CATT LABORATORY

RITIS User Group

Web Meeting | February 2, 2023

In collaboration with THE EASTERN TRANSPORTATION COALITION

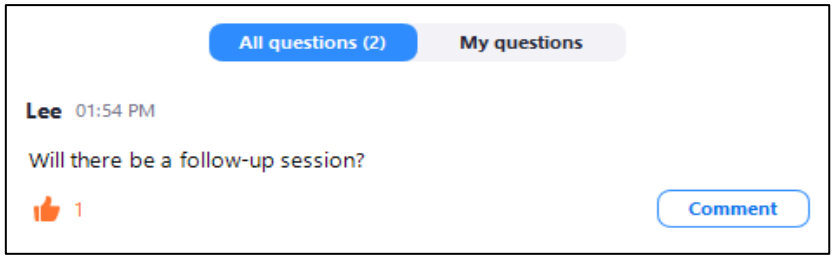
Welcome!

- We are using Zoom **Webinar**
- **AUDIO (Computer):** Use your computer speakers and microphone by clicking the "Join Audio" button at the bottom left of the screen. You will be muted.
- **Alternate Audio (Phone):** Call into the meeting by dialing the phone number based on your location (provided in the confirmation email) and enter the Meeting ID at the prompt. You will be muted.
- **This web meeting is being recorded.**
- **Questions** with the audio or web? Please contact Esther directly via email (ekleit@kmjinc.com)
- The **Chatbox** is not available to participants. Please use the **Q&A box** for questions to the presenters

Asking Questions in the Q&A Box

- Click on the Q&A icon at the bottom of your screen

- The questions in the Q&A box will be monitored and answered either between presentations or at the end of the meeting
- You can keep track of your questions in the “My Questions” tab in the Q&A box

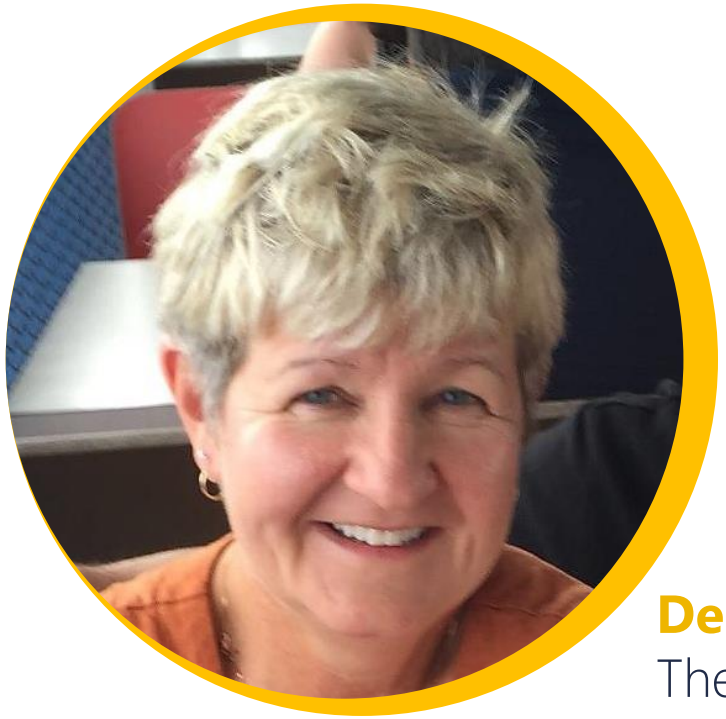


Asking Questions Verbally

- Please raise your hand *(click on the hand icon at the bottom of the screen)* and a host will unmute you.

- Please give your name and agency before asking your question
- **Please mute yourself when you are finished speaking**

Coalition Update



THE EASTERN TRANSPORTATION COALITION

Denise Markow
The Eastern Transportation Coalition
TSMO Program Director

Coalition Update – Recent Events

- ✓ **Web Event: Everything you've ever wanted to know about ATSPMs - Nov. 9, 2022**
- ✓ **Highway Operations Group (HOGs) Exchanges (In Person) (*invite only*)**
  - ✓ **Potomac HOGs Exchange - Oct. 18, 2022**
  - ✓ **Del-Val HOGs Exchange - Nov. 2, 2022**
  - ✓ **Southern HOGs Exchange - Dec. 6-7, 2022**
- ✓ **Transportation Data Marketplace (TDM) *(invite only)***
  - ✓ **TDM Validation Vendor Meeting - Nov. 1, 2022**
  - ✓ **TDM State Contracts Meeting - Nov. 29, 2022**
  - ✓ **TDM Validation Tech Advisory Committee Meeting - Jan. 24, 2023**
- ✓ **RITIS**
  - ✓ **Workshop #3 - After Action Templates - Nov. 17, 2022**
- ✓ **Waze and Google Product Updates Web Meeting (invite only) - Jan. 19, 2023**
- ✓ **Info Sharing Event: NextGen NHTS OD Data: Overview, Products, and Use Cases – Jan. 26, 2023**

Coalition Update – Upcoming Events

- **TDM Analytics Platform Vendor Forums *(invite only)* - February 9 & 23, 2023**
- **RITIS Enhancement Working Group Meeting (*invite only*) - March 2, 2023**
- **Travel Information Virtual Info Summit - March 16, 2023**
- **TSMO Strategic Planning Session *(invite only)* - April 13, 2023**
- **RITIS Workshop - April 2023 - more info coming soon!**
- **Summit: A Unified Approach to Driving Change on the Roadway - May 8-10, 2023**

Transportation Data Marketplace Update

- TDM Webpage (https://tetcoalition.org/projects/transportation-data-marketplace/)
- 6 Data Sets: Travel Time & Speed, Volume, Conflation, Origin Destination, Waypoint, and Freight
- 12 Vendors
- Automated DUA process (https://dua.tdmmarketplace.com/)

Welcome & Introductions

Matt Glasser
National TSMO Account Lead
Arcadis
RITIS User Group Co-chair

Today's Meeting

Welcome and Introductions	Denise Markow, TETC Matt Glasser, Arcadis
Spotlight Presentation: National Capital Region Twelve-Year Bottleneck Analysis	Andrew Meese, Metropolitan Washington Council of Governments/ National Capital Region Transportation Planning Board
User Delay Cost Calculation Methodologies & Potential Improvements	Mark Franz and Michael Pack, UMD CATT Lab
PDA Suite Performance Measures Working Group Update	John Allen, UMD CATT Lab
RITIS Product Enhancement Working Group Update	Bob Frey, Massachusetts DOT
New RITIS Tools and Recent Enhancements	Michael Pack
Agency Input Session	Michael Pack
Wrap Up and Remaining Questions	Matt Glasser

Today's Speakers

Michael Pack
UMD CATT Lab
Director

Andrew Meese
MWCOG
Systems Performance Planning Program Director

Mark Franz
UMD CATT Lab
Lead Transportation Analyst

John Allen
UMD CATT Lab
Faculty Assistant, Outreach & Education

Bob Frey,
Massachusetts DOT
Director of Project-Oriented Planning

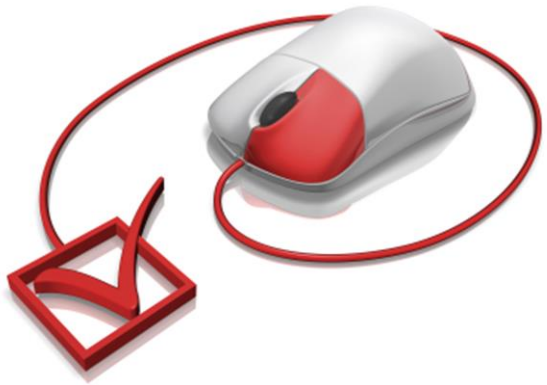
Meeting Participants

Agencies						
AASHTO	Connecticut DOT	Illinois DOT	Minnesota DOT	North Central Texas Council of Governments	Modern Mobility Partners	SRPEDD
Alaska DOT&PF	DCHC MPO	INRIX	Montgomery County Government	Northern Virginia Transportation Auhtority	National Center for Atmospheric Research	Tennessee DOT
Arcadis	District DOT	KIPDA	Montgomery County Planning Commission	Office of Intermodal Planning and Investment	Renaissance Planning	Texas A&M Transportation Institute
Arizona DOT	DVRPC	Knoxville Regional TPO	MORPC	Ohio DOT	Tighe & Bond	Texas DOT
Atlanta Regional Commission	Federal Highway Administration	Louisiana DOTD	MWCOG	Old Colony Planning Council	Ozarks Transportation Organization	Traverse City TSC
Austrade	FEMA	Macomb County Department of Roads	MWVCOG	Oregon DOT	Pennsylvania DOT	U.S. DOT
CAMPO	Florida DOT	Maryland Transportation Authority	New Jersey DOT	HDR	PlanRVA	University of Maryland CATT Lab
Capital Region Planning Commission	Florida's Turnpike Enterprise	Maryland DOT-SHA	New York State DOT	Jacobs Engineering Group	Regional Transportation Commission of Southern Nevada	Virginia DOT
Chatham County - Savannah Metropolitan Planning Commission	Gannett Fleming	Maryland Transportation Authority	NJTPA	Kimley-Horn & Associates	Rhode Island Division of Statewide Planning	Wisconsin DOT
City of Charlotte	Georgia Environmental Protection Division	Massachusetts DOT	North Carolina DOT	Mead & Hunt	SANDAG	
City of Winston-Salem	HERE Technologies	Michigan DOT	North Central Planning and Development Commission (RPO)	Michael Baker International	Southwestern Pennsylvania Commission	

Poll 1: How often do you attend RITIS User Group Web Meetings?

Response Options:

a) 1-2 times per year
b) 3-4 times per year
c) This is my first meeting



Poll 2: How do you use the data and visualization results from RITIS tools (choose one)?

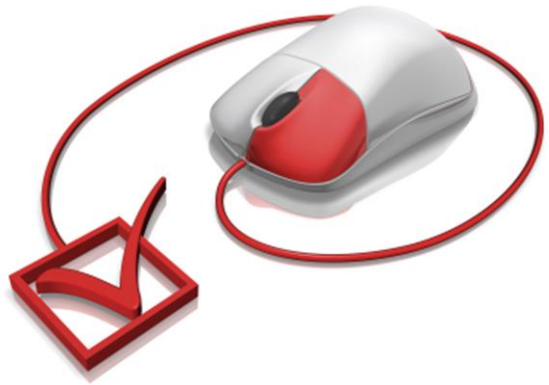
Response Options:

1. We use results directly from RITIS to develop products (reports, maps, etc.)
2. We download the data and use our own agency's in-house tools to create tables and visuals for product development
3. We do a little bit of both

Poll 3: Who is your primary audience for sharing information that was developed from RITIS and PDA Suite (choose one)?

Response Options:

1. Peers
2. Management
3. Executive Leadership
4. Elected Officials
5. General Public



National Capital Region Twelve-Year Bottleneck Analysis

Andrew Meese
Systems Performance Planning Program Director
Metropolitan Washington Council of Governments (MWCOG) /
National Capital Region Transportation Planning Board

National Capital Region
Transportation Planning Board

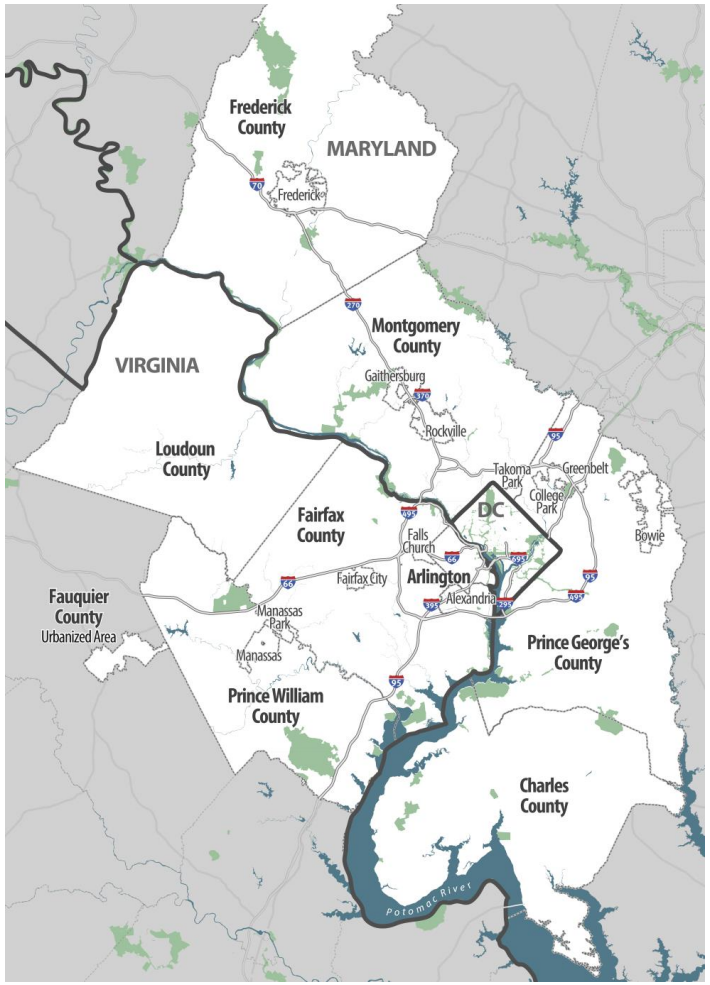
NATIONAL CAPITAL REGION TWELVE-YEAR BOTTLENECK ANALYSIS

Andrew J. Meese, AICP
Systems Performance Planning Program Director
National Capital Region Transportation Planning Board
Metropolitan Washington Council of Governments

RITIS User Group
February 2, 2023

About the TPB

- National Capital Region Transportation Planning Board (TPB) is the federally designated Metropolitan Planning Organization (MPO) for Washington, D.C., Suburban Maryland, and Northern Virginia
- Role as the regional forum for transportation planning
- Housed at the Metropolitan Washington Council of Governments (COG)
- ~3,500 square miles, 5 million population



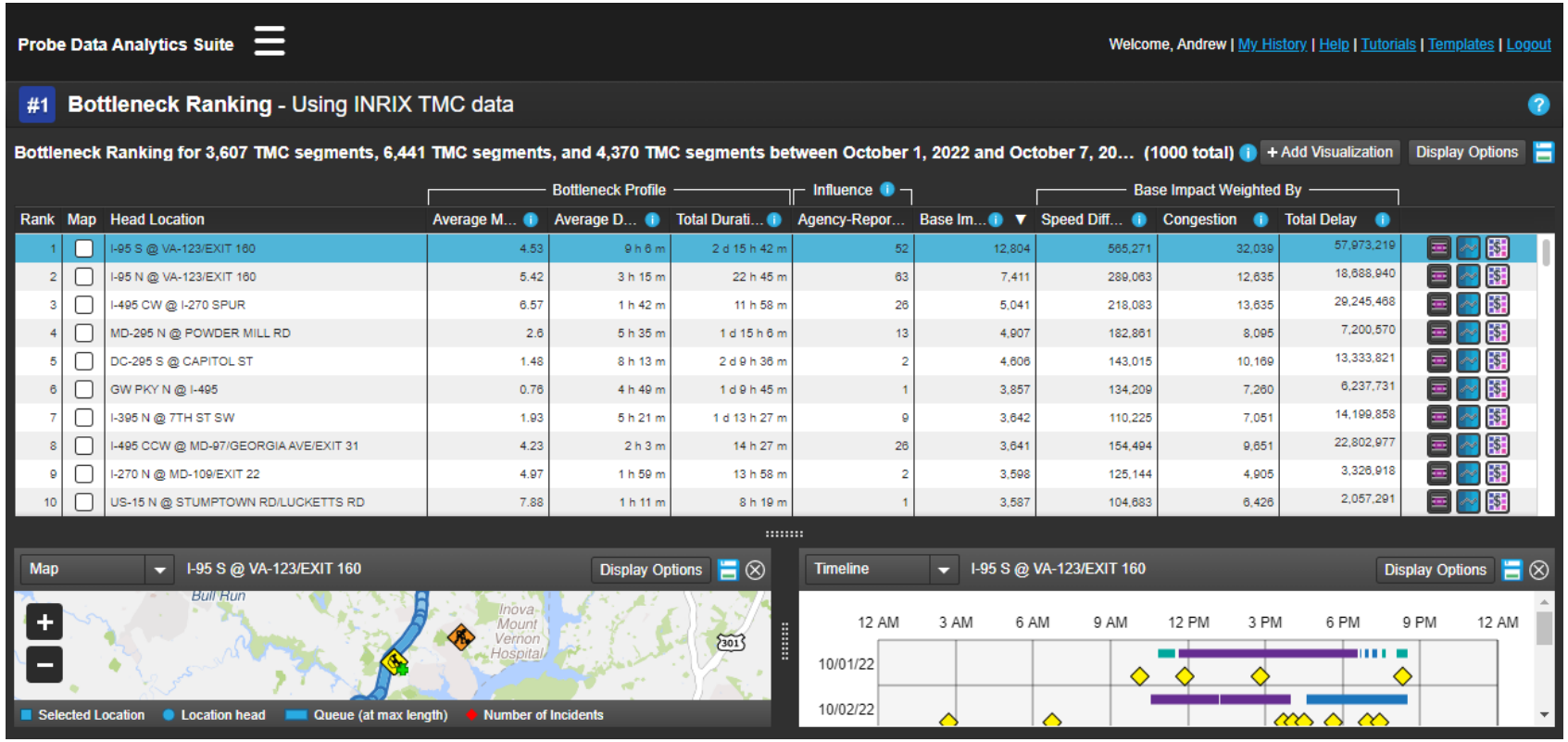
Introduction

- In July 2022, our MPO Technical Committee finalized our biennial 2022 Congestion Management Process (CMP) Technical Report
- The committee asked about one aspect of the report, a top ten bottleneck analysis (for the calendar year 2021)
  - Staff shifted this year from an in-house methodology used for previous reports) to the PDA Suite Bottleneck Ranking tool
  - Changed rankings were (mildly) questioned
- Instead of redoing the analysis with the previous methodology, staff agreed to do a multi-year analysis with the current PDA Suite tool to examine long-term trends
- We posted draft results in read-ahead materials for a December 2022 Technical Committee meeting
  - We did not anticipate it going viral…

How the PDA Bottleneck Tool Works

- Uses vehicle probe data (speeds) provided for a set of network links
  - TPB staff has access to data sourced from INRIX for a robust set of roadways thanks to data purchases by our states (DC, MD, VA)
- We choose links of interest (not trivial – staff uses a saved set of thousands of roadway links) and 12 one-year analysis periods (2010 to 2021)
- The tool produces a ranking table and maps of bottlenecks
  - The rankings in the table can be sorted by several component factors

Example Screenshot from the PDA Tool



Exploring the Tool's Ranking Factors

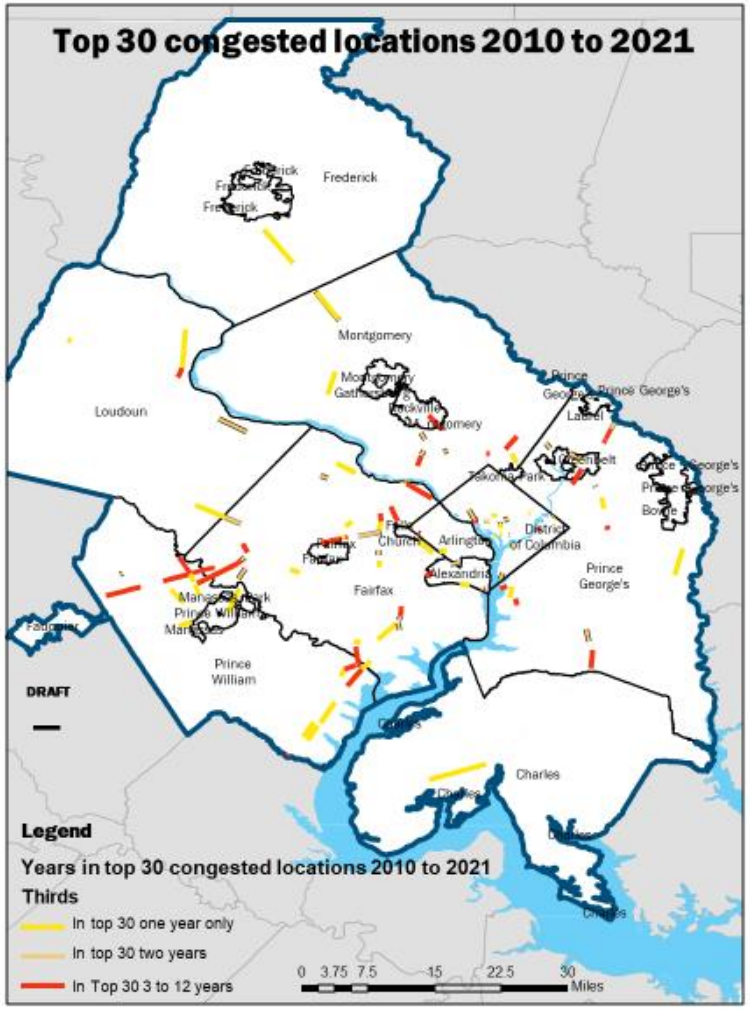
- The PDA Suite Bottleneck Tool offers several bottleneck ranking factors using tool-specific methodology:
  - ***Congestion*** (queue length and speed drop) – inclusion of speed drop may increase emphasis on smaller roadways
  - ***Total Delay*** (speed drop weighted by traffic volume) – the database's traffic volumes seem inconsistently derived, and may be a temporal mismatch (e.g., using 2019 volumes to weight 2010 conditions)
  - ***Base Impact*** (queue length and duration) – judged to be most consistent with TPB's historic aerial photography-based analyses; emphasizes major roadways

The 12-Year Analysis

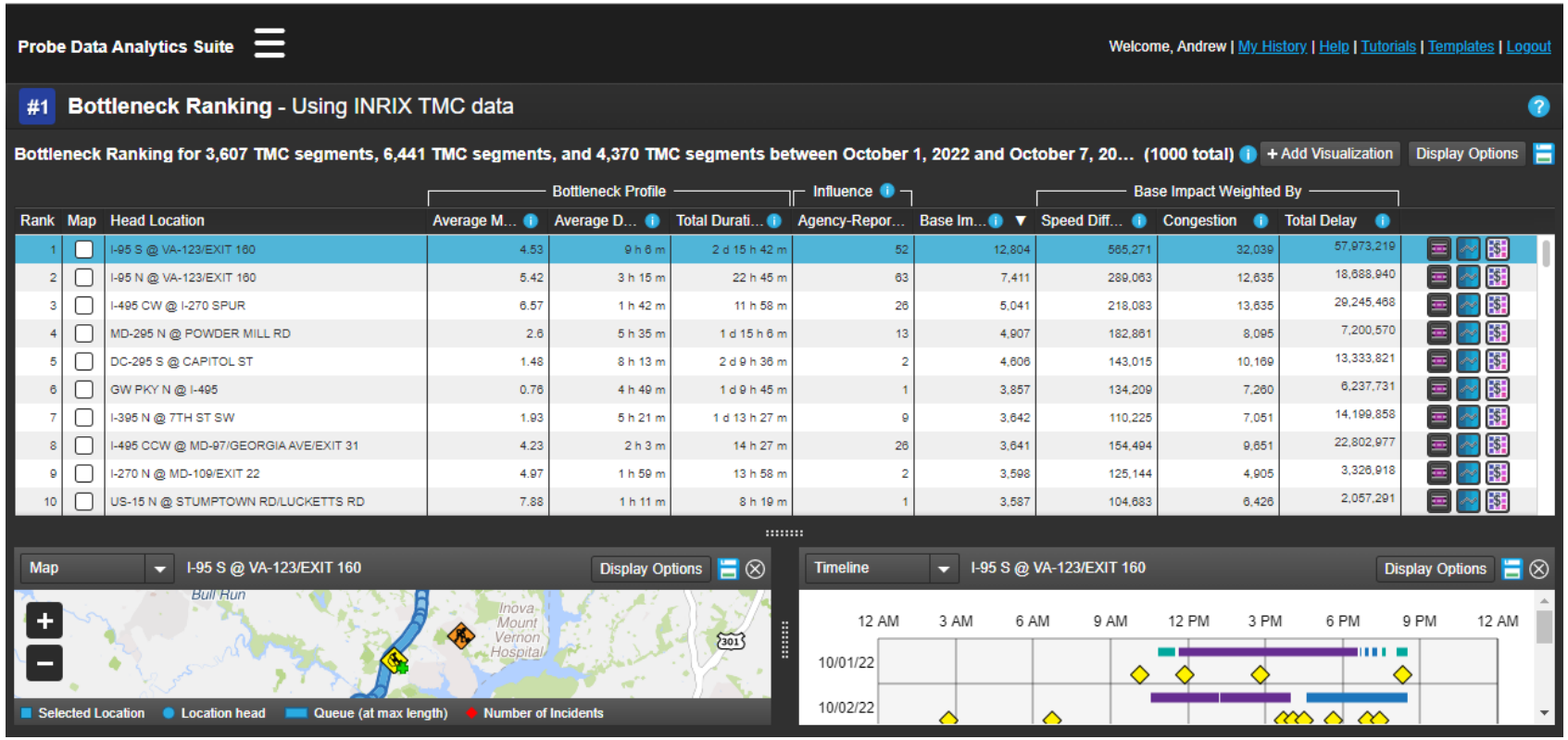
- Vehicle probe speed data (from INRIX) available in the PDA Suite back to the year 2010
- Staff performed one-year bottleneck ranking analyses for each of the twelve years of 2010 to 2021
  - Determined top ten rankings for each year
  - Base impact was used as the ranking factor
  - Compared previous years' results to 2021 rankings published in the 2022 Congestion Management Process Technical Report
- Looked for persistent versus short-lived bottleneck locations, comparative severity, and trends

Top 30 Congested Locations 2010-2021

- Persistent bottlenecks were in a relatively limited number of locations
- Other locations appear for only a year or two
- Top bottleneck in the region: I-95 S @ VA-123/Exit 160
  - Ranked #1 all 12 years
- TPB staff created this map using ArcGIS



Example Screenshot from the PDA Tool



2021 Bottlenecks by Delay, Max Length

	Location	Ranked by Base Impact	Ranked by Total Delay	Ranked by Maximum Length of Queue
1	I-95 S @ VA-123/EXIT 160	1	1	43
2	I-95 N @ VA-123/EXIT 160	2	3	27
3	DC-295 S @ EAST CAPITOL ST	3	4	303
4	BALT-WASH PKWY N @ POWDER MILL RD	4	8	110
5	I-95 N @ VA-617/BACKLICK RD/EXIT 167	5	5	42
6	US-301 S @ MCKENDREE RD/CEDARVILLE RD	6	16	149
7	I-495 INNER LOOP @ I-270-SPUR	7	2	9
8	I-66 W @ VA-234/VA-234-BR/EXIT 47	8	9	8
9	I-270 S @ MD-109/EXIT 22	9	32	47
10	I-270 N @ MD-109/EXIT 22	10	34	21

History of 2021 Bottlenecks

Rankings for each individual year 2010-2021

2021 Rank	Location	Highest Rank 2010-2021	Lowest Rank 2010-2021	Number of Times in Annual Top Ten 2010-2021
1	I-95 S @ VA-123/EXIT 160	1	1	12
2	I-95 N @ VA-123/EXIT 160	2	>100*	8
3	DC-295 S @ EAST CAPITOL ST	2	>100*	7
4	BALT-WASH PKWY N @ POWDER MILL RD	2	6	10
5	I-95 N @ VA-617/BACKLICK RD/EXIT 167	5	>100*	1
6	US-301 S @ MCKENDREE RD/CEDARVILLE RD	3	31	10
7	I-495 INNER LOOP @ I-270-SPUR	2	>100*	8
8	I-66 W @ VA-234/VA-234-BR/EXIT 47	3	66	3
9	I-270 S @ MD-109/EXIT 22	9	35	2
10	I-270 N @ MD-109/EXIT 22	10	>100*	1

*Anomalously high values may indicate data glitches for a given year rather than actual conditions.

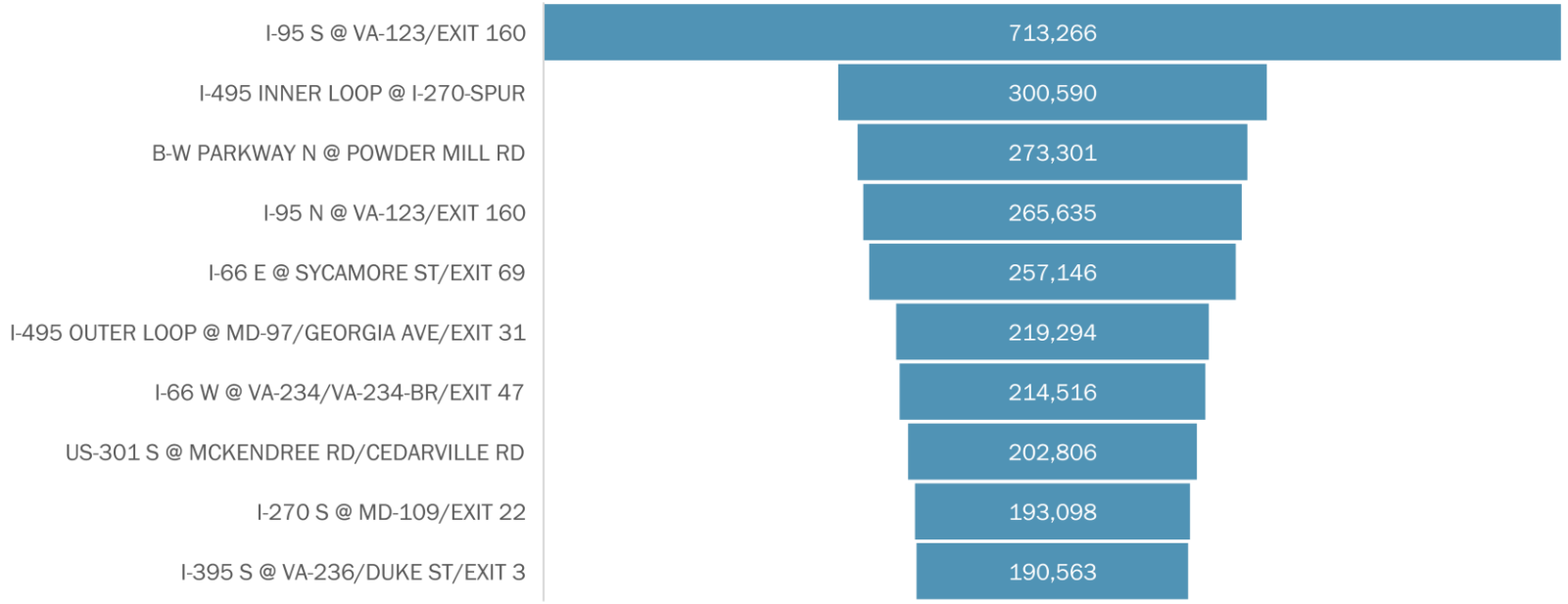
Persistent & Past Bottlenecks

Persistent Bottleneck Locations	Highest Rank 2010-2021	2021 Rank	Number of Times in Annual Top Ten 2010-2021
I-95 S @ VA-123/EXIT 160	1	1	12
BALT-WASH PKWY N @ POWDER MILL RD	2	4	10
US-301 S @ MCKENDREE RD/CEDARVILLE RD	3	6	10
I-95 N @ VA-123/EXIT 160	2	2	8
I-495 INNER LOOP @ I-270-SPUR	2	7	8
Past Bottleneck Locations	**Highest Rank 2010-2021**	**2021 Rank**	**Number of Times in Annual Top Ten 2010-2021**
I-66 E @ SYCAMORE ST/EXIT 69	2	>100	10
I-495 OUTER LOOP @ MD-97/GEORGIA AVE/EXIT 31	4	44	10
I-95 S @ MCB QUANTICO/EXIT 148	2	>100	5
I-66 W @ VADEN DR/EXIT 62	3	>100	4
I-66 E @ VADEN DR/EXIT 62	8	>100	4

Why Bottlenecks May Change Over Time

- Temporary impacts of construction zones
- Long-term impacts after construction projects
- Regional and national population and business growth
- Regional and national economic ups and downs
- Year-to-year variations in the impacts of storms and major incidents
- Still-evolving long-term travel demand impacts of the pandemic
- Changes within the PDA Suite tool and its underlying databases

Bottleneck Magnitudes (2019 Example)



Provided as an example, the magnitude of 2019's top bottleneck (measured in Base Impact [integrating queue length and bottleneck duration]) was more than twice as much as the second-ranked bottleneck and almost four times as much as the 10th-ranked bottleneck

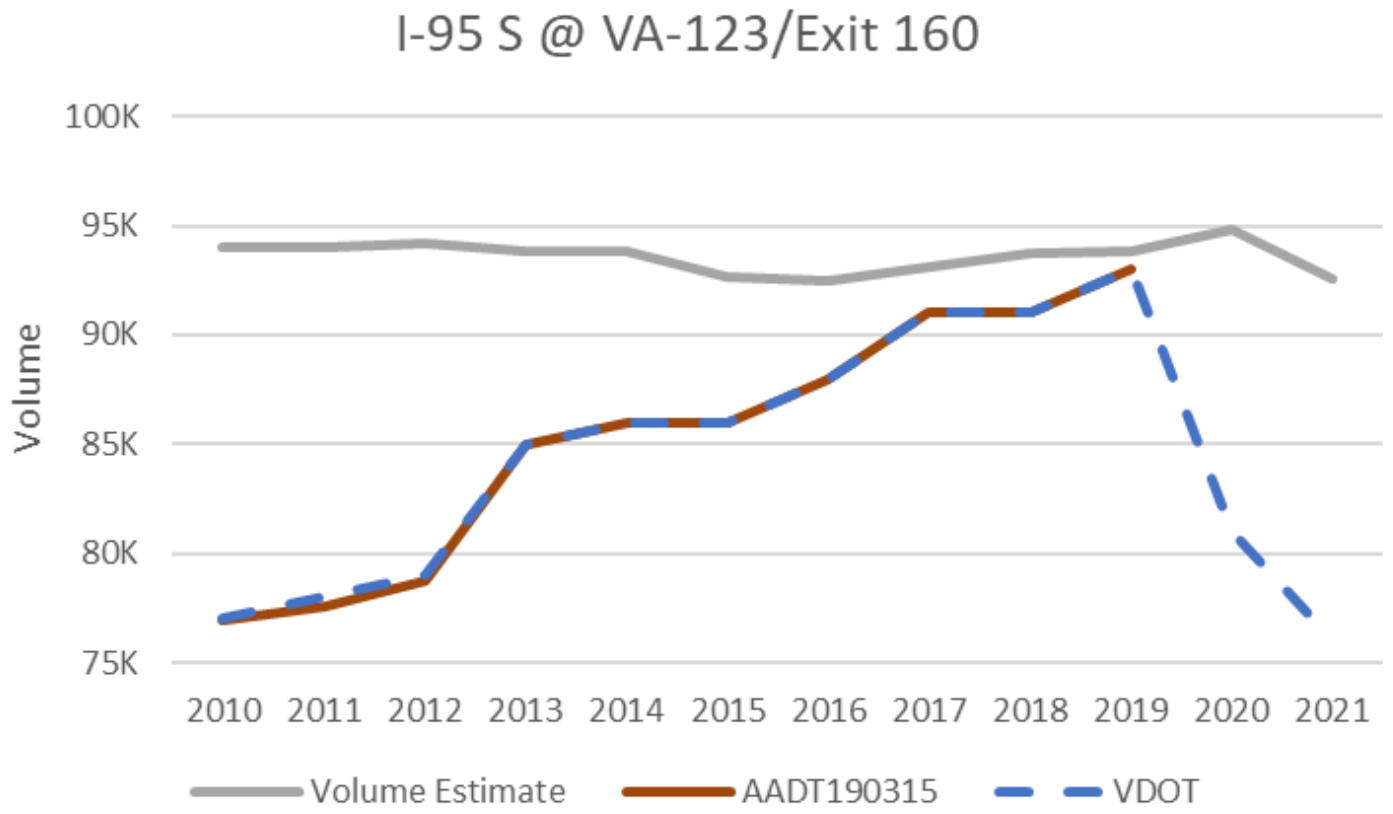
Some Major Projects 2010-2021

- 2011: MD-200 (InterCounty Connector) (east end connection to US-1 completed 2014); included I-95 interchange
- 2012: 495Express lanes between VA-620 and north of VA-267
- 2012/2013: Woodrow Wilson Bridge approaches (the main bridge was completed in 2009)
- 2013: 11th Street Bridge
- 2014: Silver Line Metro to Wiehle–Reston East
- 2014: 95Express reversible lanes from VA-294 to VA-610
- 2017: I-66 inside the Beltway converted from HOV to HOV/toll lanes
- 2019: 395Express reversible lanes from Turkeycock Run to Potomac River

Bottleneck Ranking Tool Caveats

- Limited calendar options
  - Allows analysis of only up to one year of data at a time (i.e., we could not do a single 12-year analysis, just 12 one-year analyses)
  - Simple day screening (e.g., can screen out weekends, but cannot screen out holidays)
- Traffic volumes seem to be inconsistent across locations and time periods – not reliable for a multi-year/historical analysis
- Traffic Message Channel (TMC) roadway network issues (varying lengths, consistency over time, errors, missing links, etc.)
  - We systematically remove “reversible lanes” from regional analyses due to unreliable results
- Nevertheless, the tool is handy and useful

Volume Data Caveat



This example shows that PDA Suite traffic volume estimates may not be consistent with DOT or HPMS sources.

Unanticipated Media Attention

- A presentation with DRAFT results was posted on our website as part of read-ahead materials a week ahead of an upcoming December 2, 2022 Technical Committee meeting
- Shortly afterward, staff was notified that a local television station had already done both an on-line story and a television news segment about the bottleneck ranking!
  - Months before this was slated to go to our MPO policy board
- Echoing coverage by other media outlets
  - Questions to staff on details that we did not have handy
- Showed that the media loves rankings (even if we would prefer to tell a more complex story about congestion and congestion management strategies)

Context: Range of CMP Analyses

- The context of this bottleneck analysis is the 2022 Congestion Management Process Technical Report (see mwcog.org/cmp)
- Bottlenecks analysis is not the only way that the CMP Technical Report examines the extent of congestion; also reported, based on vehicle probe data speeds, are:
  - Congestion, reported as Travel Time Index (see mwcog.org/congestion for definition)
  - Reliability, reported as Planning Time Index
  - Travel time along defined major commute routes and designated arterial roadways
- The CMP Technical Report also describes the many congestion management strategies pursued in the region, featuring Commuter Connections programs

Acknowledgements

- Jan-Mou Li, TPB Transportation Engineer
- C. Patrick Zilliacus, TPB Transportation Engineer
- Eric Randall, TPB Transportation Engineer and Manager, Systems Performance Planning and Reporting
- University of Maryland Probe Data Analytics Suite developers and support personnel

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User Delay Cost Calculation Methodologies & Potential Improvements

Michael L. Pack, Director

Mark Franz, Assistant Research Engineer

UMD CATT Lab

Topics Covered

- Why a component of the UDC algorithm needs an upgrade
- Validating the revised method
  - Background on the proposed Car Following Model (CFM) volume limiting procedure
- Validation of CFM Volume Limiting Procedure

Why a new methodology is being rolled out

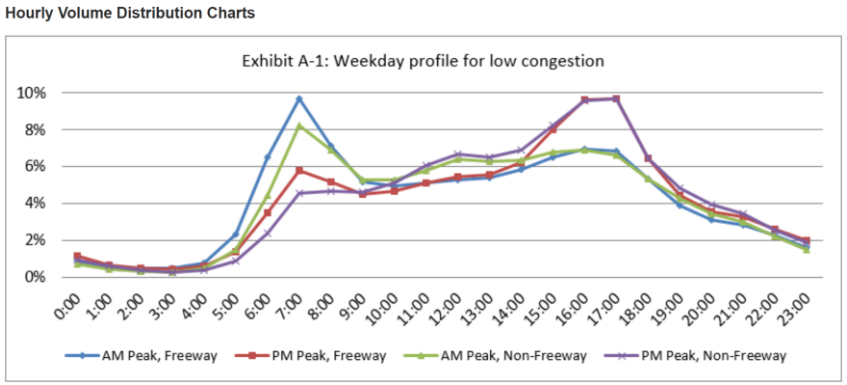
An opportunity for improvement

- While building the Causes of Congestion Graphs (CCG), we:
  - Encouraged agencies to send updated AADTs/volumes
  - Seized the opportunity to evaluate how we implemented our UDC algorithm
    - especially the volume limiting equations

Though real-time volume estimates are desired, we are not there yet!

Why is volume limiting important?

- Volume estimates come from AADT profiling
- Profiling can produce reasonable volume estimates under normal conditions
  - Profiling does not capture impact of abnormal congestion on traffic flow
    - Volume limiting tries to resolve this issue
- Example:



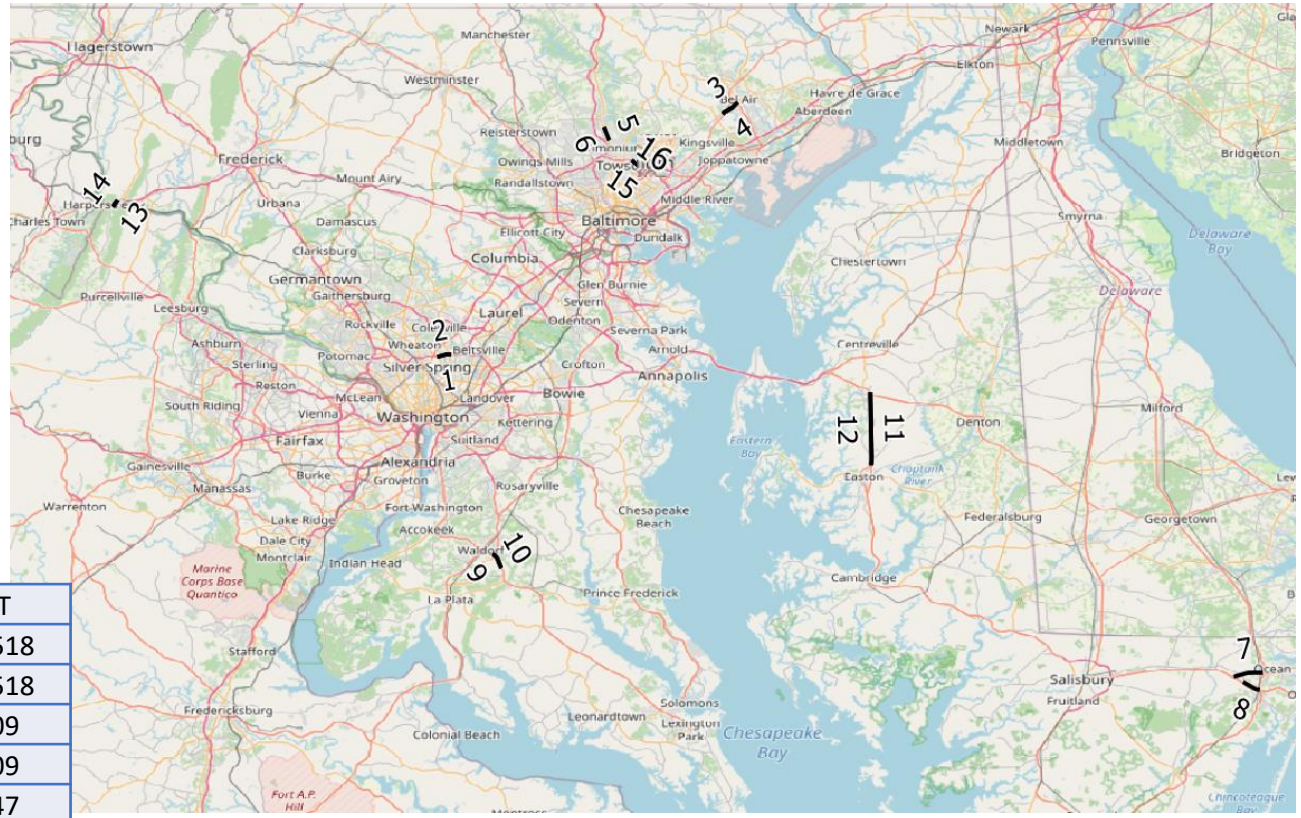
Normal Traffic Flow

Abnormal Traffic Flow

Profiling does not work under abnormal congestion
Need to limit the volumes

Validation Framework

- Ground Truth: 16 ATR stations in MD
- Analysis Period: Calendar year 2019
- Compare:
  1. UDC using ATR volumes
  2. UDC using PDA volume limiting equations



Number	Tmc	FirstName	Miles	FRC	AADT
1	110-04625	MD-193/University Blvd/Exit 29	1.19	1	107518
2	110+04626	MD-650/New Hampshire Ave/Exit 28	1.14	1	107518
3	110-12783	US-1/Belair Rd/Belair Byp	1.92	4	10509
4	110+12784	MD-24/Vietnam Vets Memorial Hwy	1.92	4	10509
5	110+05213	Warren Rd	1.36	4	13347
6	110-05212	Padonia Rd	1.36	4	13347
7	110-07392	US-50/Ocean Gtwy	3.06	3	4700
8	110-06335	US-113/Berlin Dover Rd	1.80	3	7403
9	110-09618	Renner Rd	1.73	3	15662
10	110+09619	MD-5-BR/St Charles Pky	1.74	3	15662
11	110+06360	MD-404/Queen Anne Hwy	9.55	2	16935
12	110-06359	MD-322/Easton Byp/Easton Pky	9.63	2	16944
13	110+06958	Keep Tryst Rd/Valley Rd	0.52	2	12267
14	110-10632	Maryland/Virginia State Line	0.52	2	12267
15	110+04534	MD-567/Cromwell BR Rd/Exit 29	0.25	1	78180
16	110-04533	Providence Rd/Exit 28	0.54	1	78136

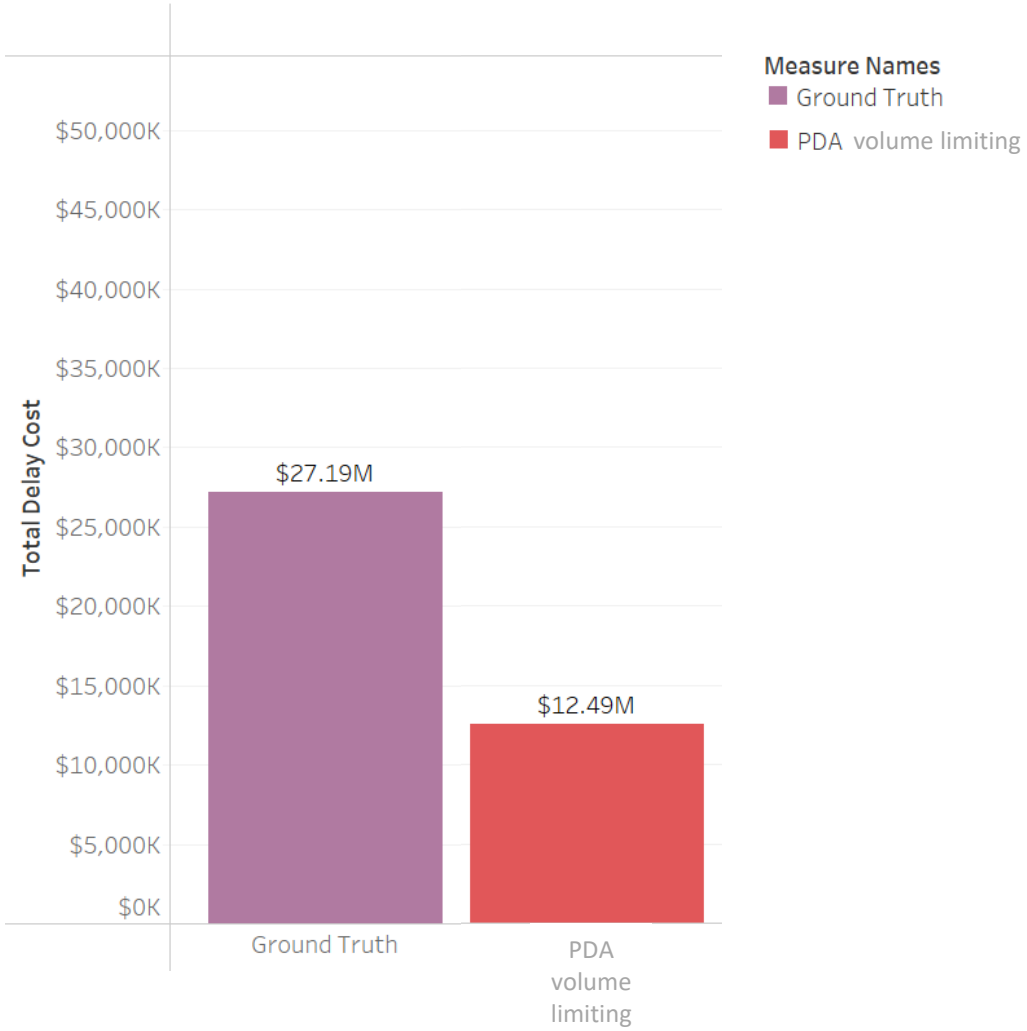
Methods

- **Ground Truth:** ATR station data
- **Car following model:** Car following model for volume limiting
- **PDA:** Current PDA outputs

Data

- **Speed:** INRIX 1-minute speeds
- **AADT:** NPMRDS 2021 (observations from 2019)
- **Ground Truth Volumes:** ATR stations' data 2019

Results of UDC Validation



- Current PDA volume limiting equations often underestimate UDC
- Can a car following based model offer more accurate volume limiting estimates?

Background on the proposed Car Following Model (CFM) volume limiting procedure

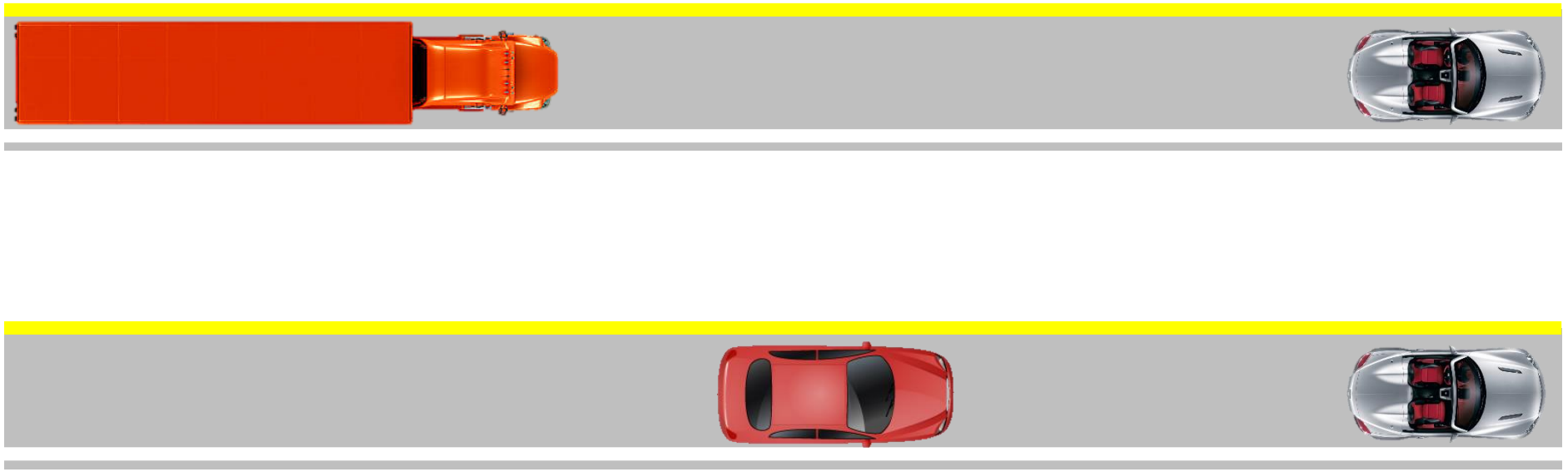
Assumption: As congestion increases, speeds drop, and vehicles follow closer

High Speed

Moderate Speed

Low Speed

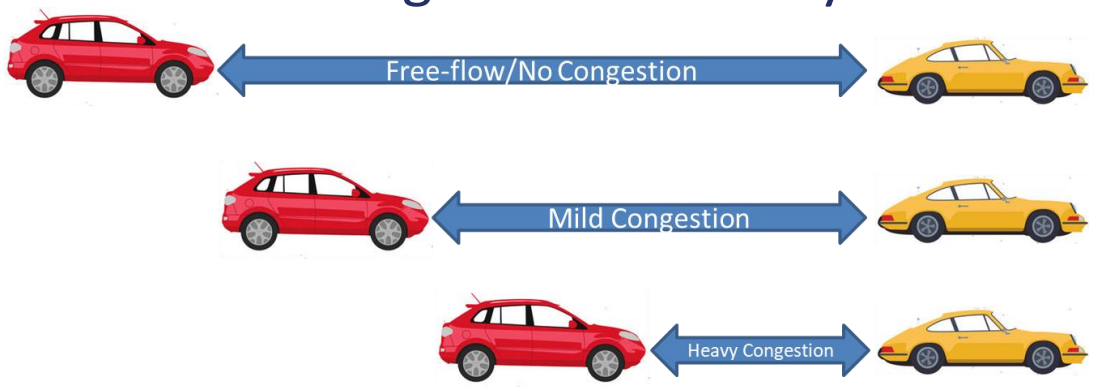
Assumption: For a given speed, cars can follow closer than trucks



Procedure

Step 1: Estimate spacing of passenger and commercial vehicles

Step 2: Calculate total lane length consumed by each vehicle (vehicle length and spacing)



Step 3: Compute # of passenger and commercial vehicles on each segment

Step 4: Compute # of passenger and commercial vehicles traversing the segment

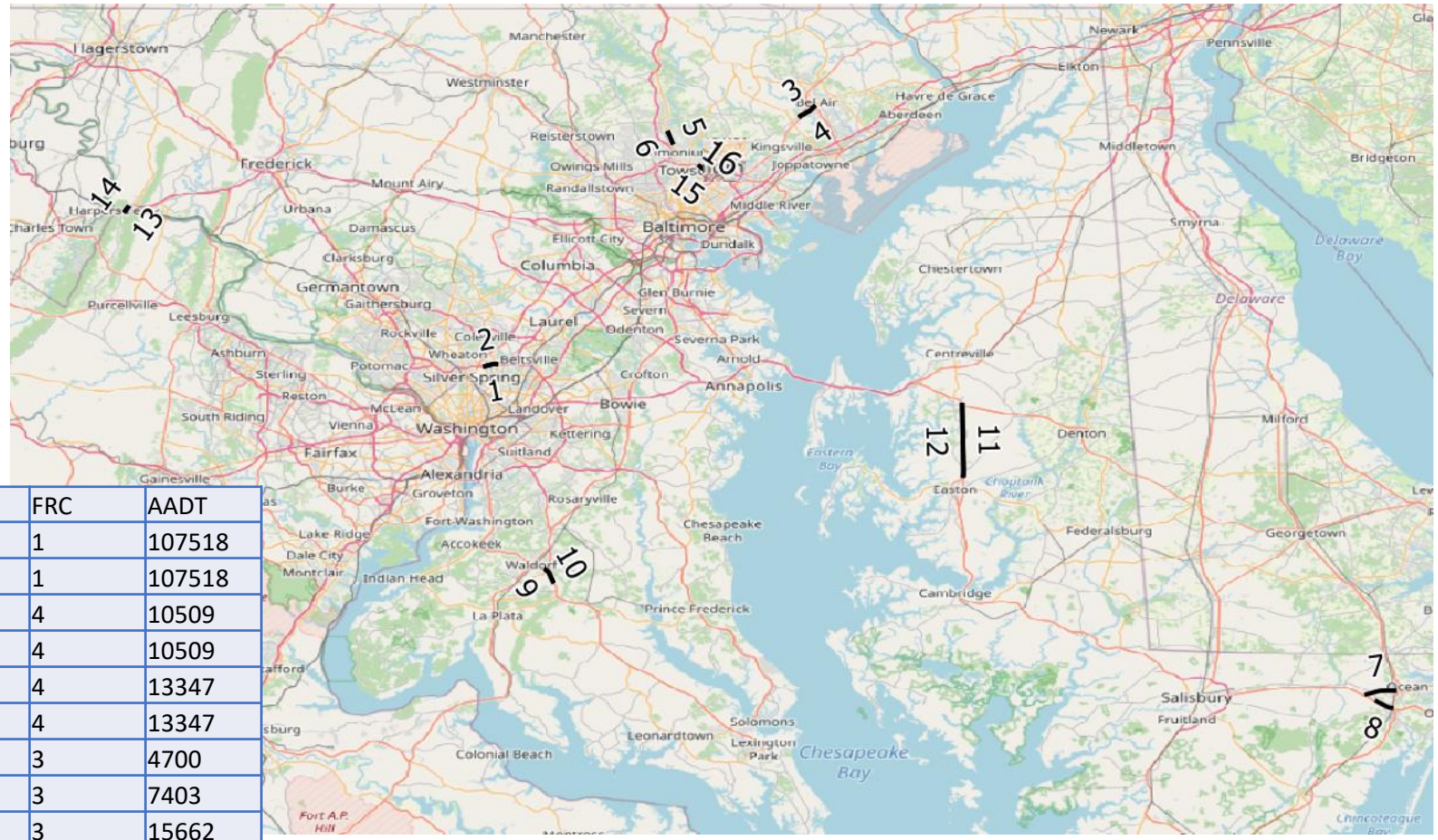
Step 5: Compare the car-following model with the historical profiling volume to pick the minimum

Validation of CFM Volume Limiting Algorithm

Validation Framework

- Ground Truth: 16 ATR stations in MD
- Analysis Period: Wed May 22, 2019
- Compare:

1. UDC using ATR volumes
2. UDC using PDA volume limiting equations
3. UDC using CFM volume limiting



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8	110-06335	US-113/Berlin Dover Rd	1.80	3	7403
9	110-09618	Renner Rd	1.73	3	15662
10	110+09619	MD-5-BR/St Charles Pky	1.74	3	15662
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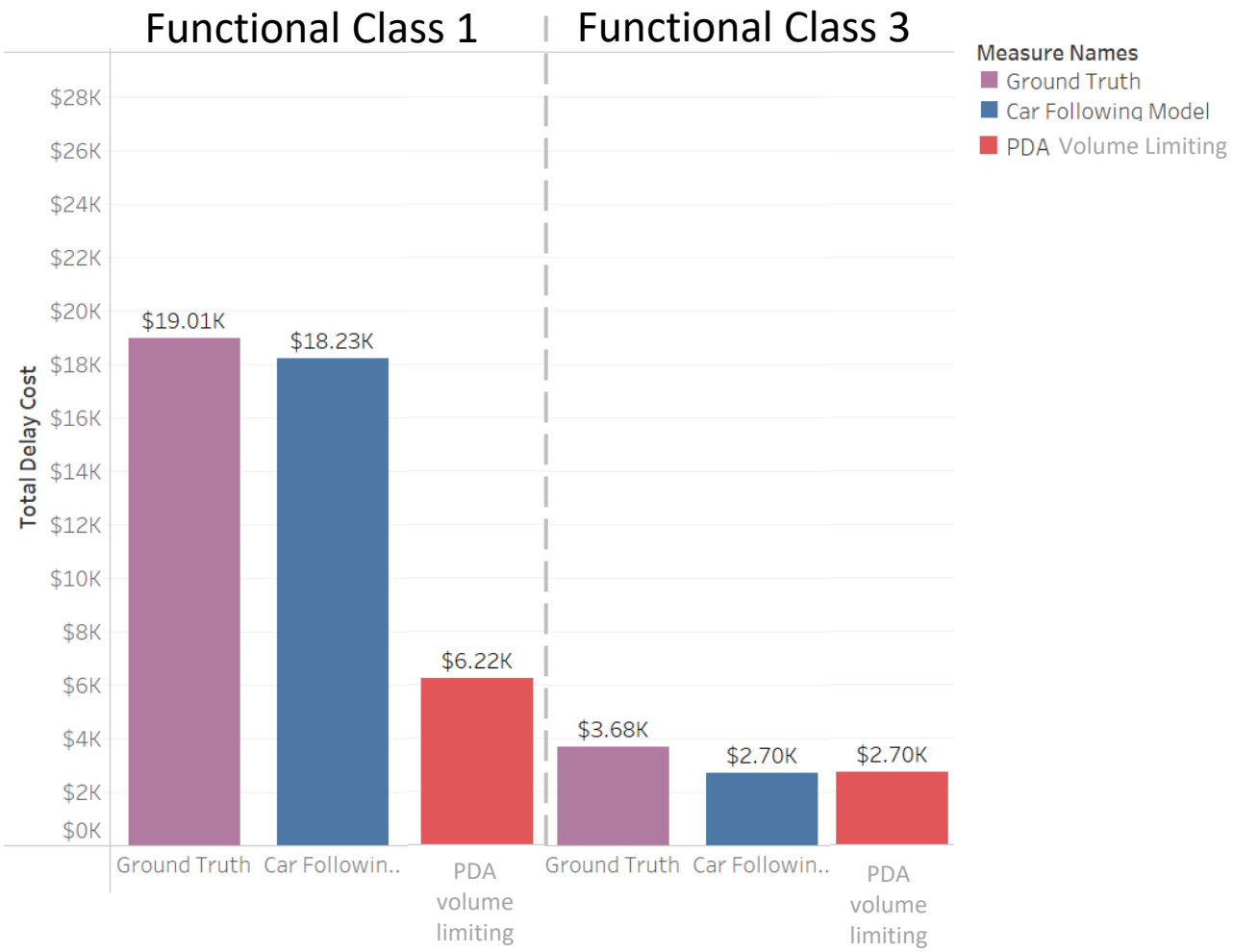
12	110-06359	MD-322/Easton Byp/Easton Pky	9.63	2	16944
13	110+06958	Keep Tryst Rd/Valley Rd	0.52	2	12267
14	110-10632	Maryland/Virginia State Line	0.52	2	12267
15	110+04534	MD-567/Cromwell BR Rd/Exit 29	0.25	1	78180
16	110-04533	Providence Rd/Exit 28	0.54	1	78136

Results of UDC Validation

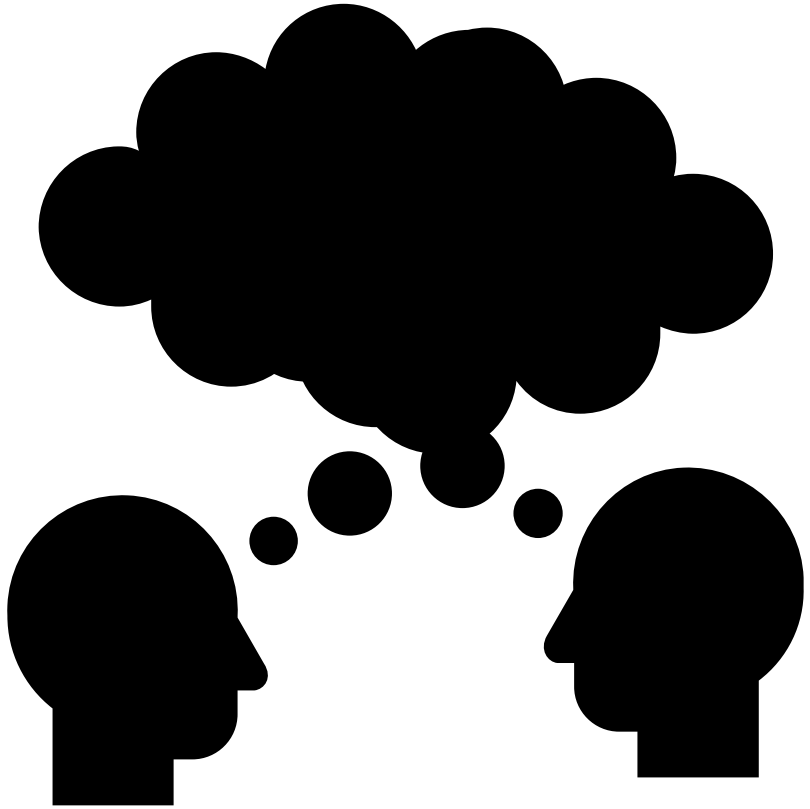


Data from Wed, May 22, 2019

Take-Aways

- ✓ Current volume limiting algorithm as implemented in PDA likely underestimates UDC, especially in Functional Class #1
- ✓ Car following model volume limiting method is closer to the ground truth than the current PDA volume limiting equations
- ✓ CATT Lab recommends changing the current volume limiting algorithm as implemented in PDA to the car following model

Discussion



Thank you

Questions or Comments?

Michael L. Pack
Director
PackML@umd.edu

Mark Franz
Assistant Research Engineer
mfranz1@umd.edu

Theoretical Example

- Example

Useful Conversion Factors
1 hour = 3600 seconds
1 mile = 5280 feet

Driver reaction time: $\beta = 1$ sec
Pass max Deceleration: $\gamma_p = 32$ ft/sec^2 = 78545.4545 mi/h^2
Truck max Deceleration: $\gamma_T = 20$ ft/sec^2 = 49090.9091 mi/h^2
Pass length: $\alpha_p = 15$ ft $= 0.00284091$ mi
Truck length: $\alpha_T = 50\ ft$ = 0.0094697 mi
% of Pass: $\delta_P = 90\%$
% of Truck: $\delta_T = 10\%$

Speed: $V = 10, 20, 30, 40\ mph$ (the detailed calculation procedure is shown only for 10mph. The other data points are provided for validation purposes)

Segment length: $\theta = \frac{1}{3}\ mi$
Number of Lanes: $N = 3$

Step 2.1: Estimating Vehicles in Queue

- Step 2.1:Vehicle Spacing: Steady-State Following Model

$$S_{i,j}(t) = \beta V_j(t) + \gamma_i V_j^2(t)$$

$S_{i,j}(t)$ = vehicle spacing for vehicle type i in segment j at time t
β = driver reaction time
γ_i = the reciprocal of twice the maximum average deceleration of a following vehicle
$V_j(t)$ = vehicle velocity in segment j at time t

$$S_P = \frac{1}{3600} \times 10 + \frac{1}{2 \times 78545.4545} \times 10^2 = 0.003414\ mi$$

$$S_T = \frac{1}{3600} \times 10 + \frac{1}{2 \times 49090.9091} \times 10^2 = 0.003796\ mi$$

Step 2.2: Calculating consumed lane length

- Step 2.2: Calculate total lane length consumed by each vehicle (based on observed speed)

$$L_{i,j}(t) = \alpha_i + S_{i,j}(t)$$

$L_{i,j}(t)$ = lane length consumed by vehicle type i in segment j at time t
α_i = length of vehicle type i
$S_{i,j}(t)$ = vehicle spacing for vehicle type i in segment j at time t

$L_P = 0.00284091 + 0.005619 = 0.006255\ mi$
$S_T = 0.0094697 + 0.003796 = 0.013266\ mi$

Step 2.3: Estimating Vehicles in Queue

- Step 2.3: Compute # of passenger and commercial vehicles on each segment in the queue

Considering two types of vehicles

(P: passenger, T: commercial),

$$n_{P,j}(t)^* L_{P,j}(t) + n_{T,j}(t)^* L_{T,j}(t) = \theta_j \qquad \text{(Eqn 2.3.1)}$$

$$\frac{n_{P,j}(t)}{n_{T,j}(t)} = \frac{\delta_P}{\delta_T} \qquad \text{(Eqn 2.3.2)}$$

θ_j = length of segment j

$n_{i,j}(t)$ = # of vehicle type i in the queue

δ_i = percentage of vehicle type i

$$n_P \times 44.56 + n_T \times 84.1 = 1760$$

$$\frac{n_P}{n_T} = 9$$

Step 2.3: Estimating Vehicles in Queue

- Step 2.3: Compute # of passenger and commercial vehicles on each segment in the queue

Solving the system of equations (Equ 2.3.1 and Eque 2.3.2) we get:

$$n_{P,j}(t) = \frac{\frac{\delta_P}{\delta_T} * \theta_j}{\frac{\delta_P}{\delta_T} * L_{P,j}(t) + L_{T,j}(t)} \qquad n_P = \frac{9 \times \frac{1}{3}}{9 * 0.006255 + 0.013266} = 43.13$$

$$n_{T,j}(t) = \frac{\theta_j}{\frac{\delta_P}{\delta_T} * L_{P,j}(t) + L_{T,j}(t)} \qquad n_T = \frac{\frac{1}{3}}{9 * 0.006255 + 0.013266} = 4.79$$

Step 2.4: Estimating Vehicles Traversing the segment

- Step 2.4: Compute # of passenger and commercial vehicles Traversing the segment

$$f_{i,j}(t) = \frac{n_{i,j}(t) * V_j(t)}{\theta_j * 60} * N_j$$

$f_{i,j}(t)$ = # of vehicles of type i traversing segment j at time t (per minute)
N_j = lanes on segment j

$$f_P = \frac{43.13 \times 10}{\frac{1}{3} \times 60} \times 3 = 64.69$$

$$f_T = \frac{4.79 \times 10}{\frac{1}{3} \times 60} \times 3 = 7.19$$

$$\sum_{i}^{I} f_{i,j}(t) = 46.69 + 7.19 = 71.88$$

Values based on other speeds

Speed (mph)	L_pass (mi)	L_truck (mi)	n _pass (veh)	f_pass (veh/min)	n _truck (veh)	f_truck (veh/min)	flow total (veh/min)
10	0.006255	0.013266	43.12616	64.68924	4.791795	7.187694	71.87694
20	0.010943	0.019099	25.51363	76.54091	2.834848	8.504546	85.04546
30	0.016903	0.02697	16.75038	75.37673	1.861154	8.375192	83.75192
40	0.024137	0.036877	11.80582	70.83492	1.311758	7.870547	78.70547

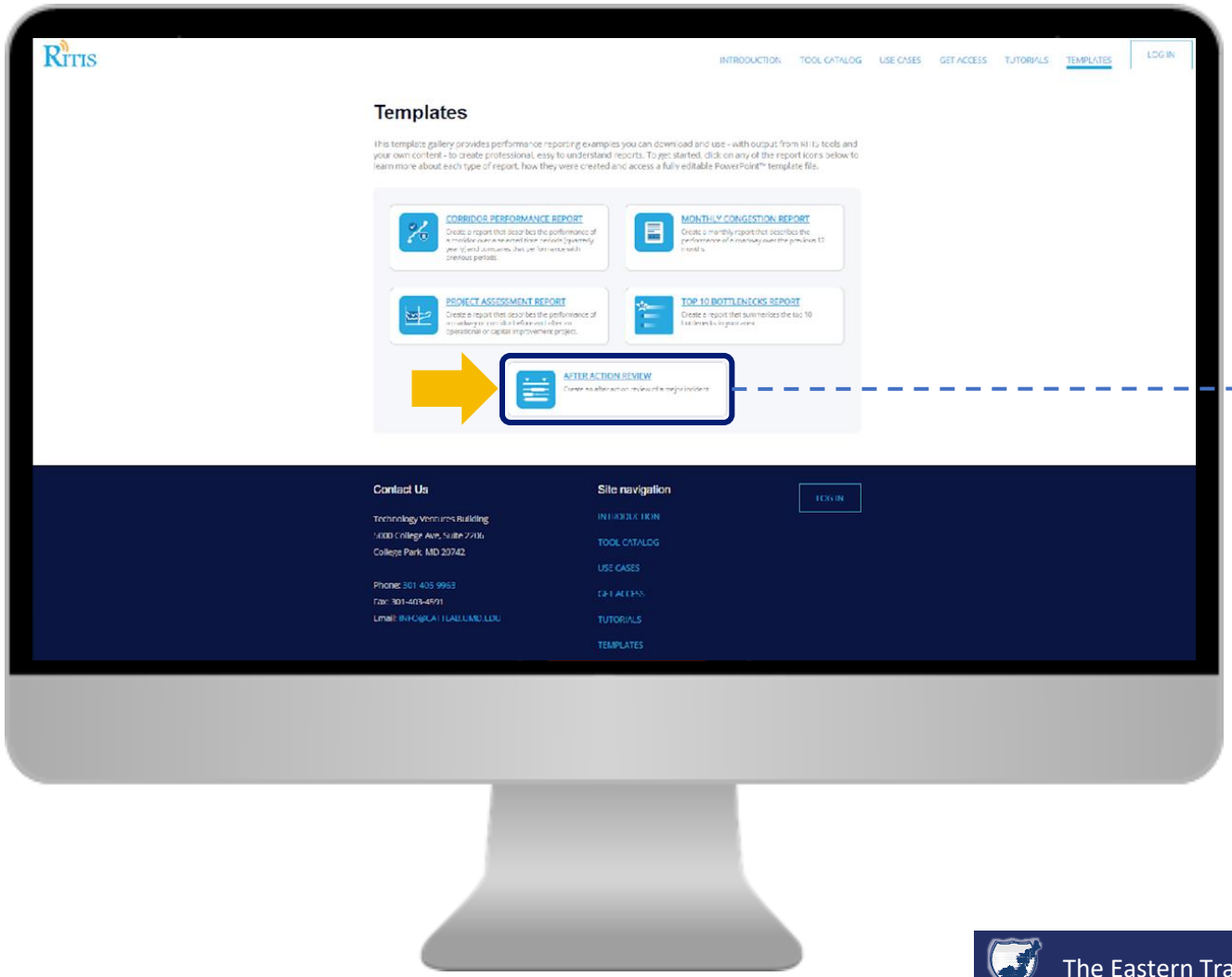
RITIS | PROBE DATA ANALYTICS SUITE

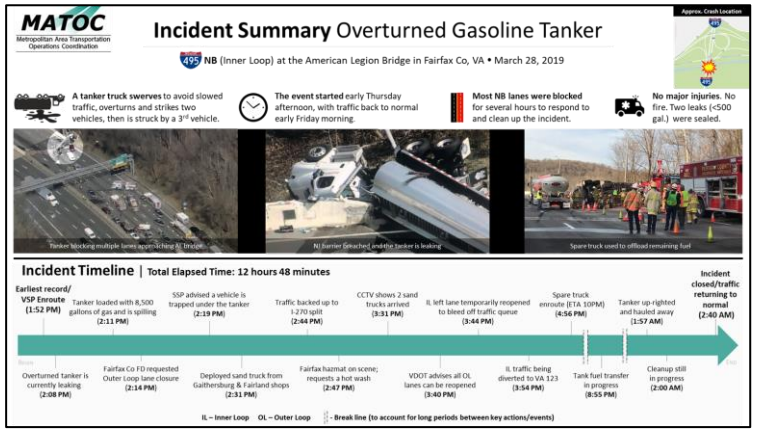
PDA Suite Performance Measures Working Group

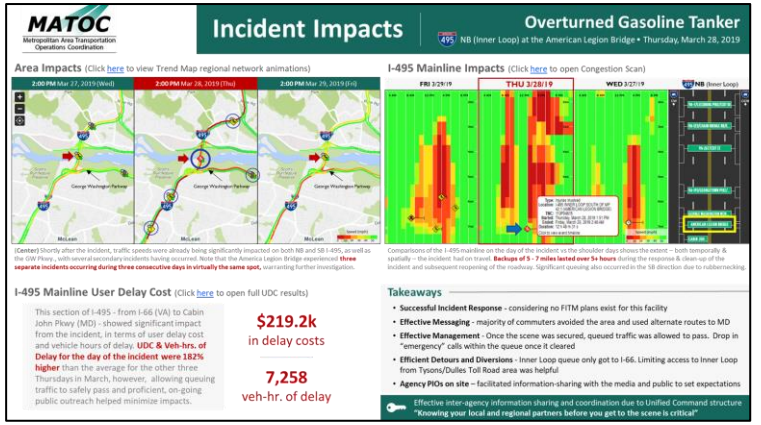
John Allen
Faculty Assistant, Outreach & Education
UMD CATT Lab

Performance Reporting **Templates**

The **After-action Reporting** package is now available on the [RITIS Templates page](#)…







Performance Reporting **Workshop #3**

On 11.17.2022, we held a workshop on creating an effective after event report:

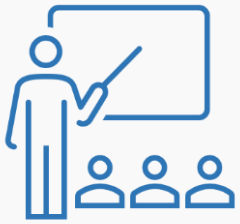
- ODOT use case - weekend closure of a section of I-84 for bridge work related to the MAX Red Line (rail project)
- Executive leadership asked for a report indicating impact on I- 84 and findings
- Rick Ayers (CATT Lab) stepped through the process of using RITIS tools and ODOT content to build this report

Performance Reporting **Workshop #3**

We conducted several polls during the Workshop. Here's what we learned:

52%

said they were familiar with the RITIS templates page.



62%

learned about the templates from attending RITIS / TETC meetings or colleagues.

17%

have used, and shared performance reports created from templates.

75%

said the reports made a positive difference in presenting data.

93%

found the workshop a valuable resource to their agency.

To see the workshop video & slides, go to TETC's RITS & PDA SUITE page here, the scroll down to **Workshops and Working Groups** tab

Performance Reporting **Templates**

We plan to have the Holiday Travel Forecast template package* deployed in about 4-6 weeks

Holiday Travel Forecast Infographic

Use this template package along with RITIS tool results to create a holiday travel forecast infographic to share with the traveling public during major holidays with high levels of traffic, such as Thanksgiving and Labor Day. These infographic-style templates help communicate vital advisory information such as which hours are likely to be most congested, specific roadways that could be significantly impacted or higher than average accidents occurring on a particular day. These infographics, along with agency safety tips and travel service apps (like 511) can help provide drivers with a safer, more relaxing travel experience.

Overview

1. **Click to download the PowerPoint template** to create a report that presents a travel forecast infographic for a region. Additional design resources are also available to help build your document.

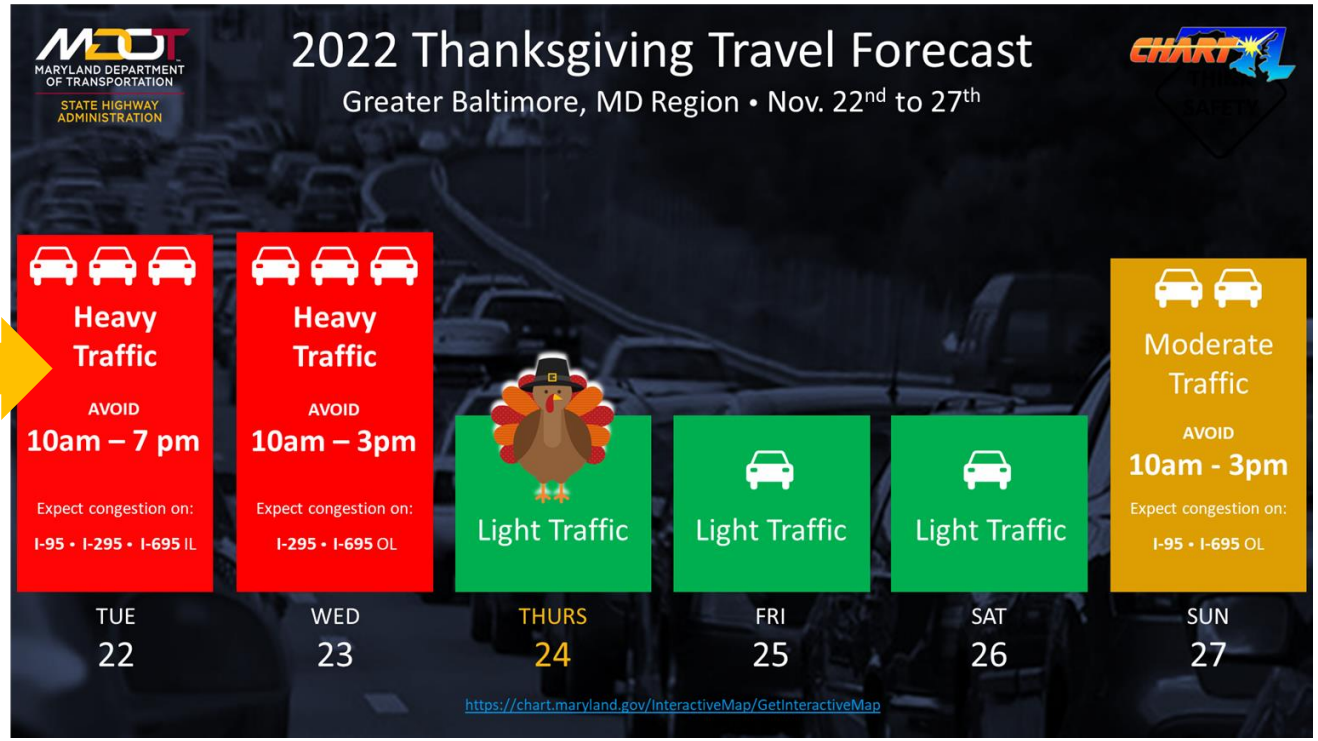
Download Template | Download Design Resources

2. **Download Agency Use Case examples** below to see how other agencies have used these templates or have created similar reports using content from RITIS :

- **MDOT** 2022 Labor Day Travel Forecast (6-day infographic, using this template)
- **MDOT** 2022 Labor Day Travel Forecast (6-day infographic)
- **MDOT** 2022 4th of July Travel Forecast (5-day infographic)
- **MDOT** 2022 Memorial Day Travel Forecast (6-day infographic)
- **GDOT** 2021 New Year's Eve Travel Forecast (7-day infographic)
- **GDOT** 2021 Thanksgiving Travel Forecast (7-day infographic + public messaging)
- **MDOT** 2021 Thanksgiving Travel Forecast (6-day infographic)
- **Baltimore Metropolitan Council** 2016 Thanksgiving Travel Forecast (7-day infographic + public messaging)
- **Baltimore Metropolitan Council** 2016 Labor Day Travel Forecast (webpage messaging)
- **Regional Transportation Commission of Southern Nevada** – multiple holiday travel forecast examples

(Note – some of these infographics are not editable but can be easily recreated)

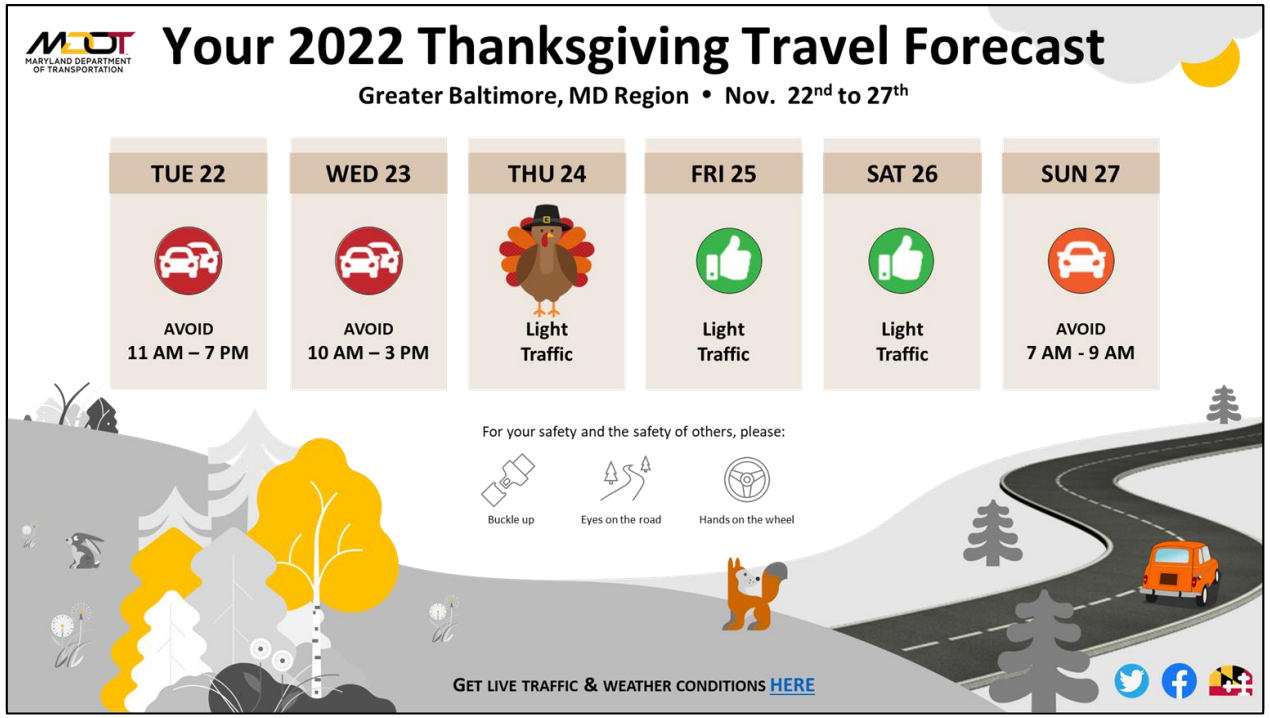
3. **Scroll down to learn how to create this report** or click on the 'How To Create Report' in the navigational menu.

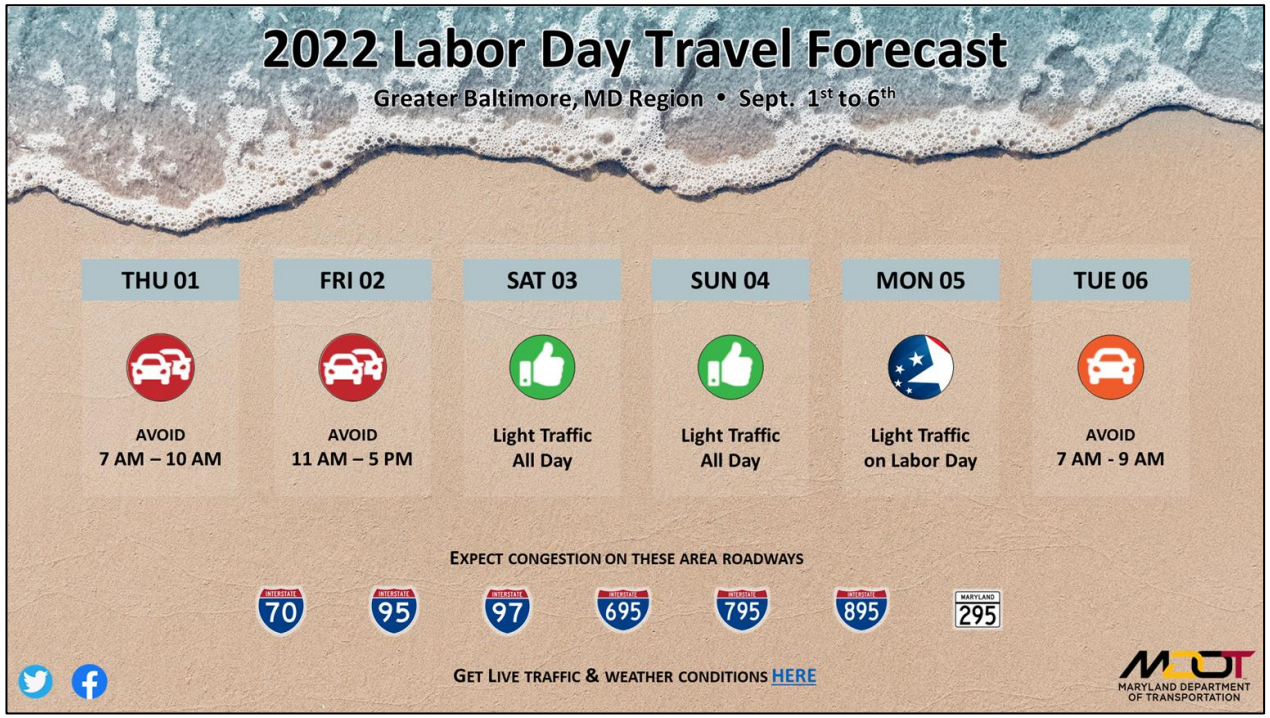


* Package includes template, design resources, agency use cases and a how-to guide

Performance Reporting **Templates**

We've developed a few new formats and layouts that will be included in the deploy…





- Easily create scenic elements using PowerPoint's Illustrations
- Use Stock Images & Icons in PowerPoint to create a different look

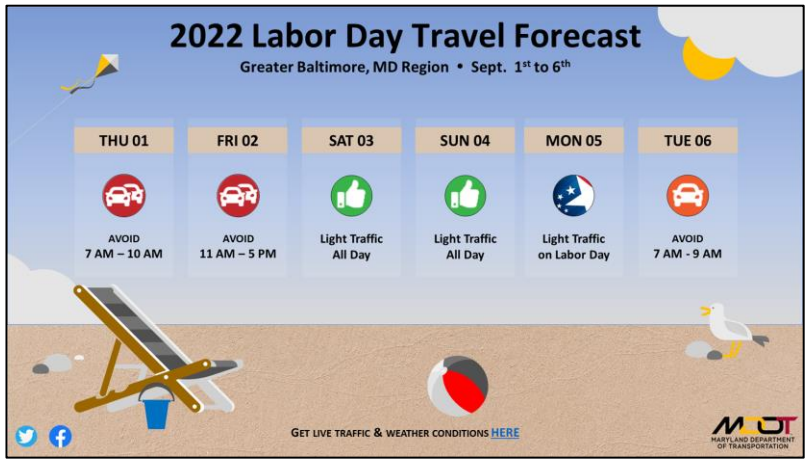
Performance Reporting **Templates**

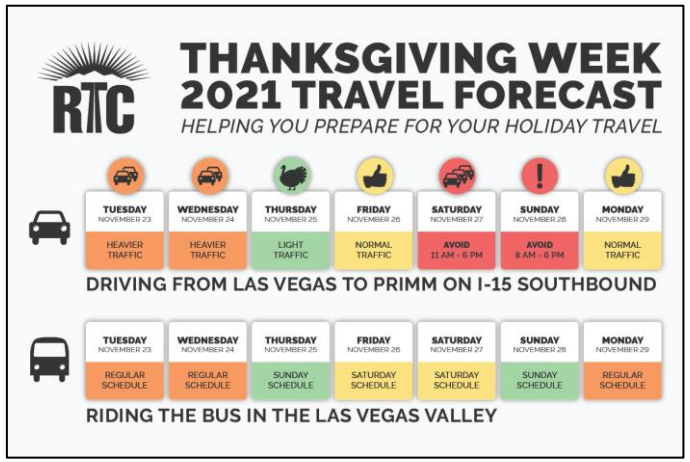
Holiday travel forecast infographics are great for your social media pages…

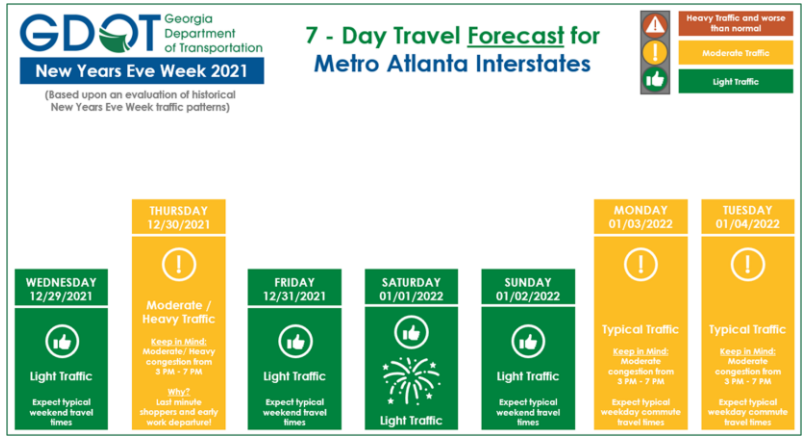
This is a mocked-up page to illustrate using a RITIS infographic

Performance Reporting **Templates**

Look for a Holiday Travel Forecast deploy announcement, coming soon.

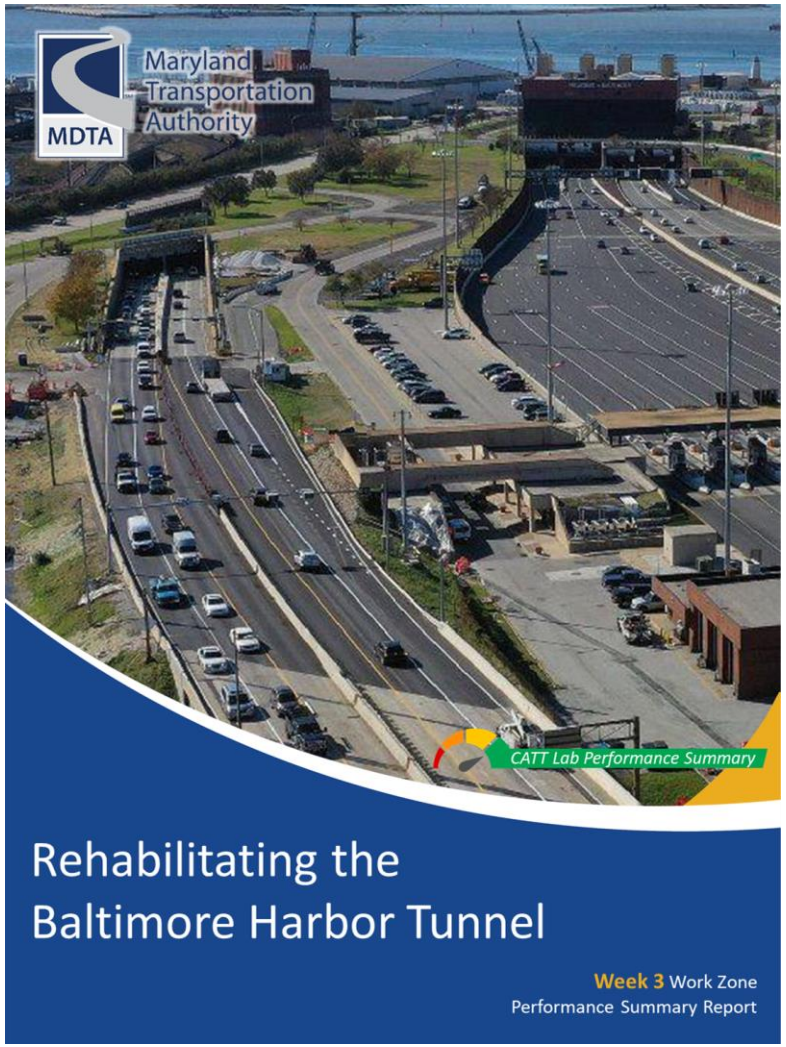


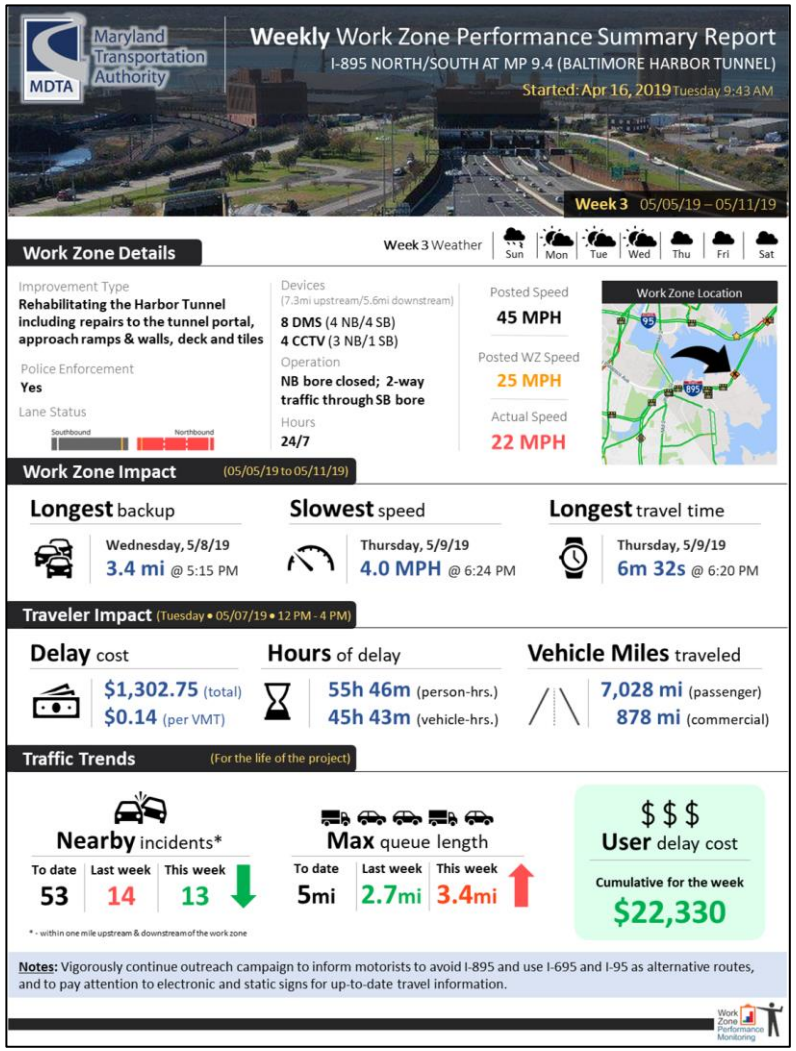




Performance Reporting **Templates**

We will be working to develop a work zone reporting development package next…





We'll use intel from the AWZR group discussions & scoping study design process to better develop WZ templates

Reminder | RITIS **Workshop**

RITIS Workshop

Session 4 | Topic To Be Announced

April 20, 2023 • 1:00 pm to 2:15 pm ET

RITIS | PROBE DATA ANALYTICS SUITE

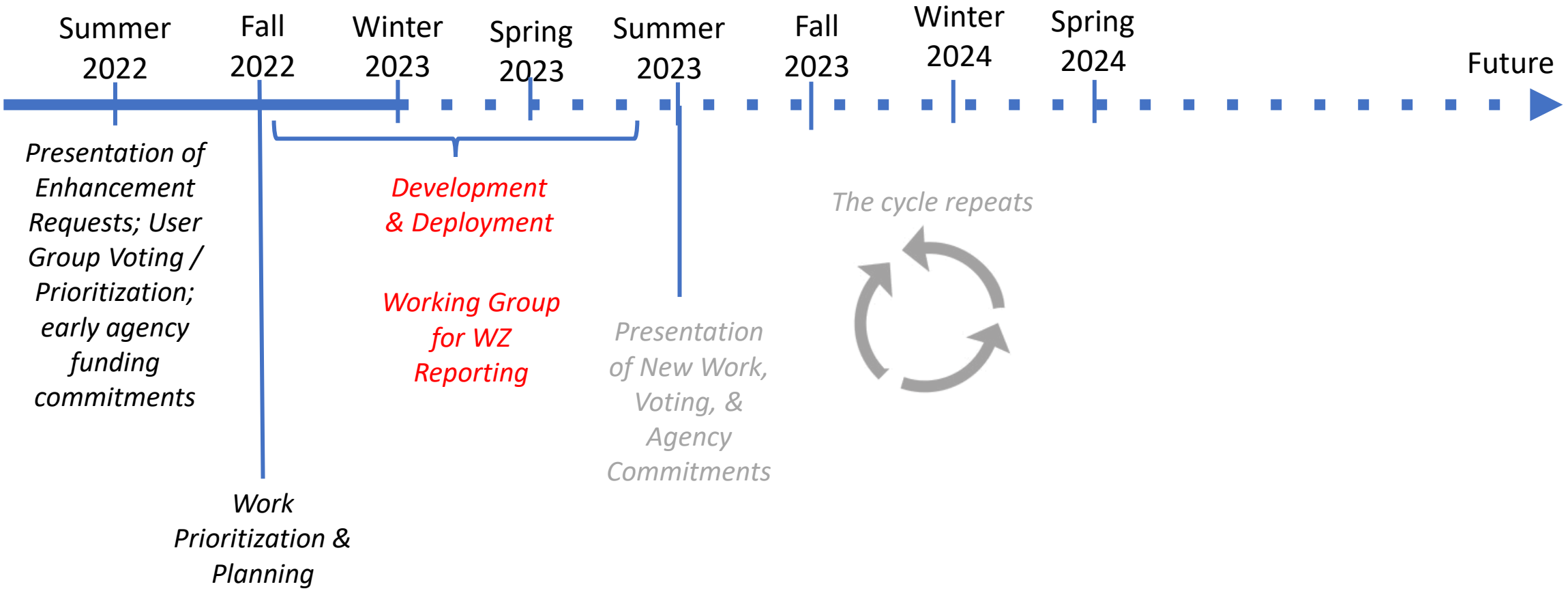
RITIS Product Enhancement Working Group

Bob Frey,
Director of Project-Oriented Planning
Massachusetts DOT

RITIS Product Enhancement Working Group: Purpose and Goal

- Form and maintain a nimble “pooled fund” like group to:
  - Fund RITIS Enhancements
  - Assist with prioritization efforts for the CATT Lab
- Provide stable, annualized funding
- Connect agencies with similar needs

Annual Enhancement Cycle: Current Status



Enhancements in Development:

Priorities through June 2023

RITIS Enhancement Working Group Funds will support:

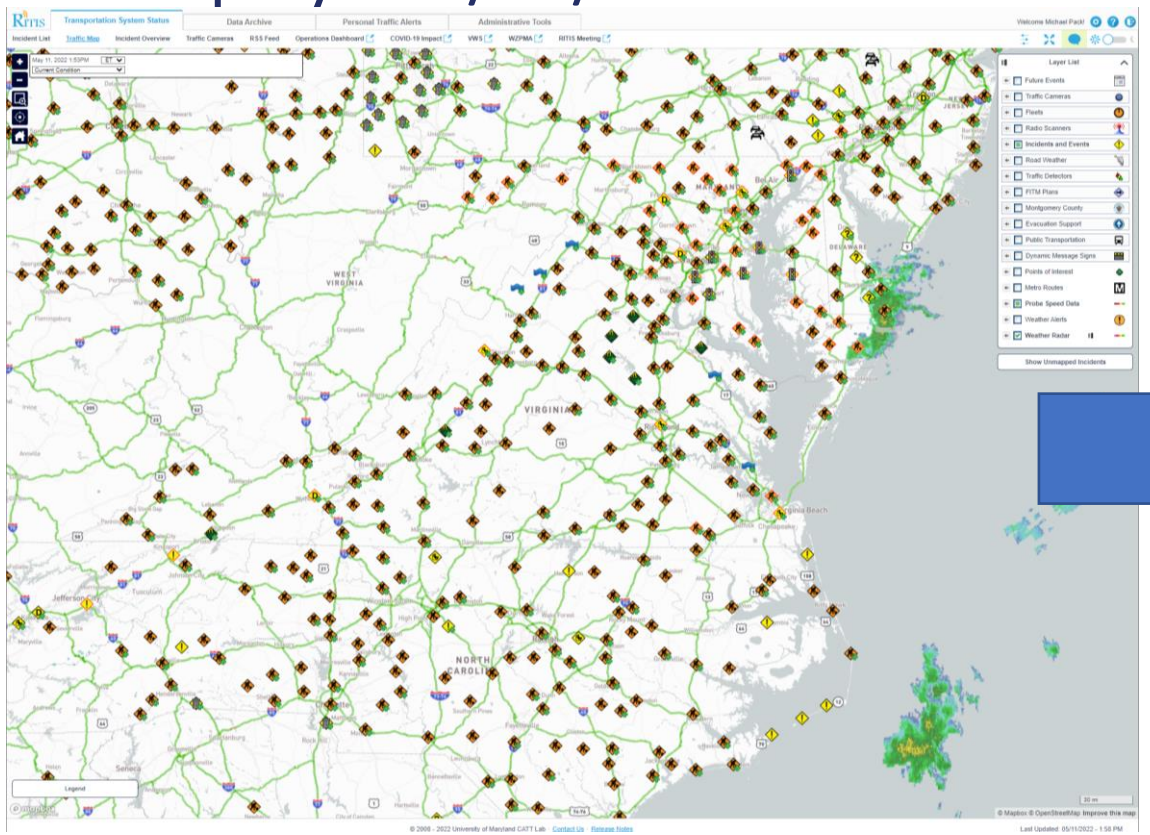
Enhancement	Estimated Cost	
Sharing of Dashboard Reports	$125k	started
Automated Work Zone Reports Scoping	$25k	started
Aerial Photography in RITIS Maps	$10k	✓
Additional Reporting Templates	$35k	almost
Speed Tile Layers	$30k	almost
Causes of Congestion Enhancements	$50k	progress
Total =	$275k	

Other funds (grants) will support

Enhancement	Estimated Cost	
Freight Movement & Safety Avoidance Analytics	$1M+	
Safety Analytics (police crash reports) Partially funded	~$250k	Seeking data
Signal Analytics Enhancements	$TBD	
Trips Analytics Enhancements	$TBD	
Energy Analytics Geographic Expansion	TBD	
Speed Bins Visualization (time permitting)	$75k	started
Total =	$$$	

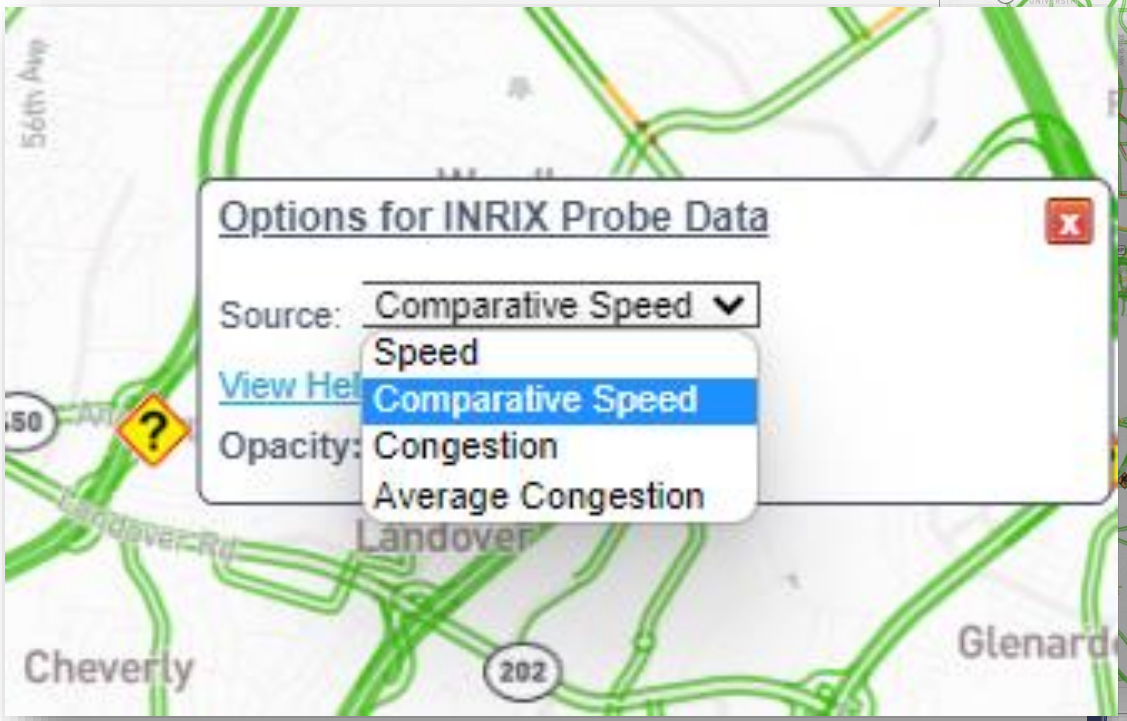
Aerial Photography in RITIS Maps

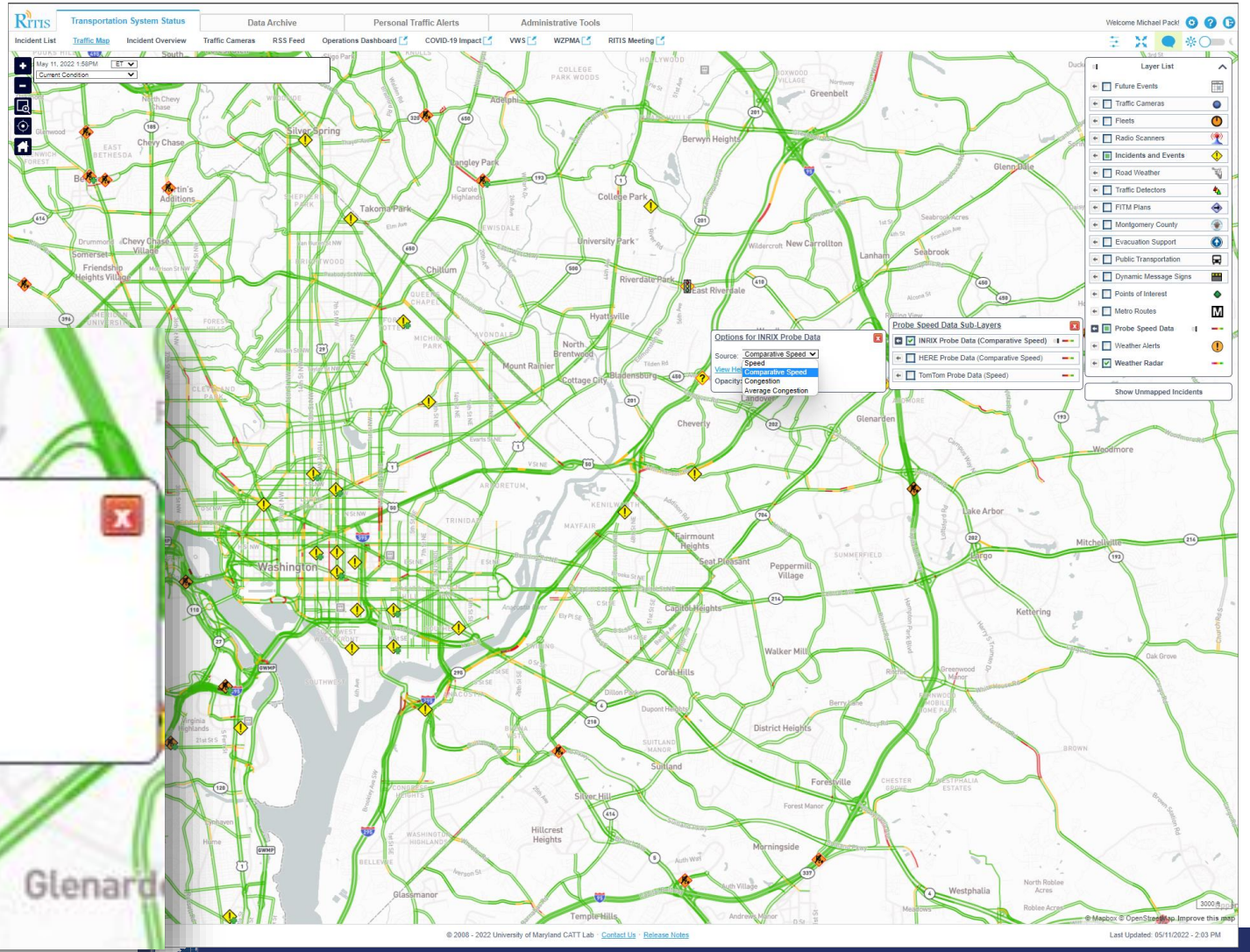
- Deployed 9/20/22



New Speed Tile Layer Options:

1. Only show congestion (hide green)
2. Only show bottlenecks
3. Only show high speeds
4. Road weather



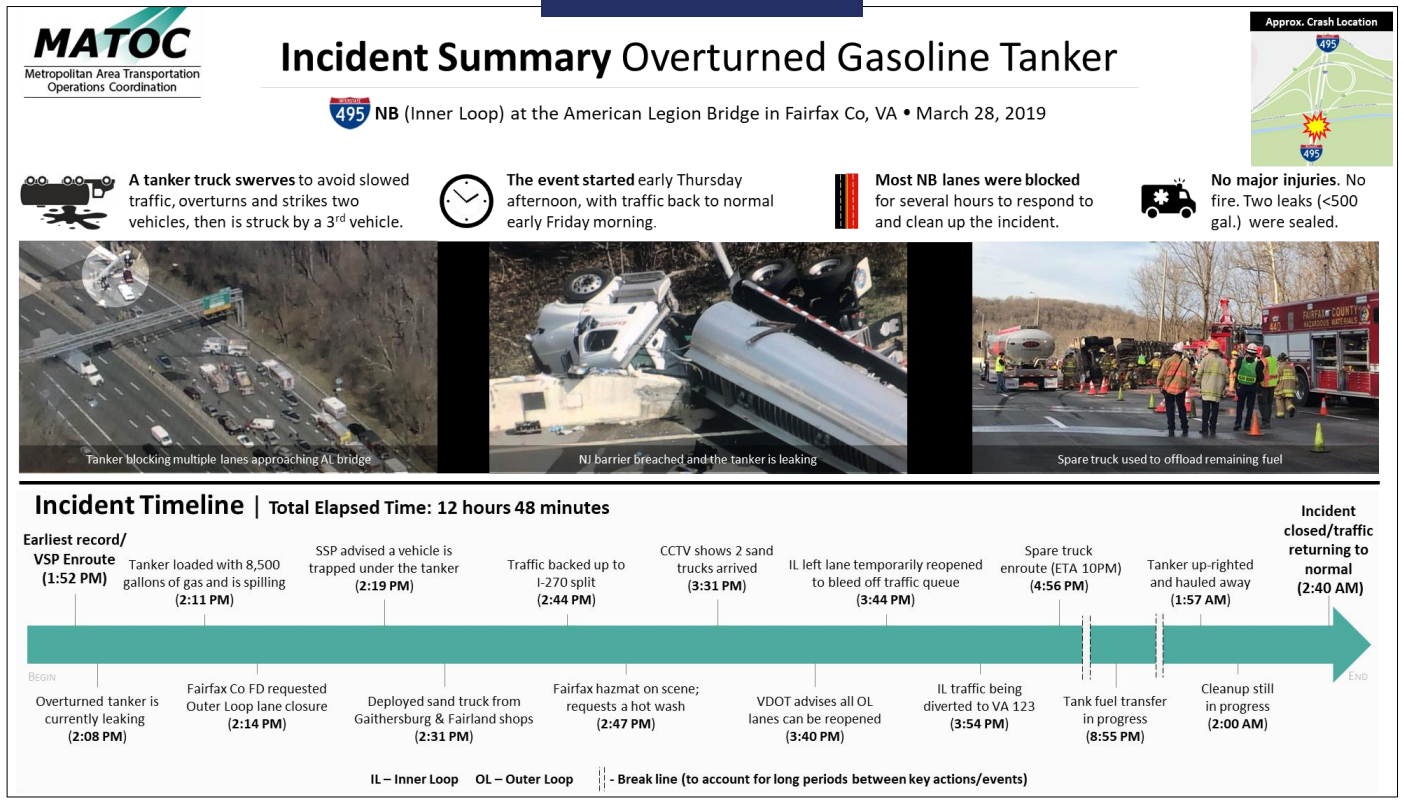


Build Additional Reporting Templates

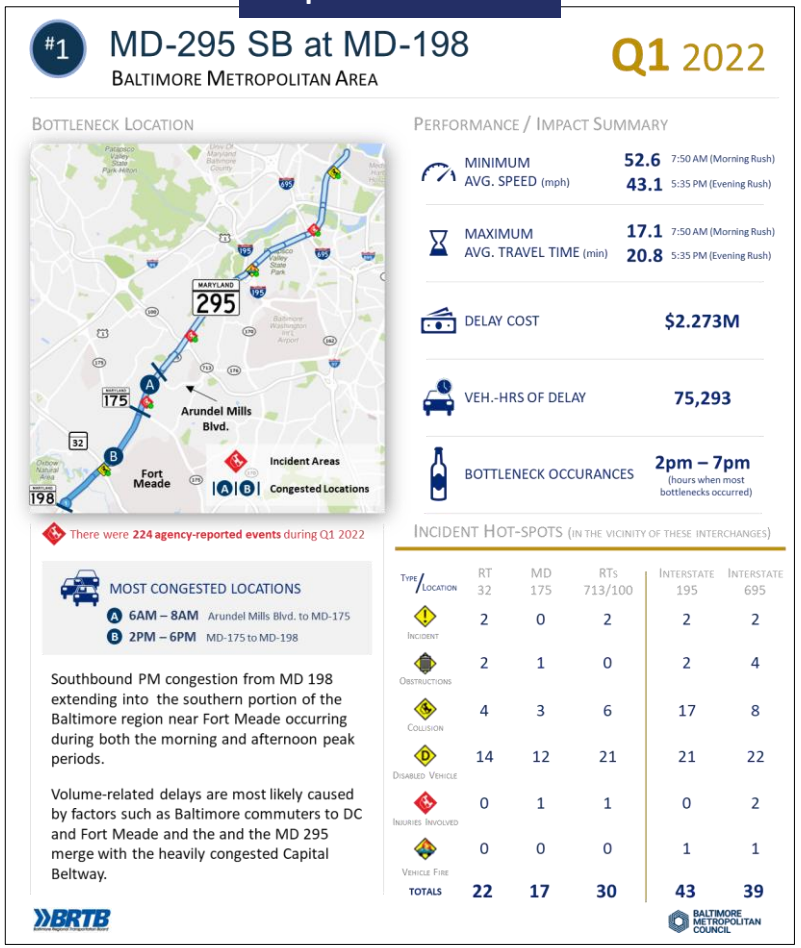
IN PROGRESS

We're continuing to provide RITIS users with a wide range of performance reporting options for their mobility, safety and operational needs

After-action Review



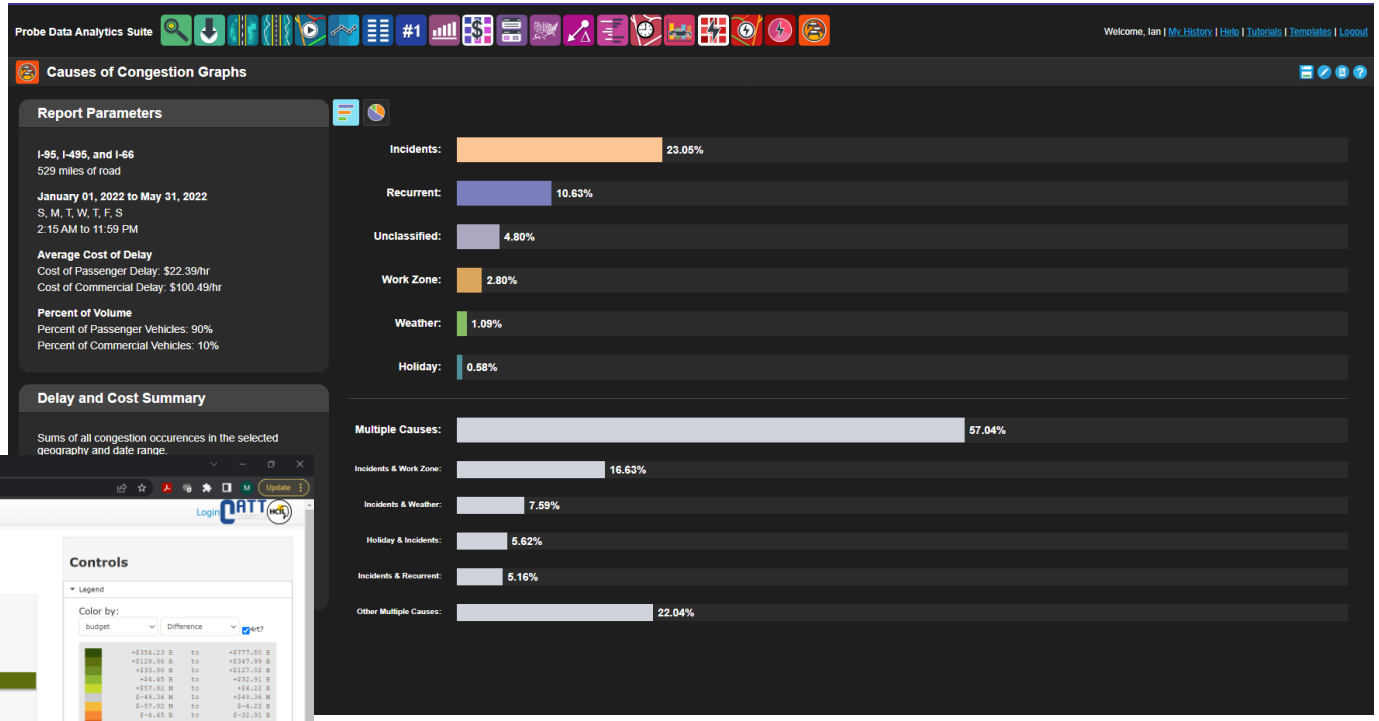
Top 10 Bottlenecks

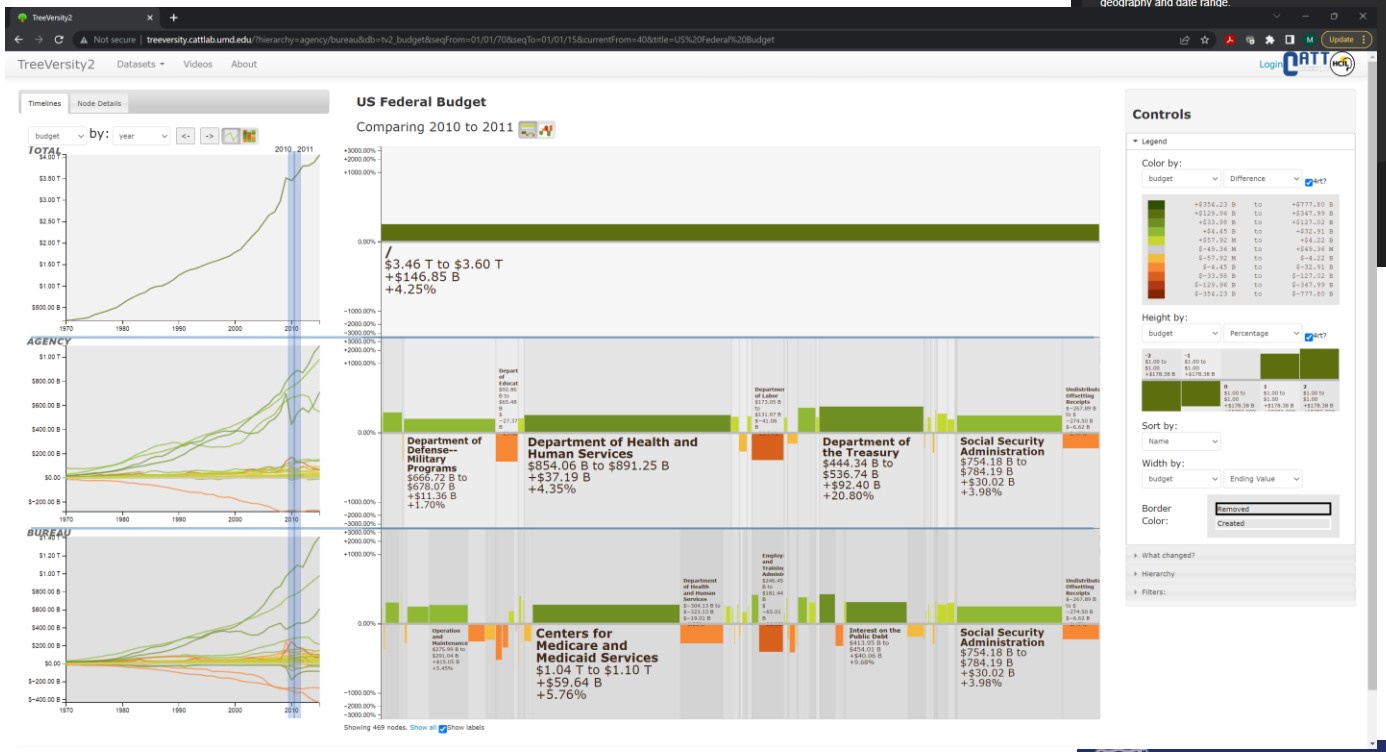


(CLICK HERE TO ACCESS **RITIS PERFORMANCE REPORTING** TEMPLATES, DESIGN RESOURCES, USE CASE EXAMPLES AND HOW-TO GUIDE)

Causes of Congestion: Enhancements & Analysis

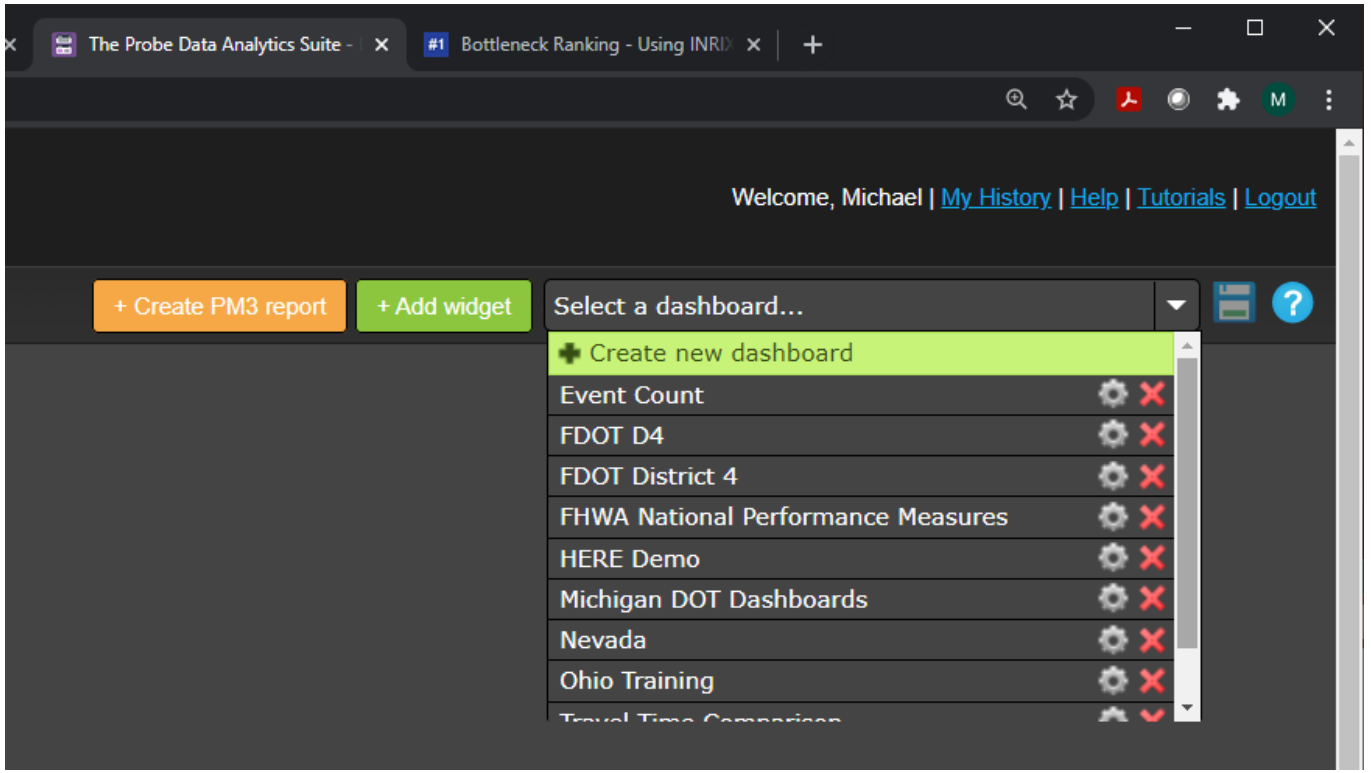
- Additional Filtering & Drill-down Capabilities
- Better Visualizations for Trend Analysis / Comparison
- Will be updating the causes of congestion weekly





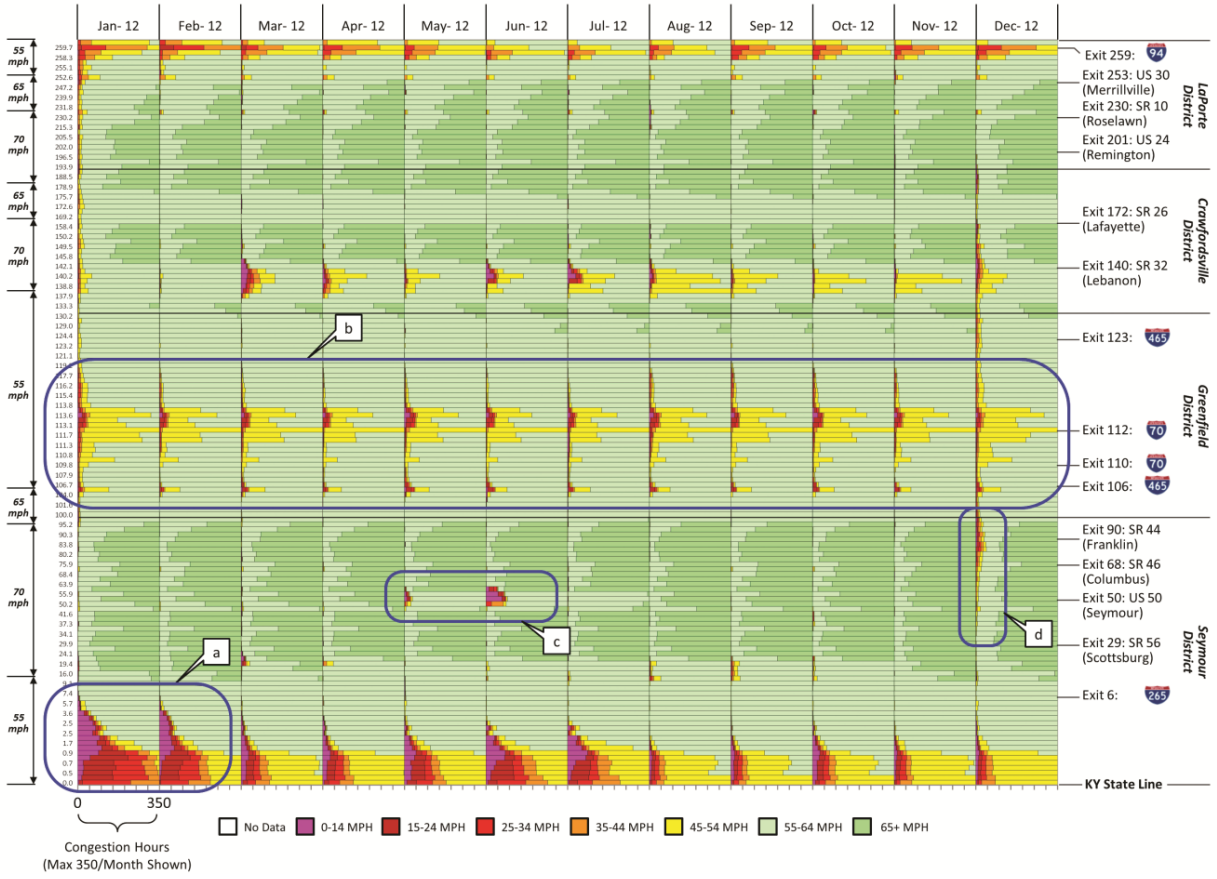
Sharing of Dashboards and Reports

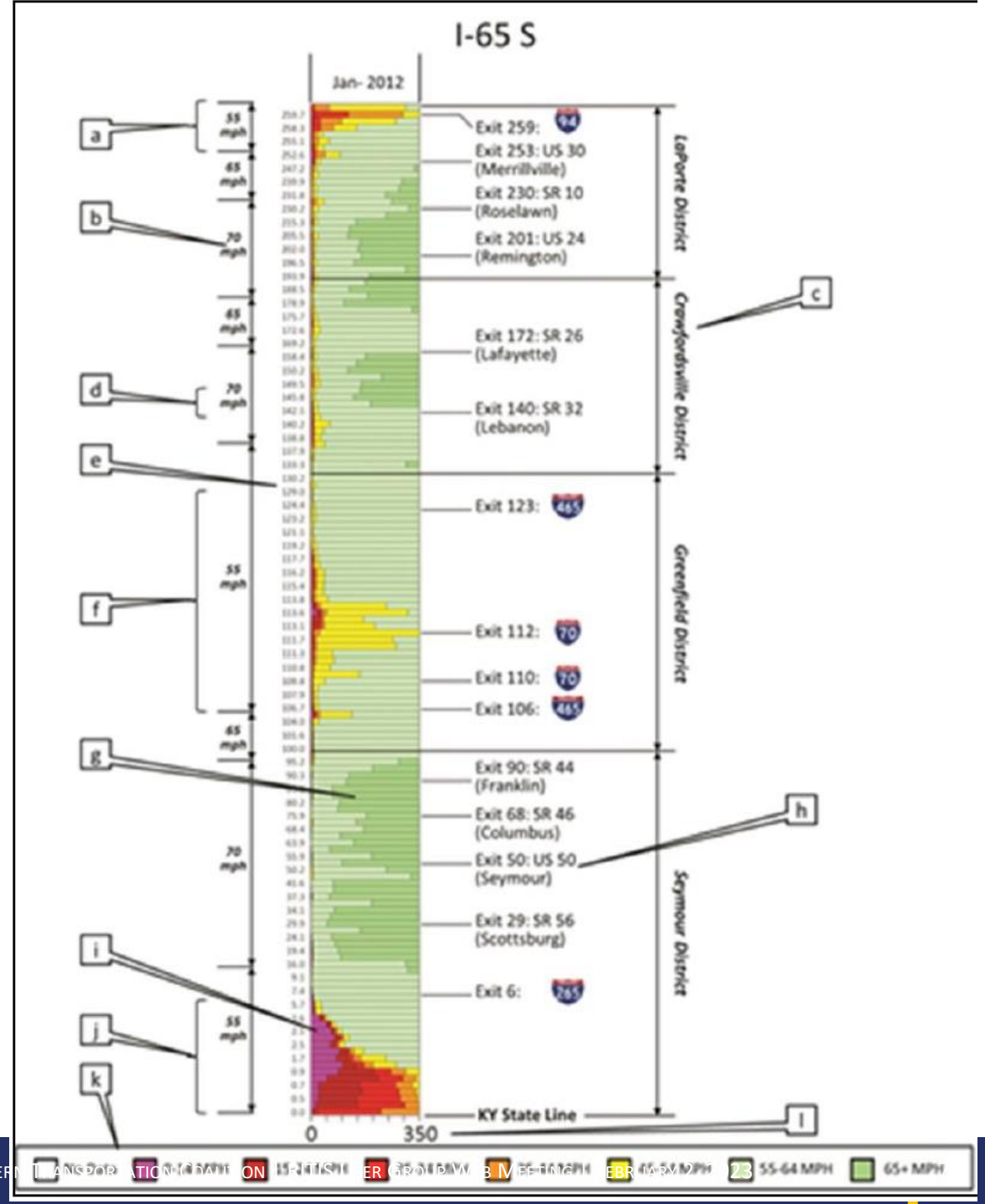
- Sharing with members of your organization
- Design work, but no coding yet



Speed Bins Visualizations

Stretch Goal

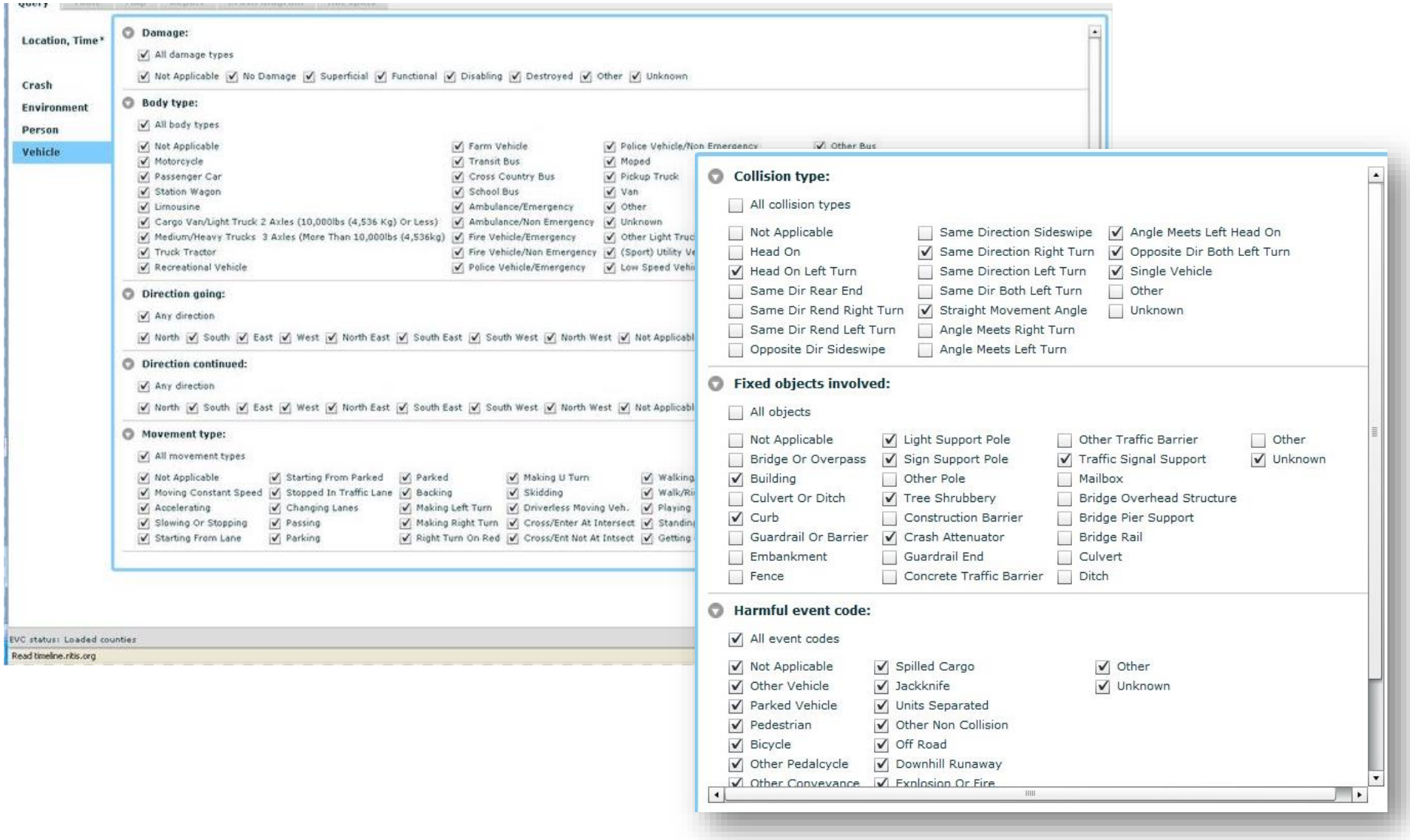




Safety Analytics: Police Crash Data Analytics

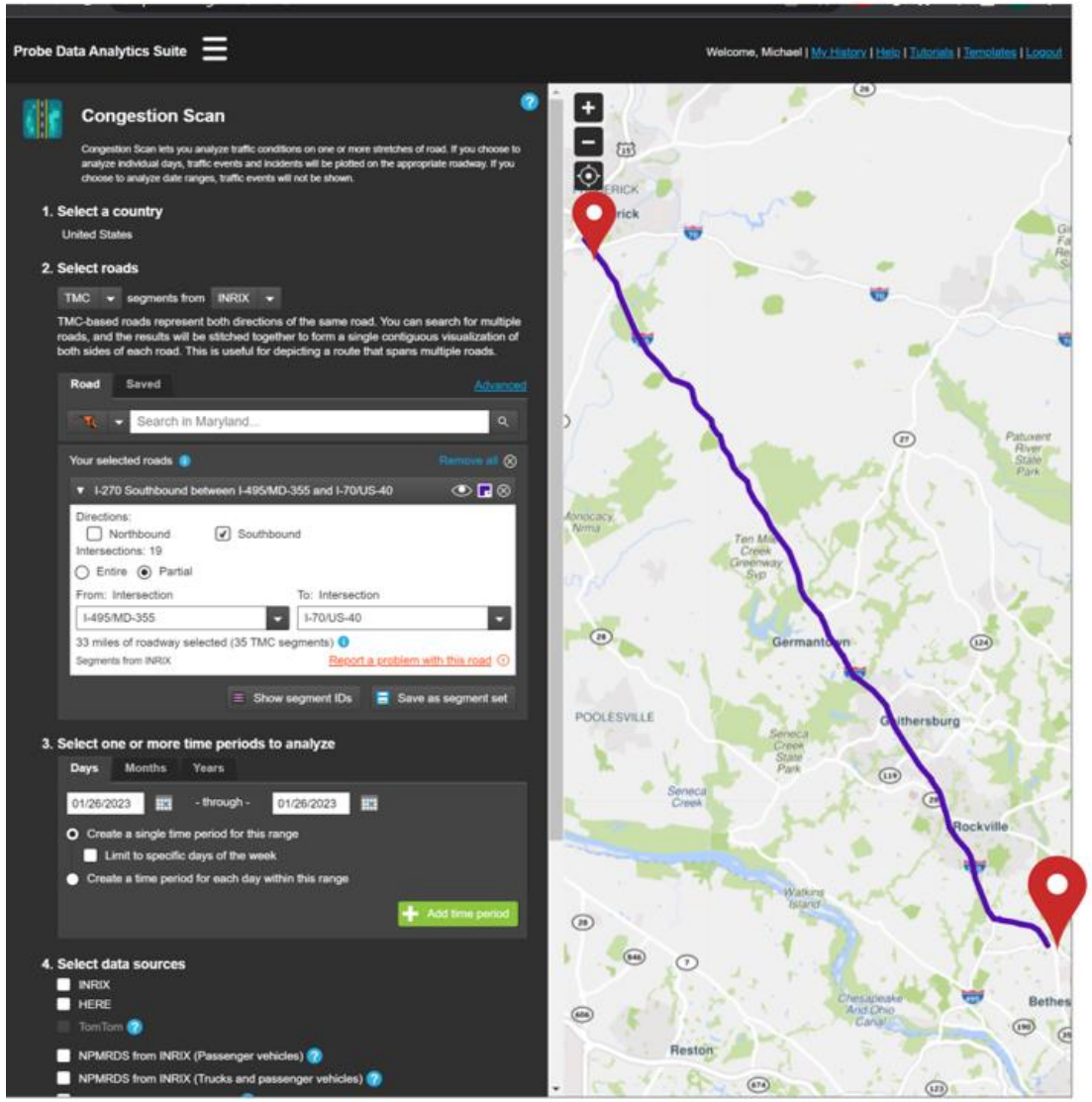
Stretch Goal

- Highly detailed query functionality on causality and other crash variables.
- We NEED data from agencies to ensure multi-agency functionality



Map Click Corridor Selection

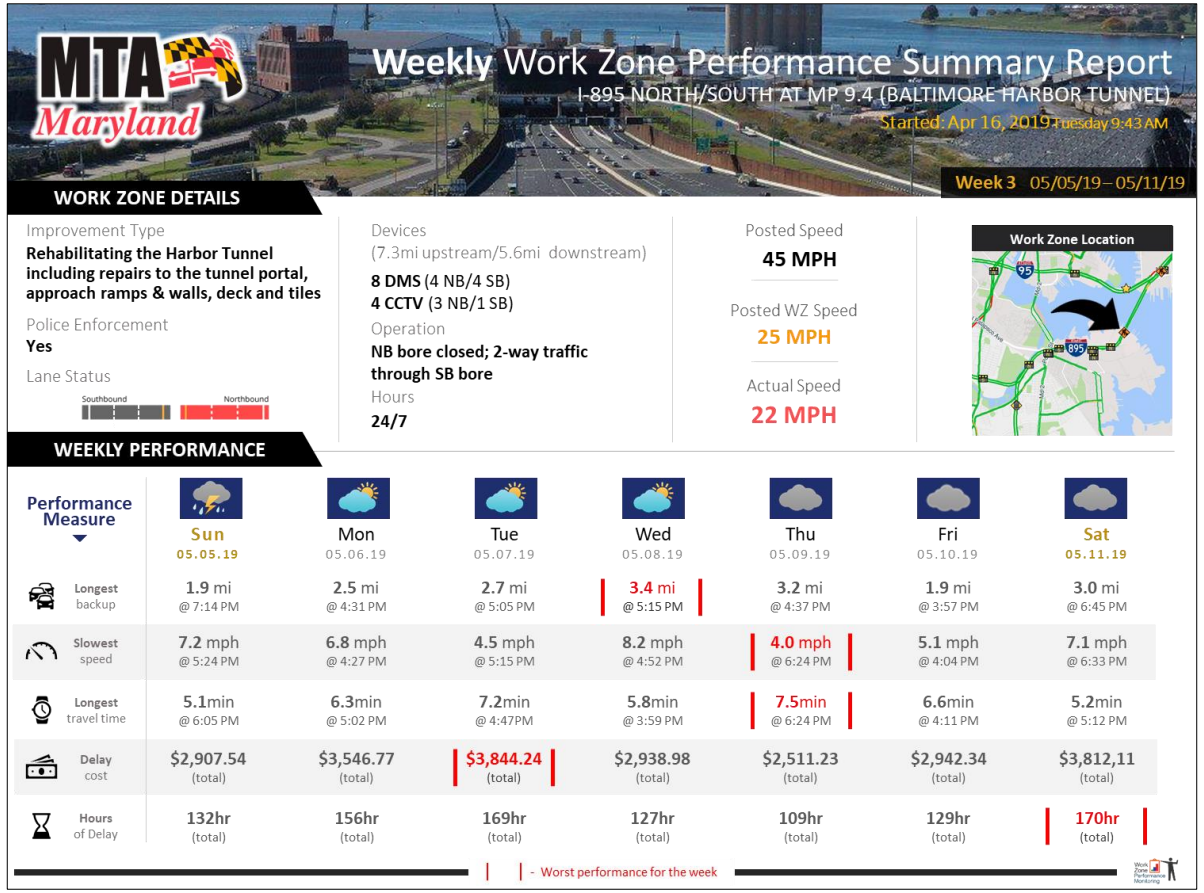
- Click start and end location, and the map automatically connects the points and selects all of the segments
- In-development (several months remain)
- Finishing API and related back-end development
- Front-end work is next



Automated Work Zone Reporting

IN PROGRESS

We're exploring a broad range of possibilities to develop a Level of Effort for AWZR in RITIS, highly ranked by the RITIS Enhancement Working Group



MTA Maryland

Weekly Work Zone Performance Summary Report

I-895 NORTH/SOUTH AT MP 9.4 (BALTIMORE HARBOR TUNNEL)

Started: Apr 16, 2019 Tuesday 9:43 AM

Week 3 05/05/19 – 05/11/19

WORK ZONE DETAILS

Improvement Type
Rehabilitating the Harbor Tunnel including repairs to the tunnel portal, approach ramps & walls, deck and tiles

Police Enforcement
Yes

Lane Status
Southbound Northbound

Devices (7.3mi upstream/5.6mi downstream)
8 DMS (4 NB/4 SB)
4 CCTV (3 NB/1 SB)

Operation
NB bore closed; 2-way traffic through SB bore

Hours
24/7

Posted Speed
45 MPH

Posted WZ Speed
25 MPH

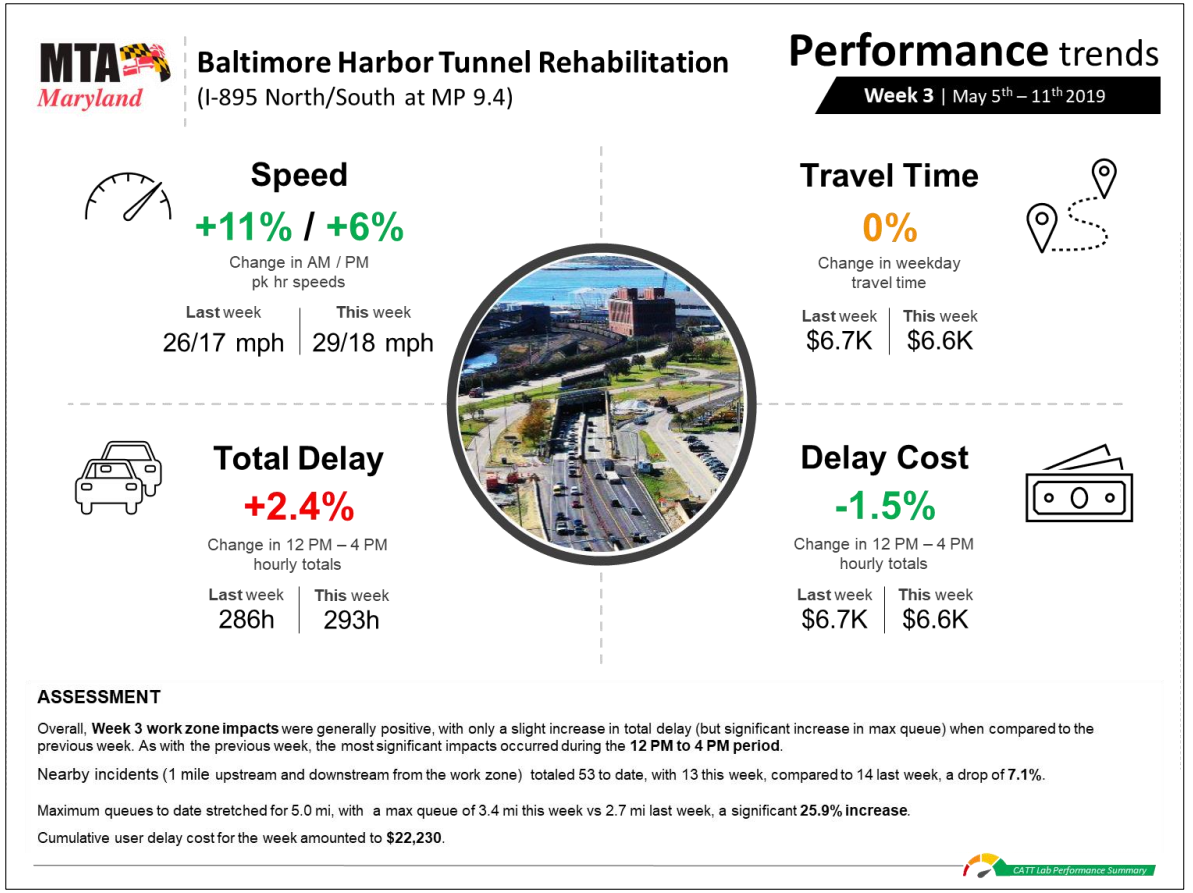
Actual Speed
22 MPH

Work Zone Location

WEEKLY PERFORMANCE

Performance Measure	Sun 05.05.19	Mon 05.06.19	Tue 05.07.19	Wed 05.08.19	Thu 05.09.19	Fri 05.10.19	Sat 05.11.19
Longest backup	1.9 mi @ 7:14 PM	2.5 mi @ 4:31 PM	2.7 mi @ 5:05 PM	3.4 mi @ 5:15 PM	3.2 mi @ 4:37 PM	1.9 mi @ 3:57 PM	3.0 mi @ 6:45 PM
Slowest speed	7.2 mph @ 5:24 PM	6.8 mph @ 4:27 PM	4.5 mph @ 5:15 PM	8.2 mph @ 4:52 PM	4.0 mph @ 6:24 PM	5.1 mph @ 4:04 PM	7.1 mph @ 6:33 PM
Longest travel time	5.1min @ 6:05 PM	6.3min @ 5:02 PM	7.2min @ 4:47PM	5.8min @ 3:59 PM	7.5min @ 6:24 PM	6.6min @ 4:11 PM	5.2min @ 5:12 PM
Delay cost	$2,907.54 (total)	$3,546.77 (total)	$3,844.24 (total)	$2,938.98 (total)	$2,511.23 (total)	$2,942.34 (total)	$3,812,11 (total)
Hours of Delay	132hr (total)	156hr (total)	169hr (total)	127hr (total)	109hr (total)	129hr (total)	170hr (total)

- Worst performance for the week



MTA Maryland

Baltimore Harbor Tunnel Rehabilitation
(I-895 North/South at MP 9.4)

Performance trends
Week 3 | May 5th – 11th 2019

Speed
+11% / +6%
Change in AM / PM pk hr speeds
Last week 26/17 mph | This week 29/18 mph

Travel Time
0%
Change in weekday travel time
Last week $6.7K | This week $6.6K

Total Delay
+2.4%
Change in 12 PM – 4 PM hourly totals
Last week 286h | This week 293h

Delay Cost
-1.5%
Change in 12 PM – 4 PM hourly totals
Last week $6.7K | This week $6.6K

ASSESSMENT

Overall, **Week 3 work zone impacts** were generally positive, with only a slight increase in total delay (but significant increase in max queue) when compared to the previous week. As with the previous week, the most significant impacts occurred during the **12 PM to 4 PM period**.

Nearby incidents (1 mile upstream and downstream from the work zone) totaled 53 to date, with 13 this week, compared to 14 last week, a drop of **7.1%**.

Maximum queues to date stretched for 5.0 mi, with a max queue of 3.4 mi this week vs 2.7 mi last week, a significant **25.9% increase**.

Cumulative user delay cost for the week amounted to **$22,230**.

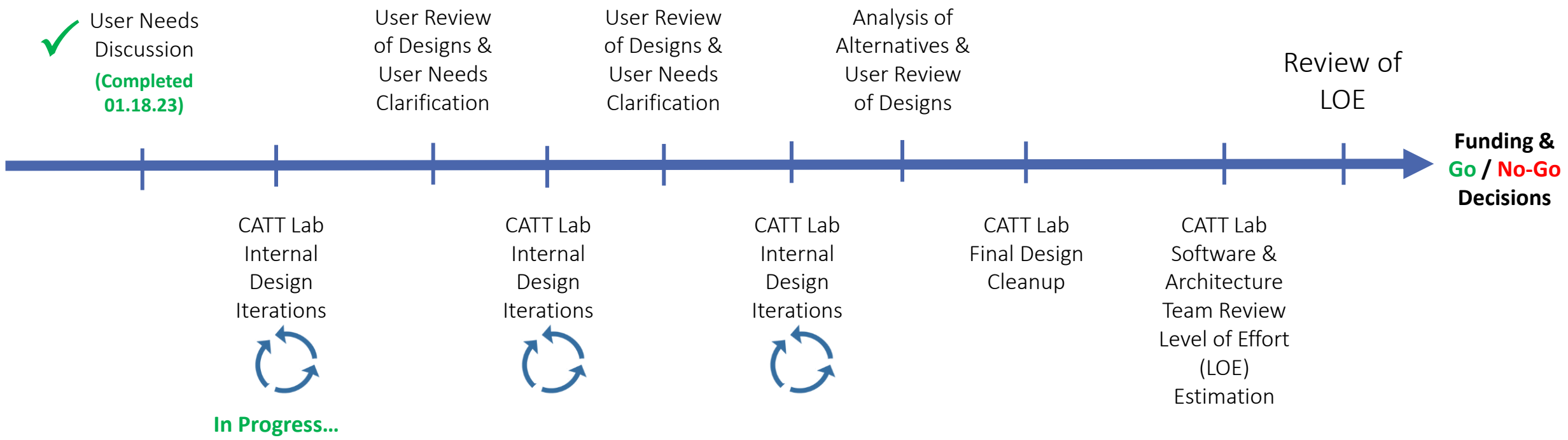
CATT Lab Performance Summary

Automated Work Zone Reporting

IN PROGRESS

We've kicked off the scoping study design process w/partners from the RITIS Enhancement Working Group by having an in-depth User Needs Discussion

Scoping Study Design Process



Next Steps

- Establish Automated Work Zone PM Group + Schedule Meetings
  - Doodle Poll for User-needs Discussion Forthcoming
- Continued Design & Development by the CATT Lab
- Next **RITIS Product Enhancement Working Group Meeting** – March 2, 2023, 2:00pm-3:00pm, ET

RITIS | PROBE DATA ANALYTICS SUITE

New RITIS Tools and Recent Enhancements

Michael Pack
UMD CATT Lab
Director

Enhancements/Updates since the last meeting

- Application and Server Security Patching
- Added Transurban detector, DMS, and event content in Virginia to the Traffic Map.
- Added VDOT Wavetronix detector content to the Traffic Map.
- Added Arlington Bike Counter data source.
- Added support for HERE TS segment filtering by ID.
- Added new Reporting Templates for AARs
- HERE Topological Subsegment Data is now supported in the following PDA tools:
  - Congestion Scans
  - Corridor Time Comparisons
  - Trend Maps
  - Performance Charts
  - Performance Summaries
- Dozens of improvements to Trips Analytics: https://trips-beta.ritis.org/new

NEW Visualization:
Intersection Matrix (part of Signal Analytics)

	12 AM	1 AM	2 AM	3 AM	4 AM	5 AM	6 AM	7 AM	8 AM	9 AM	10 AM	11 AM	12 PM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM	Daily Average
Mon	67%	100%	100%	86%	80%	50%	53%	77%	76%	76%	81%	82%	80%	82%	77%	75%	78%	76%	73%	79%	80%	41%	67%	50%	Mon 75%
Tue	100%	50%	100%	91%	50%	46%	57%	77%	77%	73%	77%	76%	74%	73%	69%	75%	75%	68%	73%	83%	86%	41%	25%	50%	Tue 72%
Wed	0%	33%	100%	50%	64%	46%	54%	76%	78%	66%	79%	81%	75%	79%	73%	81%	78%	71%	73%	84%	90%	61%	75%	33%	Wed 73%
Thu	0%	67%	100%	80%	71%	37%	61%	70%	79%	76%	74%	80%	80%	76%	72%	76%	78%	69%	66%	78%	87%	49%	30%	52%	Thu 72%
Fri	60%	100%	100%	90%	69%	44%	56%	78%	77%	76%	84%	77%	63%	79%	69%	67%	70%	63%	67%	70%	86%	43%	52%	63%	Fri 71%
Sat	41%	33%	43%	100%	89%	44%	51%	68%	82%	81%	63%	55%	52%	55%	62%	67%	71%	66%	86%	59%	32%	38%	43%	33%	Sat 63%
Sun	40%	60%	100%	0%	75%	70%	47%	73%	78%	80%	76%	64%	60%	65%	74%	78%	65%	74%	82%	73%	51%	42%	50%	44%	Sun 70%
Weekday Average	50%	74%	100%	82%	68%	45%	57%	75%	78%	74%	79%	79%	74%	78%	72%	74%	75%	69%	70%	77%	86%	46%	47%	54%	Weekday Average 73%
Weekend Average	41%	50%	50%	67%	85%	58%	49%	69%	81%	81%	70%	60%	56%	59%	68%	73%	68%	70%	84%	64%	38%	40%	45%	38%	Weekend Average 66%
Total Average	44%	67%	83%	80%	69%	46%	56%	75%	78%	75%	77%	73%	68%	73%	71%	74%	74%	69%	73%	73%	69%	44%	46%	51%	Total Average 71%

RITIS | PROBE DATA ANALYTICS SUITE

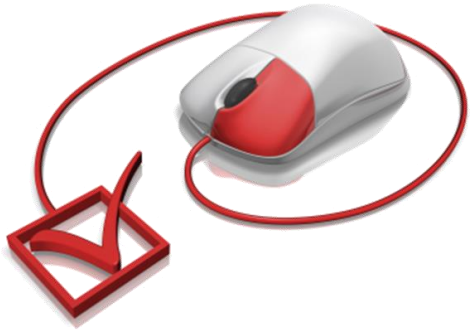
Agency Input Session

Michael Pack
UMD CATT Lab
Director

Agency Input – Polling and Open Discussion

Please type your answers under each question in the pop-up box.

Poll 4 - What kinds of things are you currently doing with RITIS - Planning/Ops, presentations, project/funding justification, etc.- that you'd be willing to share at a future meeting?



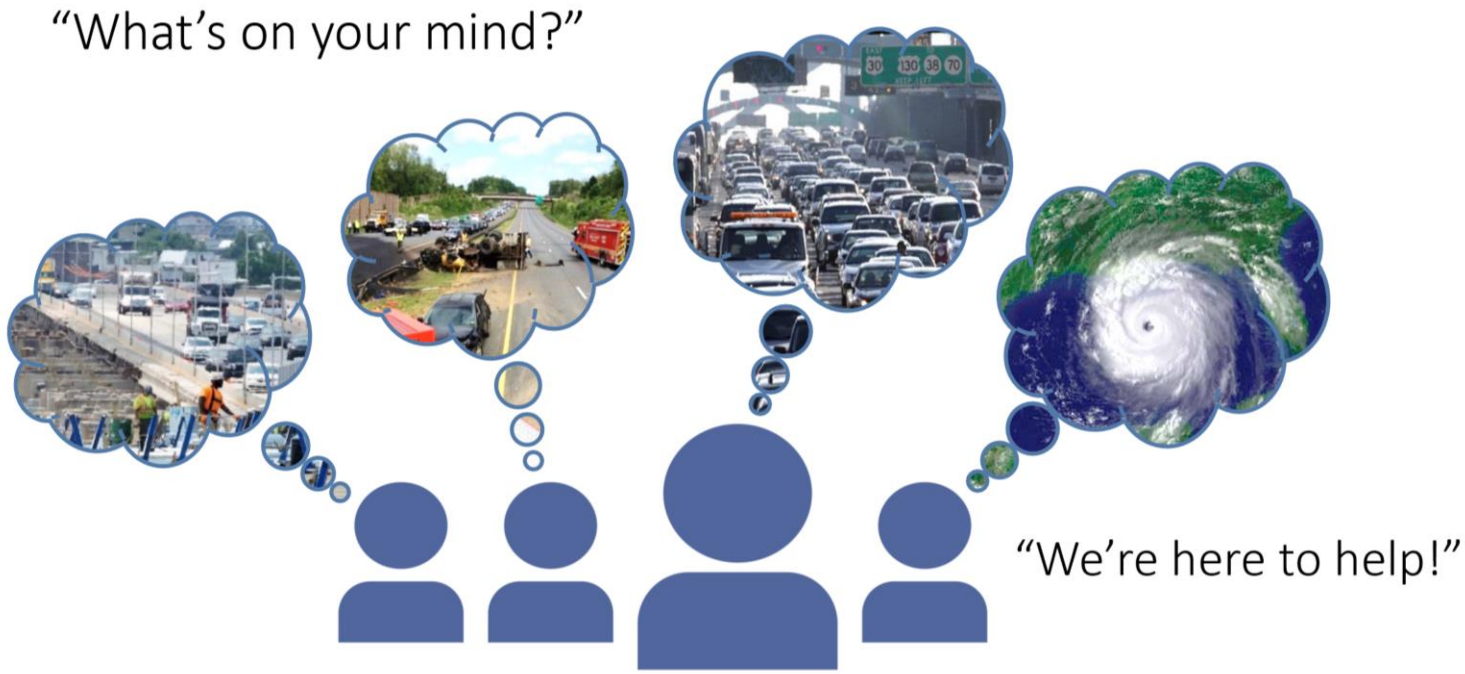
Poll 5 - What frustrates you the most about using RITIS tools (including PDA, Trip Analytics, or Signal Analytics)?

Poll 6 - What features or functionality, if added to RITIS, would make your life easier?

Poll 7 - What are some examples of important things your agency wants to know, that you wish RITIS could help answer?

We want to hear from you!

- All features and functionality are driven by state/MPO users.
- You are welcome to join any of our User Groups / Working Groups / Listening Sessions to brainstorm/define these new features and functionality.
- You can also type your comments to us today either in the Q&A box or with an email to support@ritis.org

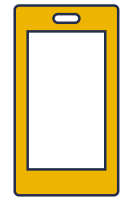


Wrap Up

Matt Glasser
National TSMO Account Lead
Arcadis
RITIS User Group Co-chair

Questions?





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