THE EASTERN TRANSPORTATION COALITION

CONNECTING FOR SOLUTIONS

Rebuilding the Causes of Congestion Pie Chart with Real-World Data

November 10, 2021

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Asking Questions in the Q&A Box

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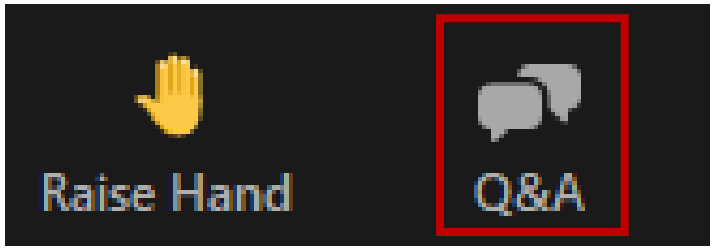

- The questions in the Q&A box will be monitored and answered either between presentations or at the end of the meeting
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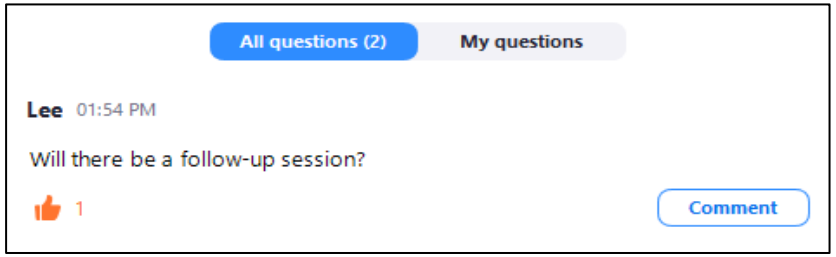


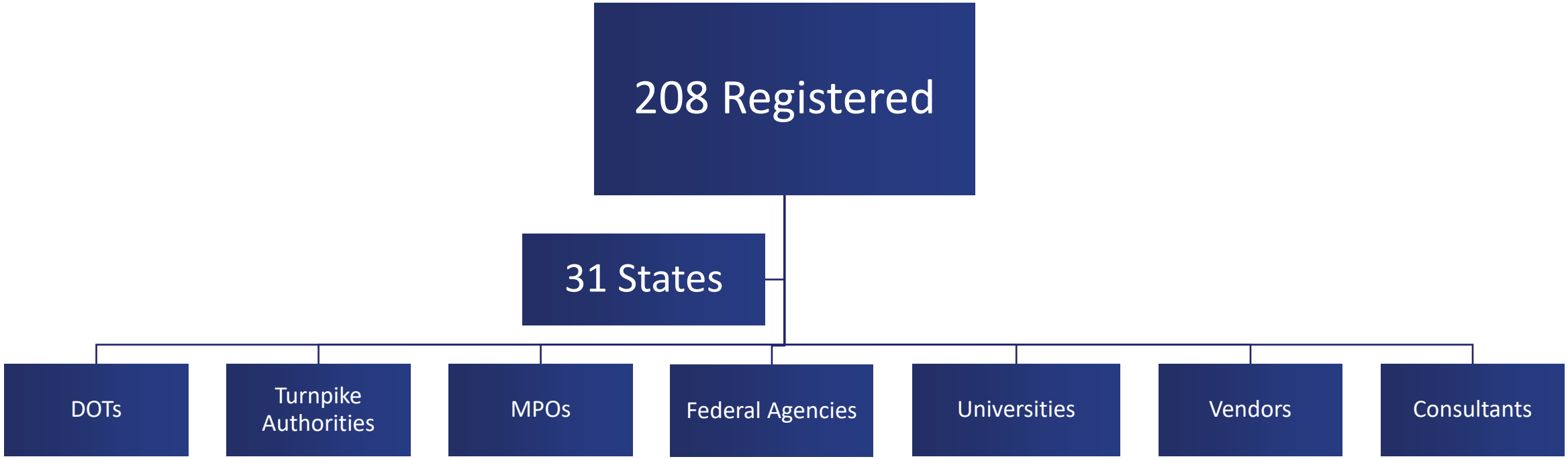
Welcome

Denise Markow, TSMO Program Director
The Eastern Transportation Coalition

Agenda

Topic	Speaker
Welcome from the Coalition	Denise Markow, The Eastern Transportation Coalition
Rebuilding the Causes of Congestion Pie Chart with Real-World Data	Mark Franz, Lead Transportation Analyst University of Maryland CATT Lab
Wrap Up and Remaining Questions	Denise Markow

The Eastern Transportation Coalition Sponsored Event



Rebuilding the Causes of Congestion Pie Chart with Real-World Data

Mark Franz, Lead Transportation Analyst
University of Maryland CATT Lab

Transportation Disruption and Disaster Statistics (TDADS)

Identifying and Quantifying the Causes of Congestion

Mark L. Franz, Ph.D.

Center for Advanced Transportation Technology (CATT Lab)

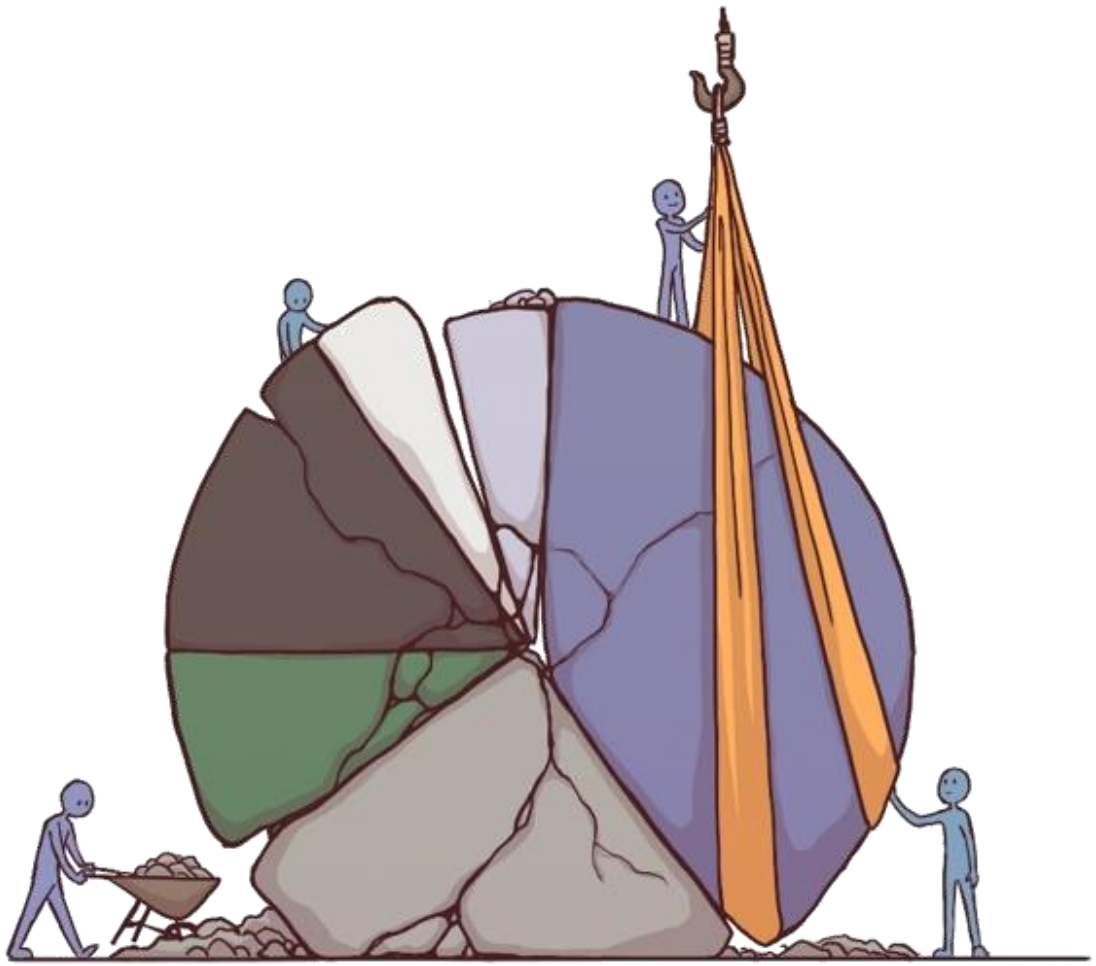
Today's topics

- Motivation
- Objectives
- Steering Committee Members
- Data
- Methodology
- Demo, Use Cases, and Results
- Next Steps

Motivation - Moving Past old assumptions

The congestion pie chart is:

- A national statistic
- 15+ years old
- Largely modeled
- In a nutshell… outdated



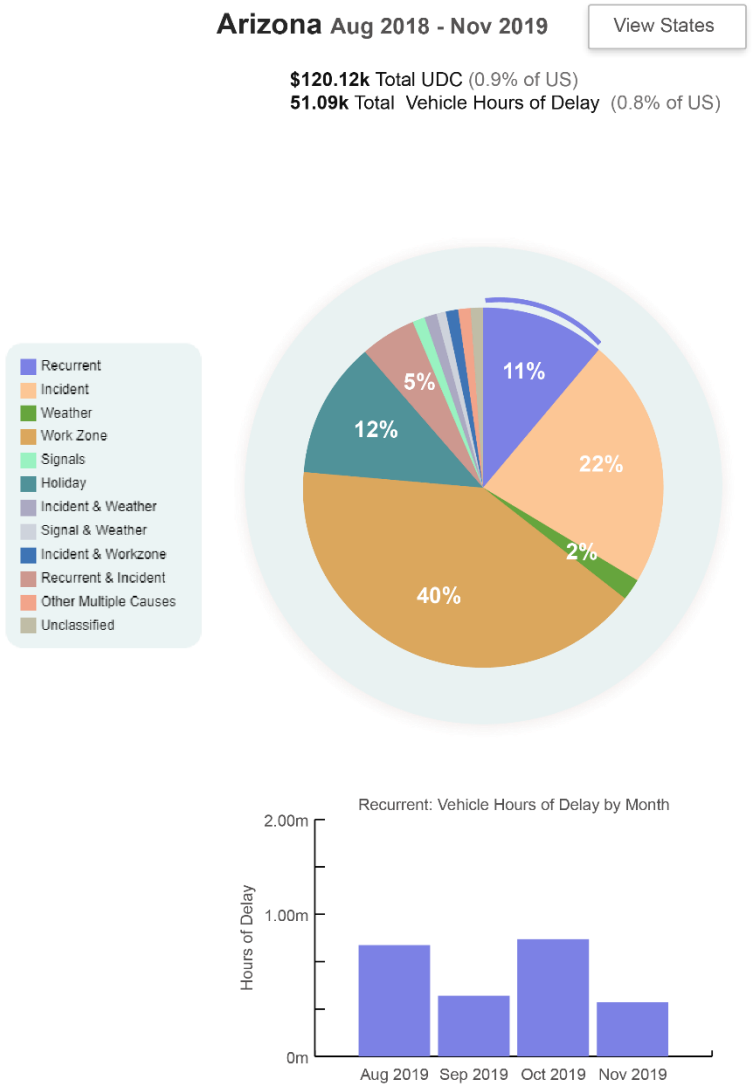
TDADS project goal/objectives

Goal

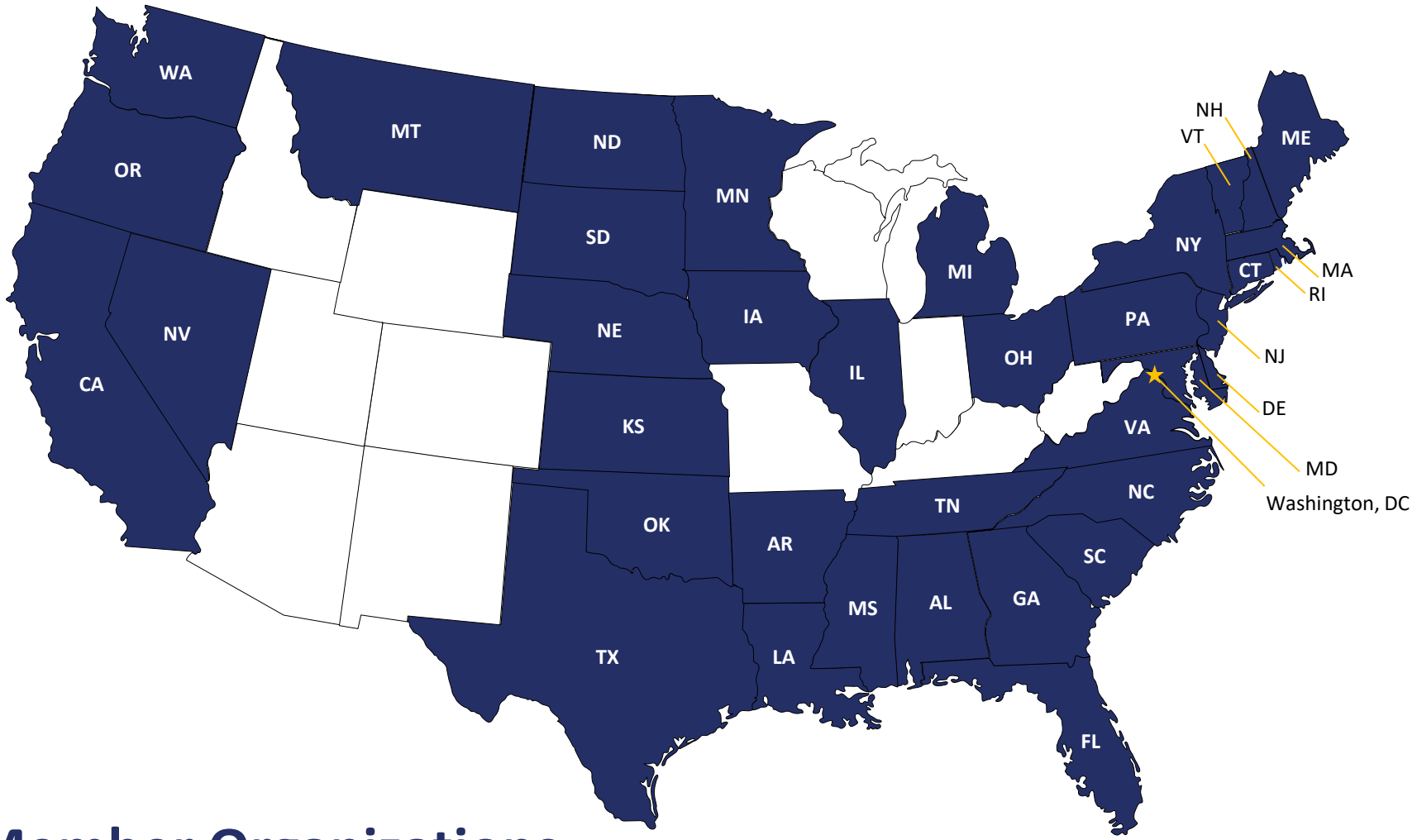
> “Create a method to compile and archive operational related information into a data system that can support the goal of standardization of transportation system disruption, resilience and disaster statistics nationally.”

Objectives

- Upgrade the ancient “pie chart”
  - Across entire NHS
  - Provide consistent data sources across the country
  - One full year of data - 2019
- Create an interactive, easily-accessible tool and put it in the hands of decision-makers
- Practitioner Steering Committee guides ALL work



Steering Committee members



47 Member Organizations

35 State DOTs **9** MPOs **2** Universities **1** National Assoc.

AASHTO	MWCOG
Alabama DOT	Nebraska DOT
Arkansas DOT	Nevada DOT
Baltimore Metropolitan Council	New Hampshire DOT
Birmingham MPO (AL)	New Jersey DOT
California DOT	New York State DOT
City of Charlotte, NC	North Carolina DOT
Connecticut DOT	North Dakota DOT
Connecticut Metropolitan COG	Ohio DOT
Delaware DOT	Oklahoma DOT
District DOT	Pennsylvania DOT
DVRPC	Rhode Island Statewide Planning
Florida DOT	South Alabama Regional Planning Commission
Georgia DOT	South Carolina DOT
Iowa DOT	South Dakota DOT
Kansas DOT	South Jersey Transportation Planning Organization
Louisiana DOT	Tennessee DOT
Maine DOT	Texas DOT
Maryland DOT - SHA	University of Alabama
Massachusetts DOT	University Of Maryland CATT Lab
Michigan DOT	Vermont AOT
Minnesota DOT	Virginia DOT
Mississippi DOT	Washington State DOT
Montana DOT	

Data Sources

Temporal Coverage: CY 2019
Spatial Coverage: Entire National Highway System (NHS)
NHS Volume data provided by the Highway Performance Monitoring System (HPMS)

Data Item	Data source	Data Size
Congestion/Disruption	1-minute probe data (INRIX)	**370K** Highway segments with data for each minute
Recurrent Congestion	1-minute probe data (INRIX)	
Incidents	Waze	**78M** Waze Incident events
Weather	NOAA radar and Waze	**5.6M** Waze weather events and 2-minute radar readings for each 370k highway segment
Work Zones	Waze	**8M** Waze work zones
Holiday Travel	Holiday Calendar (including travel days before/after holiday)	**46** holiday travel days
Signals	OSM Traffic Signal Database	**332k** traffic signals (each intersection approach was associated with a signal)
Multiple Causes	Combination of above	
Unclassified Disruption	NA	

Methodology Summary

Step 1: Identify

Discover when and where congestion occurs

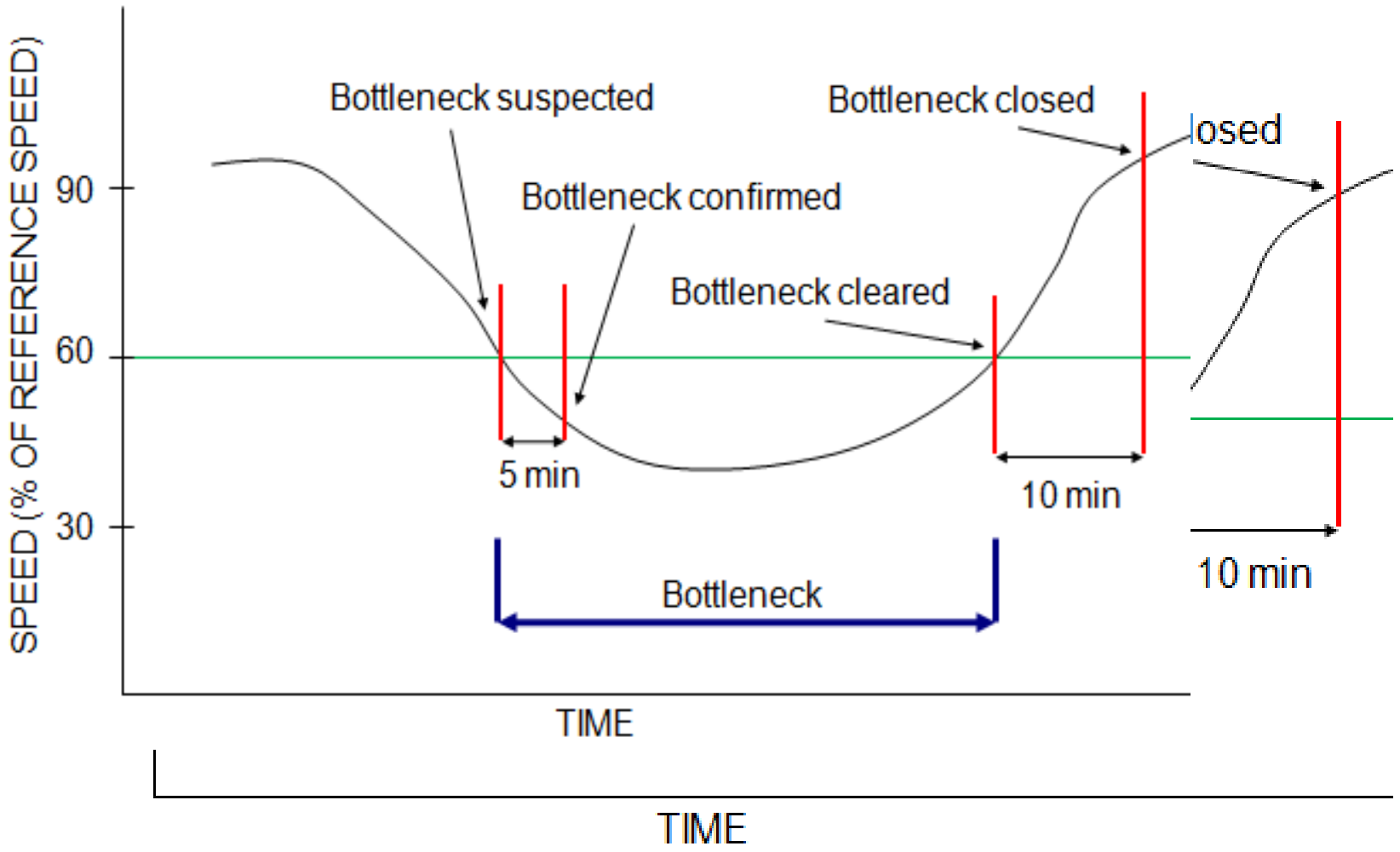
Step 2: Quantify

Estimate the severity of congestion

Step 3: Categorize

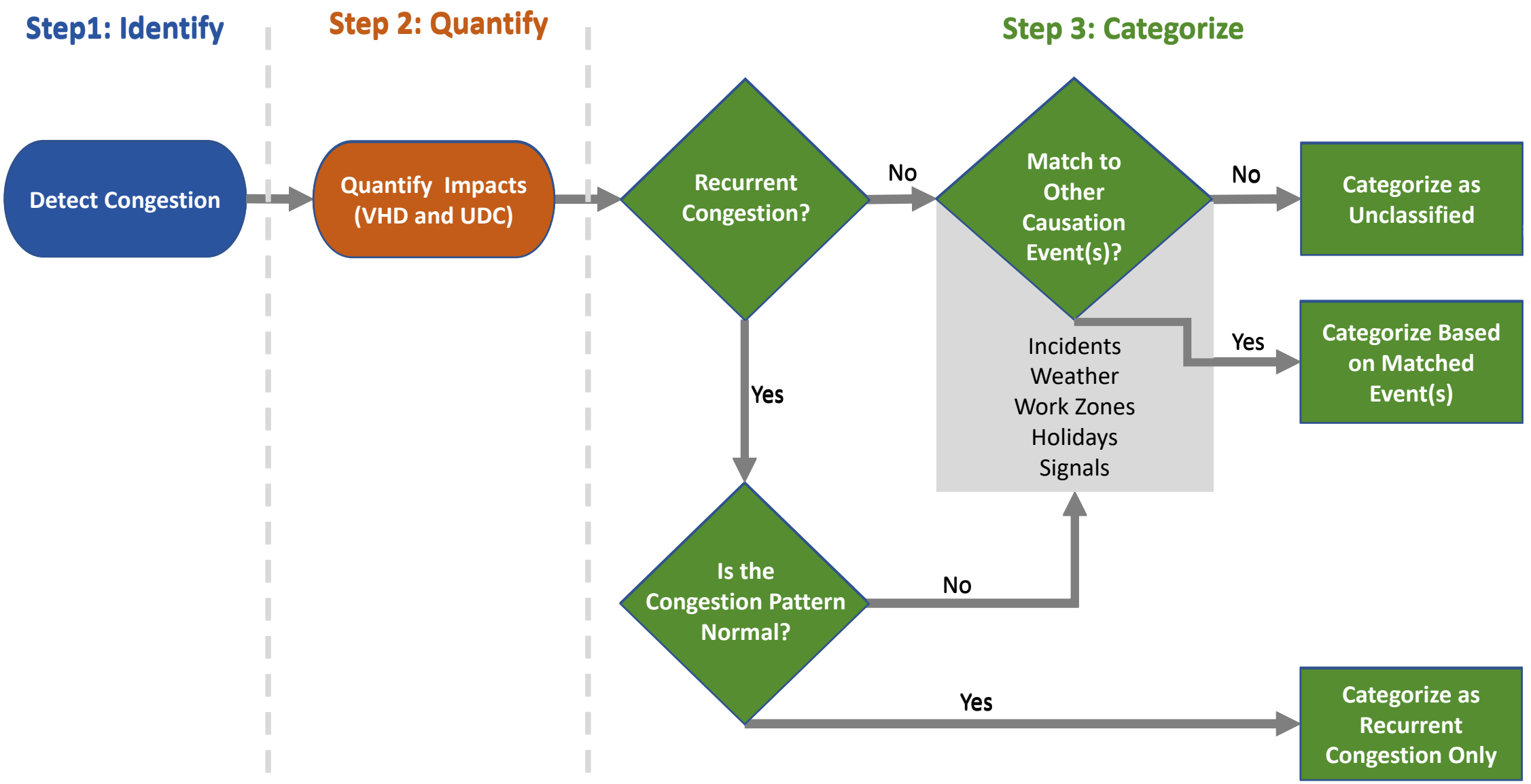
Match congestion to a specific cause

Methodology: Detecting Congestion

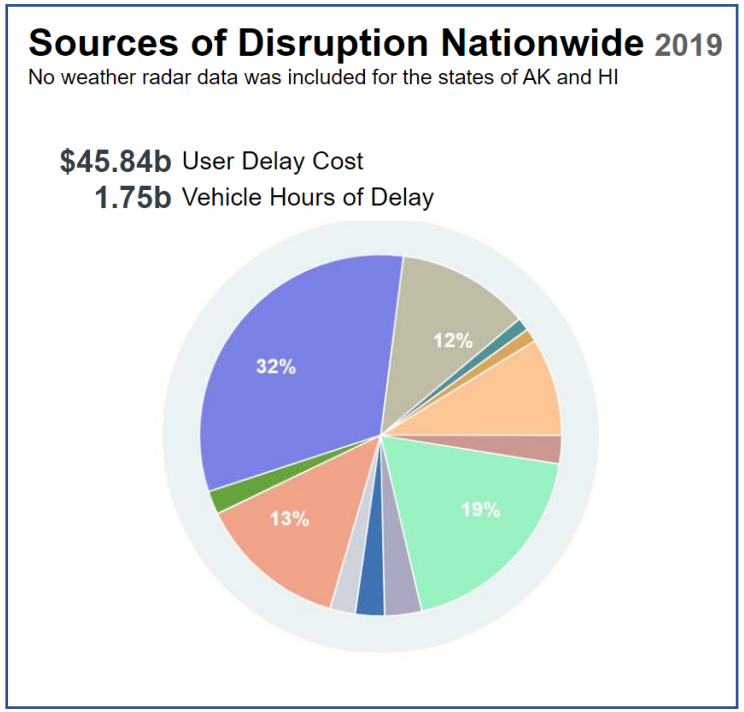


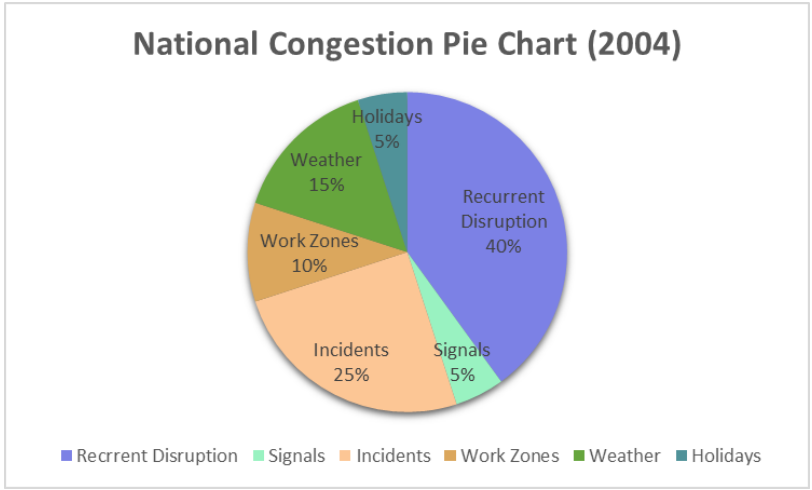
Lund, A., Pack, M.L., Plaisant, C., and Franz, M.L. Algorithms for Identifying and Ranking Bottlenecks Using Probe Data. Transportation Research Board 96h Annual Meeting. Washington, D.C. 2017.

Methodology Logic



Results –2019 National vs 2004 National



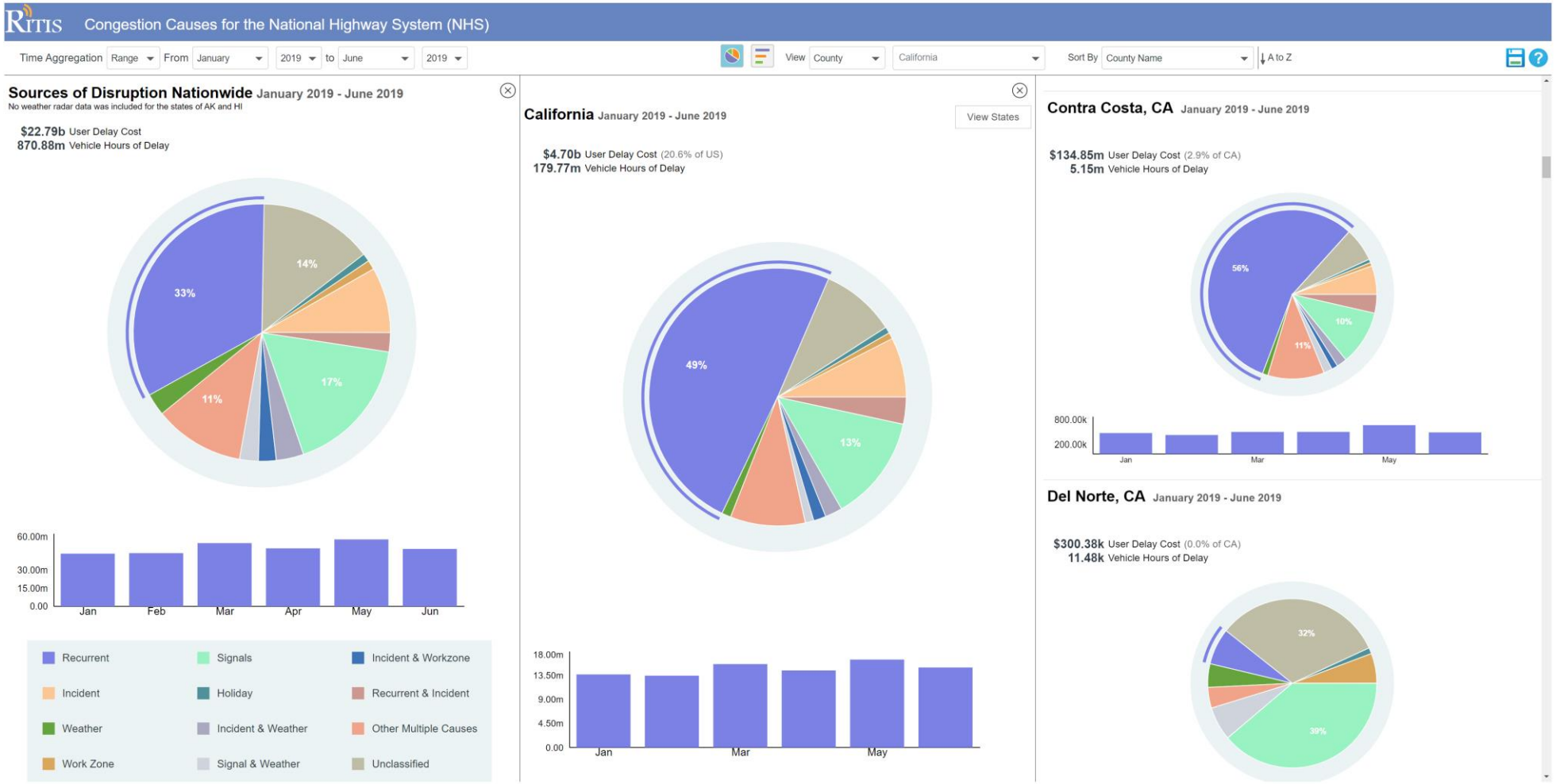


Congestion Cause	National 2004 %	National 2019 %	Change
Recurrent Congestion	40%	32%	-8%
Incidents	25%	9%	-16%
Weather	15%	2%	-13%
Work Zones	10%	1%	-9%
Signals	5%	19%	14%
Holidays	5%	1%	-4%
Incident & Weather	NA	3%	NA
Signal & Weather	NA	2%	NA
Incident & Work Zone	NA	3%	NA
Incident & Recurrent	NA	3%	NA
Other Multiple Causes	NA	13%	NA
Unclassified	NA	12%	NA

Not included in 2004 study

DEMO

- Use Case 1: Urban versus Rural County in Oregon
- Use Case 2: Weather Impacts in Colorado

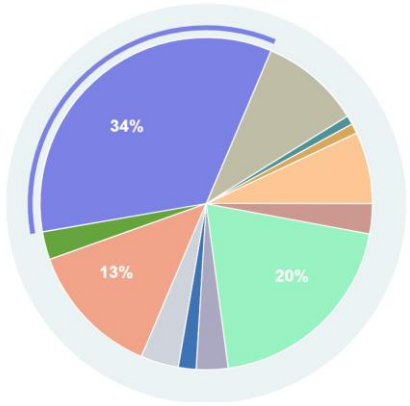


Results
Annual Pie Charts with Monthly Recurrent Congestion Trend

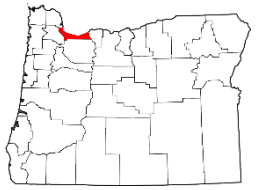
- Recurrent
- Incident
- Weather
- Work Zone
- Signals
- Holiday
- Incident & Weather
- Signal & Weather
- Incident & Workzone
- Recurrent & Incident
- Other Multiple Causes
- Unclassified

Oregon 2019

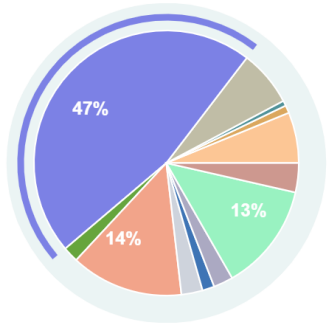
$543.88m User Delay Cost (1.2% of US)
20.78m Vehicle Hours of Delay



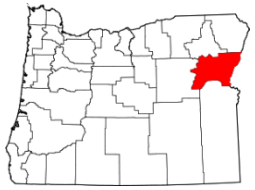
Multnomah, OR 2019



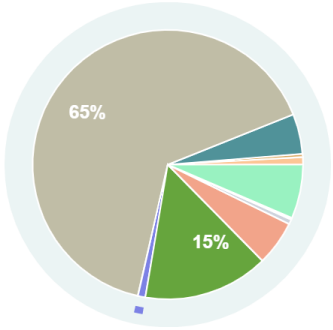
$276.39m User Delay Cost (50.8% of OR)
10.56m Vehicle Hours of Delay

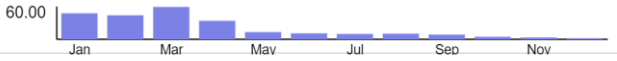


Baker, OR 2019

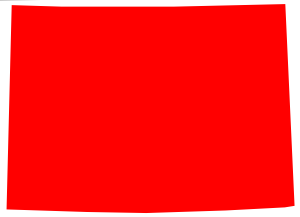


$710.64k User Delay Cost (0.1% of OR)
27.16k Vehicle Hours of Delay



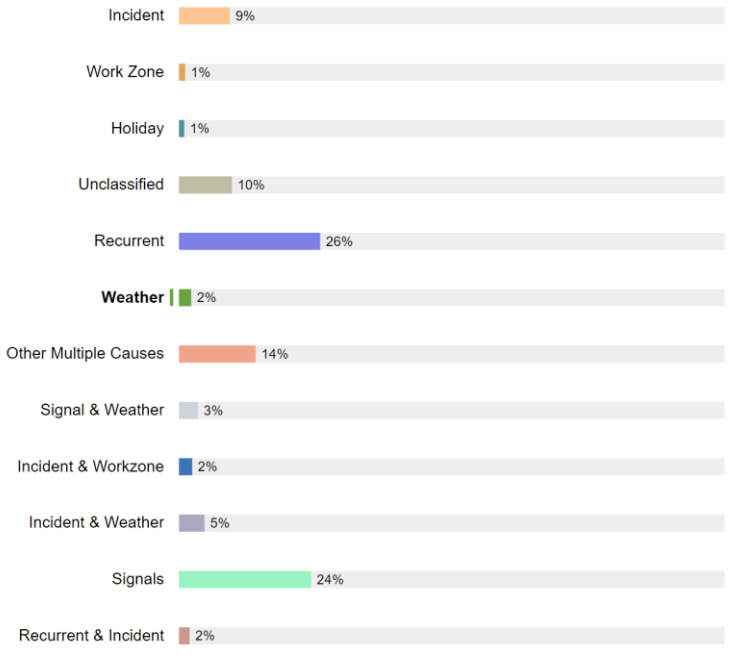


Results
Annual Bar Charts with Monthly Weather CongestionTrend

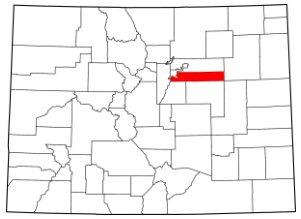


Colorado 2019

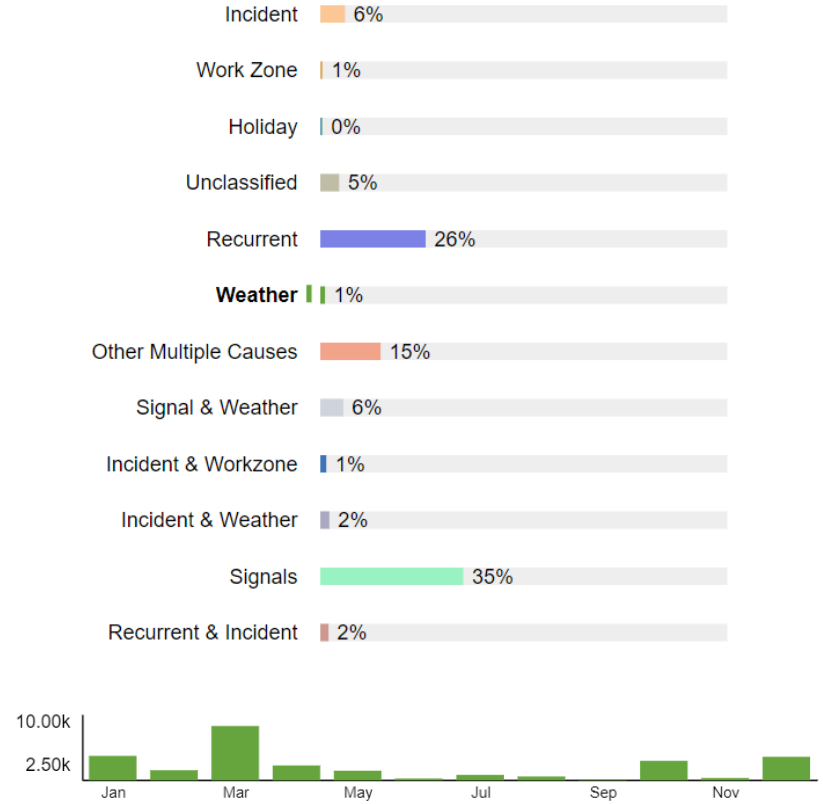
$936.11m User Delay Cost (2.0% of US)
35.77m Vehicle Hours of Delay



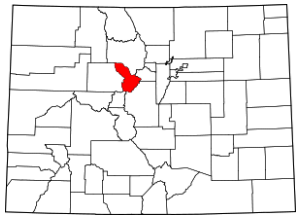
Arapahoe, CO 2019



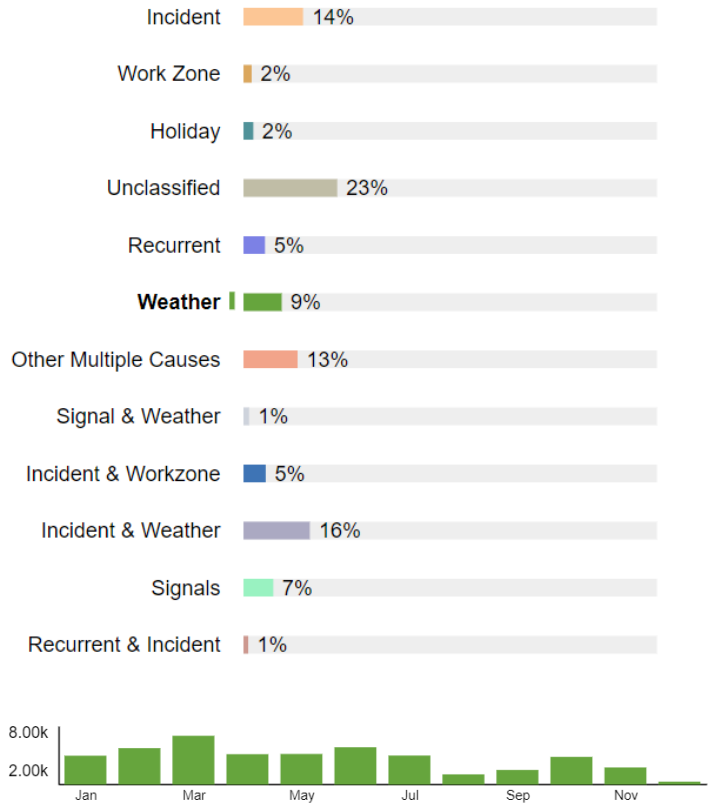
$98.39m User Delay Cost (10.5% of CO)
3.76m Vehicle Hours of Delay



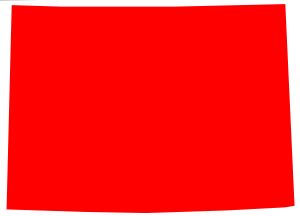
Summit, CO 2019



$7.47m User Delay Cost (0.8% of CO)
285.44k Vehicle Hours of Delay



Results
Annual Bar Charts with Monthly Weather CongestionTrend



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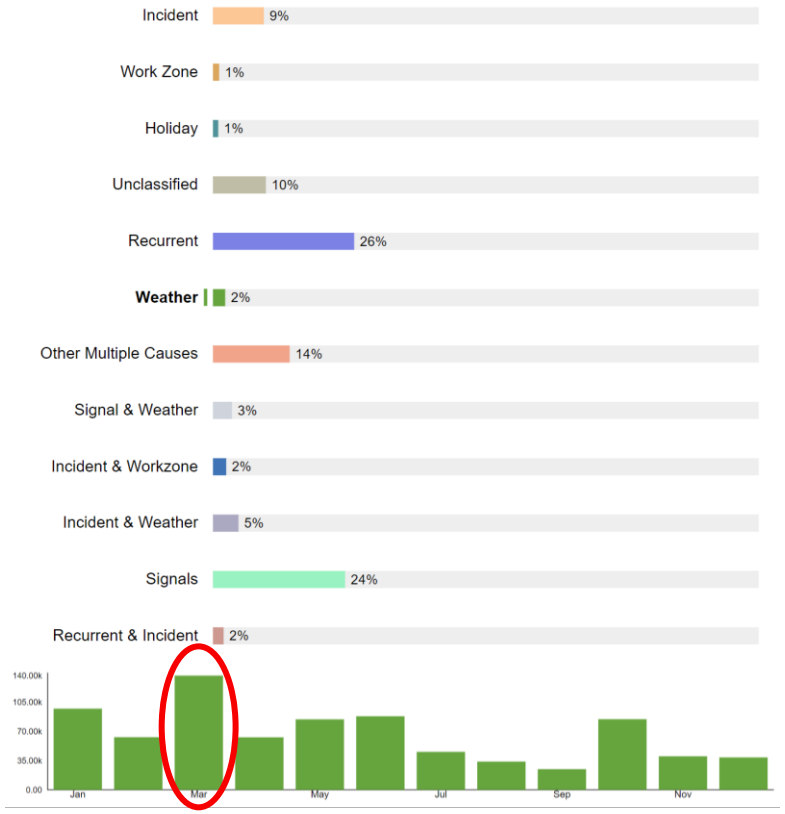
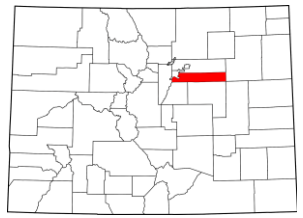


Arapahoe, CO 2019



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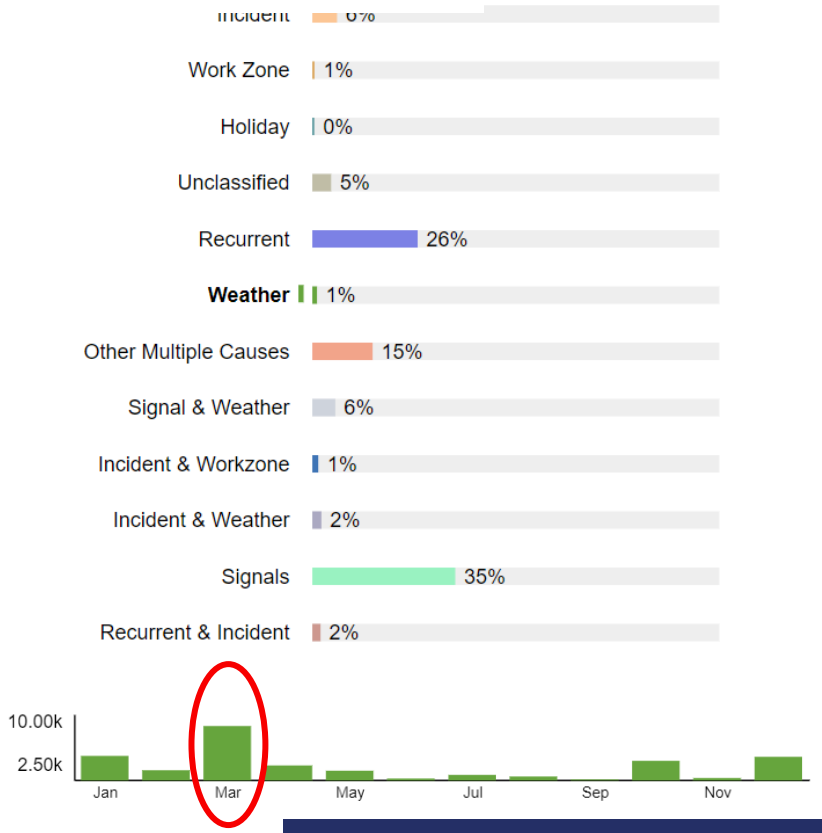
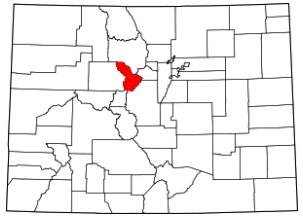
3.76m Vehicle Hours of Delay



Summit, CO 2019



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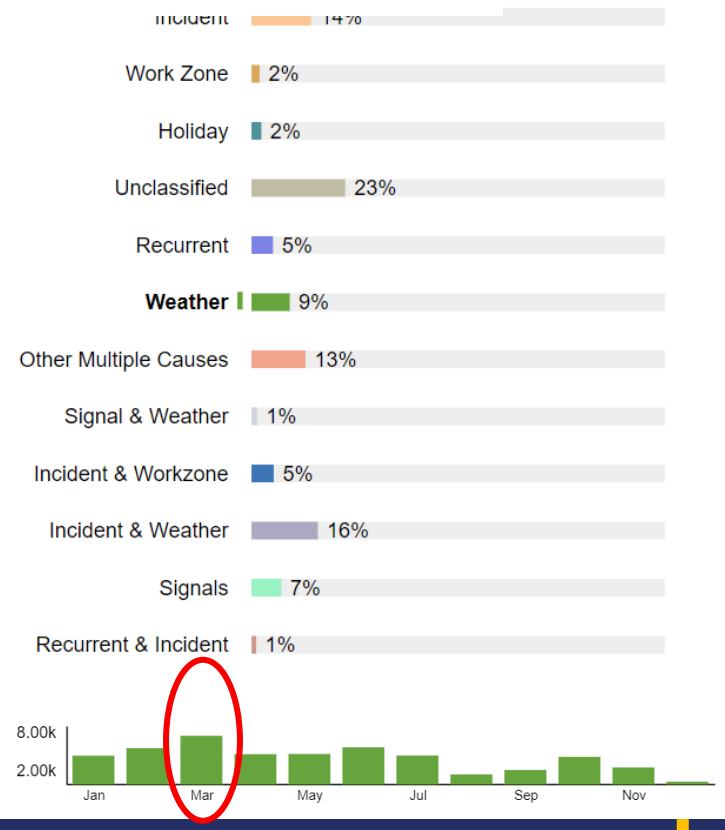
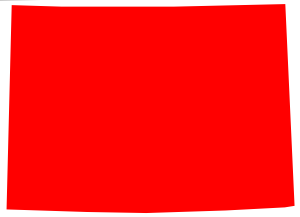
285.44k Vehicle Hours of Delay

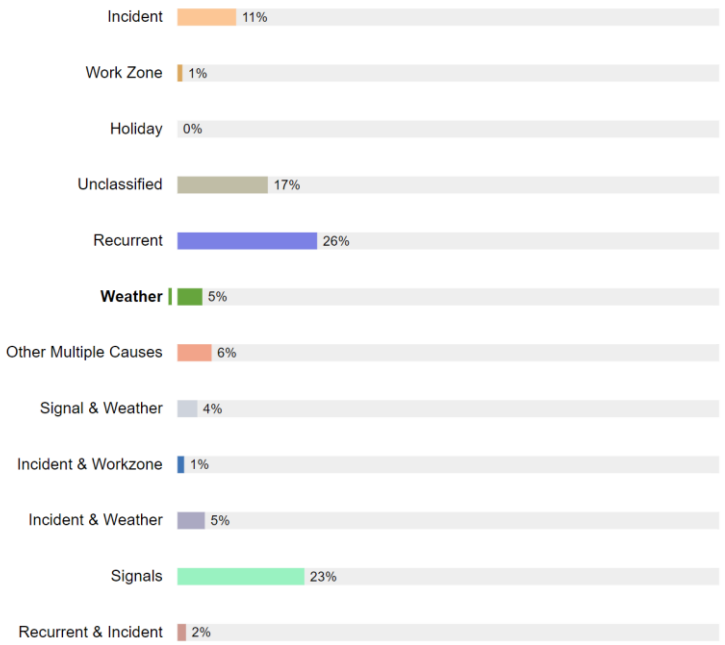


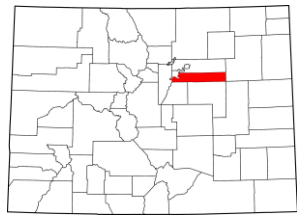
Results
March 2019 Bar Charts for Weather Congestion



Colorado March 2019

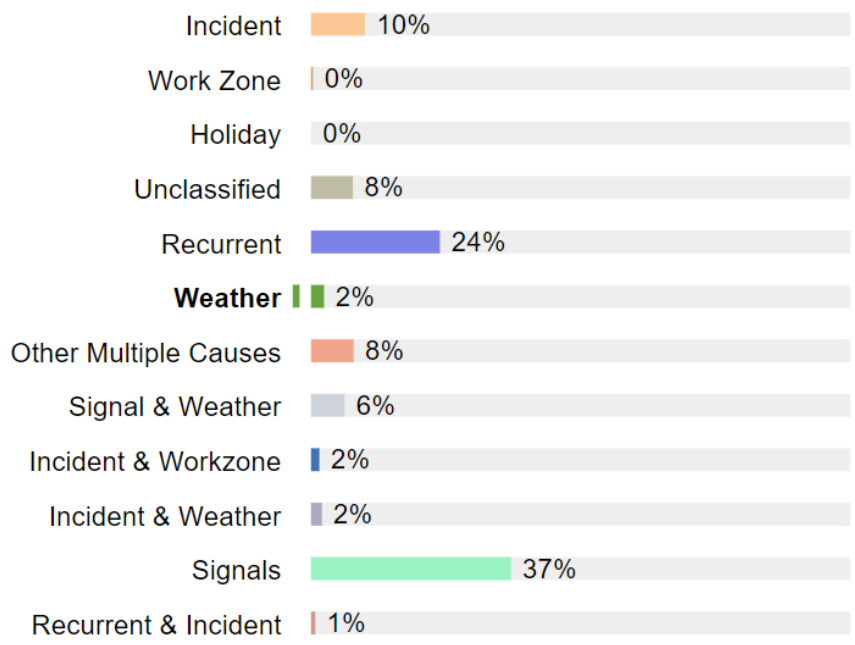
$78.00m User Delay Cost (1.9% of US)
2.98m Vehicle Hours of Delay

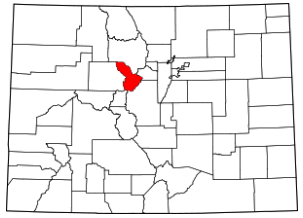




Arapahoe, CO March 2019

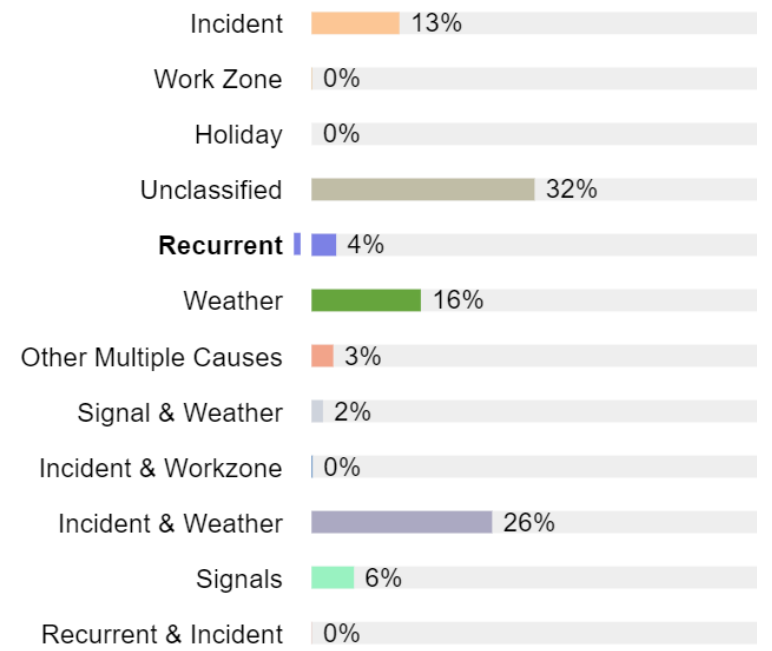
$7.31m User Delay Cost (9.4% of CO)
279.50k Vehicle Hours of Delay





Summit, CO March 2019

$1.40m User Delay Cost (1.8% of CO)
53.47k Vehicle Hours of Delay



Other Potential Use Cases

- Justification of continued funding for various operational strategies and/or requesting additional funding for new countermeasures related to a "Cause"
- Did the new transit line reduce recurrent congestion?
- Did the increased road plowing decrease delay during a snowstorm?
- Did Safety Service Patrol (SSP) staging reduce incident induced delay?
- How much delay occurs at signalized intersections in rural regions?
- Does inclement weather make work zone delays more severe? If so, by how much?

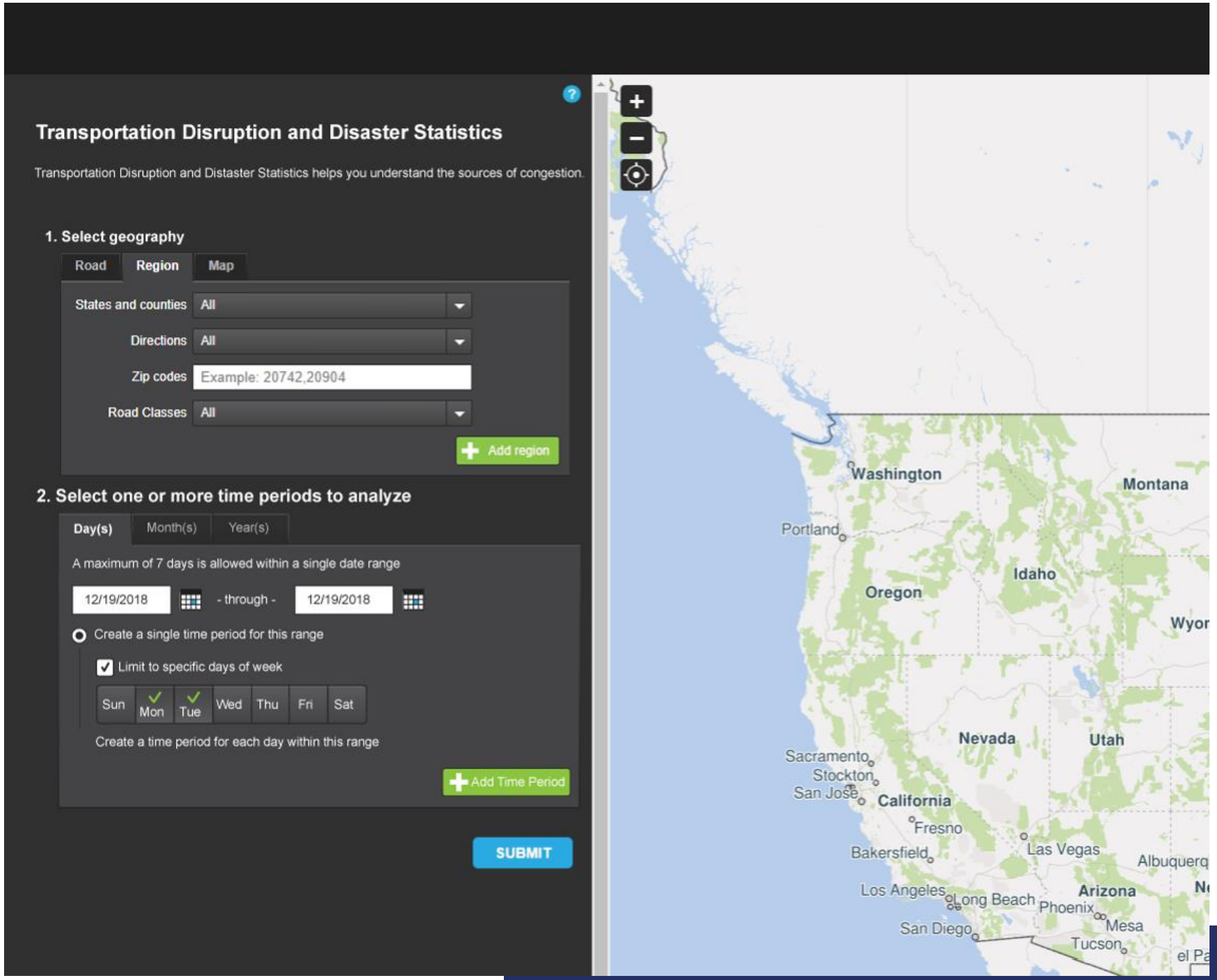
Next Steps for BTS Funding

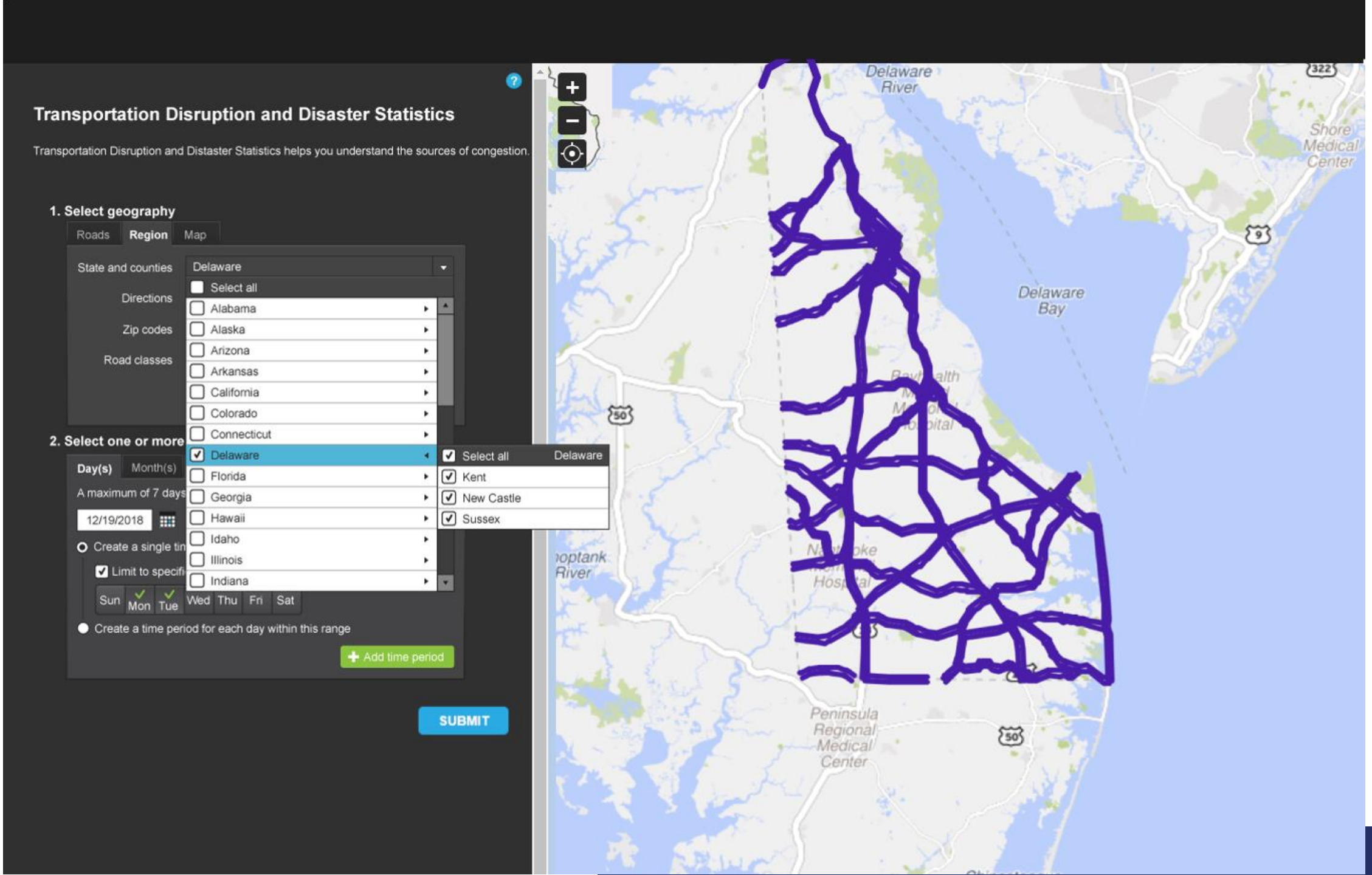
- Other potential future research paths
  - Segregating signalized corridors – some delay at signals is unavoidable
  - Inclusion of user defined special events – sporting events, parades, protests, etc.
  - Enhanced data filtering – user can filter by road class and AADT ranges
  - Trend Analytics and Comparative Analysis – compare results by time of day (AM Peak vs PM Peak), compare regions (Mid-Atlantic versus New-England)

Next Steps for RITIS Funding

- RITIS and PDA have an established working group
- Working group funded a Deep-Dive Congestion Pie Chart Tool for ***full RITIS Agency Members*** to include:
  - Custom road and date/hour of day selection
  - Non-NHS routes
  - Additional years of data for longer term trend analysis
  - Add agency data for incidents, work zones and signals
- Challenges of deep-dive tool
  - Real-time weather conflation
  - Backfilling data – processing historical data on all roads
  - Visualizing multiple causes on charts
  - Volumes on non-NHS roads

Causes of Congestion Deep-Dive Tool Interface Designs


Transportation Disruption and Disaster Statistics
Transportation Disruption and Distaster Statistics helps you understand the sources of congestion.
1. Select geography
Road
Region
Map
States and counties
All
Directions
All
Zip codes
Example: 20742,20904
Road Classes
All
Add region
2. Select one or more time periods to analyze
Day(s)
Month(s)
Year(s)
A maximum of 7 days is allowed within a single date range
12/19/2018
- through -
12/19/2018
Create a single time period for this range
Limit to specific days of week
Sun
Mon
Tue
Wed
Thu
Fri
Sat
Create a time period for each day within this range
Add Time Period
SUBMIT
Washington
Montana
Portland
Idaho
Oregon
Nevada
Utah
Sacramento
Stockton
San Jose
California
Fresno
Bakersfield
Las Vegas
Albuquerq
Los Angeles
Long Beach
Arizona
Phoenix
Mesa
San Diego
Tucson


Transportation Disruption and Disaster Statistics
Transportation Disruption and Distaster Statistics helps you understand the sources of congestion.
1. Select geography
Roads
Region
Map
State and counties
Delaware
Directions
Zip codes
Road classes
Select all
Alabama
Alaska
Arizona
Arkansas
California
Colorado
Connecticut
Delaware
Florida
Georgia
Hawaii
Idaho
Illinois
Indiana
Select all
Delaware
Kent
New Castle
Sussex
2. Select one or more
Day(s)
Month(s)
A maximum of 7 days
12/19/2018
Create a single tin
Limit to specifi
Sun
Mon
Tue
Wed
Thu
Fri
Sat
Create a time period for each day within this range
Add time period
SUBMIT
Delaware River
Delaware Bay
Shore Medical Center
Peninsula Regional Medical Center
50
9
322

Causes of Congestion Graphs

Report Parameters

Delaware
4364 miles of road

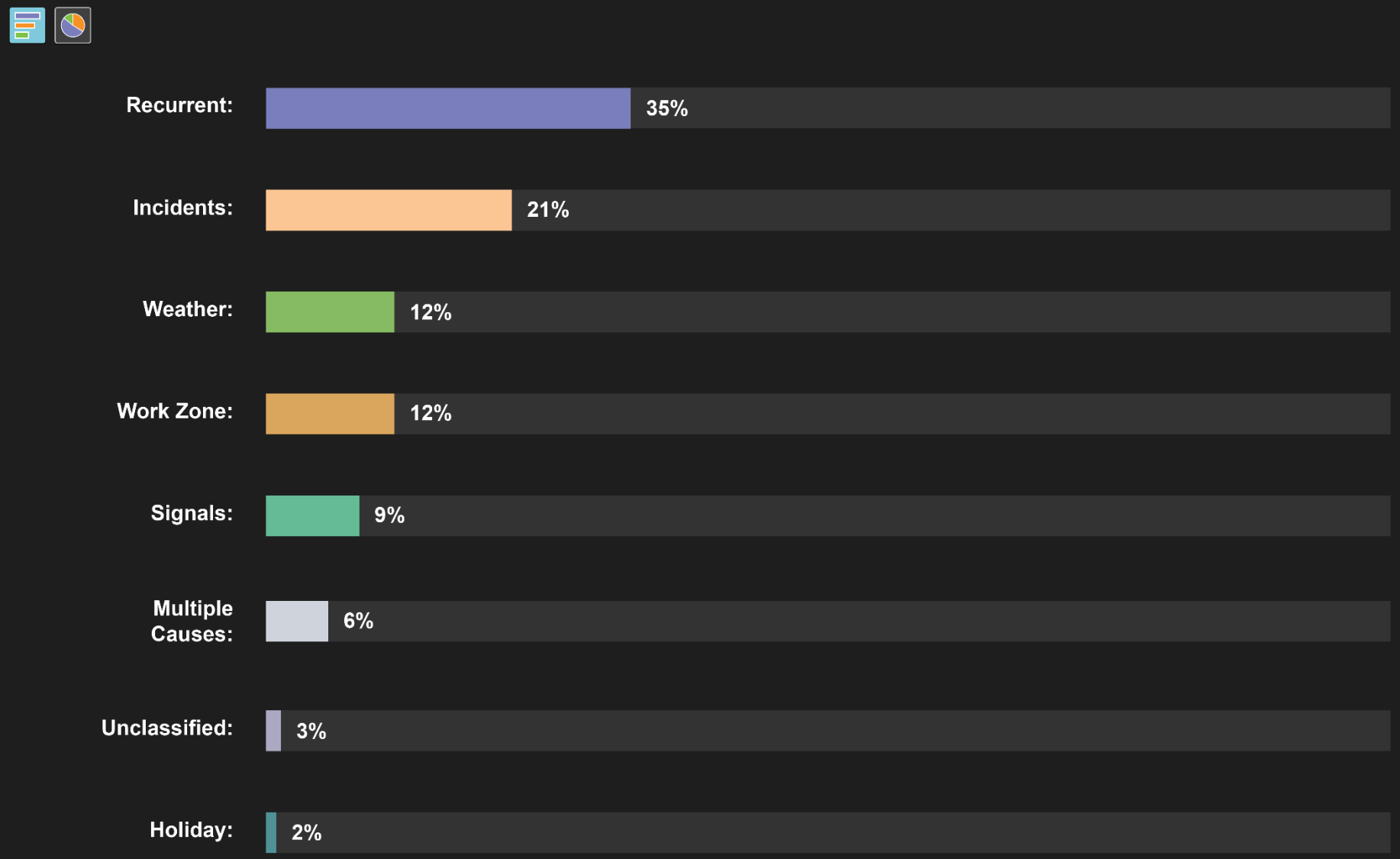
December 24, 2018 to December 25th, 2018
S M T W T F S
12:00 AM - 11:59 PM

Average Cost of Delay
Cost of Passenger Delay: $17.91/hr
Cost of Commercial Delay: $100.49/hr

Causes of Congestion Summary

Sums of all congestion occurrences in the selected geography and date range.

Vehicle Hours of Delay:	5,245 hrs
Passenger:	$140k
Commercial:	$210k
Total:	$350k



Causes of Congestion Graphs

Report Parameters

Delaware
4364 miles of road

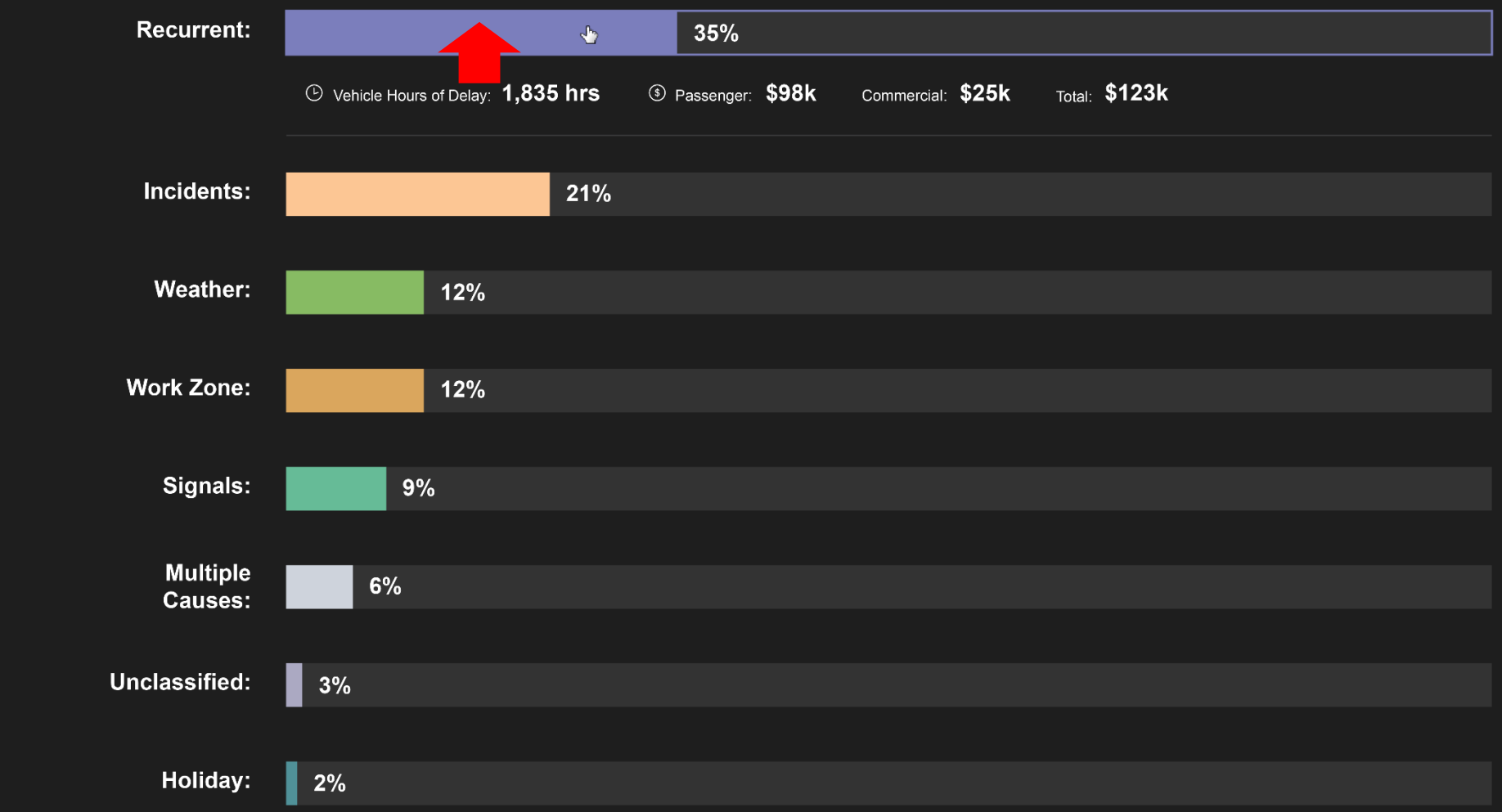
December 24, 2018 to December 25th, 2018
S M T W T F S
12:00 AM - 11:59 PM

Average Cost of Delay
Cost of Passenger Delay: $17.91/hr
Cost of Commercial Delay: $100.49/hr

Causes of Congestion Summary

Sums of all congestion occurrences in the selected geography and date range.

Vehicle Hours of Delay:	5,245 hrs
Passenger:	$140k
Commercial:	$210k
Total:	$350k



Causes of Congestion Graphs

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Recurrent:	35%	Vehicle Hours of Delay:	1,835 hrs	Passenger:	$98k	Commercial:	$25k	Total:	$123k
Incidents:	21%	Vehicle Hours of Delay:	1,097 hrs	Passenger:	$37k	Commercial:	$64k	Total:	$101k
Weather:	12%	Vehicle Hours of Delay:	1,835 hrs	Passenger:	$44k	Commercial:	$47k	Total:	$91k
Work Zone:	12%	Vehicle Hours of Delay:	1,835 hrs	Passenger:	$21k	Commercial:	$68k	Total:	$89k
Signals:	9%	Vehicle Hours of Delay:	1,835 hrs	Passenger:	$38k	Commercial:	$27k	Total:	$65k
Multiple Causes:	6%	Vehicle Hours of Delay:	1,835 hrs	Passenger:	$19k	Commercial:	$35k	Total:	$54k

Causes of Congestion Graphs

Save as
Excel file - data
PDF - report
Save

Report Parameters

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4364 miles of road

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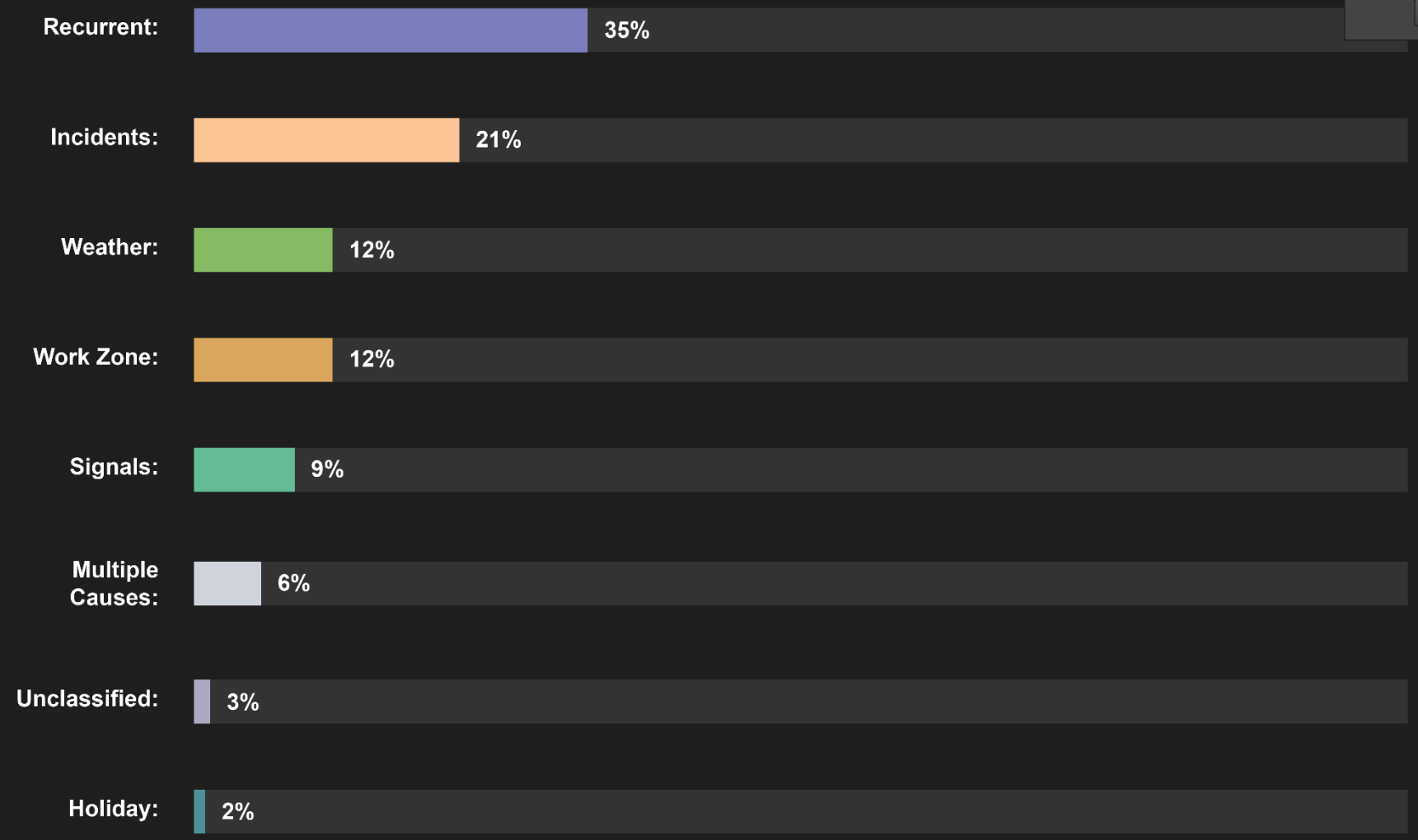

Causes of Congestion Graphs

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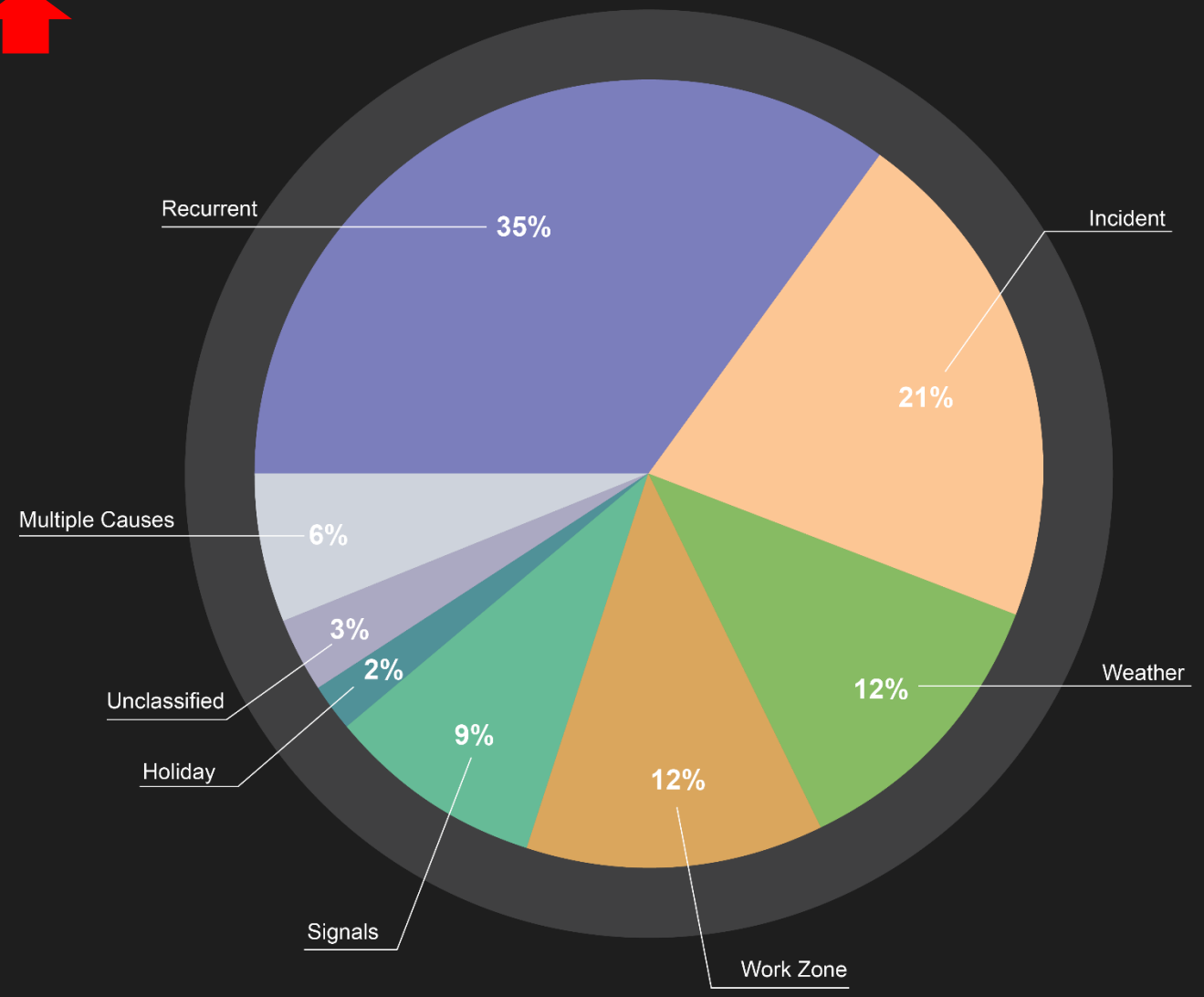

Legend

Percentages of congestion types in the selected geography and date range.

Recurrent:	35%
Incidents:	21%
Weather:	12%
Work Zone:	12%
Signals:	9%
Holiday:	2%
Unclassified:	3%
Multiple Causes:	6%

Incident & Recurrent:	2%
Incident & Weather:	1%
Incident & Work Zone:	1%
Signal & Weather:	1%
Other Multiple Causes:	1%

Causes of Congestion Graphs

Report Parameters

Delaware
4364 miles of road

December 24, 2018 to December 25th, 2018
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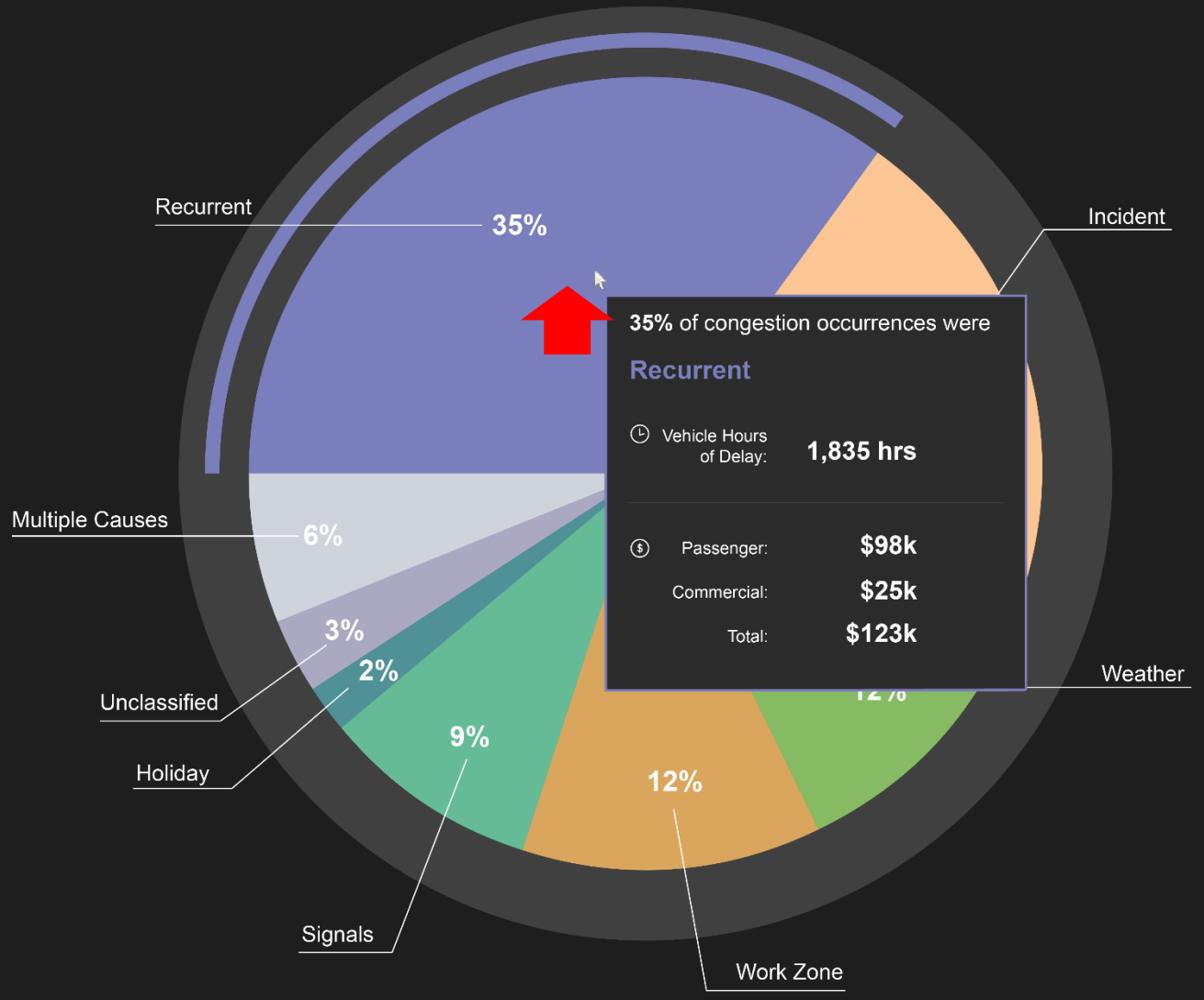

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Incident & Recurrent:	2%
Incident & Weather:	1%
Incident & Work Zone:	1%
Signal & Weather:	1%
Other Multiple Causes:	1%

Tool Links

Access
For those who have access to RITIS - https://ritis.org/archive/congestion
For those without access to RITIS - https://congestion-causes.ritis.org/

Tutorial
https://ritis.org/tutorials/videos/634641555

Help Page
https://congestion-causes.ritis.org/help

Questions?

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UMD CATT Lab

mfranz1@umd.edu

Wrap Up

Denise Markow, TSMO Program Director
The Eastern Transportation Coalition

Additional Questions

Meeting information & presentations will be posted to The Eastern Transportation Coalition website.
Participants will receive a link to the presentations after they are posted.

THE EASTERN TRANSPORTATION COALITION

CONNECTING FOR SOLUTIONS

THANK YOU!

For Questions or Additional Information, please contact:

Denise Markow, TSMO Director, *301-789-9088,* *dmarkow@tetcoalition.org*