

# Transportation Disruption and Disaster Statistics (TDADS)

## Identifying and Quantifying the Causes of Congestion



# Today's topics

- Motivation
- Goals and objectives
- Data
- Methodology
- Use cases
- Demo and results
- Next steps

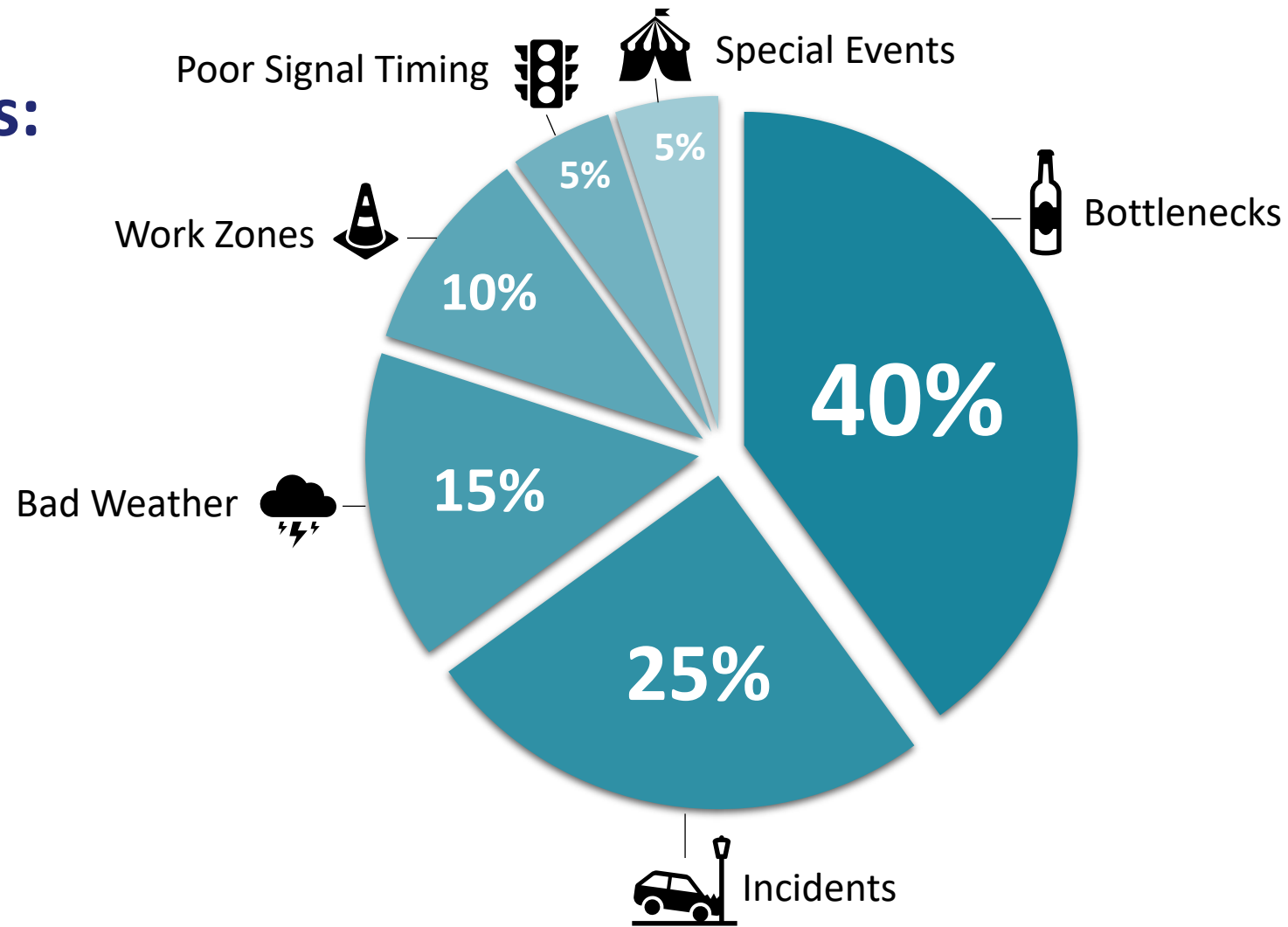
<https://congestion-causes.ritis.org>



# Moving Past old assumptions

## The congestion pie chart is:

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 outdated



# 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.”

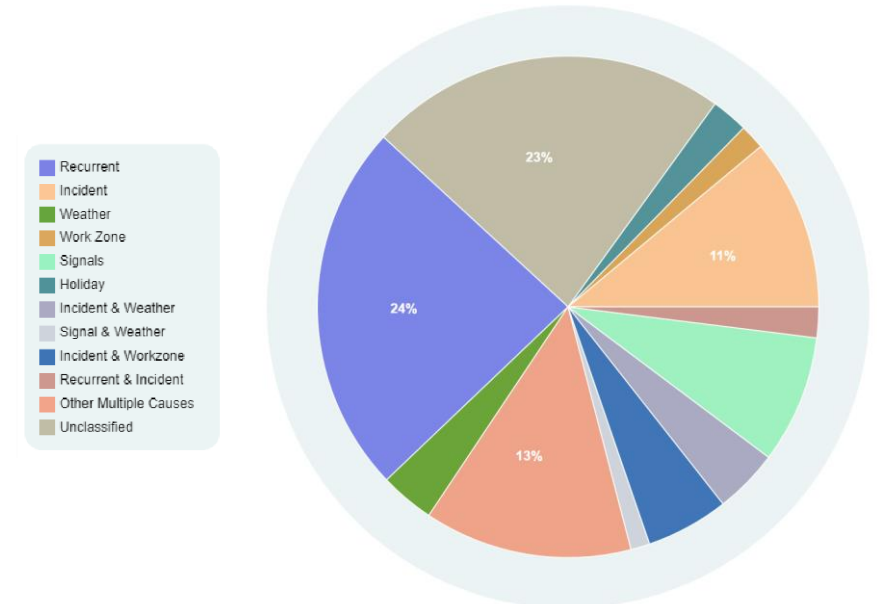
## Objectives

- Upgrade the legacy “pie chart”
  - Across entire National Highway System (NHS)
  - Provide consistent data sources across the country
  - One full year of data – 2019
  - Explore data by county and by month of the year
- Create a cloud-based, interactive tool and put it in the hands of decision-makers
- Practitioner Steering Committee guides ALL work

## Louisiana 2019

**\$521.02m** User Delay Cost (1.1% of US)

**19.91m** Vehicle Hours of Delay



# Data Sources

National Highway System (NHS) Volume data provided by the Highway Performance Monitoring System (HPMS)

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

# Methodology Summary

## Step 1: Identify



Discover when and where congestion occurs



## Step 2: Quantify



Estimate the severity of congestion

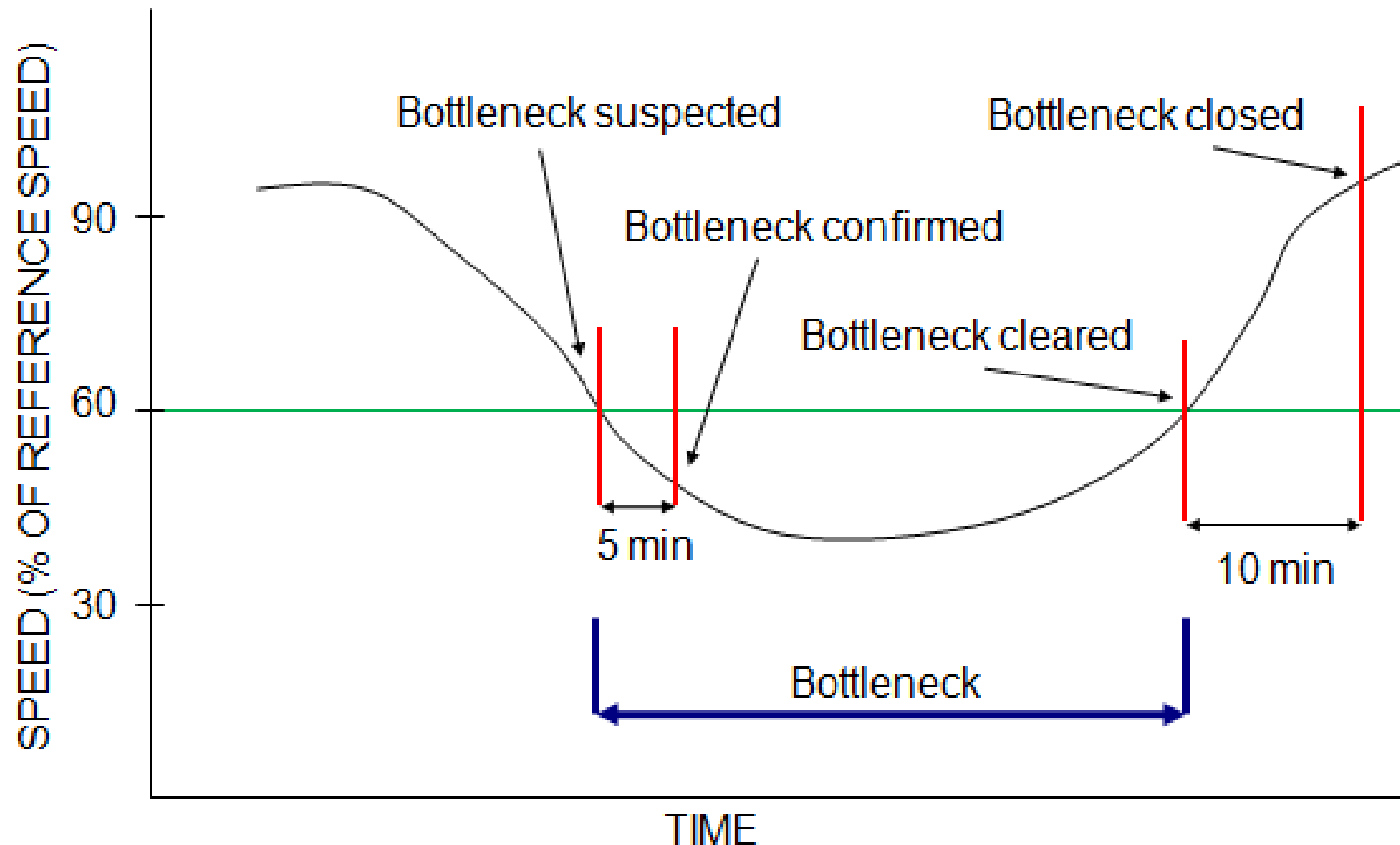


## Step 3: Categorize



Match to congestion to a specific cause

# Methodology: Detecting Congestion/Disruption



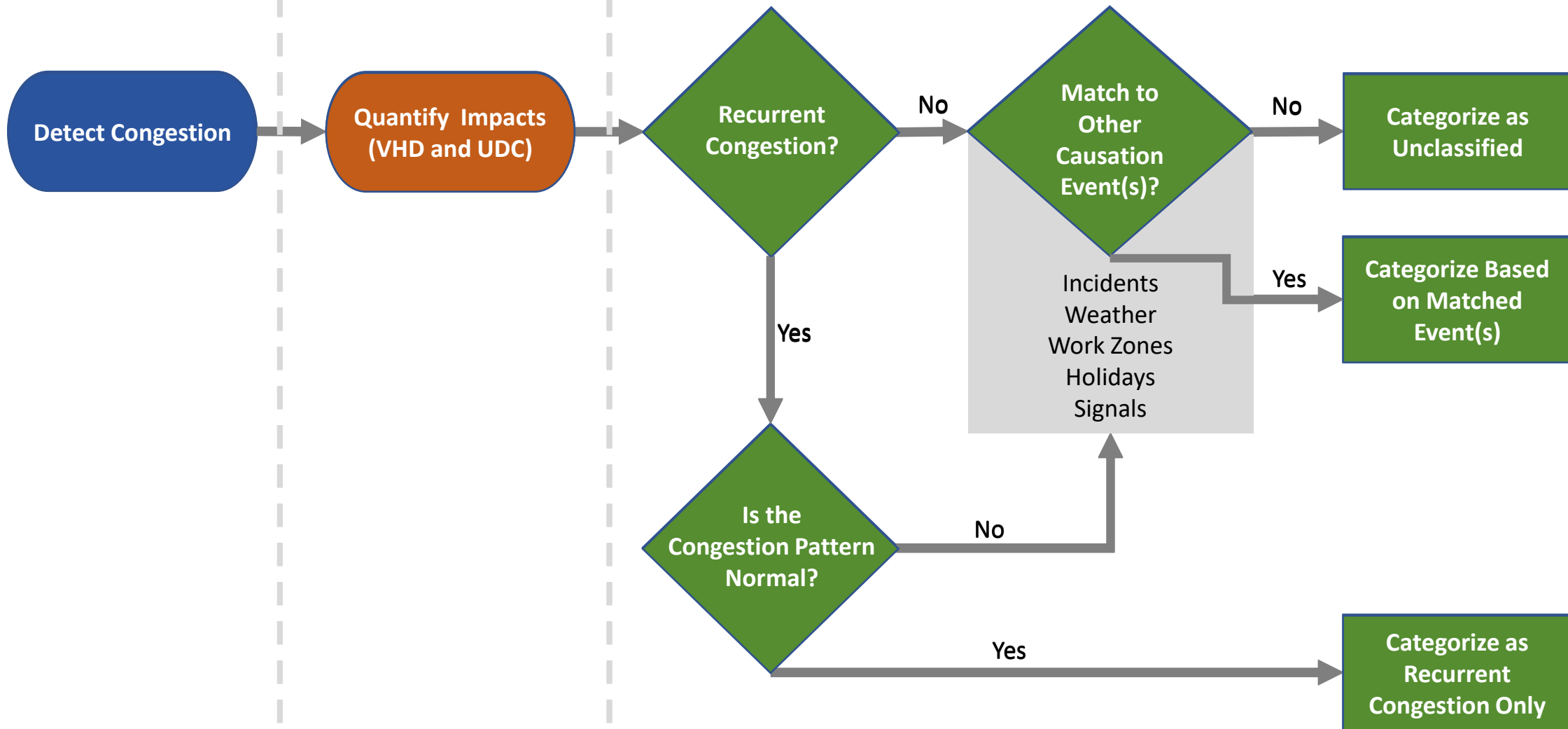
Lund, A., Pack, M.L., Plaisant, C., and Franz, M.L. Algorithms for Identifying and Ranking Bottlenecks Using Probe Data. Transportation Research Board 96th Annual Meeting. Washington, D.C. 2017.

# Methodology

## Step 1: Identify

## Step 2: Quantify

## Step 3: Categorize



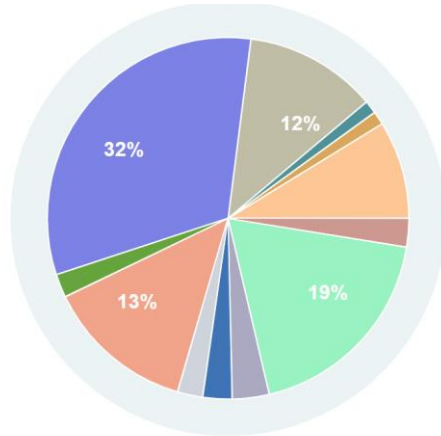


# Results –2019 National vs 2004 National

## Sources of Disruption Nationwide 2019

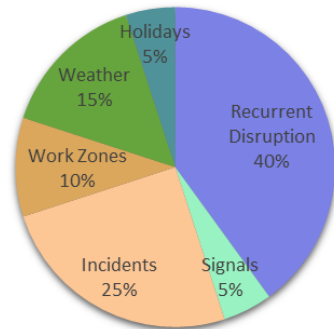
No weather radar data was included for the states of AK and HI

**\$45.84b** User Delay Cost  
**1.75b** Vehicle Hours of Delay



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

## National Congestion Pie Chart (2004)



- Recurrent Disruption
- Signals
- Incidents
- Work Zones
- Weather
- Holidays

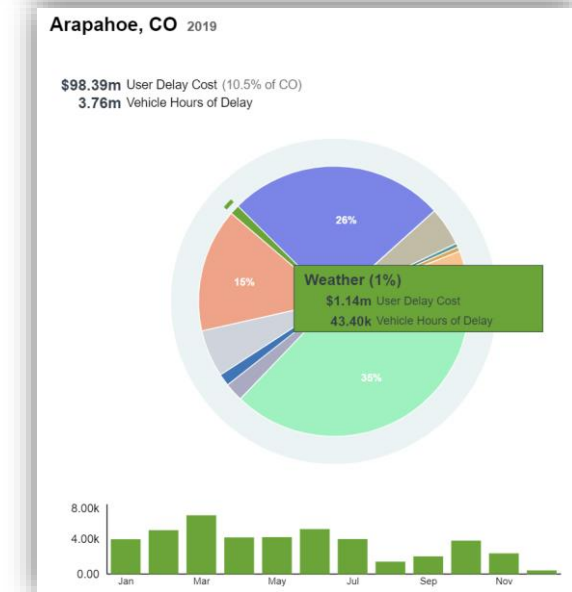
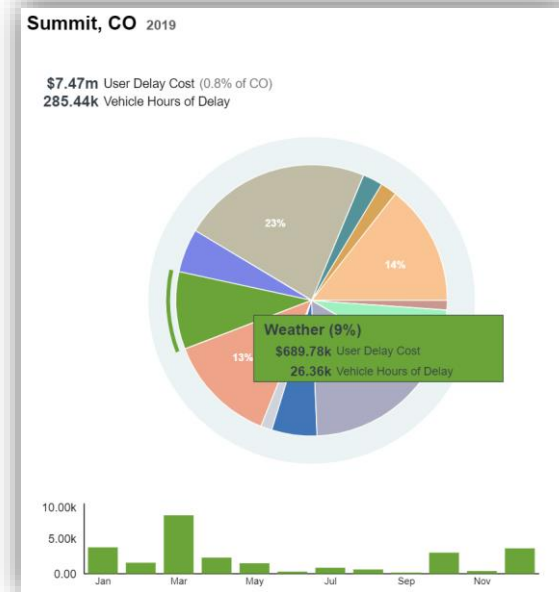
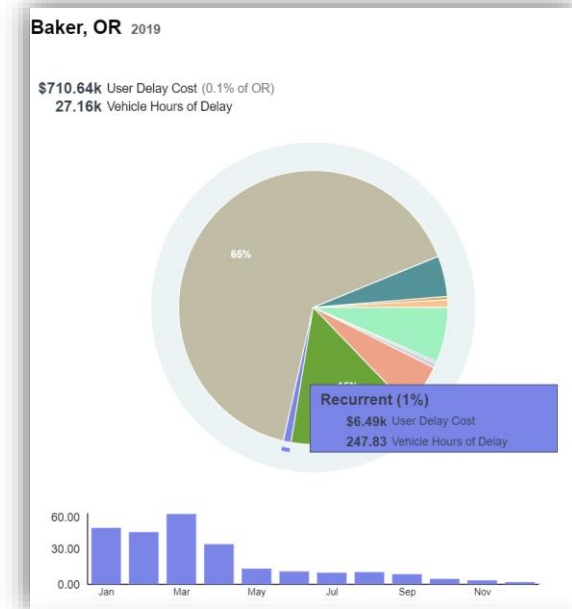
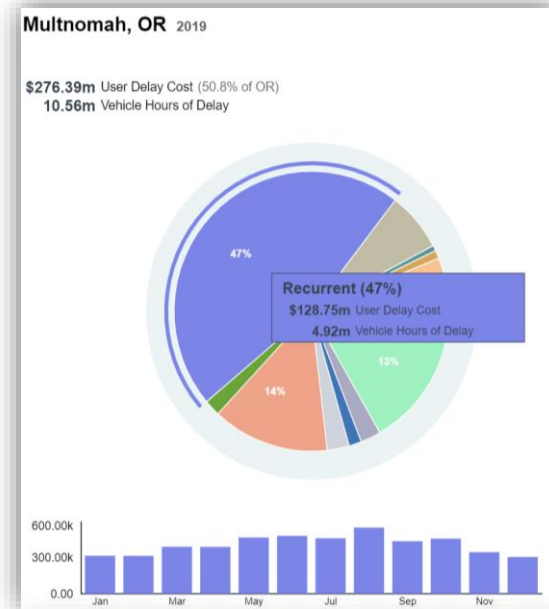
Congestion Cause	National 2004 %	National 2019 %	Change
<b>Recurrent Congestion</b>	40%	32%	-8%
<b>Incidents</b>	25%	9%	-16%
<b>Weather</b>	15%	2%	-13%
<b>Work Zones</b>	10%	1%	-9%
<b>Signals</b>	5%	19%	14%
<b>Holidays</b>	5%	1%	-4%
<b>Incident &amp; Weather</b>	NA	3%	NA
<b>Signal &amp; Weather</b>	NA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



Not included in 2004 study

# Causes of Congestion – Use Cases

- Causal variations in congestion between urban and rural areas
  - Multnomah County, OR vs
  - Baker County, OR
  
- Illustrate how weather impacts traffic flow
  - Summit County, Colorado vs
  - Arapahoe County, Colorado



# 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?

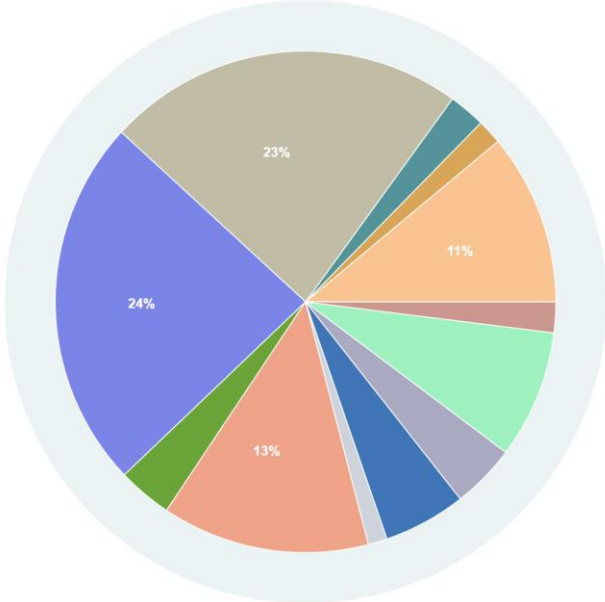


# Results – 2019 LA vs 2004 National

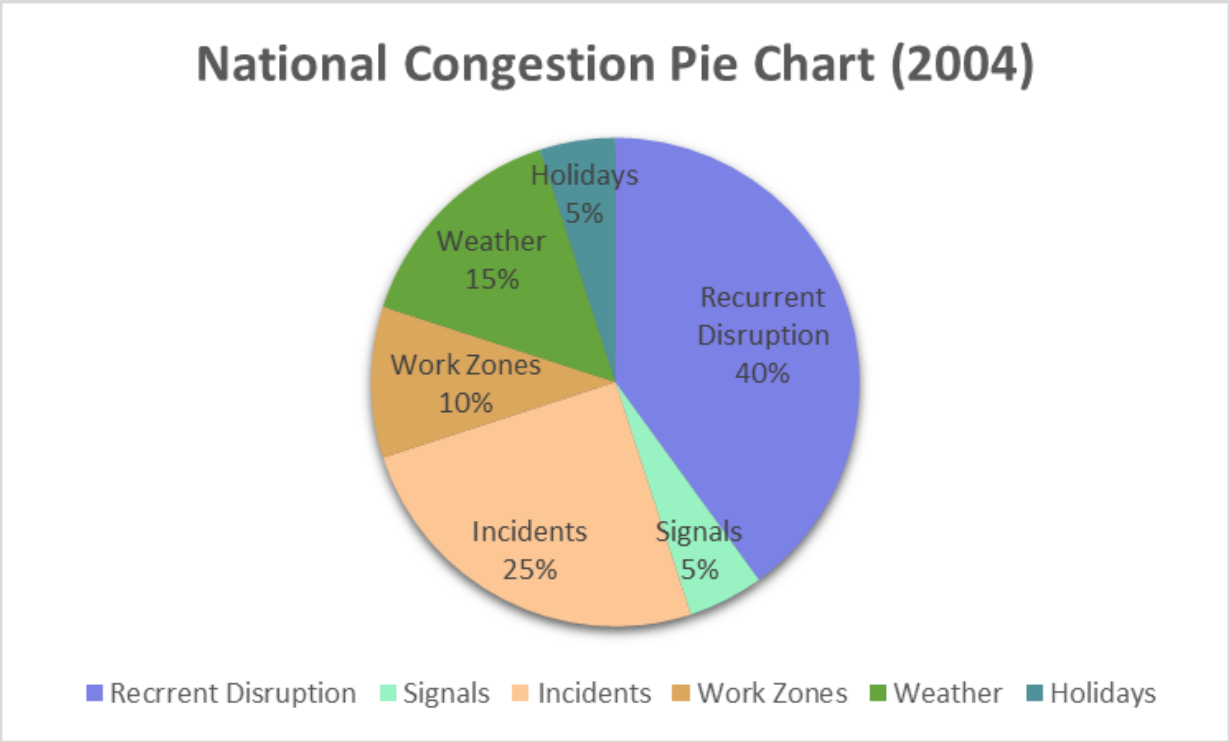
## Louisiana 2019

**\$521.02m** User Delay Cost (1.1% of US)  
**19.91m** Vehicle Hours of Delay

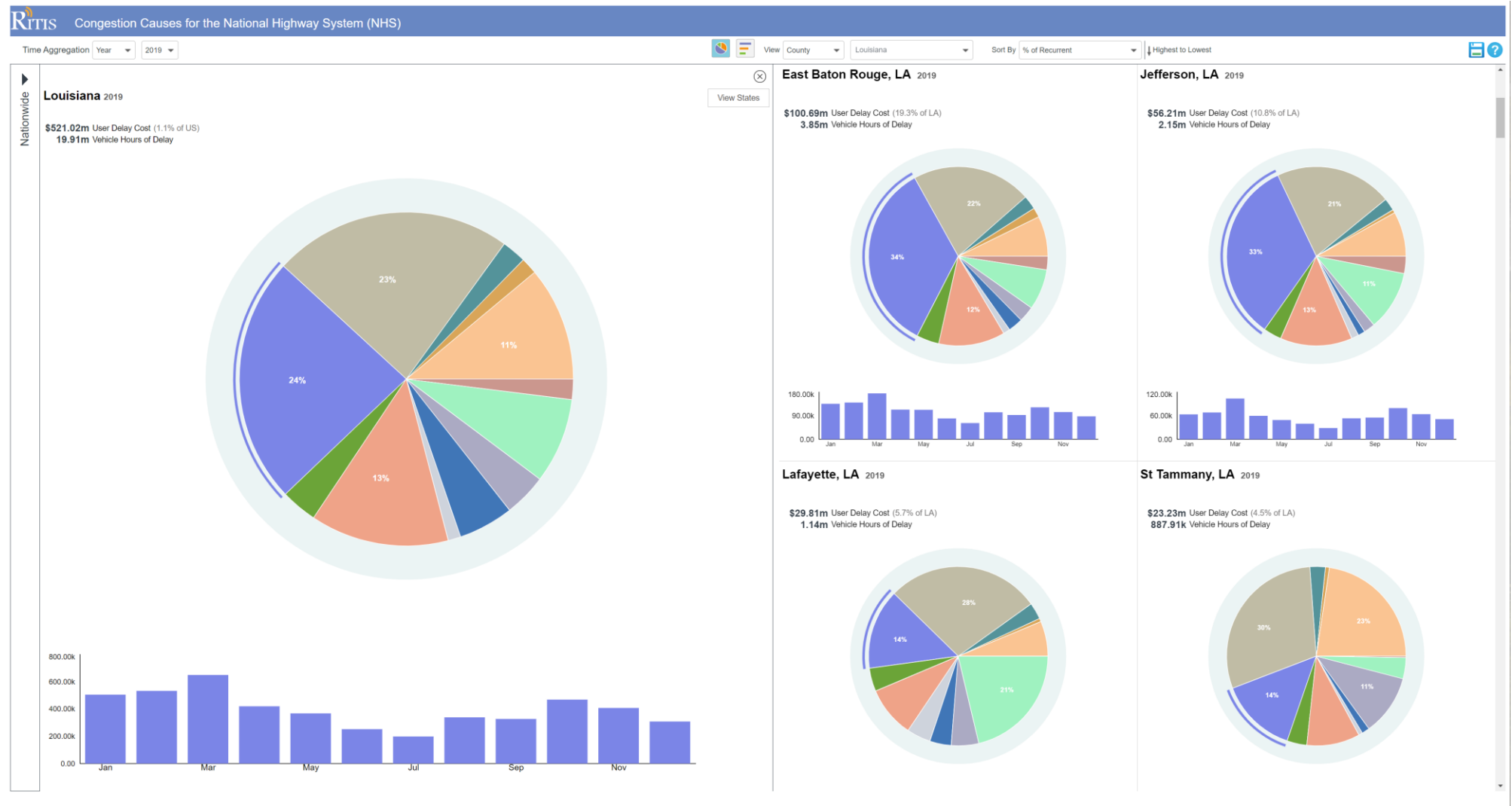
- Recurrent
- Incident
- Weather
- Work Zone
- Signals
- Holiday
- Incident & Weather
- Signal & Weather
- Incident & Workzone
- Recurrent & Incident
- Other Multiple Causes
- Unclassified



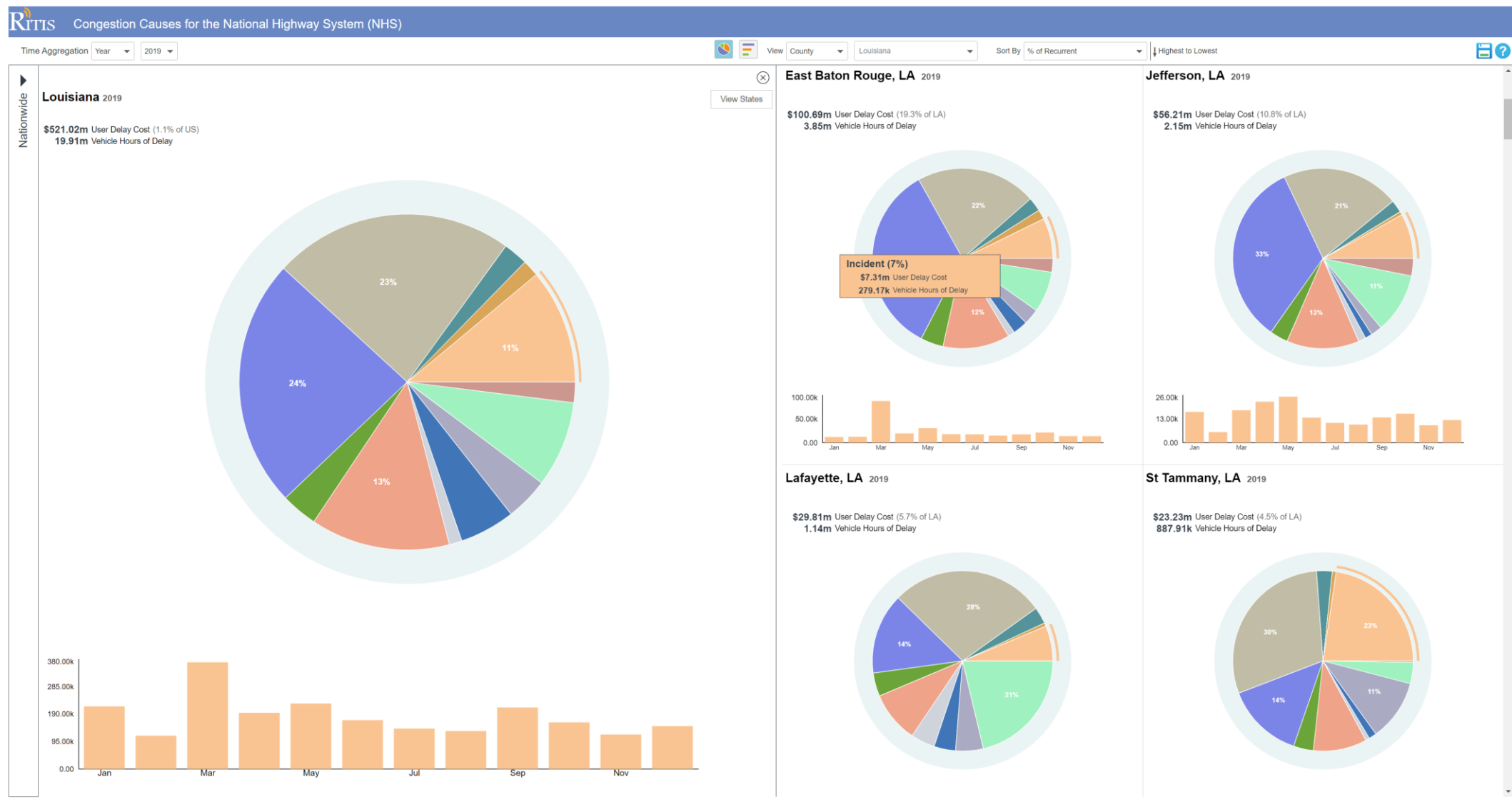
## National Congestion Pie Chart (2004)



# Results – Louisiana Recurrent Congestion w/ County Stats



# Results – Louisiana Incidents w/ County Stats



# Demo

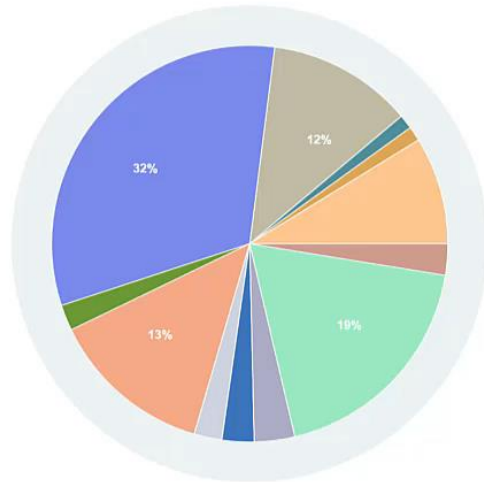
Time Aggregation Year 2019

View States Select a state Sort By State 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

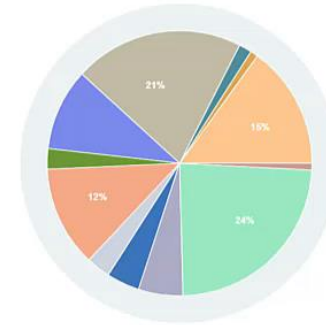


- Recurrent
- Incident
- Weather
- Work Zone
- Signals
- Holiday
- Incident & Weather
- Signal & Weather
- Incident & Workzone
- Recurrent & Incident
- Other Multiple Causes
- Unclassified

## Alabama 2019

View Counties

\$361.88m User Delay Cost (0.8% of US)  
13.83m Vehicle Hours of Delay

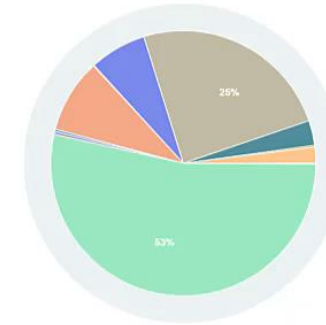


## Alaska 2019

View Counties

No weather radar data was included in the AK analysis

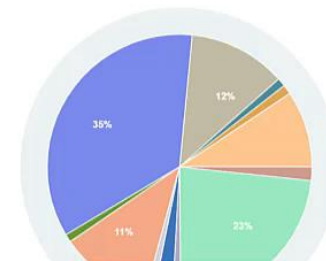
\$39.53m User Delay Cost (0.1% of US)  
1.51m Vehicle Hours of Delay



## Arizona 2019

View Counties

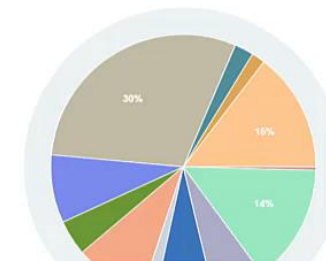
\$541.75m User Delay Cost (1.2% of US)  
20.70m Vehicle Hours of Delay



## Arkansas 2019

View Counties

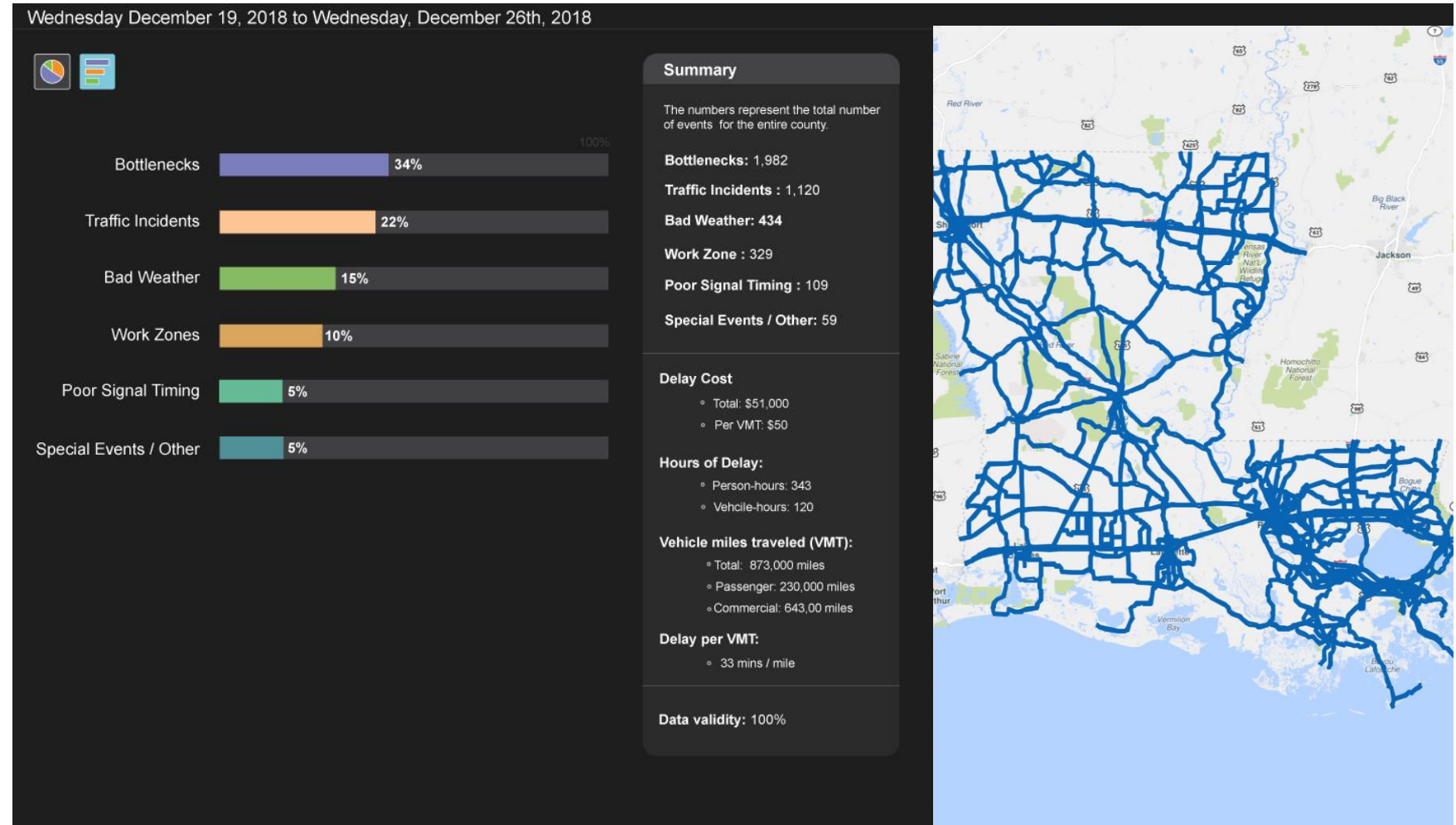
\$145.80m User Delay Cost (0.3% of US)  
5.57m Vehicle Hours of Delay



Select state to view counties

# Next Steps

- Deep Dive Tool
  - Custom road selection
  - More finite temporal filtering
  - Non-NHS roads
- Available Q3 2022







**Explore your causes of congestion at:  
<https://congestion-causes.ritis.org>**

# Thank You!



Rick Ayers

703.989.3221

rayers@umd.edu

cattlab.umd.edu

