MARYLAND TRANSPORTATION SYSTEMS MANAGEMENT & OPERATIONS

OVERVIEW & CORRIDOR IDENTIFICATION

National Capital Region
Transportation Planning Board

Systems Performance, Operations, and Technology Subcommittee (SPOTS) Meeting

March 2, 2022

Presented By:

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MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

What ***IS***

Transportation

System

Management &

Operations?

DEFINITION

Transportation **S**ystems **M**anagement & **O**perations is:

1. **Organizationally…**actively bridging gaps between planning, engineering, operations, and maintenance.

2. **Operationally…**maximize the operations of existing facilities by managing the system to its full potential.

TSMO

MARYLAND TRANSPORTATION SYSTEMS MANAGEMENT & OPERATIONS

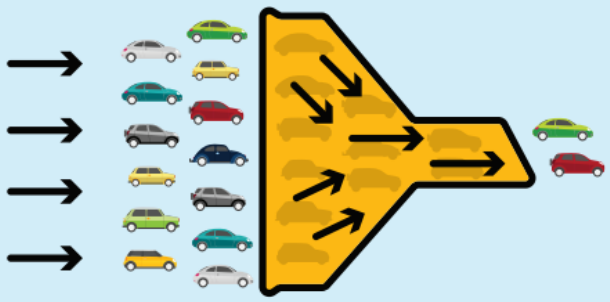
WHAT is TSMO?

An integrated approach to programmatic optimization of **planning, engineering, operations, and maintenance** in implementing new and existing multi-modal systems, services, and projects to preserve capacity and improve the security, safety, and reliability of our transportation system.

HOW does TSMO work?

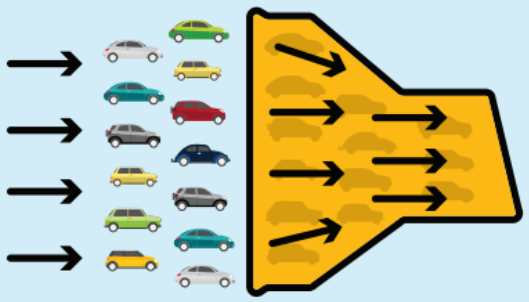
CONGESTION PROBLEM

When large volumes of vehicles try to use a road all at once, it creates traffic jams, making traffic move very slowly.



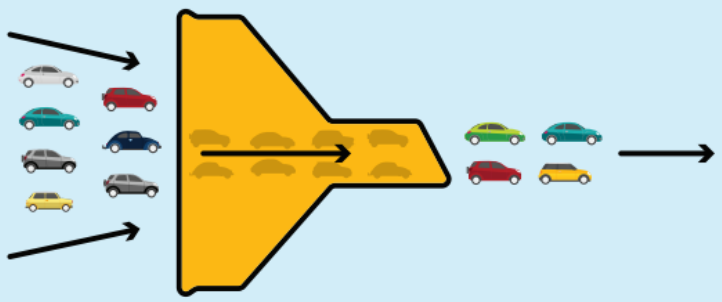
TRADITIONAL CAPACITY EXPANSION

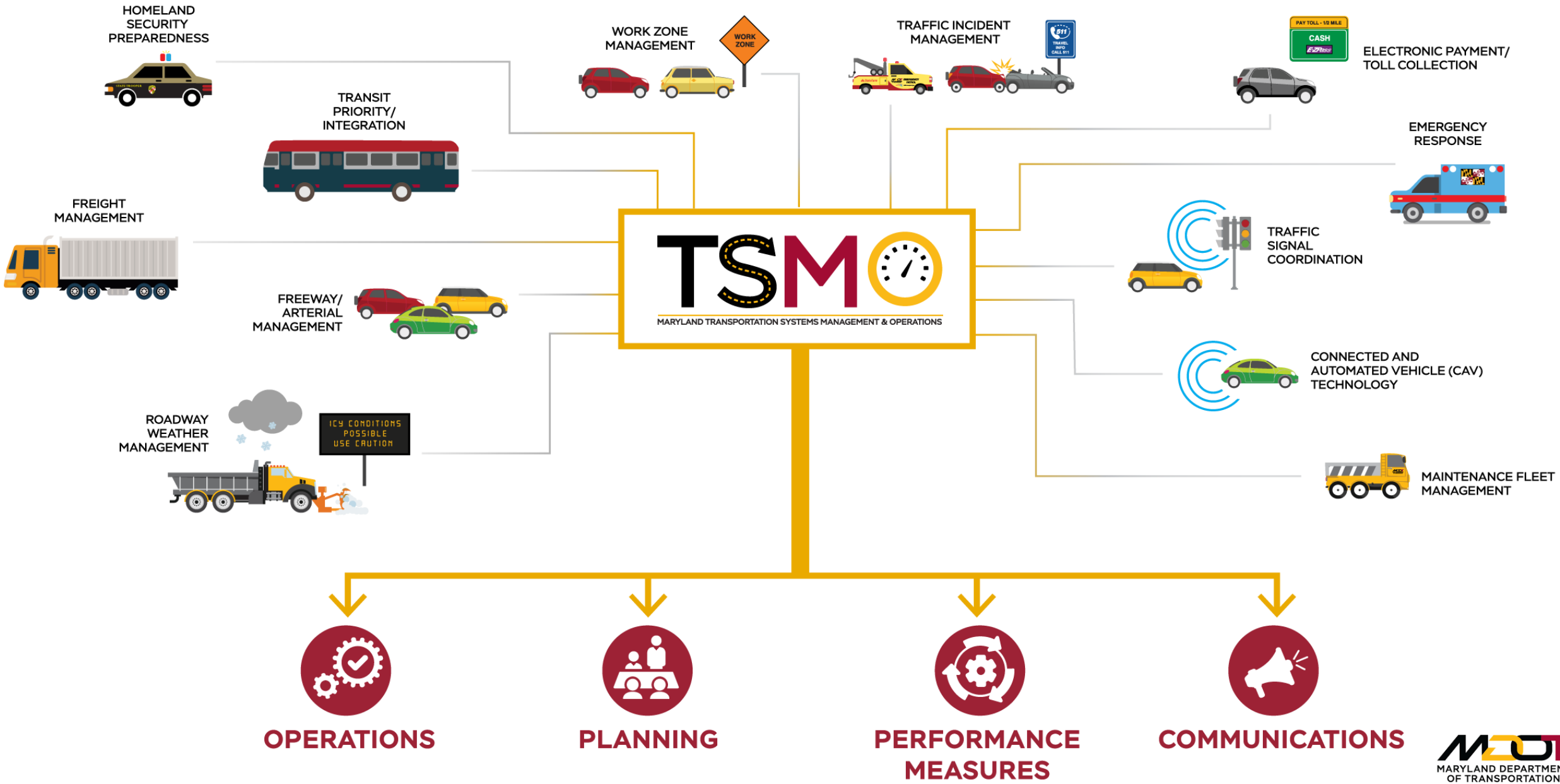
Expanding the available capacity is one option to increase flow, but can be expensive, will take time, and isn't always feasible.



TSMO

A faster and more cost-effective alternative that uses technology to maximize existing capacity, optimizing the flow of traffic by timing it properly.





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MDOT SHA TSMO PROGRAM

- **TSMO Executive Committee** provides strategic direction
- **TSMO Leadership Position** in the Office of Transportation Mobility & Operations
- **Strategic Plan (2018)** for vision and goals [link]
- **Master Plan (2020)** for projects [link]
- **Funded** through mix of funding sources (planning and operations)

MDOT SHA OFFICE RESPONSIBILITIES

- **Office of Planning and Preliminary Engineering** perform traffic analysis and environmental impacts
- **Office of Highway Development** does the designs for major projects and helps with the bid/procurement
- **Office of Traffic and Safety** is responsible for smaller ITS design, signals, safety, heavy vehicles (e.g., WIM)
- **Office of Transportation Mobility and Operations** provides TSMO guidance, tools, standards, planning, partial design, operates and maintains all ITS
- **Districts** are responsible for identification of local needs, outreach, development of planning ideas, making sure the locals are heard when projects are implemented

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STATE HIGHWAY ADMINISTRATION

U.S. Department of Transportation
Federal Highway Administration

Mainstreaming TSMO

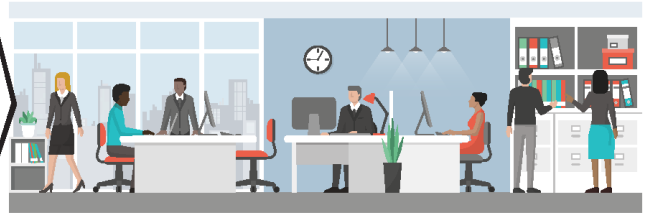
21-014L-TSMO (dot.gov)

Examples of Integrating TSMO Across a Transportation Agency

Transportation Agency

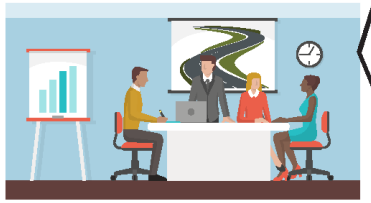
EXECUTIVE LEADERSHIP

- Endorse TSMO with strategic plans and communications
- Consider TSMO directives in agency activities
- Include TSMO measures in agency dashboards
- Budget for TSMO activities



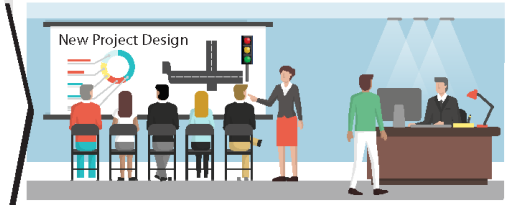
HUMAN RESOURCES

- Provide TSMO training
- Develop job categories for new workforce requirements for TSMO
- Establish a career path for those involved in TSMO



PROJECT DEVELOPMENT AND DESIGN

- Evaluate TSMO options to support performance-based practical design
- Include TSMO strategies in capacity projects to maximize investments
- Incorporate TSMO assets in infrastructure design
- Incorporate TSMO elements in design manuals



TRANSPORTATION MANAGEMENT

- Monitor travel conditions 24/7
- Coordinate with partners for traffic incident management
- Share operations data with planners

Transportation Management Center

PLANNING AND PROGRAMMING

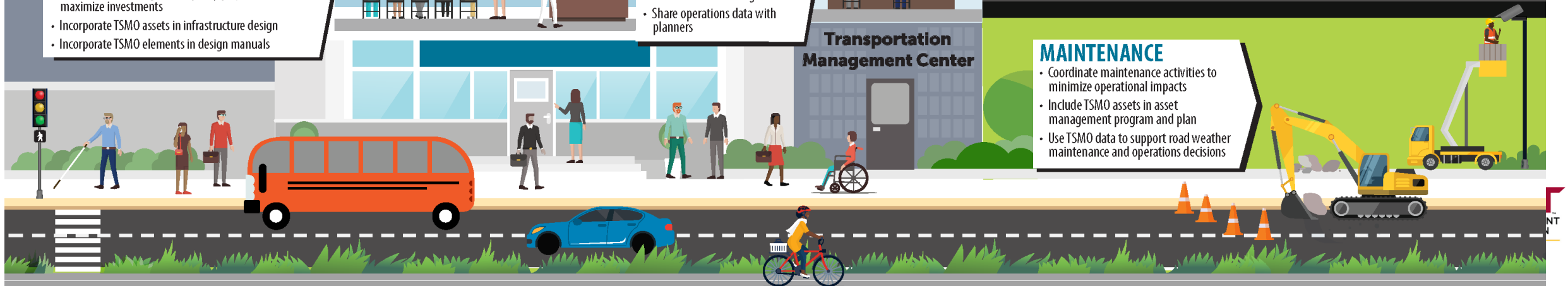
- Consider TSMO solutions as alternatives to capacity expansion projects
- Incorporate travel time reliability, efficiency, and equity in performance goals and objectives
- Identify and prioritize operations needs and investments
- Evaluate TSMO strategies for programming
- Integrate TSMO into transportation plans

CONSTRUCTION

- Apply TSMO strategies to improve work zone safety and mobility
- Coordinate work zone scheduling
- Provide traveler information on construction projects
- Accelerate construction methods

MAINTENANCE

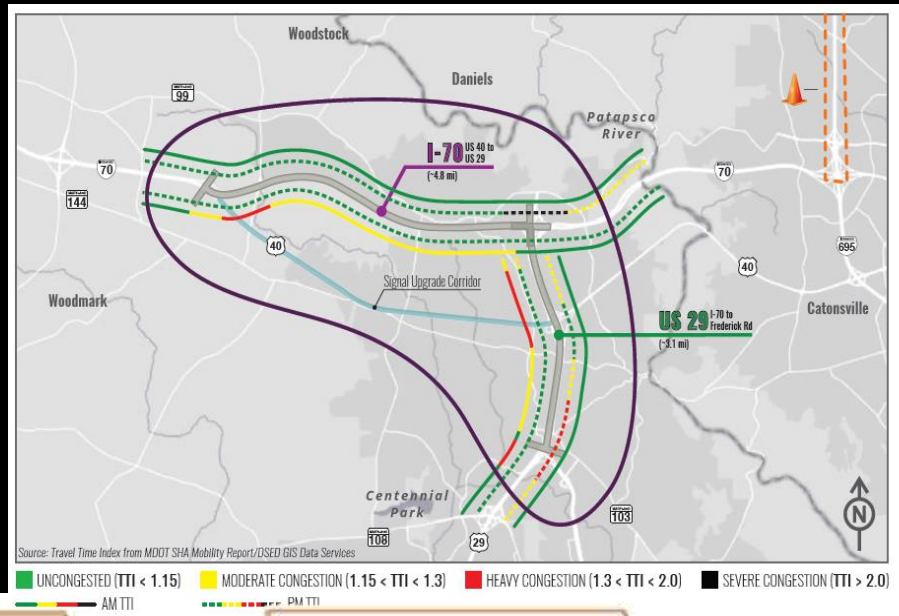
- Coordinate maintenance activities to minimize operational impacts
- Include TSMO assets in asset management program and plan
- Use TSMO data to support road weather maintenance and operations decisions

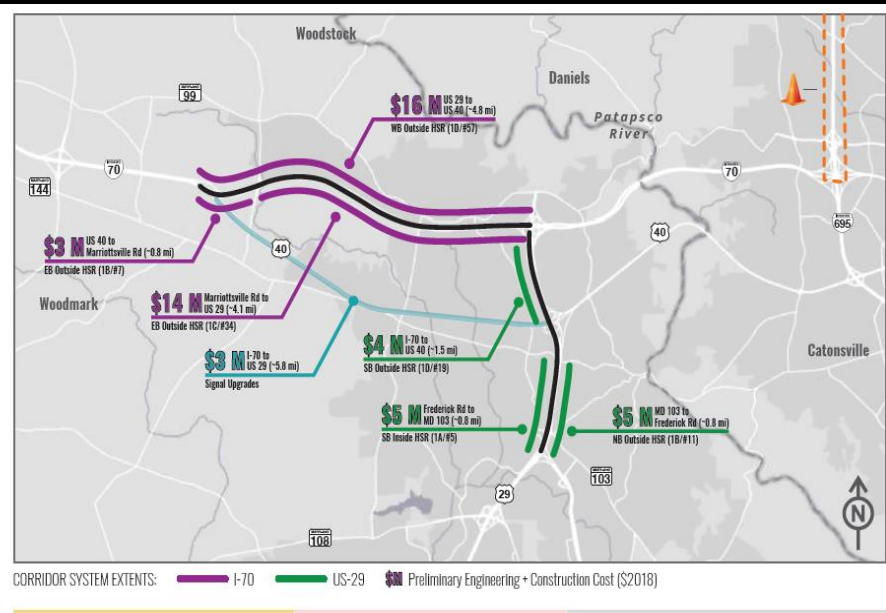


TSMO PROJECTS AND PROGRAMMING

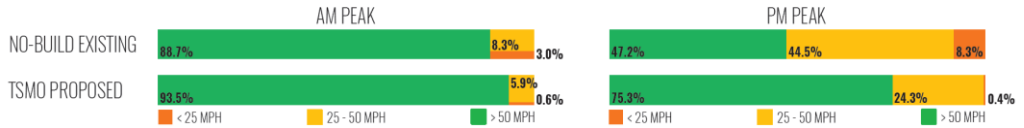
Rethinking

- Projects as Systems
- Performance Measures
- Models





SHRP2 LO5



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WHEN DO YOU HAVE A TSMO PROJECT?

- Based on a need (bonus points if it is an operational need)
- Can quickly be implemented (compared to major civil projects)
- Encompasses the entire lifecycle (including operations and maintenance!) and has performance measures in place to track success (and limitations)
- Likely includes some form of technology
- Likely has multiple stakeholders affected that should be collaborated with

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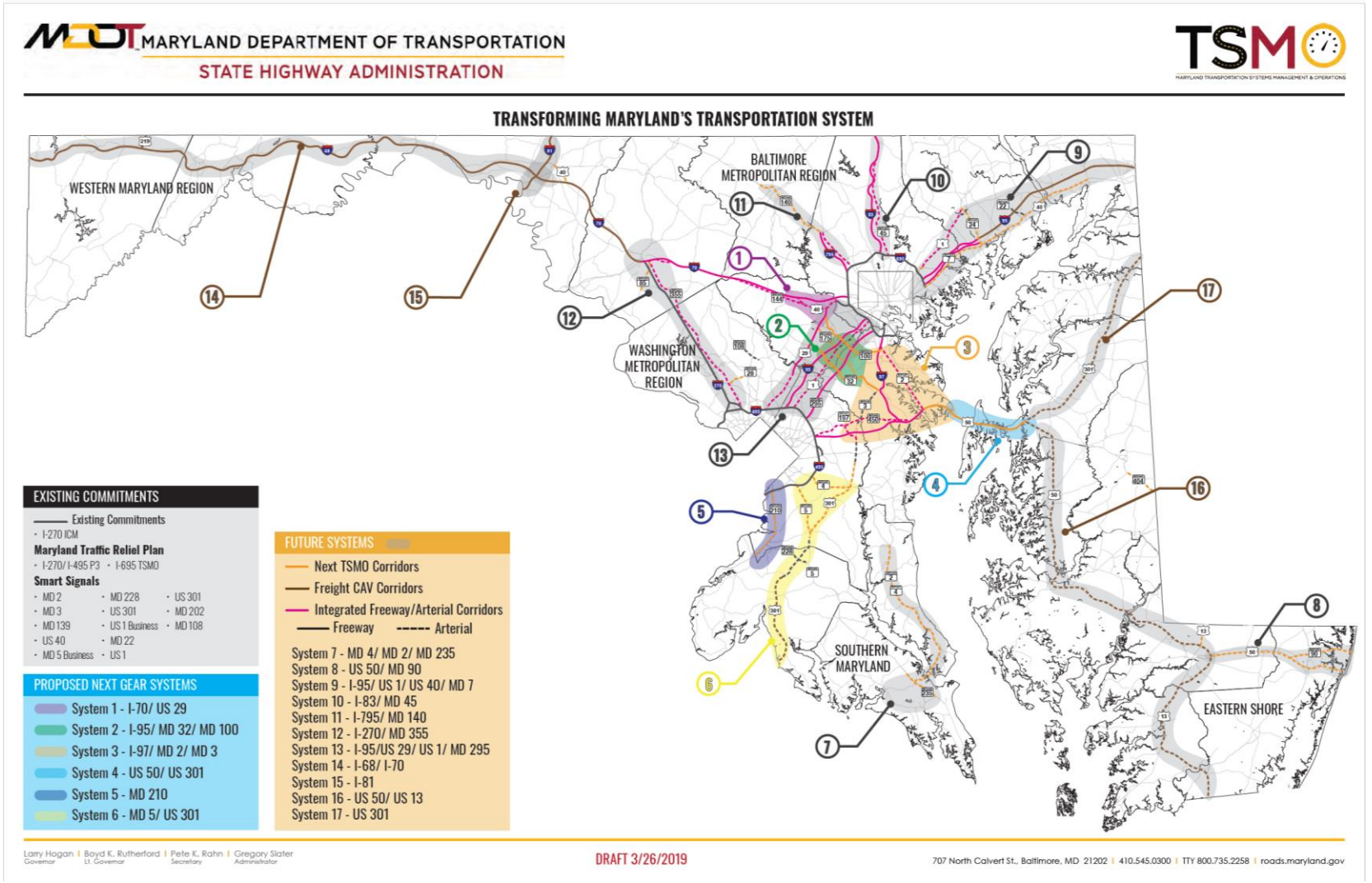
MDOT SHA TSMO MASTER PLAN



[TSMO Master Plan]

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TSMO STRATEGIES

TSMO STRATEGY ▼	Access	Capacity & Demand	Econ. Dev.	Envi. Impact	Freight	Incident Resp.	Mobility	Multimodality	Reliability	Safety	Special Events	Travel Time	Unplanned Events	Work Zones
	TRANSPORTATION NEEDS ADDRESSED ▶													
Access Management	●						●		●	●		●		
Adaptive Ramp Metering		●	●			●	●		●	●	●	●		
Alternative Intersections	●	●							●	●				
Bike Facilities	●	●	●	●			●	●	●	●		●		
Bus on Shoulder		●	●	●			●	●	●		●	●		
Channelization & Delineation	●						●	●	●	●				
Congestion Pricing		●	●			●	●		●	●		●		
CAV Technology		●	●	●	●		●	●	●	●		●		●
Dynamic Lane Reversal		●		●		●	●		●		●	●		
Dynamic Lane Use Control		●		●		●	●		●	●		●		
Dynamic Speed Limit		●				●	●		●	●	●	●		
Electronic Payment/Toll Collection		●		●			●		●			●		
Hard Shoulder Running		●		●			●		●			●		
Homeland Security Preparedness		●			●	●	●		●	●	●	●		
Integrated Corridor Management		●		●		●	●	●	●	●	●	●		●
Maintenance Fleet Management						●	●		●	●	●			●
Managed Lanes	●	●	●	●			●		●			●		
Minor Roadway Improvements	●	●		●	●		●	●	●	●		●		●
Parking Management	●	●	●	●	●		●		●		●	●		
Pavement Markings	●	●							●		●			●
Pedestrian Facilities	●	●		●			●	●	●		●	●		●
Queue Warning				●			●			●		●	●	●
Road Diets	●	●		●			●	●	●	●		●		
Roadway Weather Management						●	●		●				●	
Safety Countermeasures			●			●		●		●				●
Signing	●				●	●	●	●		●				●
Smart Signals		●	●		●	●	●	●	●	●	●	●	●	●
Smart Work Zones					●		●		●	●		●		

https://www.roads.maryland.gov/mdotsha/pages/otmo.aspx?pageid=886

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PART TIME SHOULDER USE

- Also called Hard Shoulder Running
- Utilizes existing shoulders to add a lane for some hours of the day
- Can be “static” or “dynamic”
- Requires increased operational oversight, especially if dynamic
- Reduces congestion related crashes, may increase other crashes
- Impacts traffic incident management

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DYNAMIC SPEED LIMIT

- Also called Variable Speed Limit
- Controls speeds before reaching chokepoints to manage queues
- Must be dynamic (i.e., technology)
- Requires increased operational oversight
- Impacts driver behavior
- Reduces crashes

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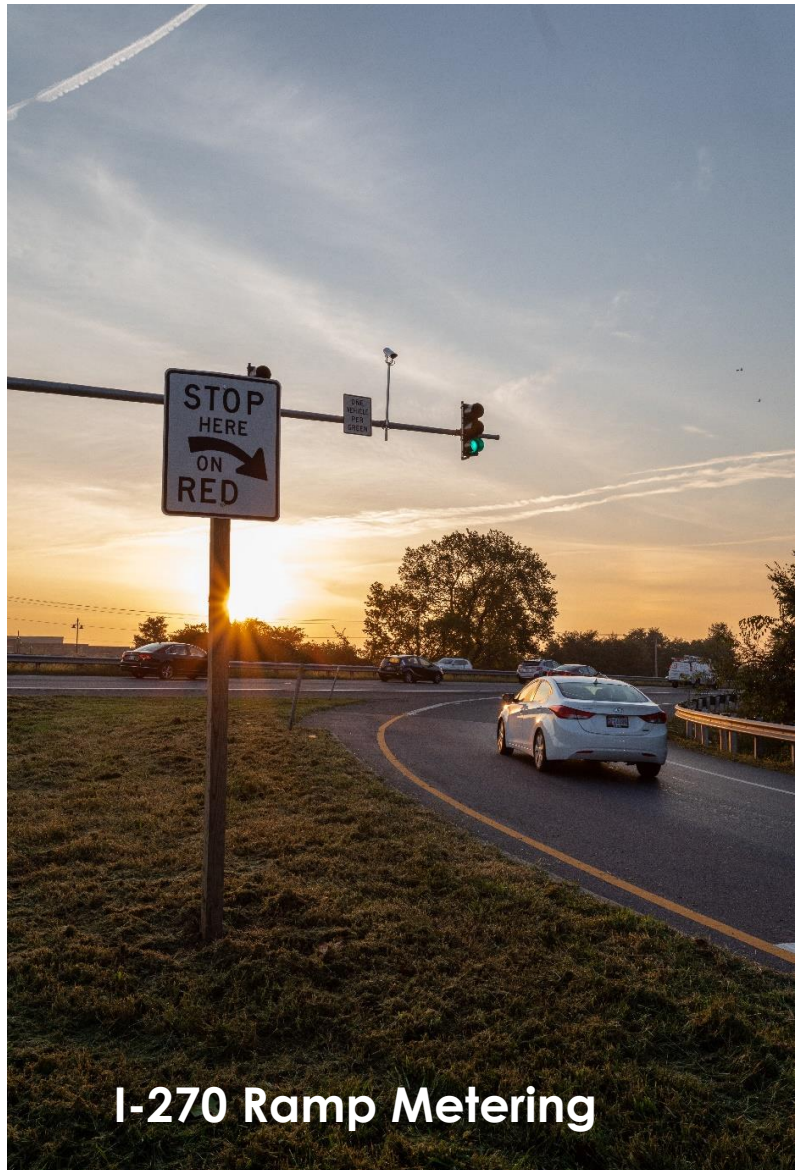
EXAMPLES OF TSMO IN MARYLAND



I-270 Ramp Metering

I-695 TSMO Project

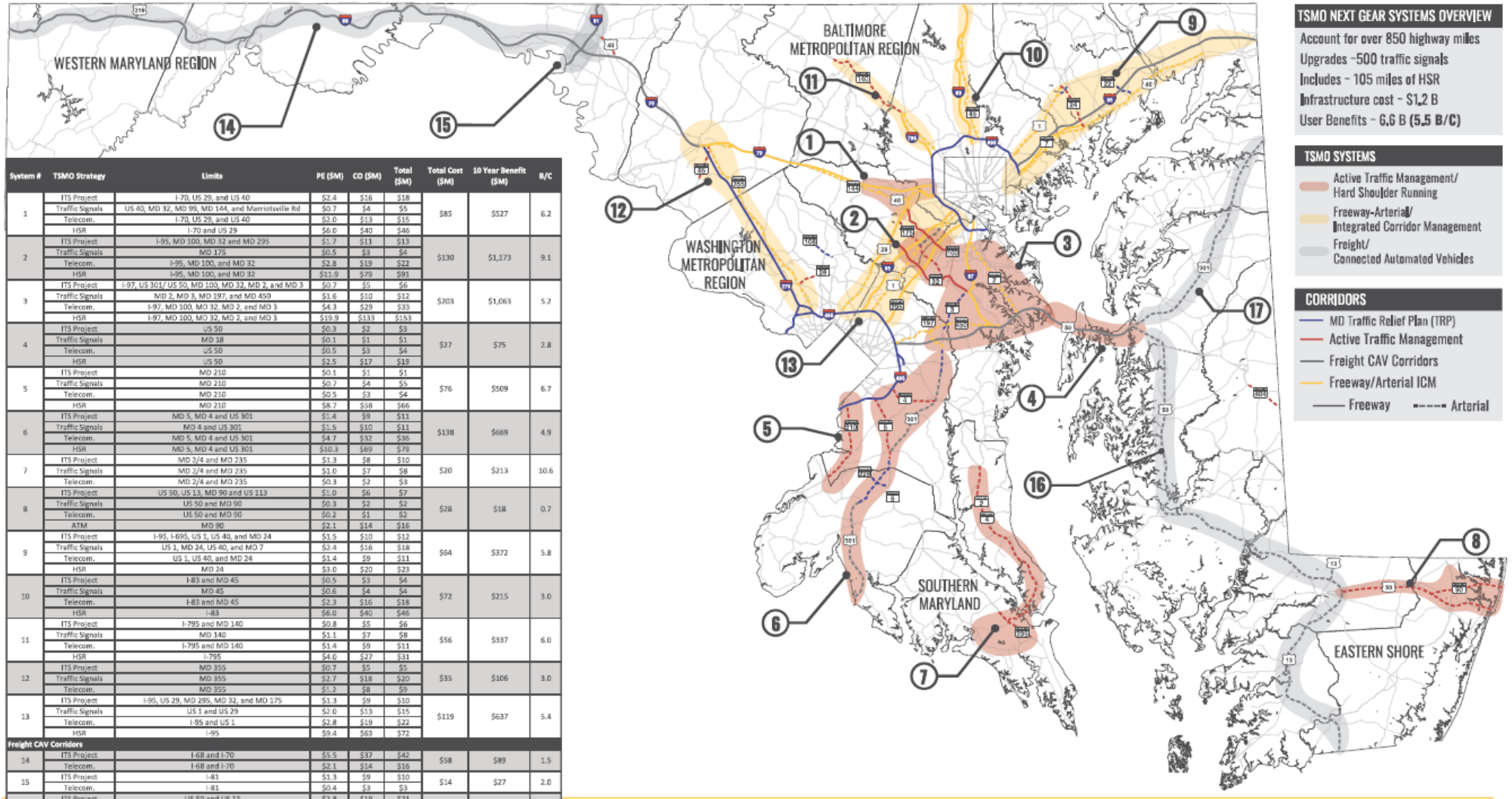
Incident Response

SOC Floor Reconfiguration

OPPORTUNITY AREAS

- **Planning**
- **Design**
- **Construction**
- **Operations**
- **Maintenance**
- **Asset Management**
- **Performance Management**
- **Data / Technology**
- **Human Resources**

CORRIDOR IDENTIFICATION

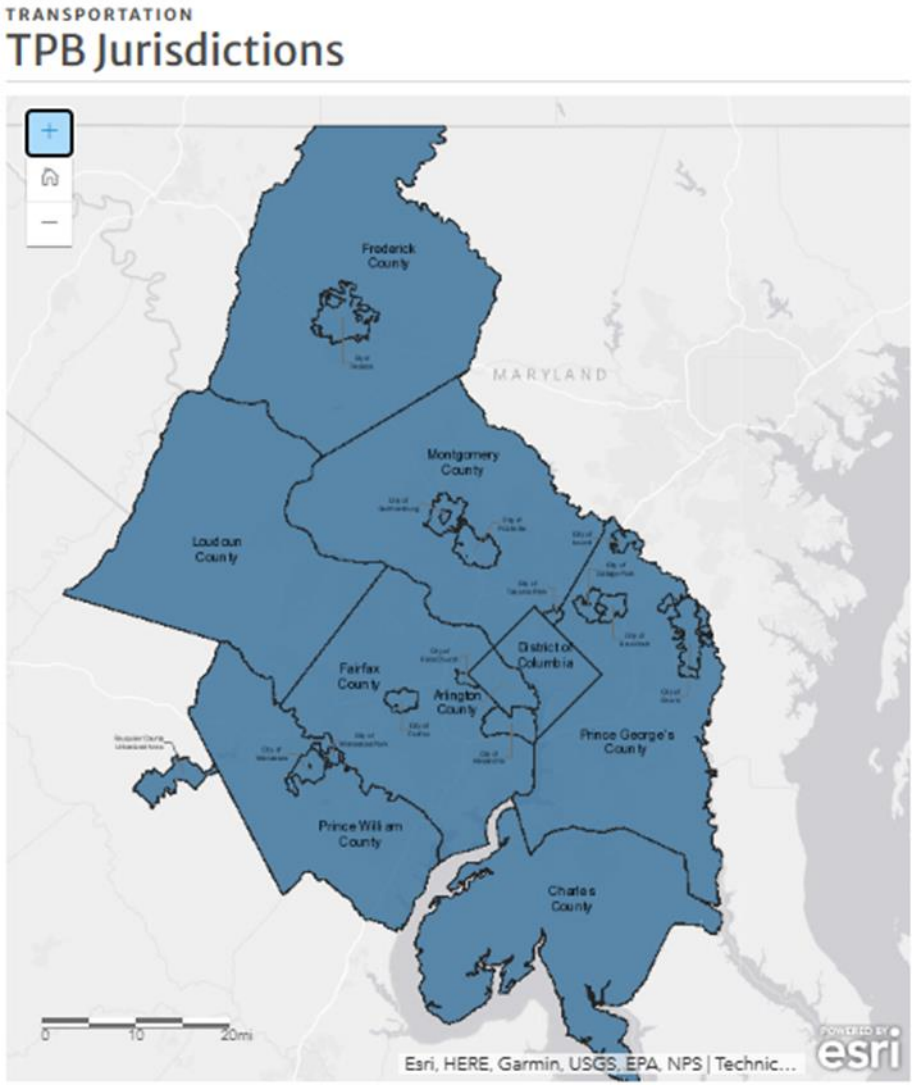


System #	TSMO Strategy	Limits	PE ($M)	CO ($M)	Total ($M)	Total Cost ($M)	10 Year Benefit ($M)	B/C
1	ITS Project	I-70, US 29, and US 40	$2.4	$16	$18	$85	$527	6.2
	Traffic Signals	US 40, MD 32, MD 99, MD 144, and Marriotsville Rd	$0.7	$4	$5			
	Telecom.	I-70, US 29, and US 40	$2.0	$13	$15			
	HSR	I-70 and US 29	$6.0	$40	$46			
2	ITS Project	I-95, MD 100, MD 32 and MD 295	$1.7	$11	$13	$130	$1,173	9.1
	Traffic Signals	MD 175	$0.5	$3	$4			
	Telecom.	I-95, MD 100, and MD 32	$2.8	$19	$22			
	HSR	I-95, MD 100, and MD 32	$11.9	$79	$91			
3	ITS Project	I-97, US 301/ US 50, MD 100, MD 32, MD 2, and MD 3	$0.7	$5	$6	$203	$1,063	5.2
	Traffic Signals	MD 2, MD 3, MD 197, and MD 450	$1.6	$10	$12			
	Telecom.	I-97, MD 100, MD 32, MD 2, and MD 3	$4.3	$29	$33			
	HSR	I-97, MD 100, MD 32, MD 2, and MD 3	$19.9	$133	$153			
4	ITS Project	US 50	$0.3	$2	$3	$27	$75	2.8
	Traffic Signals	MD 18	$0.1	$1	$1			
	Telecom.	US 50	$0.5	$3	$4			
	HSR	US 50	$2.5	$17	$19			
5	ITS Project	MD 210	$0.1	$1	$1	$76	$509	6.7
	Traffic Signals	MD 210	$0.7	$4	$5			
	Telecom.	MD 210	$0.5	$3	$4			
	HSR	MD 210	$8.7	$58	$66			
6	ITS Project	MD 5, MD 4 and US 301	$1.4	$9	$11	$138	$669	4.9
	Traffic Signals	MD 4 and US 301	$1.5	$10	$11			
	Telecom.	MD 5, MD 4 and US 301	$4.7	$32	$36			
	HSR	MD 5, MD 4 and US 301	$10.3	$69	$79			
7	ITS Project	MD 2/4 and MD 235	$1.3	$8	$10	$20	$213	10.6
	Traffic Signals	MD 2/4 and MD 235	$1.0	$7	$8			
	Telecom.	MD 2/4 and MD 235	$0.3	$2	$3			
8	ITS Project	US 50, US 13, MD 90 and US 113	$1.0	$6	$7	$28	$18	0.7
	Traffic Signals	US 50 and MD 90	$0.3	$2	$2			
	Telecom.	US 50 and MD 90	$0.2	$1	$2			
	ATM	MD 90	$2.1	$14	$16			
9	ITS Project	I-95, I-695, US 1, US 40, and MD 24	$1.5	$10	$12	$64	$372	5.8
	Traffic Signals	US 1, MD 24, US 40, and MD 7	$2.4	$16	$18			
	Telecom.	US 1, US 40, and MD 24	$1.4	$9	$11			
	HSR	MD 24	$3.0	$20	$23			
10	ITS Project	I-83 and MD 45	$0.5	$3	$4	$72	$215	3.0
	Traffic Signals	MD 45	$0.6	$4	$4			
	Telecom.	I-83 and MD 45	$2.3	$16	$18			
	HSR	I-83	$6.0	$40	$46			
11	ITS Project	I-795 and MD 140	$0.8	$5	$6	$56	$337	6.0
	Traffic Signals	MD 140	$1.1	$7	$8			
	Telecom.	I-795 and MD 140	$1.4	$9	$11			
	HSR	I-795	$4.0	$27	$31			
12	ITS Project	MD 355	$0.7	$5	$5	$35	$106	3.0
	Traffic Signals	MD 355	$2.7	$18	$20			
	Telecom.	MD 355	$1.2	$8	$9			
13	ITS Project	I-95, US 29, MD 295, MD 32, and MD 175	$1.3	$9	$10	$119	$637	5.4
	Traffic Signals	US 1 and US 29	$2.0	$13	$15			
	Telecom.	I-95 and US 1	$2.8	$19	$22			
	HSR	I-95	$9.4	$63	$72			
Freight CAV Corridors								
14	ITS Project	I-68 and I-70	$5.5	$37	$42	$58	$89	1.5
	Telecom.	I-68 and I-70	$2.1	$14	$16			
15	ITS Project	I-81	$1.3	$9	$10	$14	$27	2.0
	Telecom.	I-81	$0.4	$3	$3			
16	ITS Project	US 50 and US 13	$2.8	$19	$21	$52	$618	11.9
	Traffic Signals	US 50 and US 13	$0.7	$5	$5			
	Telecom.	US 50 and US 13	$3.3	$22	$25			
17	ITS Project	US 301	$1.5	$10	$11	$40	$18	0.5
	Traffic Signals	US 301	$0.8	$6	$6			
	Telecom.	US 301	$2.9	$19	$22			

Figure 12. TSMO SYSTEMS SUMMARY

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

NCR TPB Jurisdiction & TSMO Systems



MDOT TSMO Systems:

- **System 3 (MD 197, MD 450, US 50, US 301)**
- **System 5 (MD 210)**
- **System 6 (MD 4, MD 5, US 301)**
- **System 7 (MD 2/4, MD 235)**
- **System 12 (MD 355)**
- **System 13 (I-95, MD 295, US 1, US 29)**

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION
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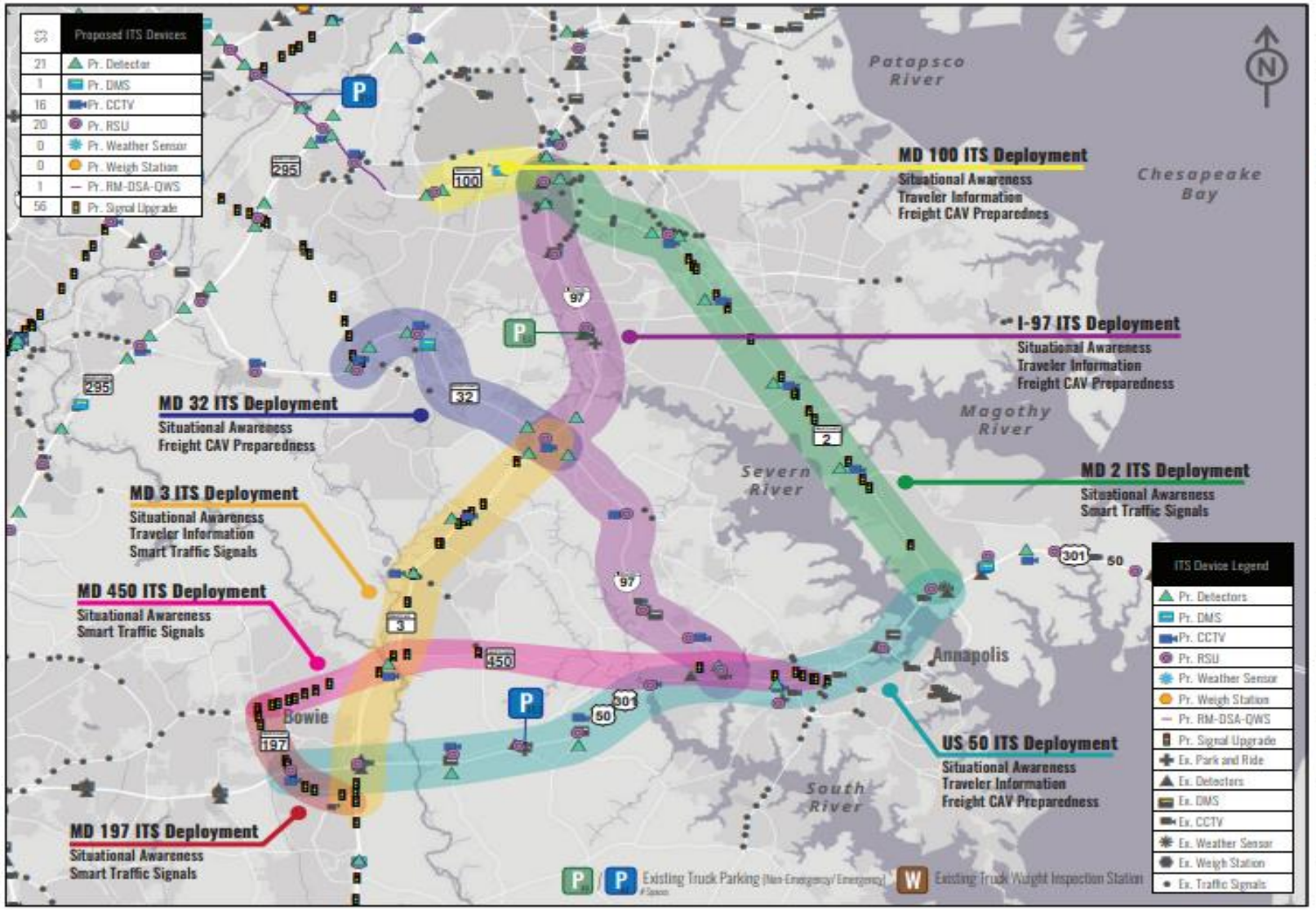
TSMO System 3

TSMO SYSTEM # 3: ITS OVERVIEW



COST SUMMARY:

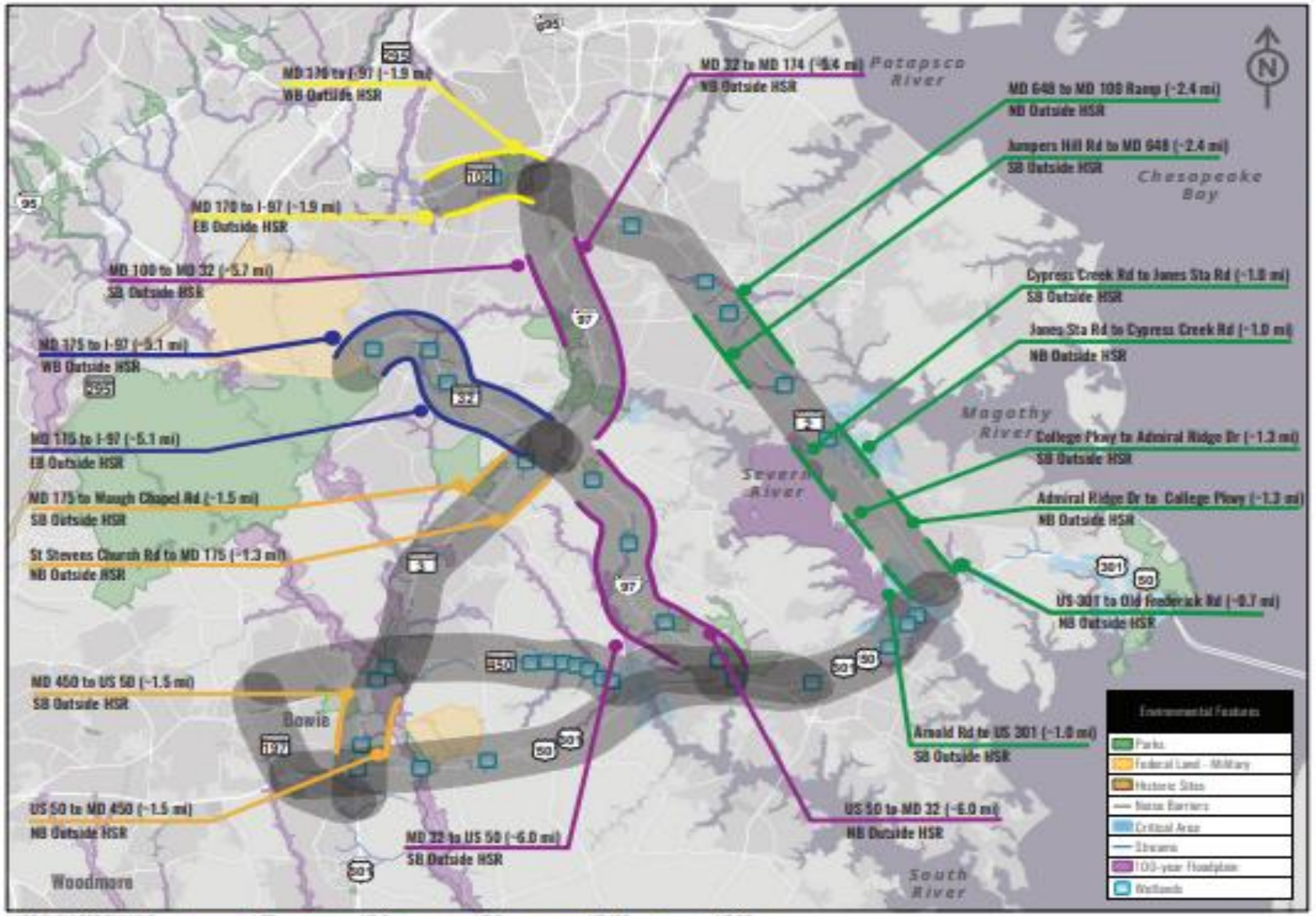
Cost Summary ($ millions)	ITS	Signals	Telecomm.	Roadway
Preliminary Engineering	$1	$2	$4	$20
Construction	$5	$10	$29	$133
Total	$6	$12	$33	$153
Annual recurring costs: $484.6 K		Annual O&M costs: $7.4 M		

SUB-SYSTEM DEPLOYMENT:

System 3.1.1 (B/C: 32) Tier 1	I-97 ITS Deployment Deployment of CCTV, traffic detectors, and RSU along I-97 between MD 100 and US 50.	PE: $0.2 M CO: $1.3 M Recurring Cost: $20.5 K Annual O&M: $0.2 M
System 3.1.2 (B/C: 46) Tier 1	US 50/ US 301 ITS Deployment Deployment of CCTV, traffic detectors, VMS signs, and RSU along US 50/ US 301 between MD 3 and MD 2.	PE: $0.2 M CO: $1.2 M Recurring Cost: $19.9 K Annual O&M: $0.2 M
System 3.1.3 (B/C: 12) Tier 1	MD 100 ITS Deployment Deployment of traffic detectors and VMS signs along MD 100 between MD 170 and I-97.	PE: $0.2 M CO: $1.0 M Recurring Cost: $6.6 K Annual O&M: $0.2 M
System 3.1.4 (B/C: 32) Tier 1	MD 32 ITS Deployment Deployment traffic detectors along MD 32 between MD 170 and I-97.	PE: <$0.1 M CO: $0.2 M Recurring Cost: $4.4 K Annual O&M: <$0.1 M
System 3.1.5 (B/C: 75) Tier 1	MD 2 ITS Deployment Deployment of CCTV, traffic detectors, and RSU along MD 2 between MD 100 and US 50/ US 301.	PE: $0.1 M CO: $0.5 M Recurring Cost: $11.2 K Annual O&M: $0.1 M
System 3.1.6 (B/C: 79) Tier 1	MD 3 ITS Deployment Deployment of VMS signs, CCTV, traffic detectors, and RSU along MD 3 between I-97 and US 50/ US 301.	PE: $0.1 M CO: $0.6 M Recurring Cost: $11.9 K Annual O&M: $0.1 M
System 3.2.1 (B/C: 4) Tier 2	MD 2 Traffic Signal Upgrade Upgrade existing traffic signals along MD 2 between MD 100 and US 50/ US 301.	PE: $0.5 M CO: $3.1 M Recurring Cost: $10.8 K Annual O&M: $0.5 M
System 3.2.2 (B/C: 4) Tier 2	MD 3 Traffic Signal Upgrade Upgrade existing traffic signals along MD 3 between I-97 and US 50/ US 301.	PE: $0.4 M CO: $2.5 M Recurring Cost: $10.8 K Annual O&M: $0.4 M
System 3.2.3 (B/C: 9) Tier 2	MD 450 Traffic Signal Upgrade Upgrade existing traffic signals along MD 450 between US 50/ US 301 and MD 197.	PE: $0.4 M CO: $2.4 M Recurring Cost: $12.2 K Annual O&M: $0.4 M
System 3.2.4 (B/C: 8) Tier 2	MD 197 Traffic Signal Upgrade Upgrade existing traffic signals along MD 197 between MD 450 and US 301.	PE: $0.4 M CO: $2.4 M Recurring Cost: $7.9 K Annual O&M: $0.4 M
System 3.3.1 Tier 2	Telecommunications Fiber connections for ITS deployment in sub systems and to provide critical connections for the network	PE: $4.3 M CO: $28.9 M Annual O&M: $1.3 M

TSMO System 3

TSMO SYSTEM # 3: ROADWAY OVERVIEW



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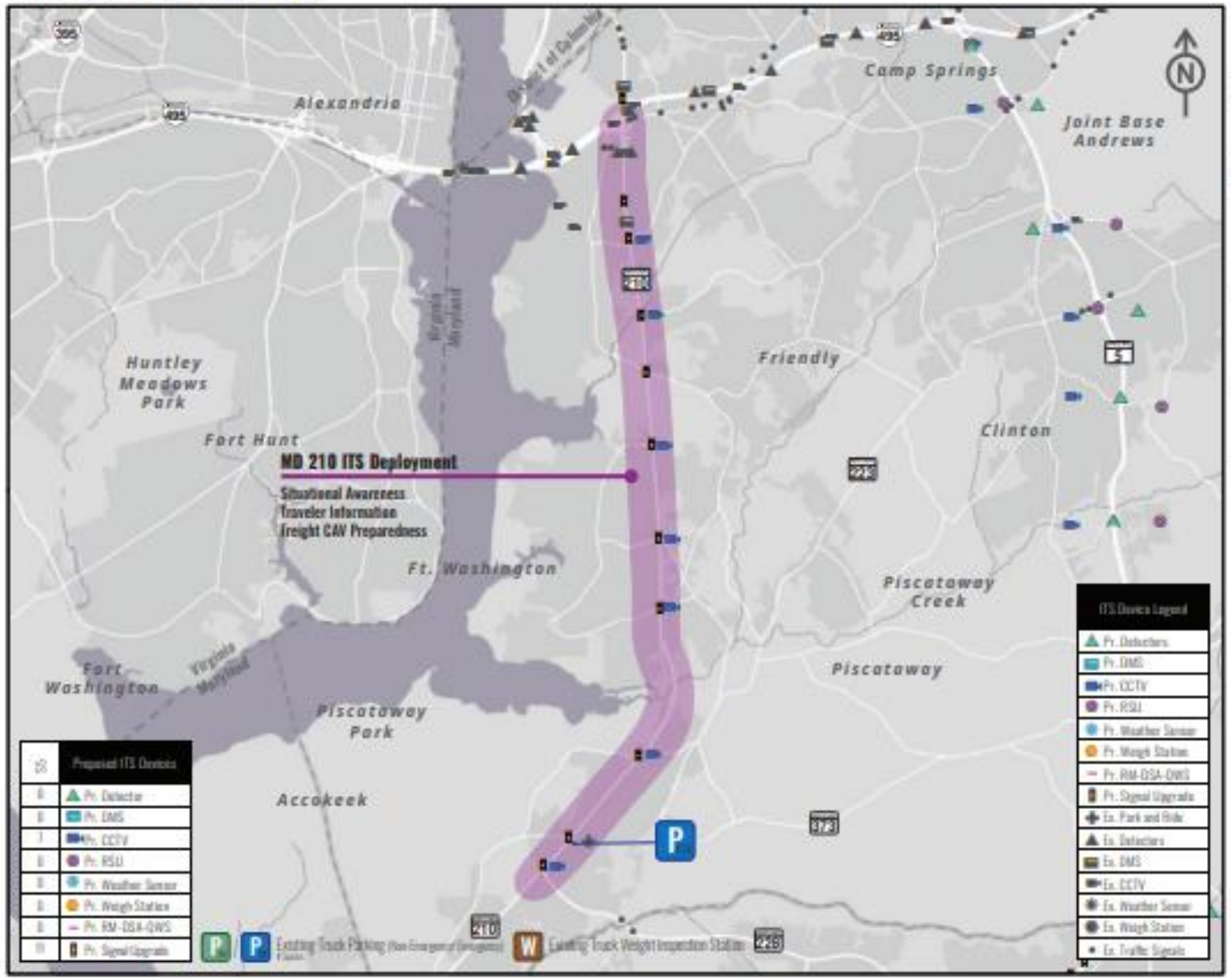
Total	$6	$12	$33	$153
Annual recurring costs: $484.6 K		Annual O&M costs: $7.4 M		

SUB-SYSTEM DEPLOYMENT:

System 3.4.1 (B/C: 8) Tier 3	I-97 Hard Shoulder Running (ITS) Deployment of dynamic lane controls, fixed cameras, CCTV, Communication and ITS equipment, and fiber connection for outside hard shoulder running along I-97 at key locations.	PE: $1.4 M CO: $9.6 M Recurring Cost: $141.4 K Annual O&M: $1.4 M
System 3.4.2 (B/C: 8) Tier 3	I-97 Hard Shoulder Running (Roadway) Civil improvements for outside hard shoulder running along I-97 at key locations.	PE: $6.5 M CO: $43.2 M
System 3.4.3 (B/C: 5) Tier 3	MD 2 Hard Shoulder Running (ITS) Deployment of dynamic lane controls, fixed cameras, CCTV, Communication and ITS equipment, and fiber connection for outside hard shoulder running along MD 2 at key locations.	PE: $0.8 M CO: $5.6 M Recurring Cost: $81.8 K Annual O&M: $0.8 M
System 3.4.4 (B/C: 5) Tier 3	MD 2 Hard Shoulder Running (Roadway) Civil improvements for outside hard shoulder running along MD 2 at key locations.	PE: $3.8 M CO: $25.4 M
System 3.4.5 (B/C: 11) Tier 3	MD 3 Hard Shoulder Running (ITS) Deployment of dynamic lane controls, fixed cameras, CCTV, Communication and ITS equipment, and fiber connection for outside hard shoulder running along MD 3 at key locations.	PE: $0.4 M CO: $2.9 M Recurring Cost: $44.6 K Annual O&M: $0.4 M
System 3.4.6 (B/C: 11) Tier 3	MD 3 Hard Shoulder Running (Roadway) Civil improvements for outside hard shoulder running along MD 3 at key locations.	PE: $2.0 M CO: $13.3 M
System 3.4.7 (B/C: <1) Tier 3	MD 32 Hard Shoulder Running (ITS) Deployment of dynamic lane controls, fixed cameras, CCTV, Communication and ITS equipment, and fiber connection for outside hard shoulder running along MD 32 at key locations.	PE: $0.7 M CO: $4.8 M Recurring Cost: $70.7 K Annual O&M: $0.7 M
System 3.4.8 (B/C: <1) Tier 3	MD 32 Hard Shoulder Running (Roadway) Civil improvements for outside hard shoulder running along MD 32 at key locations.	PE: $2.5 M CO: $16.8 M
System 3.4.9 (B/C: 4) Tier 3	MD 100 Hard Shoulder Running (ITS) Deployment of dynamic lane controls, fixed cameras, CCTV, Communication and ITS equipment, and fiber connection for outside hard shoulder running along MD 100 at key locations.	PE: $0.3 M CO: $2.0 M Recurring Cost: $29.8 K Annual O&M: $0.3 M
System 3.4.10 (B/C: 4) Tier 3	MD 100 Hard Shoulder Running (Roadway) Civil improvements for outside hard shoulder running along MD 100 at key locations.	PE: $1.3 M CO: $8.8 M

TSMO System 5

TSMO SYSTEM # 5: ITS OVERVIEW



COST SUMMARY:

Cost Summary ($ millions)	ITS	Signals	Telecomm.	Roadway
Preliminary Engineering	<$1	$1	$1	$9
Construction	$1	$4	$3	$58
Total	$1	$5	$4	$66
Annual recurring costs: $1,353.1 K		Annual O&M costs: $2.0 M		

SUB-SYSTEM DEPLOYMENT:

System 5.1.1 (B/C: 90) Tier 1	MD 210 ITS Deployment Deployment of CCTV along US MD 210 between I-495 and MD 228.	PE: $0.1 M CO: $0.9 M Recurring Cost: $21.0 K Annual O&M: $0.1 M
System 5.2.1 (B/C: 16) Tier 1	MD 210 Traffic Signal Upgrade Upgrade existing traffic signals along MD 210 between I-495 and MD 228 to be fully-actuated, equipped with S-Cabinets, have Video Detection, have CAV Equipment, ATMS enabled and have TSP.	PE: $0.7 M CO: $4.4 M Recurring Cost: $7.9 K Annual O&M: $0.1 M
System 5.3.1 Tier 3	Telecommunications Fiber connections for ITS deployment in sub systems and to provide critical connections for the network.	PE: $0.5 M CO: $3.5 M Annual O&M: $0.2 M

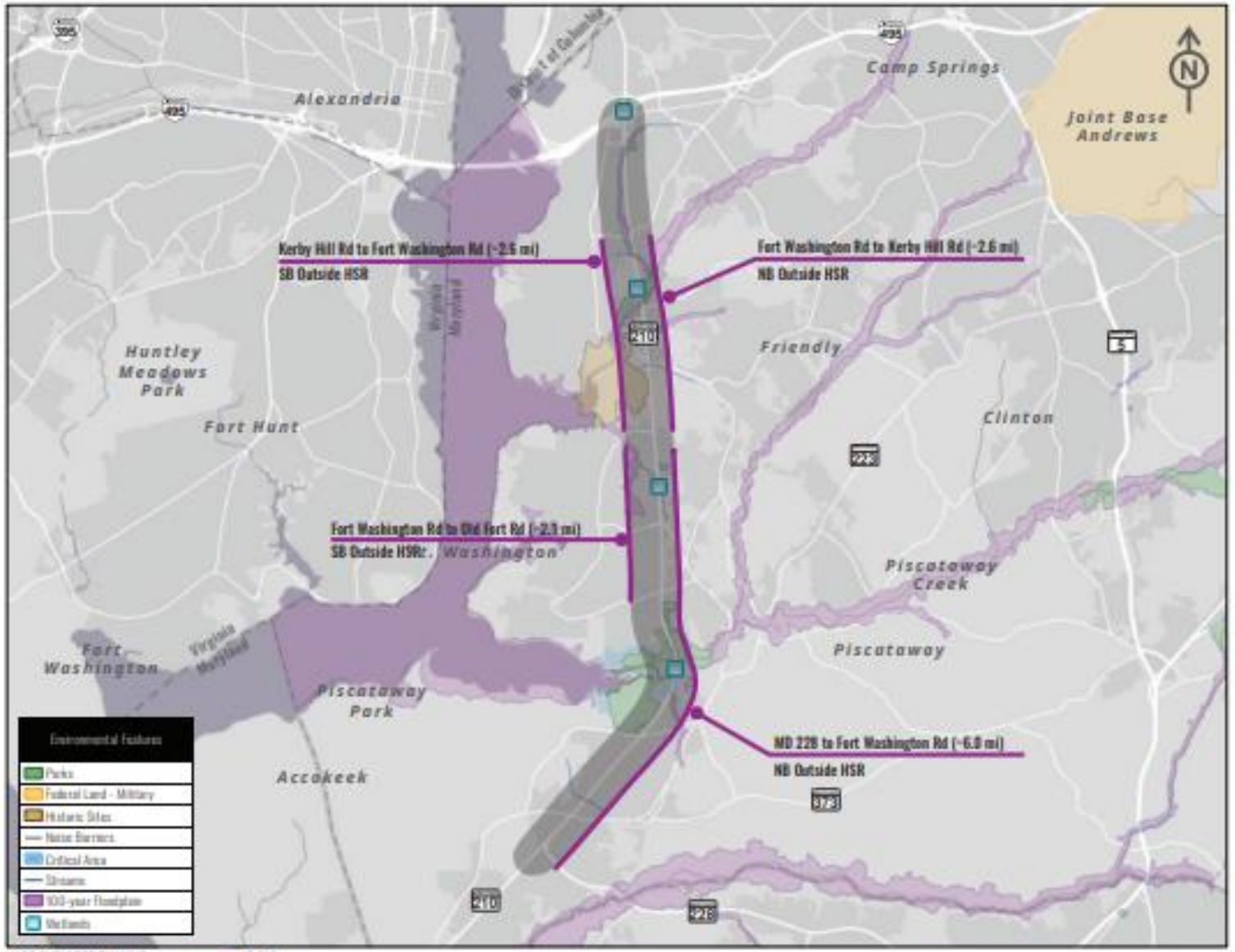
PROGRESS STATUS:

- Evaluate PG County HSR Proposal (completed)
- TSMO to be included as part of NEPA re-evaluation (TBD)

MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

TSMO System 5

TSMO SYSTEM # 5: ROADWAY OVERVIEW



COST SUMMARY:

Cost Summary ($ millions)	ITS	Signals	Telecomm.	Roadway
Preliminary Engineering	~$1	$1	$1	$9
Construction	$1	$4	$3	$58
Total	$1	$5	$4	$66
Annual recurring costs: $133.1 K		Annual O&M costs: $2.0 M		

SUB-SYSTEM DEPLOYMENT:

System 5.4.1 (B/C: 6) Tier 3	MD 210 Hard Shoulder Running (ITS) Deployment of dynamic lane controls, fixed cameras, CCTV, Communication and ITS equipment, and fiber connection for outside hard shoulder running along MD 210 at key locations.	PE: $1.1 M CO: $7.1 M Recurring Cost: $104.2 K Annual O&M: $1.1 M
System 5.4.2 (B/C: 6) Tier 3	MD 210 Hard Shoulder Running (Roadway) Civil improvements for outside hard shoulder running along MD 210 at key locations.	PE: $7.6 M CO: $59.6 M

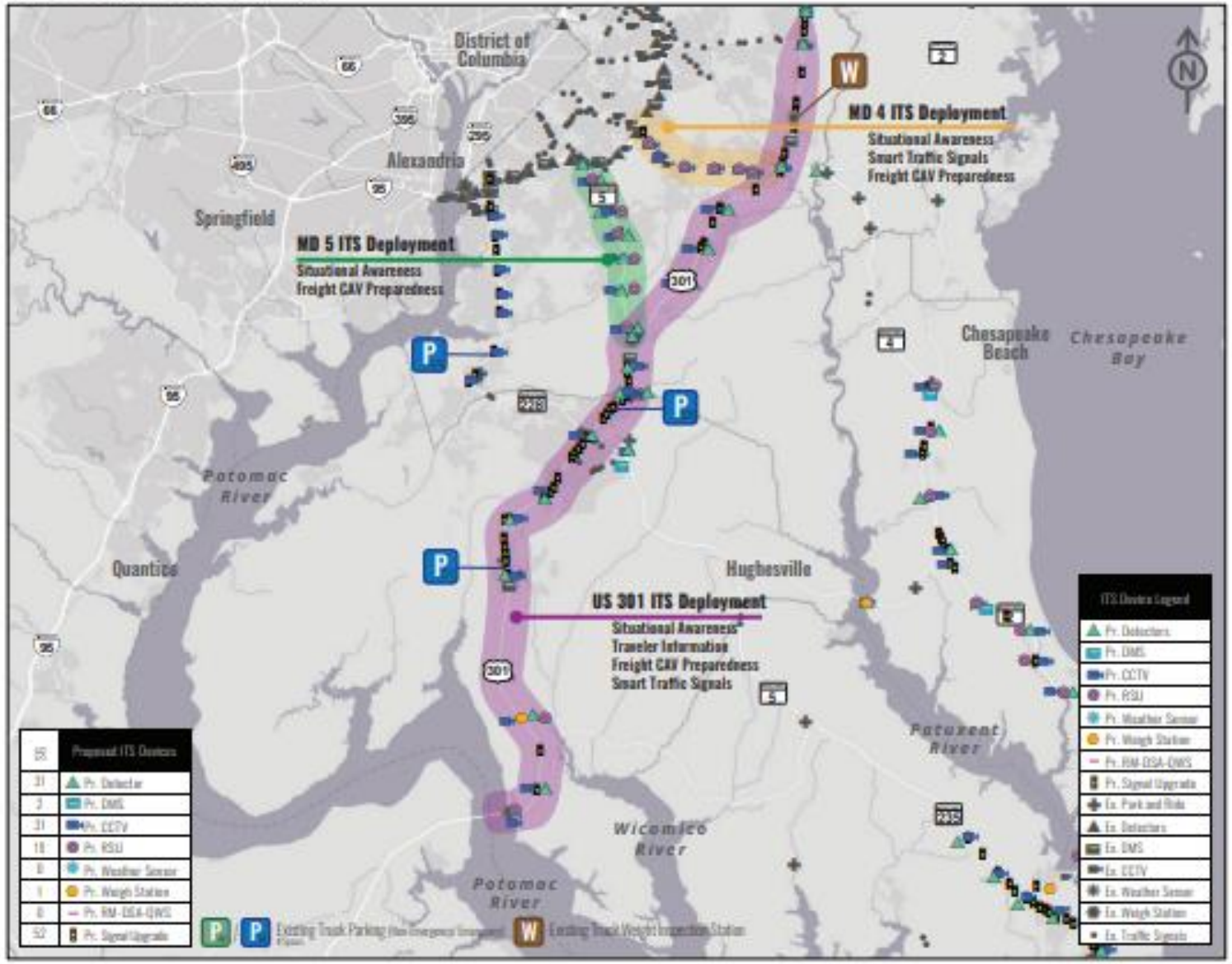
PROGRESS STATUS:

- Evaluate PG County HSR Proposal (completed)
- TSMO to be included as part of NEPA re-evaluation (TBD)

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

TSMO System 6

TSMO SYSTEM # 6: ITS OVERVIEW



COST SUMMARY:

Cost Summary ($ millions)	ITS	Signals	Telecomm.	Roadway
Preliminary Engineering	$1	$1	$5	$10
Construction	$9	$10	$32	$69
Total	$11	$11	$36	$79
Annual recurring costs: $412.7 K		Annual O&M costs: $0.8 M		

SUB-SYSTEM DEPLOYMENT:

System 6.1.1 (B/C: 6) Tier 1	MD 5 ITS Deployment Deployment of VMS signs, CCTV, traffic detectors, and RSU along MD 5 between I-495 and US 301.	PE: $0.4 M CD: $2.7 M Recurring Cost: $40.0 K Annual O&M: $0.4 M
System 6.1.2 (B/C: 31) Tier 1	MD 4 ITS Deployment Deployment of CCTV, traffic detectors, and RSU along MD 4 between I-495 and US 301.	PE: $0.2 M CD: $1.4 M Recurring Cost: $25.9 K Annual O&M: $0.2 M
System 6.1.3 (B/C: 43) Tier 1	US 301 ITS Deployment Deployment of CCTV, traffic detectors, and RSU along US 301 between US 50 and VA State Line.	PE: $0.8 M CD: $5.1 M Recurring Cost: $67.6 K Annual O&M: $0.8 M
System 6.2.1 (B/C: 16) Tier 1	US 301 Traffic Signal Upgrade Upgrade existing traffic signals along US 301 between US 50 and VA State Line to be fully actuated, equipped with 5 Cabinets, have Video Detection, have CAV Equipment, ATMS enabled and have TSP.	PE: $1.3 M CD: $8.7 M Recurring Cost: $35.3 K Annual O&M: $1.3 M
System 6.2.2 (B/C: 12) Tier 3	MD 4 Traffic Signal Upgrade Upgrade existing traffic signals along MD 4 between I-495 and US 50 to be fully-actuated, ATMS enabled, and have TSP.	PE: $0.2 M CD: $1.2 M Recurring Cost: $2.2 K Annual O&M: $0.2 M
System 6.3.1 Tier 3	Telecommunications Fiber connections for ITS deployment in sub systems and to provide critical connections for the network.	PE: $4.7 M CD: $31.7 M Annual O&M: $1.5 M

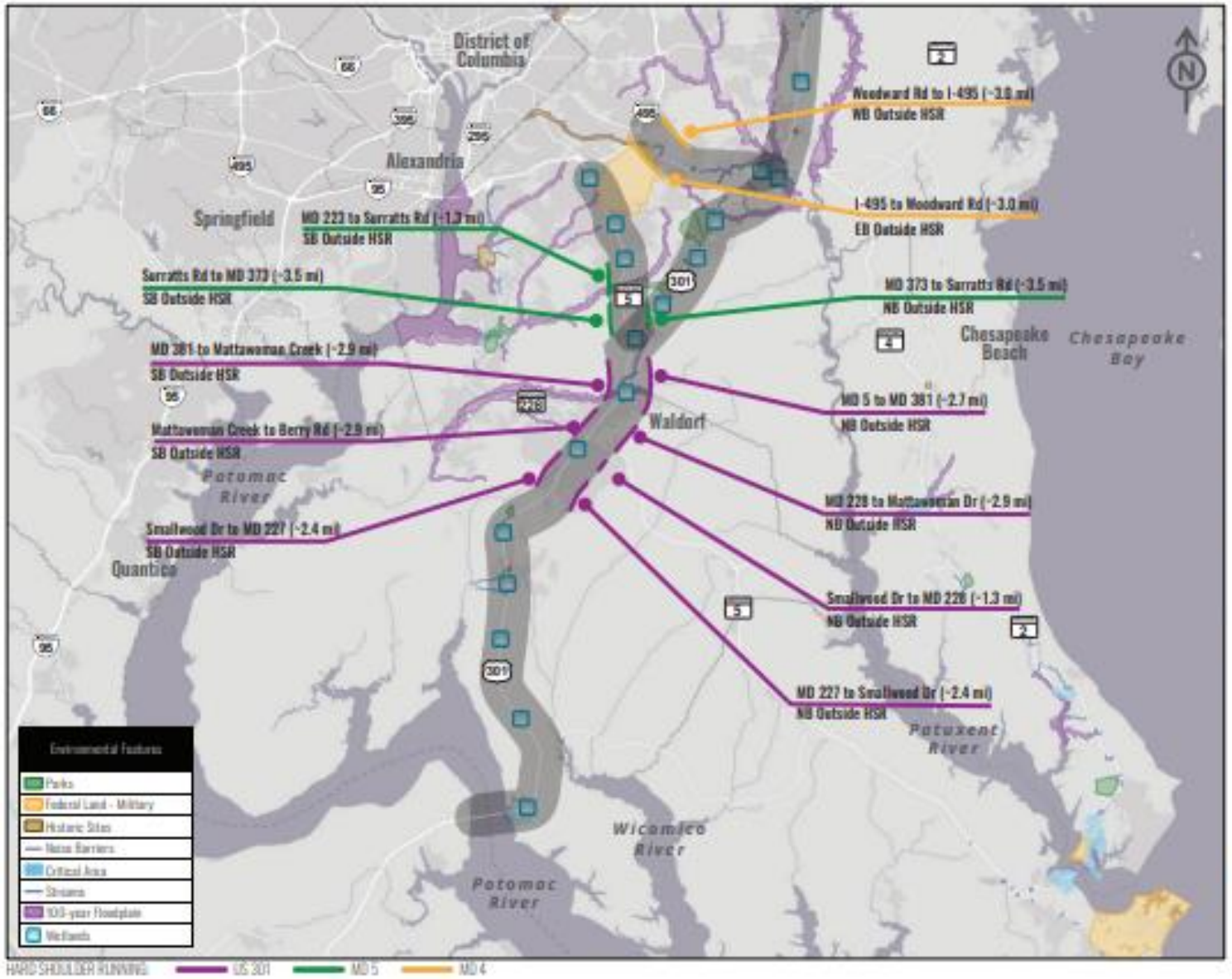
PROGRESS STATUS:

- US 301 Smart Traffic Signals (TRP)
- Hard Running Shoulder (evaluated as part of US 301 planning study)
- Nice Bridge Project (funded - potential situational awareness improvements)

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

TSMO System 6

TSMO SYSTEM # 6: ROADWAY OVERVIEW



COST SUMMARY:

Cost Summary ($ millions)	ITS	Signals	Telecomm.	Roadway
Preliminary Engineering	$1	$1	$5	$10
Construction	$9	$10	$32	$69
Total	$11	$11	$36	$79
Annual recurring costs: $412.7 K		Annual O&M costs: $0.8 M		

SUB-SYSTEM DEPLOYMENT:

System 6.4.1 (B/C: 1) Tier 3	MD 5 Hard Shoulder Running (ITS) Deployment of dynamic lane controls, fixed cameras, CCTV, Communication and ITS equipment, and fiber connection for outside hard shoulder running along MD 5 at key locations.	PE: $0.7 M CO: $4.6 M Recurring Cost: $67.0 K Annual O&M: $0.7 M
System 6.4.2 (B/C: 1) Tier 3	MD 5 Hard Shoulder Running (Roadway) Civil improvements for outside hard shoulder running along MD 5 at key locations.	PE: $3.4 M CO: $22.9 M
System 6.4.3 (B/C: 3) Tier 3	MD 4 Hard Shoulder Running (ITS) Deployment of dynamic lane controls, fixed cameras, CCTV, Communication and ITS equipment, and fiber connection outside hard shoulder running along MD 4 at key locations.	PE: $0.5 M CO: $3.0 M Recurring Cost: $44.6 K Annual O&M: $0.5 M
System 6.4.4 (B/C: 3) Tier 3	MD 4 Hard Shoulder Running (Roadway) Civil improvements for outside hard shoulder running along MD 4 at key locations.	PE: $2.1 M CO: $13.8 M
System 6.4.5 (B/C: 5) Tier 3	US 301 Hard Shoulder Running (ITS) Deployment of dynamic lane controls, fixed cameras, CCTV, Communication and ITS equipment, and fiber connection for outside hard shoulder running along US 301 at key locations.	PE: $1.3 M CO: $8.9 M Recurring Cost: $130.2 K Annual O&M: $1.3 M
System 6.4.6 (B/C: 5) Tier 3	US 301 Hard Shoulder Running (Roadway) Civil improvements for outside hard shoulder running along US 301 at key locations.	PE: $2.3 M CO: $15.1 M

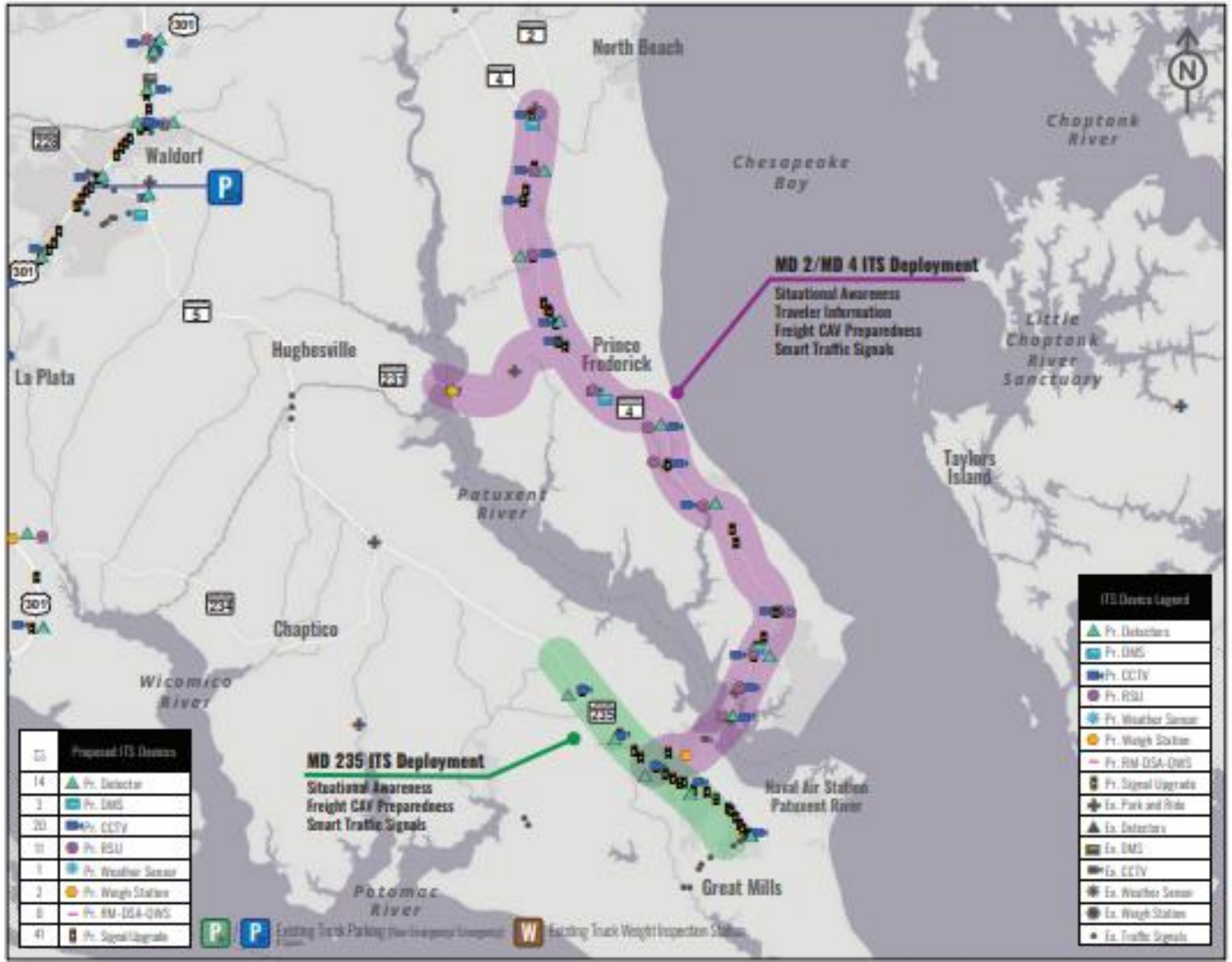
PROGRESS STATUS:

- US 301 Smart Traffic Signals (TRP)
- Hard Running Shoulder (evaluated as part of US 301 planning study)
- Nice Bridge Project (funded - potential situational awareness improvements)

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

TSMO System 7

TSMO SYSTEM # 7: ITS OVERVIEW



COST SUMMARY:

Cost Summary ($ millions)	ITS	Signals	Telecomm.	Roadway
Preliminary Engineering	$1	$1	$0	$N/A
Construction	$8	$7	$2	$N/A
Total	$10	$8	$3	$N/A
Annual recurring costs: $198.7 K		Annual O&M costs: $2.4 M		

SUB-SYSTEM DEPLOYMENT:

System 7.1.1 (B/C: 10) Tier 1	MD 2/ MD 4 ITS Deployment Deployment of an In-Motion Weight Station, VMS signs, CCTV, traffic detectors, and RSU along MD 2/ MD 4 between MD 2/ MD 4 split and MD 235.	PE: $1.1 M CD: $7.6 M Recurring Cost: $70.6 K Annual O&M: $1.1 M
System 7.1.2 (B/C: 57) Tier 2	MD 235 ITS Deployment Deployment of an In-Motion Weight Station, a Weather station, CCTV, and traffic detectors along MD 235 between MD 245 and MD 246.	PE: $0.1 M CD: $0.8 M Recurring Cost: $38.6 K Annual O&M: $0.1 M
System 7.2.1 (B/C: 4) Tier 1	MD 2/ MD 4 Traffic Signal Upgrade Upgrade existing traffic signals along MD 2/ MD 4 between MD 2/ MD 4 split and MD 235 to be fully-actuated, equipped with S-Cabinets, have Video Detection, have CAV Equipment, ATMS enabled and have TSP.	PE: $0.6 M CD: $4.1 M Recurring Cost: $15.1 K Annual O&M: $0.6 M
System 7.2.2 (B/C: 19) Tier 2	MD 235 Traffic Signal Upgrade Upgrade existing traffic signals along MD 235 between MD 245 and MD 246 to be fully-actuated, equipped with S-Cabinets, have Video Detection, have CAV Equipment, and ATMS enabled.	PE: $0.4 M CD: $2.5 M Recurring Cost: $14.4 K Annual O&M: $0.4 M
System 7.3.1 Tier 3	Telecommunications Fiber connections for ITS deployment in sub systems and to provide critical connections for the network.	PE: $0.3 M CD: $2.3 M Annual O&M: $0.1 M

PROGRESS STATUS:

- Thomas Johnson Bridge (funded - potential situational awareness improvement)

MARYLAND DEPARTMENT OF TRANSPORTATION
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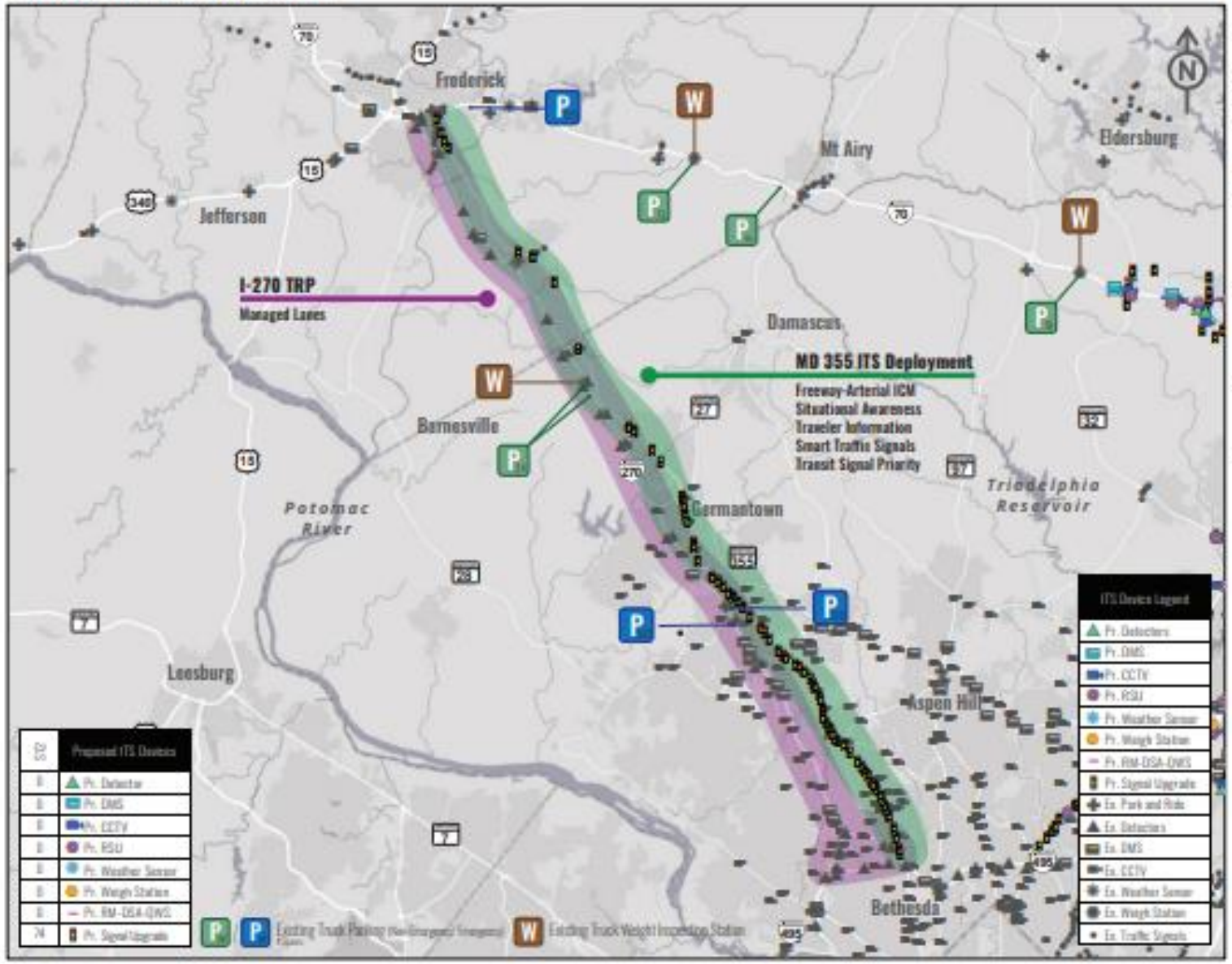
TSMO System 12

TSMO SYSTEM # 12: ITS OVERVIEW



COST SUMMARY:

Cost Summary ($ millions)	ITS	Signals	Telecomm.	Roadway
Preliminary Engineering	$1	$3	$1	$N/A
Construction	$5	$18	$8	$N/A
Total	$6	$20	$9	$N/A
Annual recurring costs: $161.3 K		Annual O&M costs: $3.7 M		

SUB-SYSTEM DEPLOYMENT:

System 12.1.1 (B/C: 18) Tier 1	MD 355 ITS Deployment Deployment of CCTV along MD 355 between I-495 and I-70.	PE: $0.7 M CO: $4.6 M Recurring Cost: $108.0 K Annual O&M: $0.7 M
System 12.2.1 (B/C: 1) Tier 2	MD 355 Traffic Signal Upgrade Upgrade existing traffic signals along MD 355 between I-495 and I-70 to be fully-actuated, equipped with S-Cabinets, have Video Detection, have CAV Equipment, ATMS enabled and have TSP.	PE: $2.7 M CO: $17.8 M Recurring Cost: $53.3 K Annual O&M: $2.7 M
System 12.3.1 Tier 2	Telecommunications Fiber connections for ITS deployment in sub systems and to provide critical connections for the network.	PE: $1.2 M CO: $8.0 M Annual O&M: $0.4 M

PROGRESS STATUS:

- I-270 ICM (ongoing)
- I-270 TRP (ongoing)

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION
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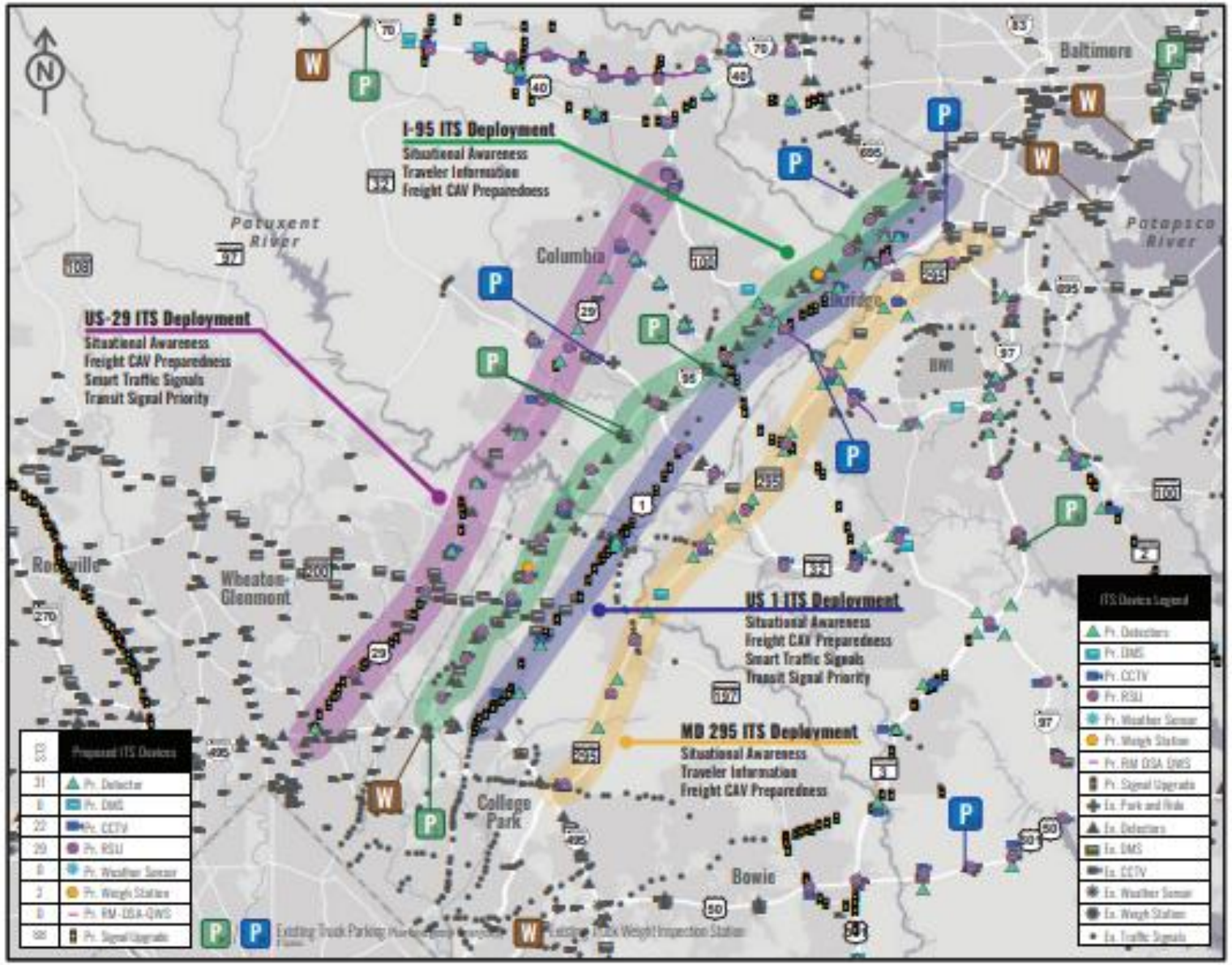
TSMO System 13

TSMO SYSTEM # 13: ITS OVERVIEW



COST SUMMARY:

Cost Summary ($ millions)	ITS	Signals	Telecomm.	Roadway
Preliminary Engineering	$1	$2	$3	$9
Construction	$9	$13	$19	$63
Total	$10	$15	$22	$72
Annual recurring costs: $280.2 K		Annual O&M costs: $5.4 M		

SUB-SYSTEM DEPLOYMENT:

System 13.1.1 (B/C: 40) Tier 2	I-95 ITS Deployment Deployment of In-Motion Weight Stations, a Weather Station, CCTV, and RSU along I-95 between I-495 and I-695.	PE: $0.6 M CO: $3.7 M Recurring Cost: $25.9 K Annual O&M: $0.6 M
System 13.1.2 (B/C: 71) Tier 1	US 29 ITS Deployment Deployment of CCTV, traffic detectors, and RSU along US 29 between MD 100 and I-495.	PE: $0.2 M CO: $1.4 M Recurring Cost: $25.0 K Annual O&M: $0.2 M
System 13.1.3 (B/C: 132) Tier 1	MD 295 ITS Deployment Deployment of traffic detectors and RSU along MD 295 between I-495 and I-695.	PE: $0.1 M CO: $0.7 M Recurring Cost: $10.2 K Annual O&M: $0.1 M
System 13.1.4 (B/C: 10) Tier 2	I-195 ITS Deployment Deployment of CCTV, traffic detectors, and RSU along I-195 between I-95 and MD 170.	PE: $0.1 M CO: $0.6 M Recurring Cost: $8.0 K Annual O&M: $0.1 M
System 13.1.5 (B/C: 45) Tier 2	MD 32 ITS Deployment Deployment of CCTV and traffic detectors along MD 32 between US 29 and I-95.	PE: $0.1 M CO: $0.4 M Recurring Cost: $5.9 K Annual O&M: $0.1 M
System 13.1.6 (B/C: 19) Tier 2	MD 175 ITS Deployment Deployment of CCTV along MD 175 between US 29 and I-95.	PE: $0.1 M CO: $0.5 M Recurring Cost: $11.2 K Annual O&M: $0.1 M
System 13.1.7 (B/C: 62) Tier 2	US 1 ITS Deployment Deployment of CCTV and detectors along US 1 between I-495 and I-695.	PE: $0.2 M CO: $1.2 M Recurring Cost: $26.0 K Annual O&M: $0.2 M
System 13.2.1 (B/C: 3) Tier 1	US 1 Traffic Signal Upgrade Upgrade existing traffic signals along US 1 between I-495 and I-695 to be fully actuated, equipped with S-Cabinets, have Video Detection, have CAV Equipment, ATMS enabled and have TSP.	PE: $1.2 M CO: $7.8 M Recurring Cost: $33.8 K Annual O&M: $1.2 M
System 13.2.2 (B/C: 5) Tier 2	US 29 Traffic Signal Upgrade Upgrade existing traffic signals along US 29 between MD 198 and I-495 fully actuated, equipped with S-Cabinets, have Video Detection, have CAV Equipment, ATMS enabled and have TSP.	PE: $0.8 M CO: $5.4 M Recurring Cost: $15.1 K Annual O&M: $0.8 M
System 13.3.1 Tier 3	Telecommunications Fiber connections for ITS deployment in sub systems and to provide critical connections for the network.	PE: $2.8 M CO: $18.9 M Annual O&M: $0.9 M

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION
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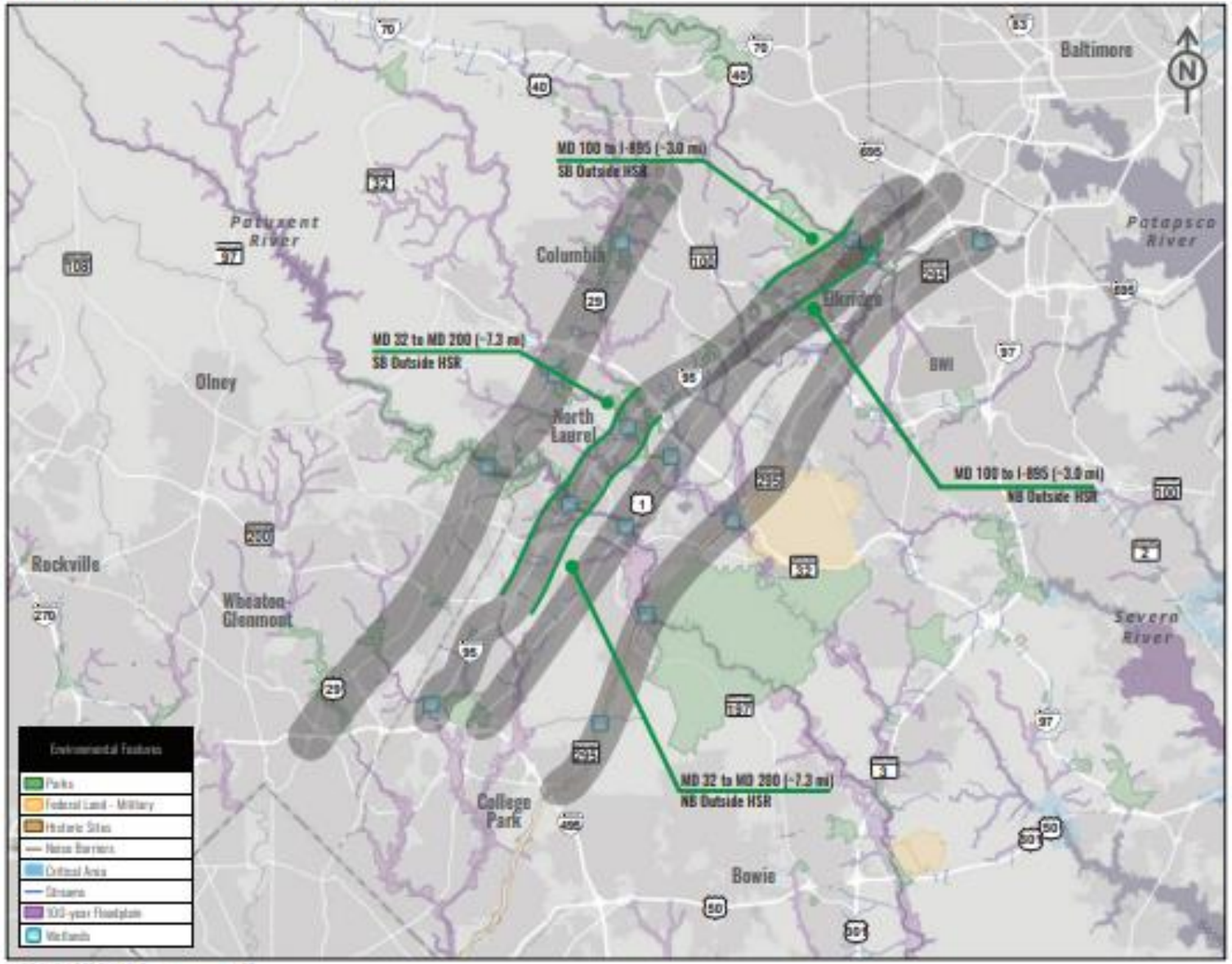
TSMO System 13

TSMO SYSTEM # 13: ROADWAY OVERVIEW



COST SUMMARY:

Cost Summary ($ millions)	ITS	Signals	Telecomm.	Roadway
Preliminary Engineering	$1	$2	$3	$9
Construction	$9	$13	$19	$63
Total	$10	$15	$22	$72
Annual recurring costs: $780.2 K		Annual O&M costs: $5.4 M		

SUB-SYSTEM DEPLOYMENT:

System T3.4.1 (B/C: 1) Tier 3	I-95 Hard Shoulder Running (ITS) Deployment of dynamic lane controls, fixed cameras, CCTV, Communication and ITS equipment, and fiber connection for outside hard shoulder running along I-95 at key locations.	PE: $1.2 M CO: $8.2 M Recurring Cost: $119.0 K Annual O&M: $1.2 M
System T3.4.2 (B/C: 1) Tier 3	I-95 Hard Shoulder Running (Roadway) Civil improvements for outside hard shoulder running along I-95 at key locations.	PE: $8.2 M CO: $54.7 M

PROGRESS STATUS:

- Baltimore-Washington Concept of Operations (completed)
- I-95 Active Traffic Management Study (in design)
- US 1 Smart Traffic Signal (ongoing)

MDOT MARYLAND DEPARTMENT OF TRANSPORTATION
STATE HIGHWAY ADMINISTRATION

Questions / Discussion

Thank you!

Learn more online here