; Outside HSR	I-70	I-795	2	3	$12.9
Concept 3C	Outer Loop; Inside HSR	I-795	I-70	5	3	$47.3
Concept 4A	Inner Loop; Inside HSR	I-795	I-83	3	3	$68.0
Concept 4B	Outer Loop; Inside HSR	I-83	I-795	3	1	$88.9
Concept 5A	Inner Loop; Inside HSR	I-83	MD 43	8	5	$46.0
Concept 5B	Outer Loop; Inside HSR	MD 43	I-83	7	9	$85.5

These are for planning purposes only. The concepts were developed based on aerial imagery and readily available information, and the construction estimates are cost-per-mile based on the MDOT SHA Cost Manual.

- Benefit/ Cost & LCAA
- Recommended Concept(s)
- Project Delivery Options
- Funding/ Phasing
- Design
- Implementation

Integrated Corridor Management/ Active Traffic Management Projects

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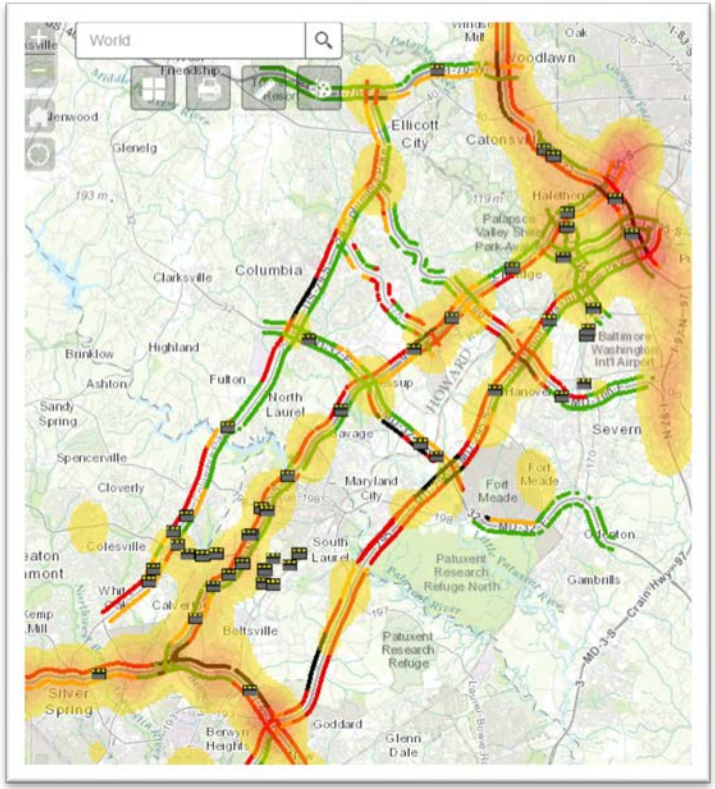

- Emphasis on Innovations & Technology Solutions
- Performance based Practical Transportation
- Innovative Procurement Strategies – Progressive Design Build
- Connected Automated Transportation

UPCOMING PM3 EFFORTS

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- Refine the Reliability Models
- Identify UNRELIABLE SEGMENTS and Causes of Unreliability
- Identify Mitigation Strategies
  - TSM&O Improvements
  - Capital Improvements
- Coordinate efforts with MPO, agencies and local partners
- Communication of Results/ Outreach

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