Identifying and Quantifying the Causes of Congestion

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Project Sponsor: Bureau of Transportation Statistics

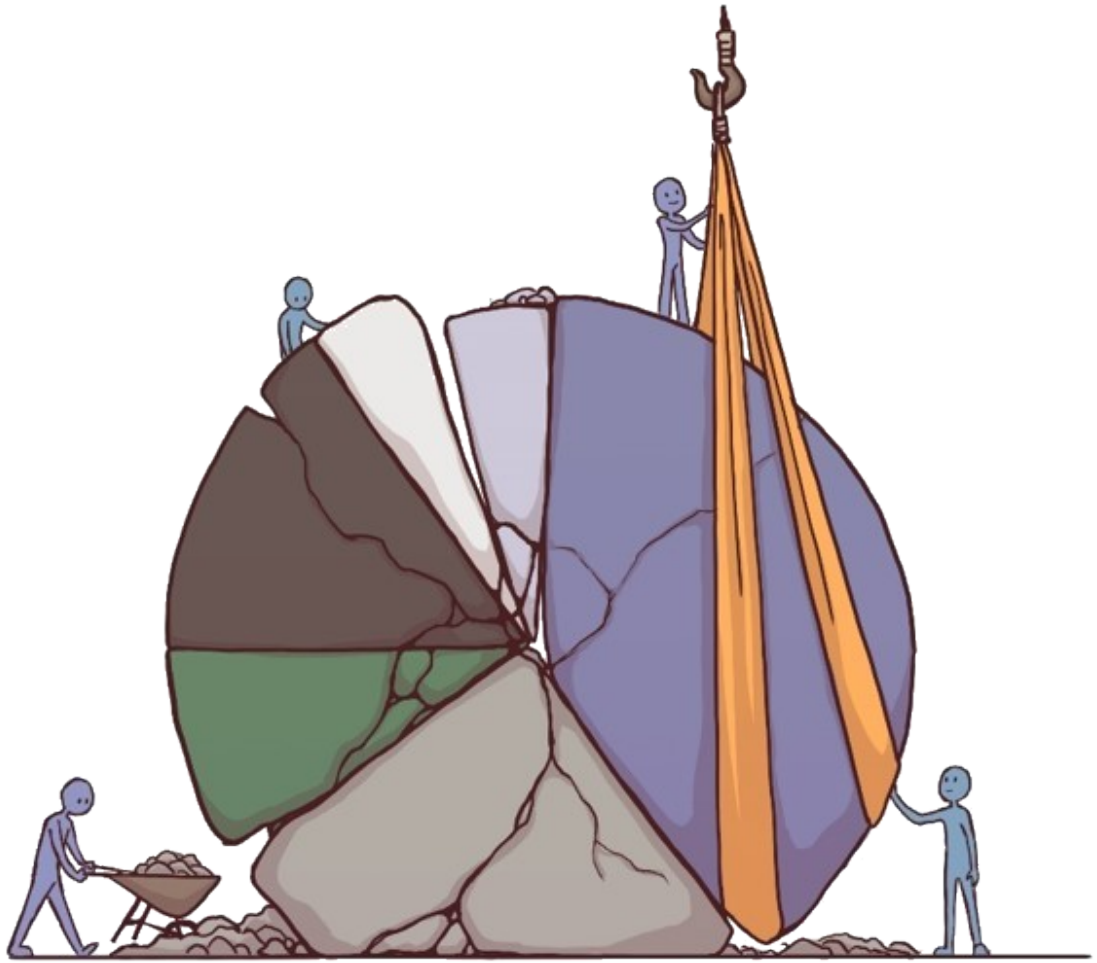
Today's topics

- Motivation
- Goals and Objectives
- Data
- Methodology
- Demo, Use Cases, and Results
- Next Steps

Motivation- Moving Past old assumptions

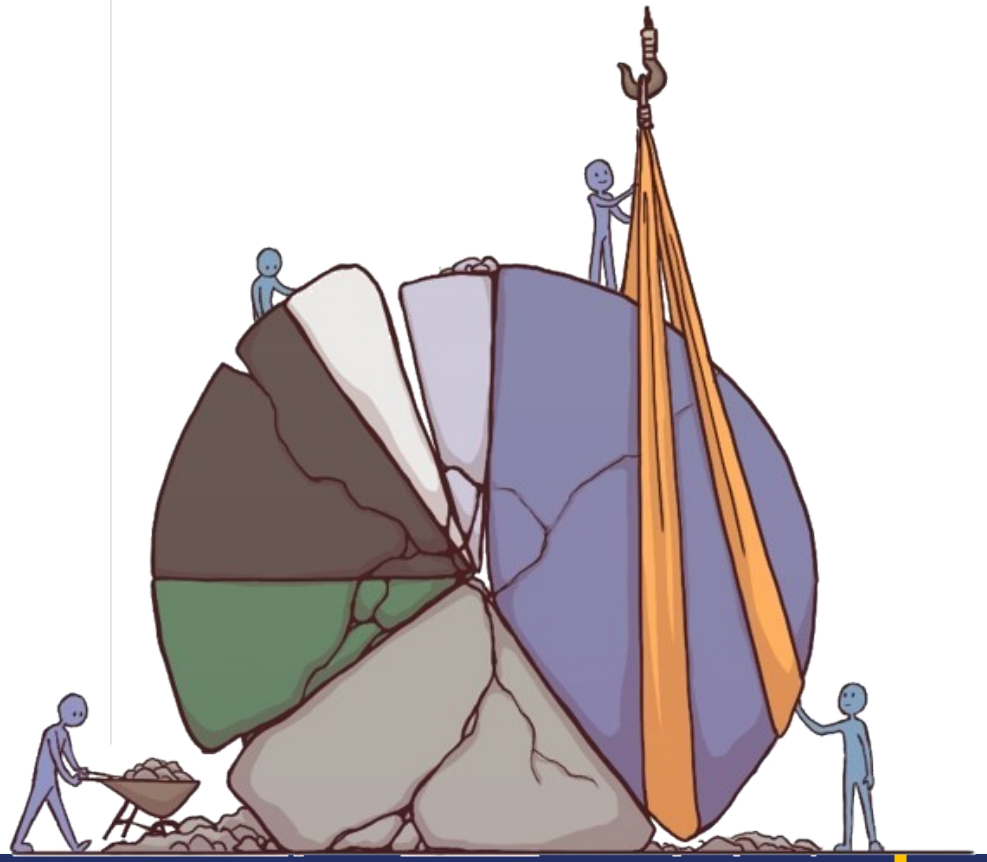
The congestion pie chart is:

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- In a nutshell… outdated



Project goals & 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



Congestion Causes and 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 (including non-NHS routes, each intersection approach was associated with a signal)
Multiple Causes	Combination of above	
Unclassified Disruption	NA	

Methodology Summary

Step1: Identify

Discover when and where congestion occurs

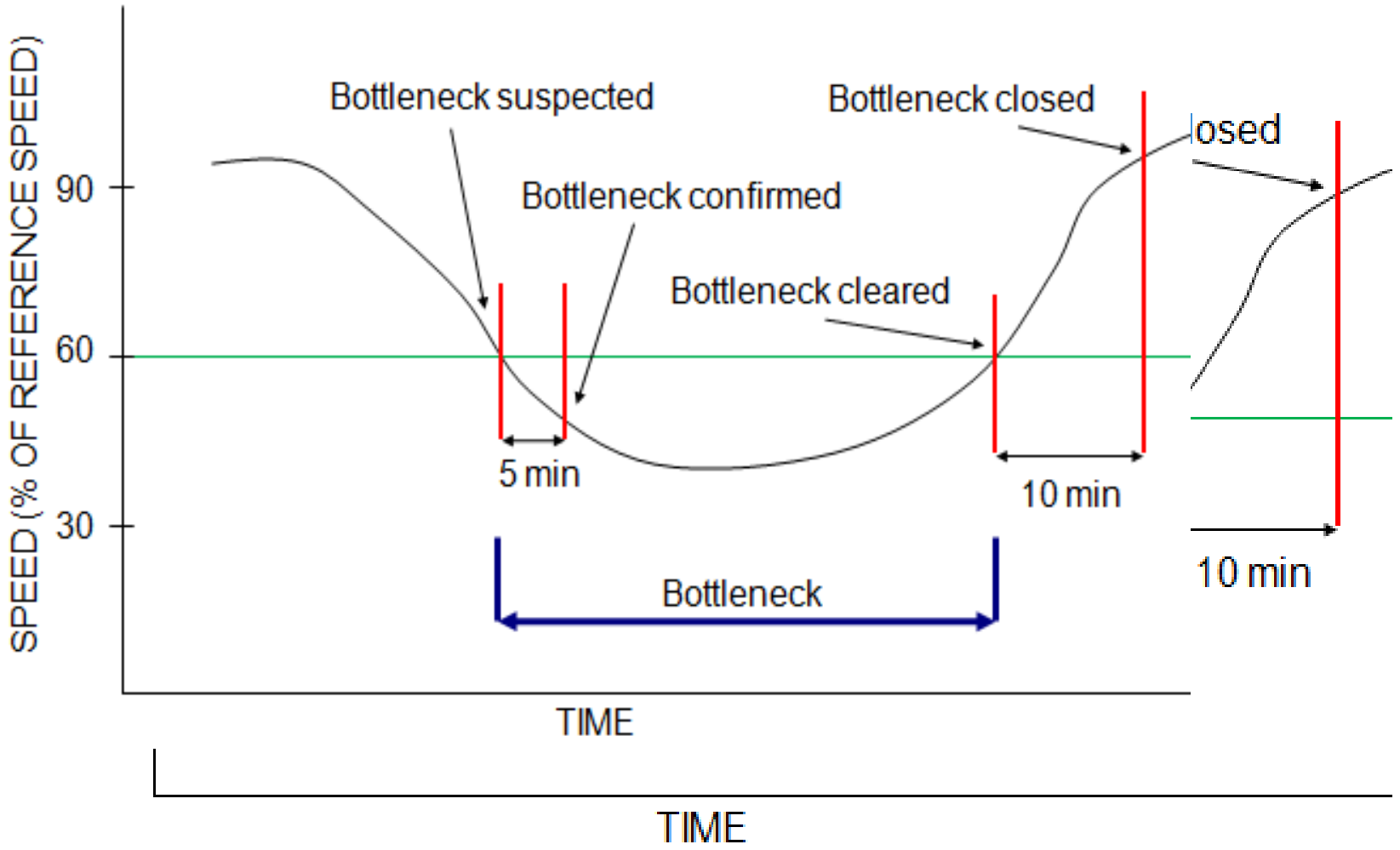
Step 2: Quantify

Estimate the severity of congestion

Step 3: Categorize

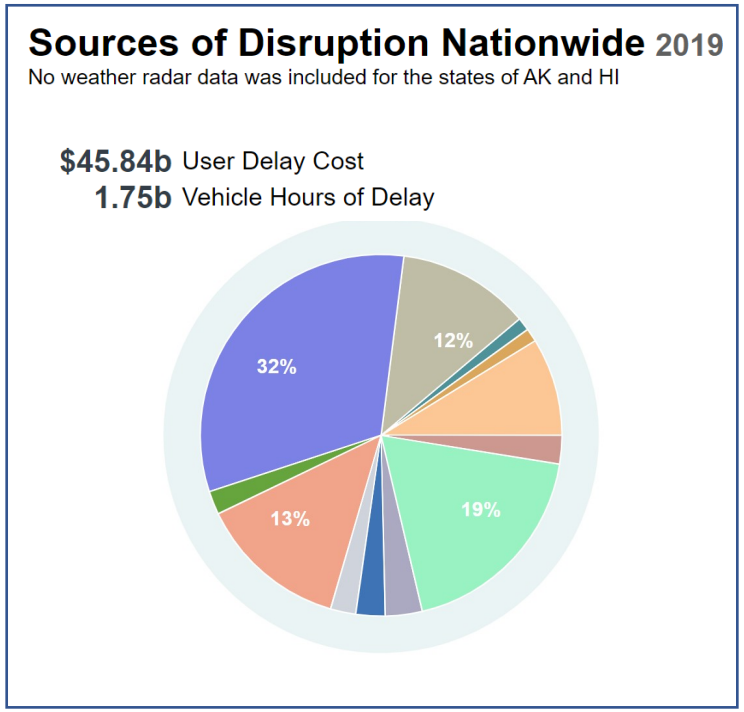
Match congestion to a specific cause

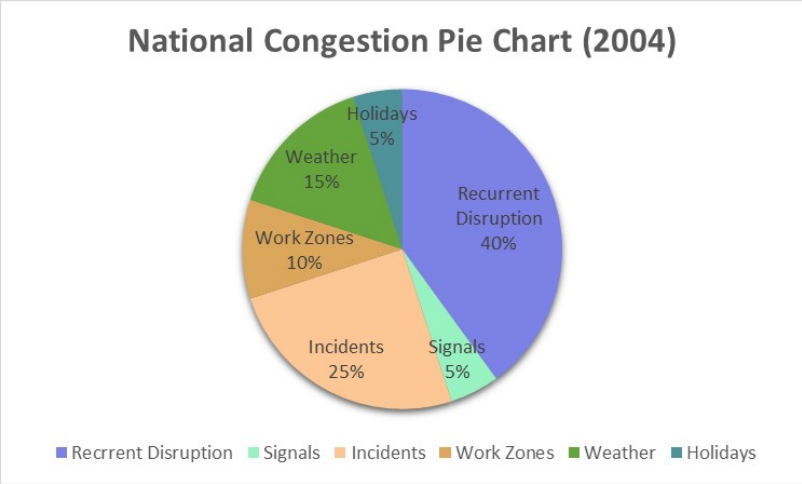
Methodology: Detecting Congestion



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.

Results –2019 National vs 2004 National

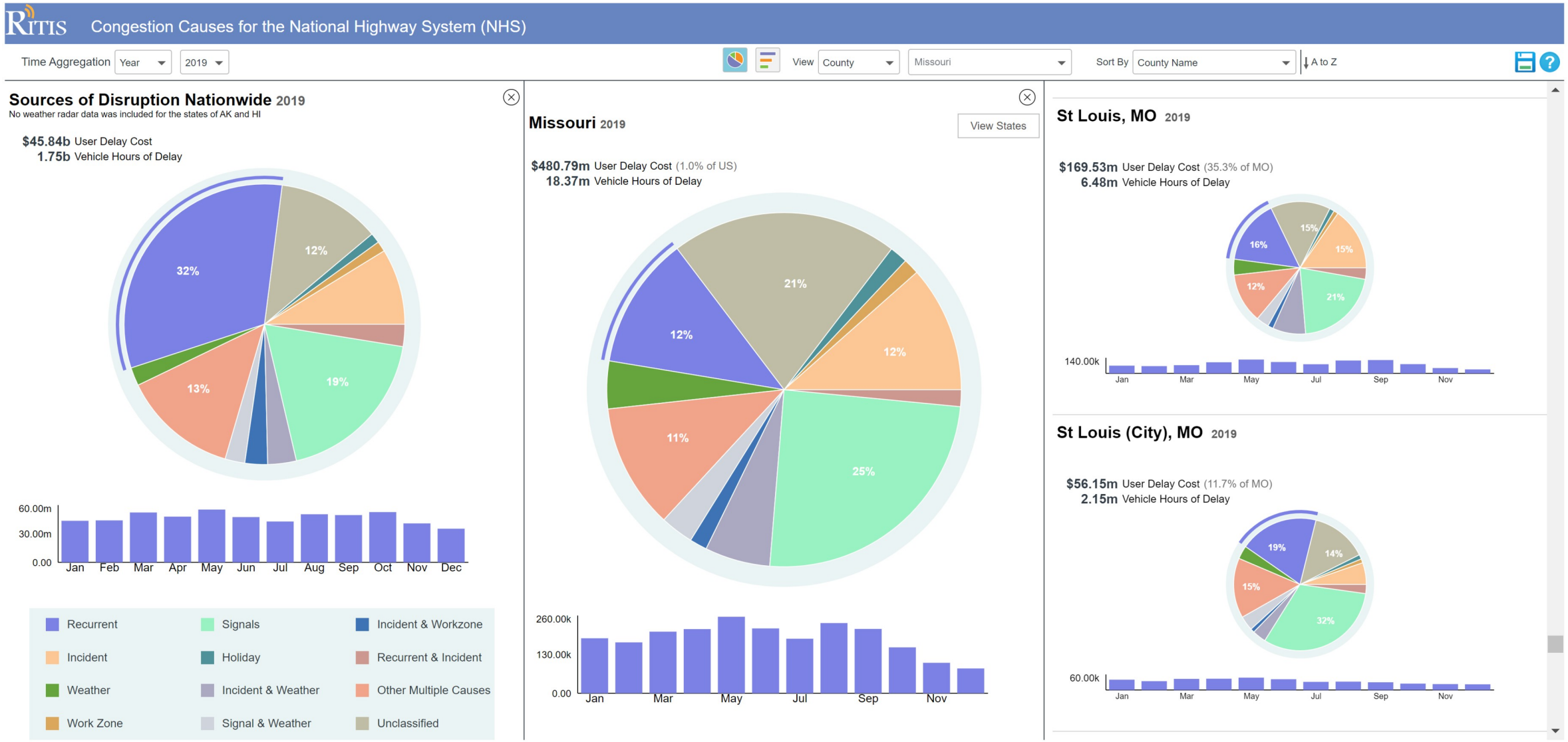




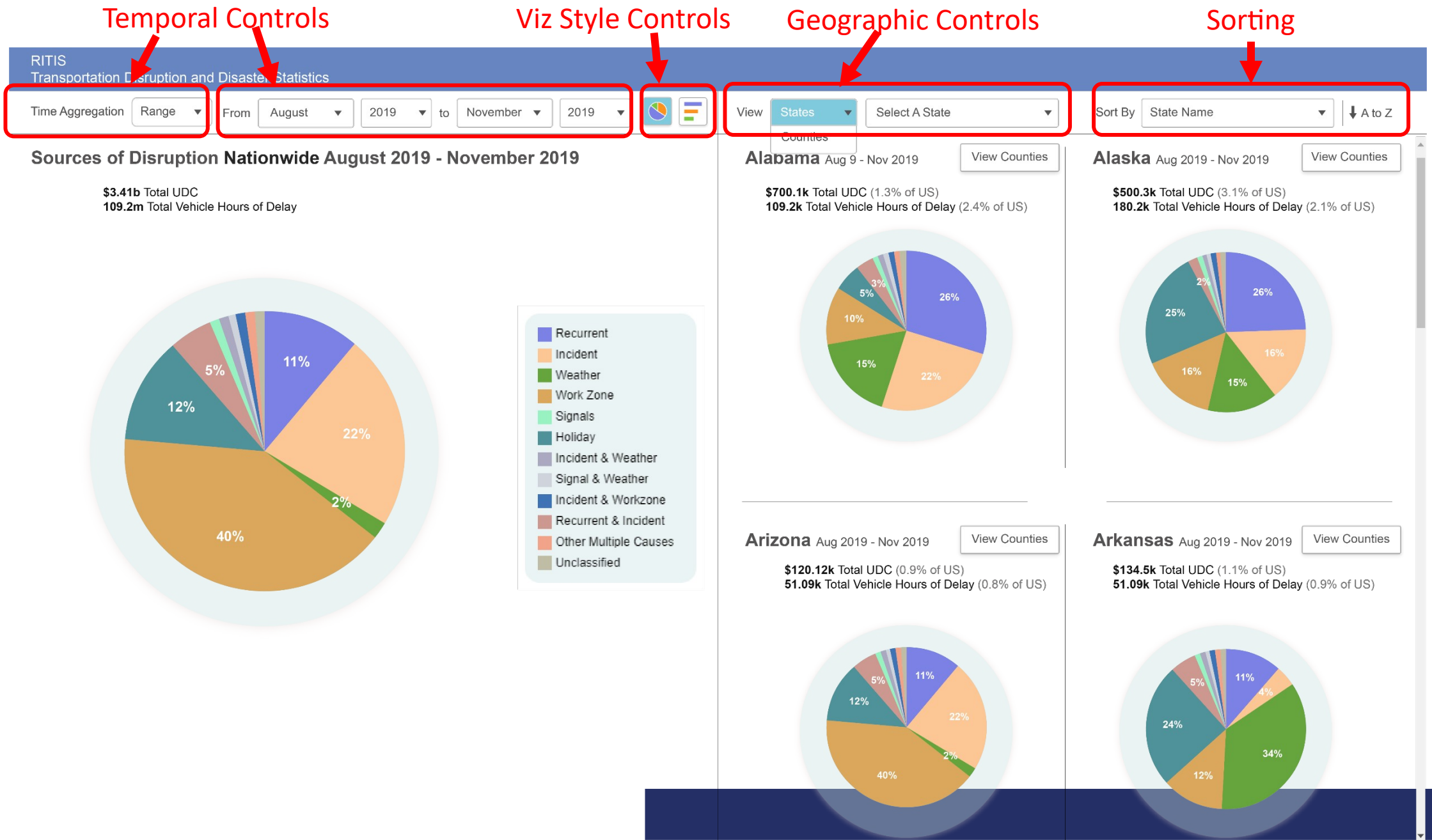
Congestion Cause	National 2004 %	National 2019 %	Change
Recurrent Congestion	40%	32%	-8%
Incidents	25%	9%	-16%
Weather	15%	2%	-13%
Work Zones	10%	1%	-9%
Signals	5%	19%	14%
Holidays	5%	1%	-4%
Incident & Weather	NA	3%	NA
Signal & Weather	NA	2%	NA
Incident & Work Zone	NA	3%	NA
Incident & Recurrent	NA	3%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

Not included in 2004 study

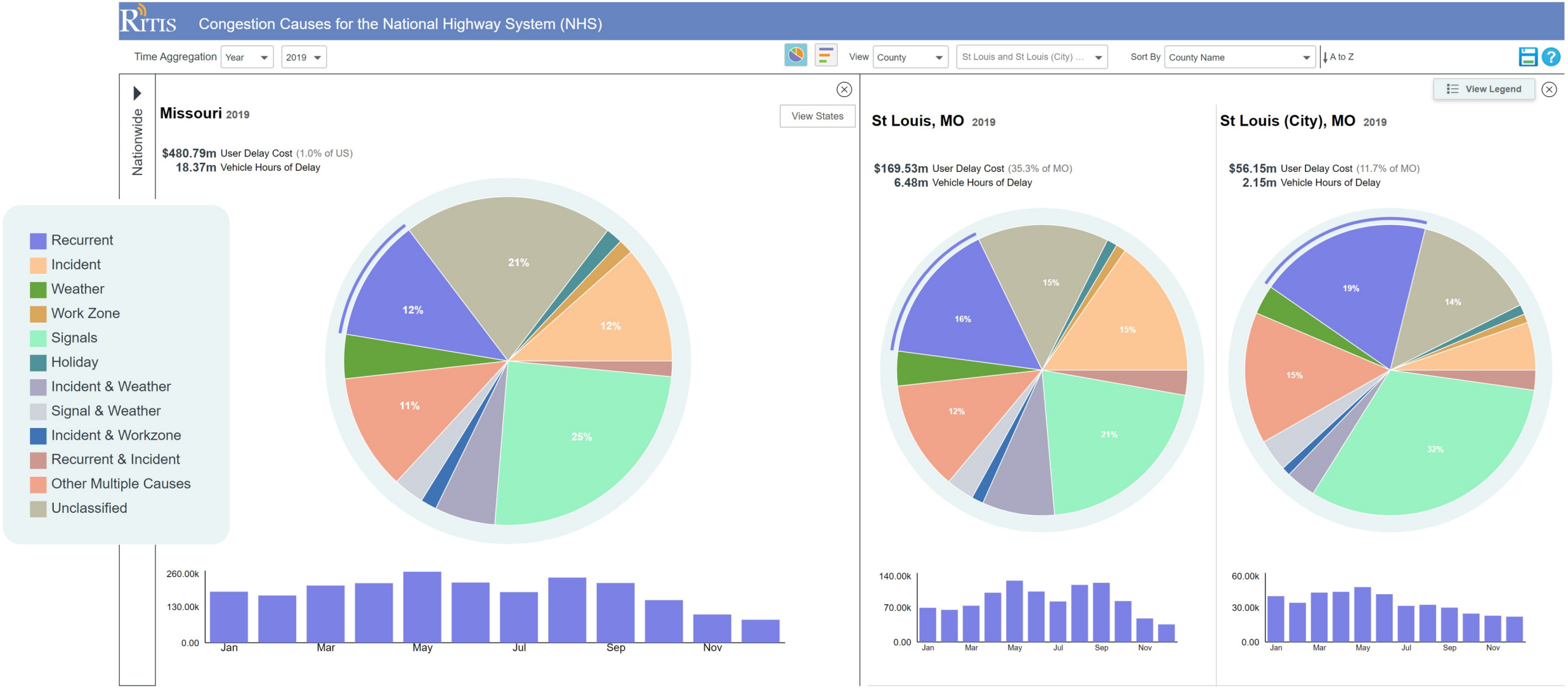
DEMO


RITIS
Congestion Causes for the National Highway System (NHS)
Time Aggregation
Year
2019
View
County
Missouri
Sort By
County Name
A to Z
Sources of Disruption Nationwide 2019
No weather radar data was included for the states of AK and HI
$45.84b User Delay Cost
1.75b Vehicle Hours of Delay
32%
12%
13%
19%
60.00m
30.00m
0.00
Jan Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec
Recurrent
Signals
Incident & Workzone
Incident
Holiday
Recurrent & Incident
Weather
Incident & Weather
Other Multiple Causes
Work Zone
Signal & Weather
Unclassified
Missouri 2019
View States
$480.79m User Delay Cost (1.0% of US)
18.37m Vehicle Hours of Delay
21%
12%
12%
11%
25%
260.00k
130.00k
0.00
Jan Mar May Jul Sep Nov
St Louis, MO 2019
$169.53m User Delay Cost (35.3% of MO)
6.48m Vehicle Hours of Delay
16%
15%
15%
12%
21%
140.00k
Jan Mar May Jul Sep Nov
St Louis (City), MO 2019
$56.15m User Delay Cost (11.7% of MO)
2.15m Vehicle Hours of Delay
19%
14%
15%
32%
60.00k
Jan Mar May Jul Sep Nov

Interface Navigation

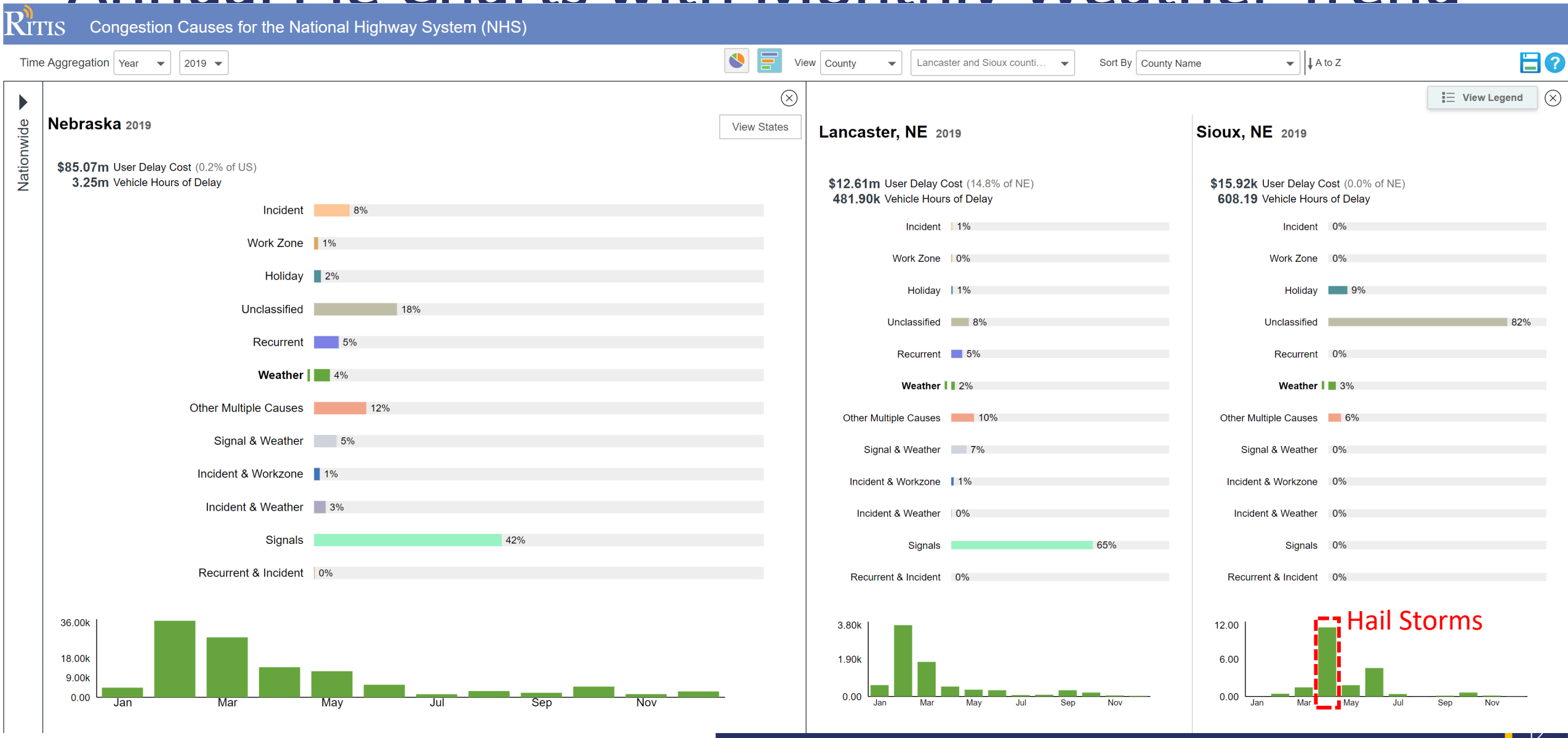


Results
Annual Pie Charts with Monthly Recurrent Congestion Trend



Results

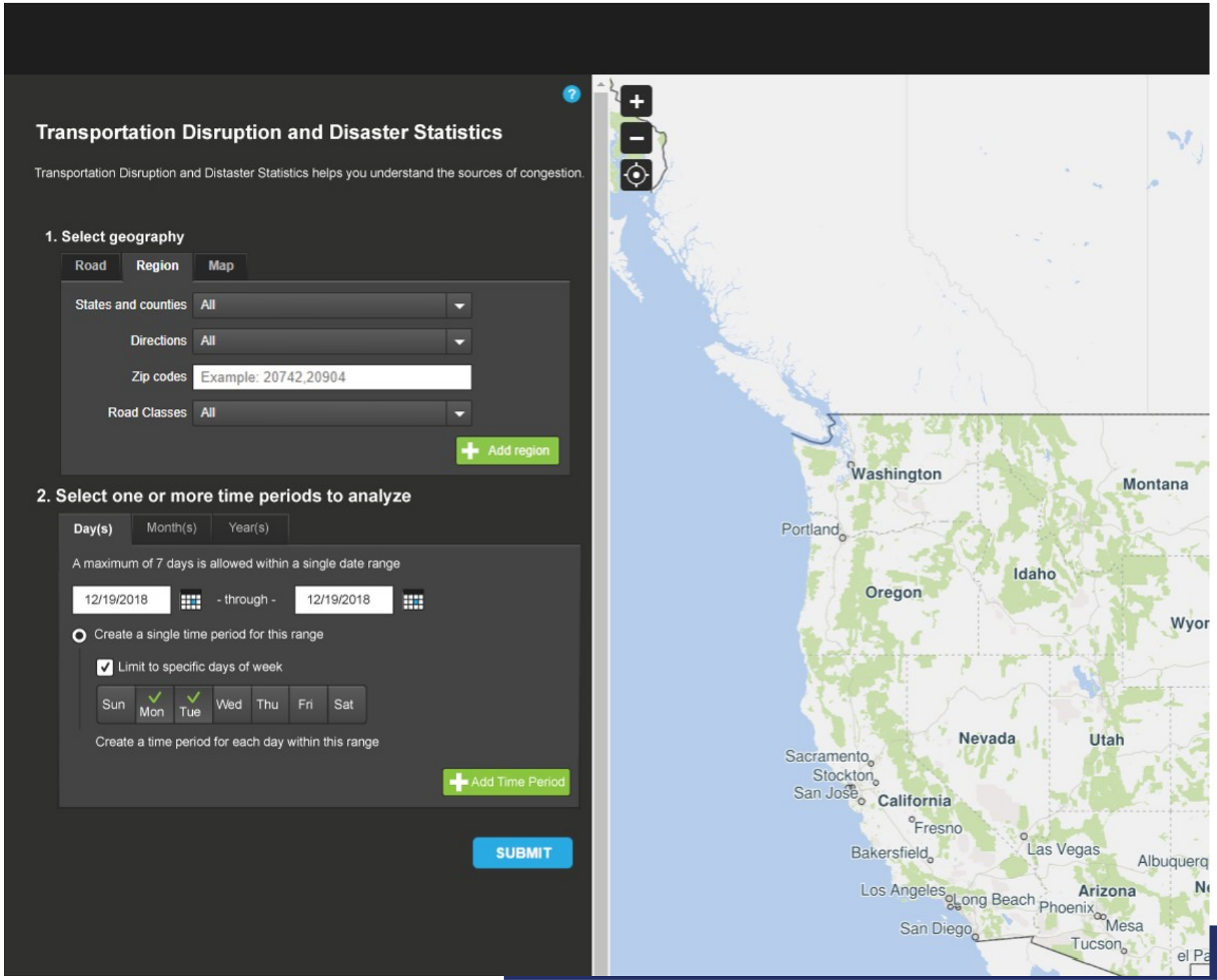
Annual Pie Charts with Monthly Weather Trend

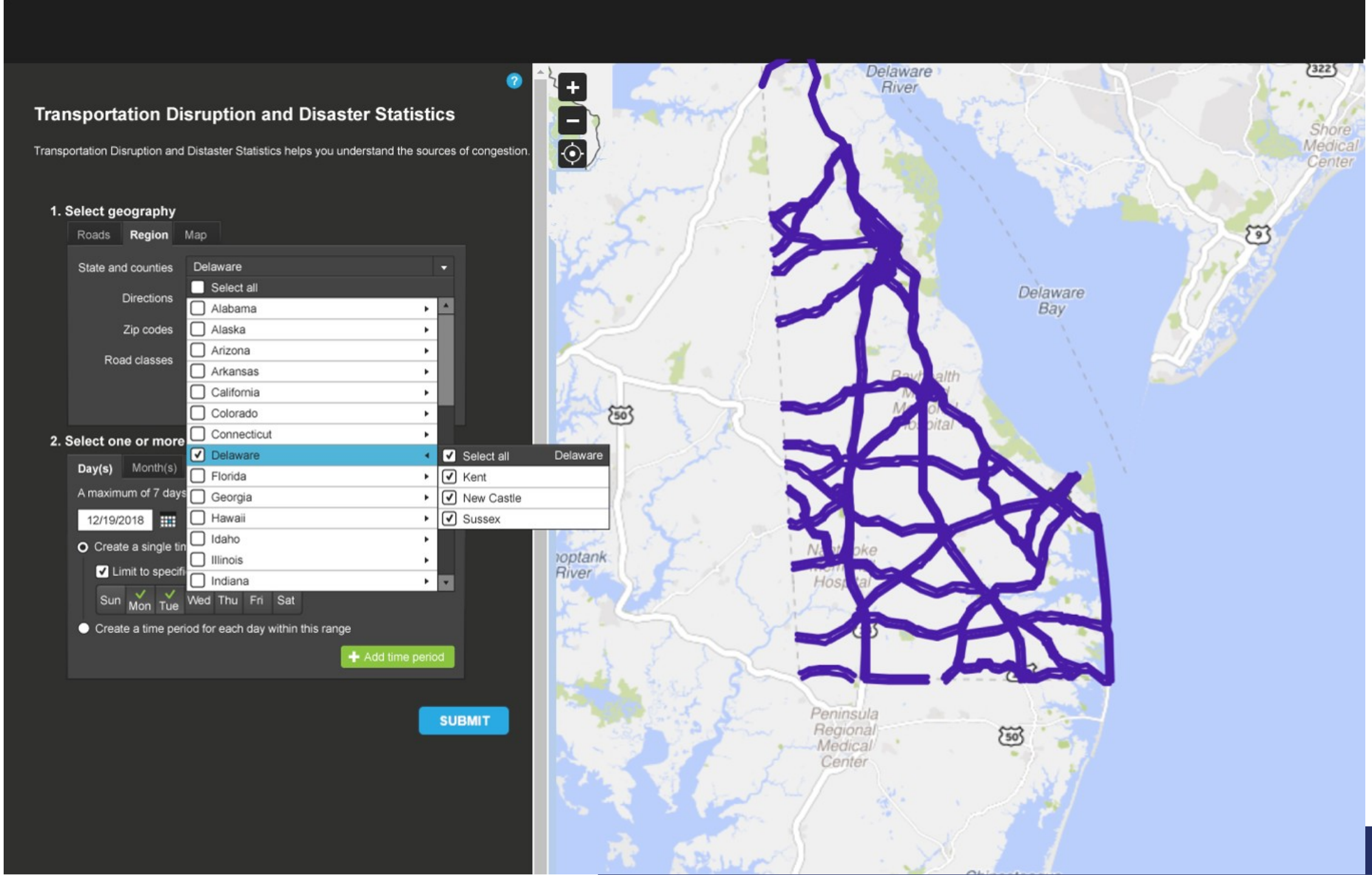


Other Potential Use Cases

- 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: 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
Wyor
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
322
9
50
50

Causes of Congestion Graphs

Report Parameters

Delaware
4364 miles of road

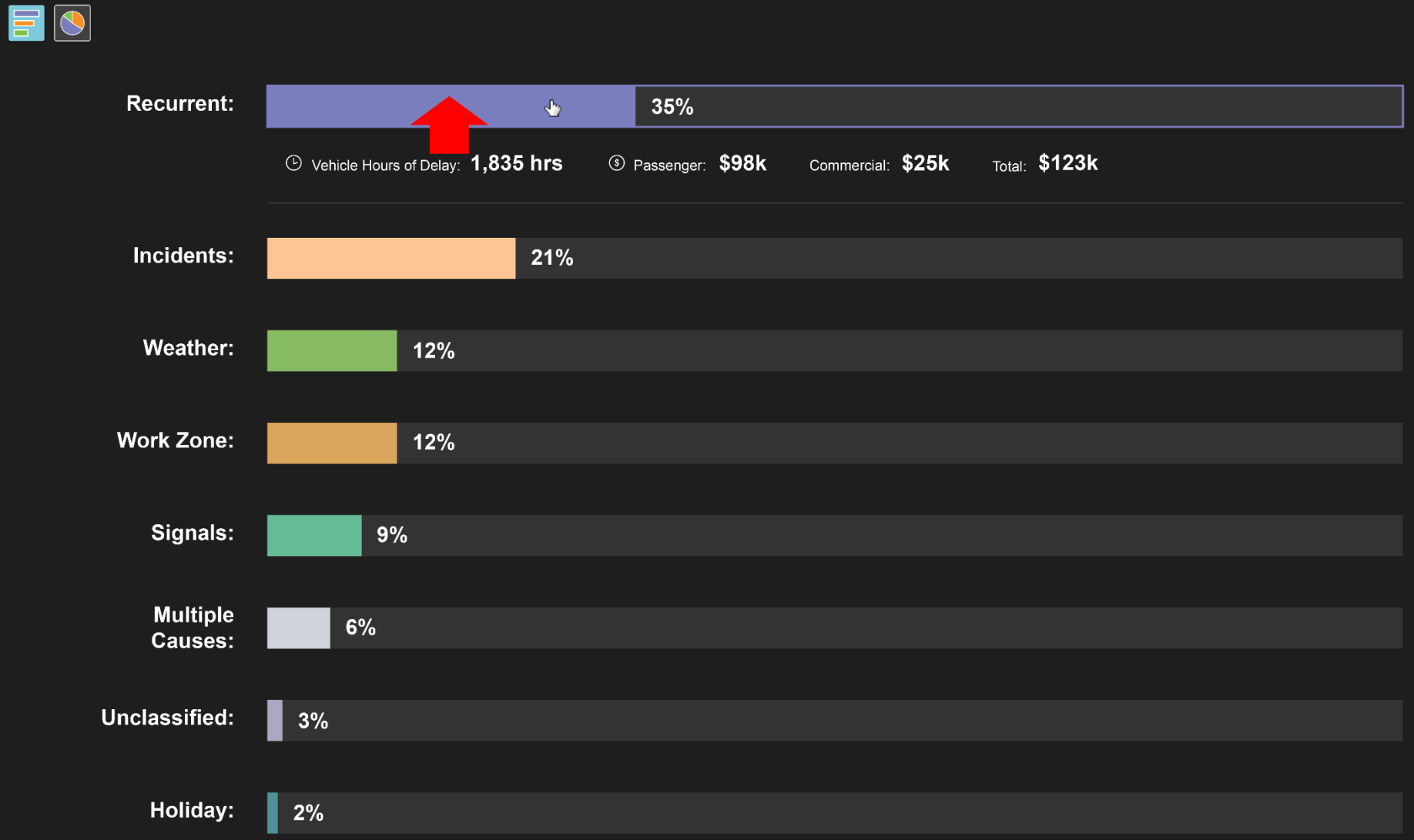
December 24, 2018 to December 25th, 2018
S M T W T F S
12:00 AM - 11:59 PM

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



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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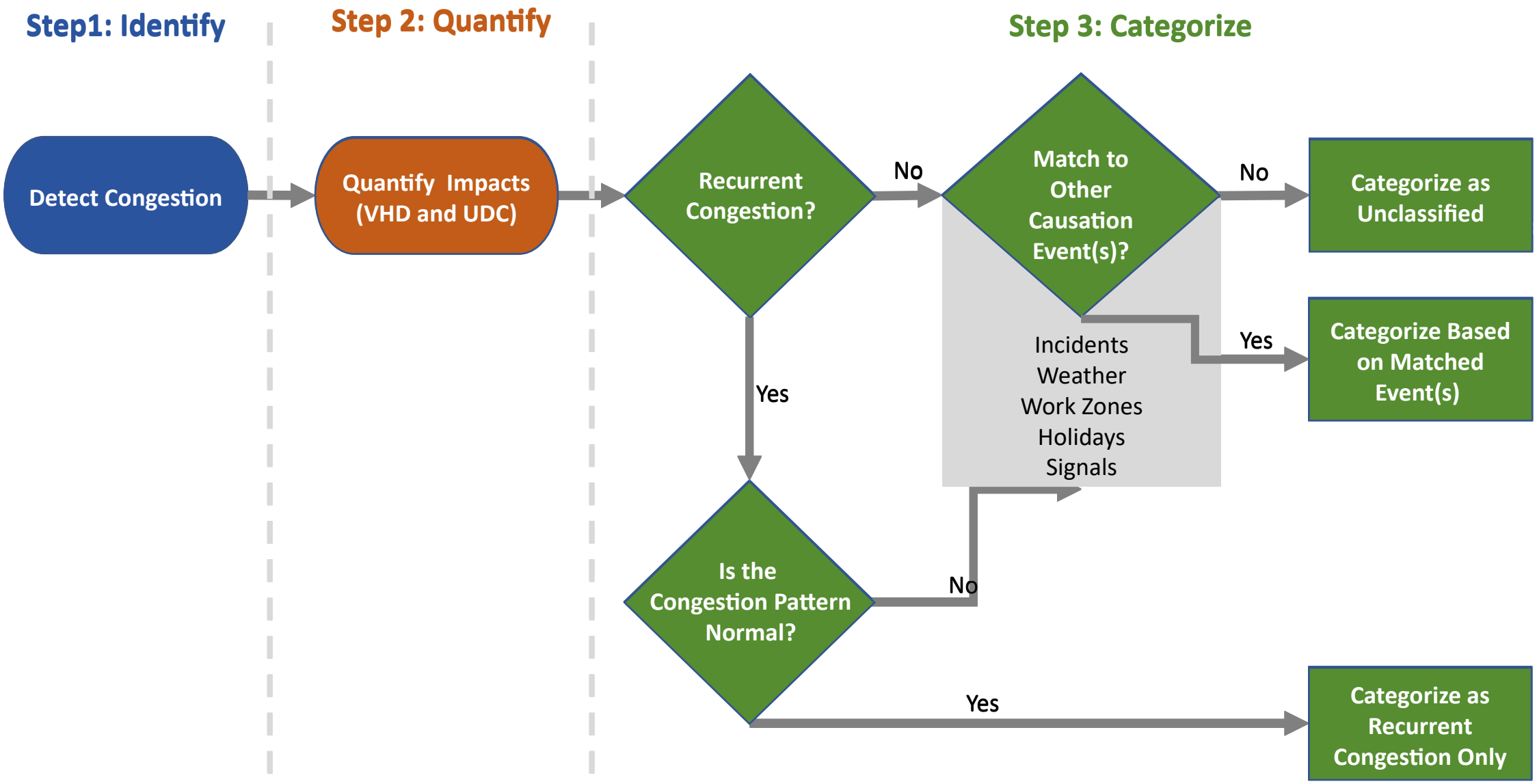
Methodology Logic