The Changing World of Optimal Traffic Monitoring Web Meeting

December 10, 2020

Audio Instructions

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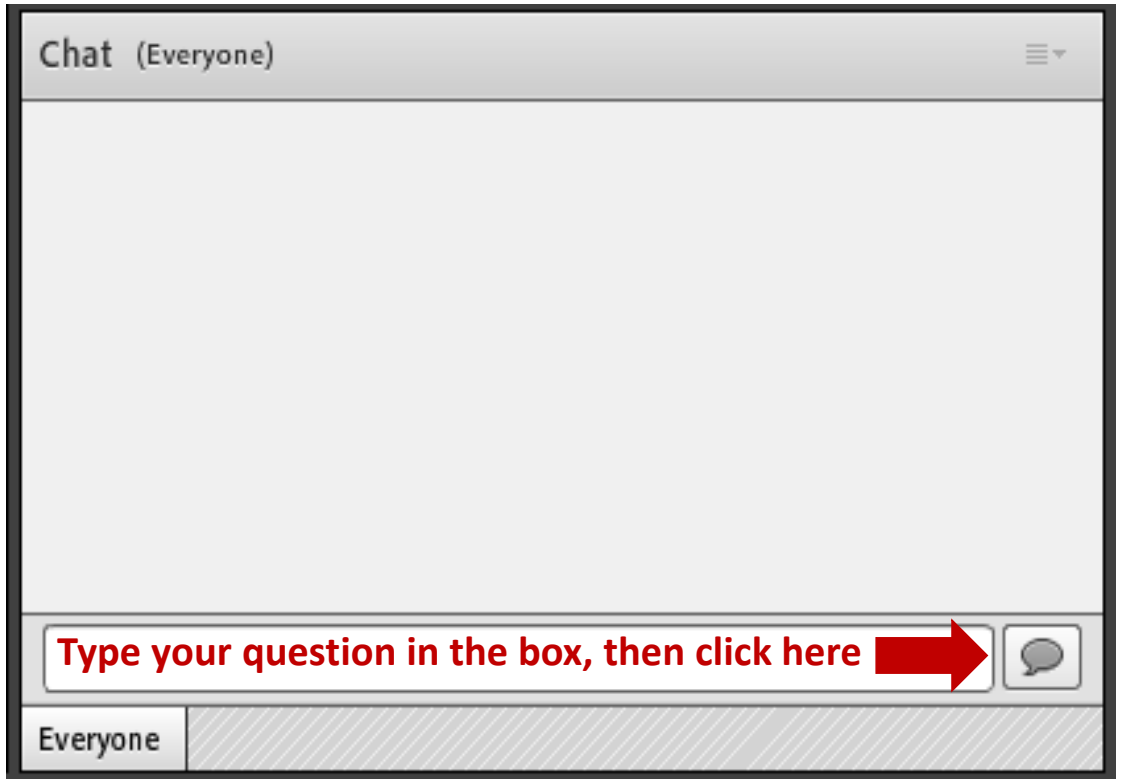
- Please press *0 to speak to an operator for questions regarding audio
- Please call Justin for difficulties with the web or audio application
- **This web meeting will be recorded**
- Presentations will be posted to the Eastern Transportation Coalition website. Participants will receive a link to the presentations after they are posted.

Asking Questions

- Please pose your questions using the **chat box**
- Questions will be monitored then answered by the speakers either at the end of their presentation or at the end of the web meeting



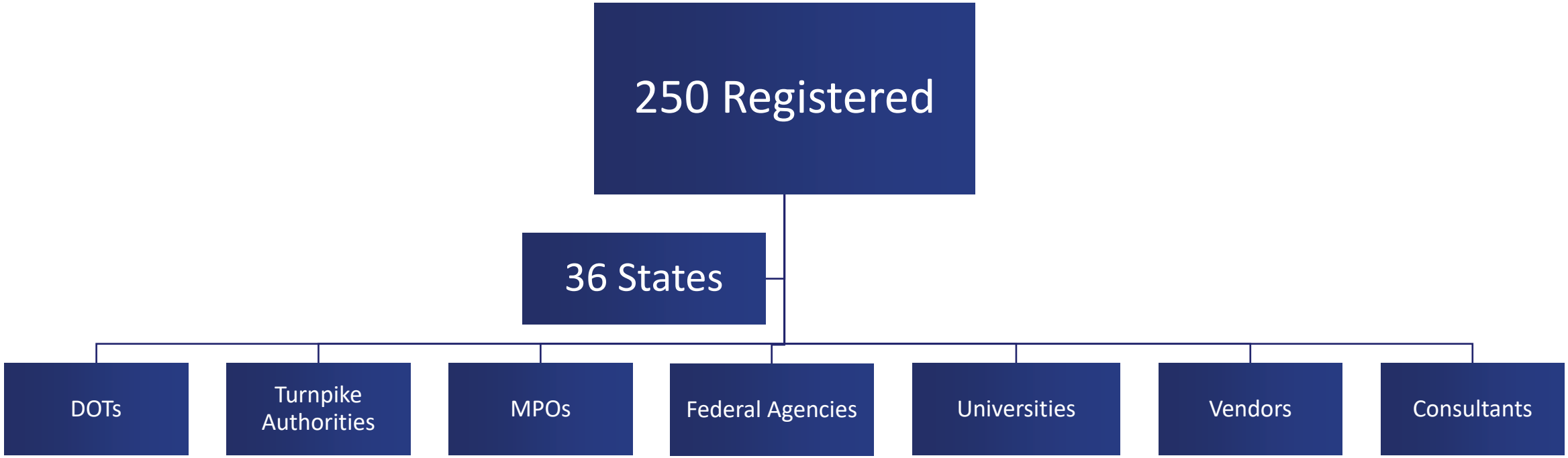
Welcome

Denise Markow, TSMO Program Director
The Eastern Transportation Coalition

Agenda

Topic	Speaker
Welcome & Introductions	Denise Markow, TSMO Program Director The Eastern Transportation Coalition
Optimal Traffic Monitoring Strategies	Stan Young, Advanced Transportation and Urban Scientist, NREL
New Traffic Monitoring (and decision-making) Opportunities	Michael Pack, Director, University of Maryland CATT Laboratory
Monitoring COVID-19 Mobility Impacts	Stan Young
Wrap Up	Denise Markow

The Eastern Transportation Coalition Sponsored Event



Coalition Update

RECENT

- ✓ **Travel Information Web Roundtable** – November 19, 2020
- ✓ **Traffic Data Marketplace (previously VPPIII) RFI Meetings** – December 2020

UPCOMING

- ✓ **TVER Working Group: Tolling Apps - The Agency Perspective** – December 15, 2020
- ✓ **Hurricane Pilot Results Webinar: States' Experience with Data** – January 28, 2021
- ✓ **RITIS-PDA Suite User Group Web Meeting** – February 4, 2021

Introductions

Stan Young

Advanced Transportation & Urban Scientist

National Reliable Energy Laboratory

Michael Pack

Director

University of Maryland CATT Laboratory

Optimal Traffic Monitoring Strategies

Stan Young, Advanced Transportation and Urban Scientist
National Renewable Energy Laboratory (NREL)

Optimal Traffic Monitoring Strategies
&
Monitoring COVID-19 Mobility Impacts

December 10, 2020

Overview

- Optimal Traffic Monitoring Guide
  - Authored in 2018 – 2019 based on best practice of using emerging traffic data technology for Road Jurisdiction purposes – Planning, Operations, and Performance Measures
  - Published in late 2019, planned for webinars/ presentation in 2020 – and then – COVID hit
- Monitoring COVID-19 Mobility Impacts
  - March 2020 COVID Pandemic severely impacted mobility, commerce & health of the nation
  - Measuring the impact, particularly mobility impacts, leaned heavily on the principles of the 'Optimal Traffic Monitoring'
  - This presentation share some analysis by NREL, and the underlying data from which it emerged

Optimal Traffic Monitoring Guide

Link

Optimal Traffic Monitoring in a New Data Age

- Created by the TETC with funding from MCOMP II Grant
- Intended to raise the awareness of viable traffic data sources that have emerged over the past decade
- Target audience is engineers, planners, and managers at state, county, MPO, and cities
- Applications span transportation planning, operations and performance measures

This new age of data and communications has opened up new avenues for traffic monitoring - How do DOTs optimally leverage these new data sources in combination with traditional data resources to accomplish their mission?

Principles

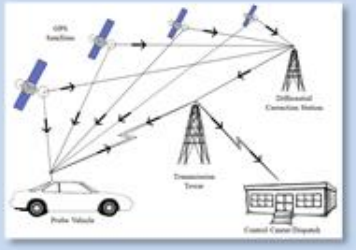
- **Traffic data and information industry has undergone a revolution** fueled by GPS, wireless and ubiquitous communications, and big data processing
- Third-party sources have extensive knowledge of the state of roadway – **rivaling or surpassing that of roadway jurisdictions.**
- At the root of the revolution are vehicles and cellphones that self-report location and speed data.
- When appropriately integrated such data has the ability to …
  - Accurately report traffic flow at nearly **all locations and at all times**
  - Fuel traditional applications and **enable completely new applications**
- Combining old and new traffic monitoring technologies provides tremendous advantage in this new data age.

Optimal Traffic Monitoring

Conventional Sensors

- Still needed and viable, and will be for the foreseeable future.
- Justified on critical portions of the roadway where ownership and direct control of the data stream trump the value proposition of probe data.
- Needed to continue to sample across a broad array of road classes and types as ground-truth sources for spot speed and counts.
- Data are owned by the agency and can be shared and used without being subject to licensing.

Commercial Probe Data



- Useful for any state DOT and sub-jurisdictions.
- High value proposition, scalability and usefulness for a variety of applications from planning to operations.
- Analytics options are robust and growing, and supported by a number of industry players.
- Key personnel within the DOT should be well-versed in its capabilities and limitations.
- **Useful Applications: Travel Time on Signs, Signal Performance Studies, Smart Work Zones**

Re-identification Data

- Bluetooth and WiFi
- Should be viewed as travel time sensors (as opposed to speed sensors). Such data is needed for travel time or O-D studies.
- Re-identification is typically used as ground truth for validating accuracy of sources of travel time data (such as commercial probe data).
- **Useful Applications: Travel Time on Signs, Travel Time Validation, Signal Performance Studies, Origin-Destination Studies, Smart Work Zones**

HRCD (High-Resolution Controller Data)

- HRCD and the corresponding Automated Traffic Signal Performance Measures (ATSPMs) are in the domain of traffic signal engineers.
- Signal upgrades should include consideration for acquisition and processing of HRCD and ASTPMs.
- **Useful Applications: Signal Performance Studies (ATSPMs)**

Emerging, Leading Edge Technologies

Trajectory Data

- Waypoint data every 1 second
- OD studies, arterial analysis, freight studies
- Market-ready by 2021

Estimated Volumes from Probe Data

- AADTs, turning movements, vehicle/hour
- I-95CC Validation
- Market-ready by 2021

Traditional/Conventional Sensors

- Still needed and viable
  - Justified on critical portions of roadway
  - Provides reference data to calibrate and validate other data sources
  - Fully owned by agency (sensors and data), and so can be shared without complex licensing agreements
- Properties
  - Expensive, requires maintenance
  - Not spatially scalable
  - Inherently 24x7x365, but at a single location

Conventional Sensors

- Still needed and viable, and will be for the foreseeable future.
- Justified on critical portions of the roadway where ownership and direct control of the data stream trump the value proposition of probe data.
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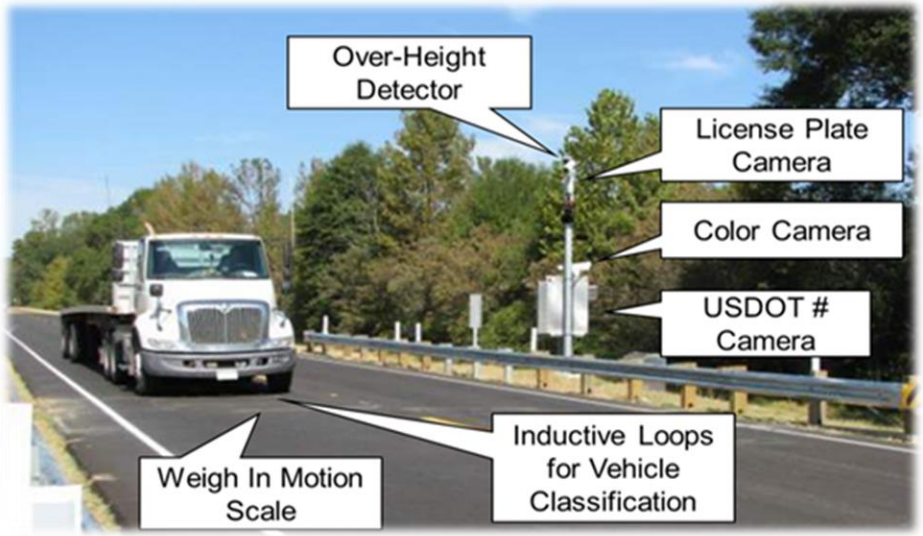
Applications

- Accurate, reference volume data for Highway Performance Monitoring System
- High volume, critical corridors - where a gap in outsourced data, or redundant coverage is needed
- Enforcement and safety critical activities

Source

Source



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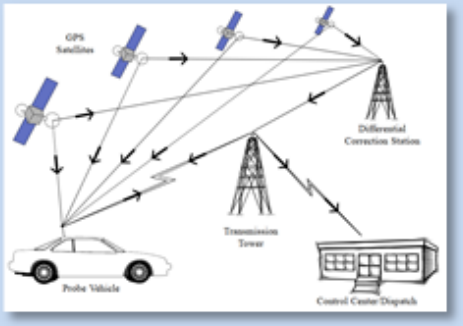
Commercial Probe Data



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- Key personnel within the DOT should be well-versed in its capabilities and limitations.
- **Useful Applications: Travel Time on Signs, Signal Performance Studies, Smart Work Zones**

Commercial Probe Data – Speed & Travel Time

- If you are not using it – you are behind
- Tracking a sample of the vehicles/travelers provides significant value proposition for any agency app
- Knowing 5-10% of vehicle behavior allows for accurate inference of travel time, congestion, bottle-necks, assessment of user costs
- Personnel in DOTs should be well versed
- Apps – Travel Time on Signs (killer app in 2008), Smart Work Zones, Bottle Necks, Traffic Performance Measures…

Applications

- Travel Time on Signs –
  - The Killer App
  - Better, Faster, Cheaper for Traveler Information
  - Quickly spread to 511 systems

Travel time on sign posted on DC Outer Loop

Florida District Four Traffic Control Room

- Traffic Management Centers
  - Fully scalable network monitoring
  - Detected slowdowns, impacts of construction

Other notable applications

Smart Work Zones

- Travel Time or Travel Delay Information
- Queue Detection
- Dynamic Lane Merge
- Work Vehicle Entry/Exit Warnings

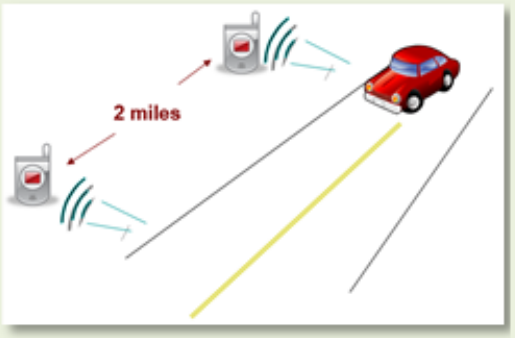
NPMRDS and MAP-21 Performance Measures

- Peak hour excessive delay (PHED)
- Level of Travel Time Reliability (LOTTR) on Interstates
- LOTTR Non-Interstates
- Truck Travel Time Reliability (TTTR)

Re-identification Data

- Consumer Electronics (Bluetooth and WIFI) allows DOTs to anonymously sample travel times and O&D
  - Bluetooth & WIFI use MAC IDs ('digital license plates')
- Properties of Re-Identification Technology
  - Inherent "Travel Time Sensors"
  - Ground-truth reference data for commercial probe data
  - Owned and operated by DOTs – similar to other sensors
  - Minimal to no calibration (GPS time based)
- 5% to 20% sample of traffic
- Applications: O&D studies, corridor signal timing, calibration of other travel time systems, mission critical corridors

Re-identification Data



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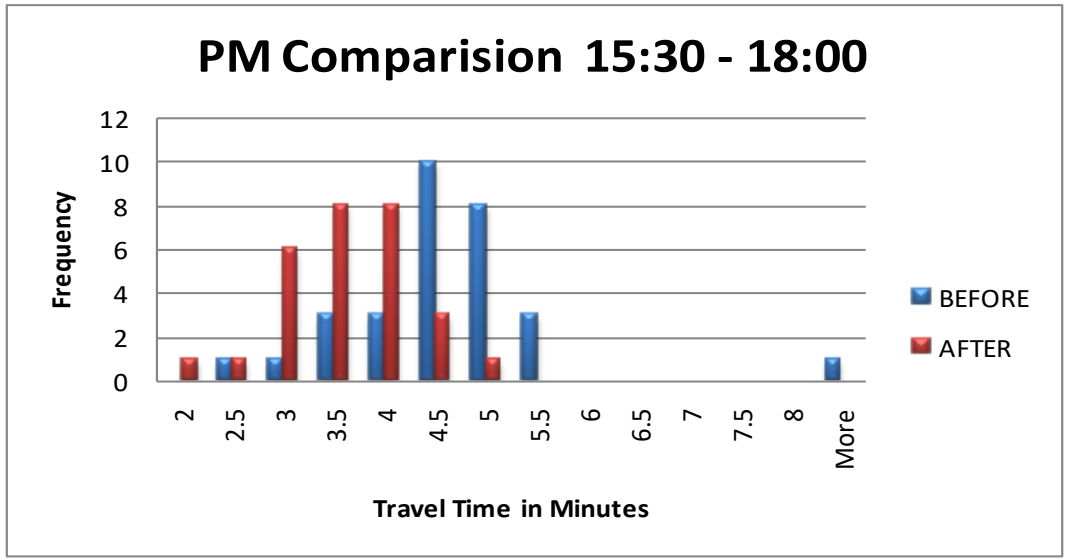
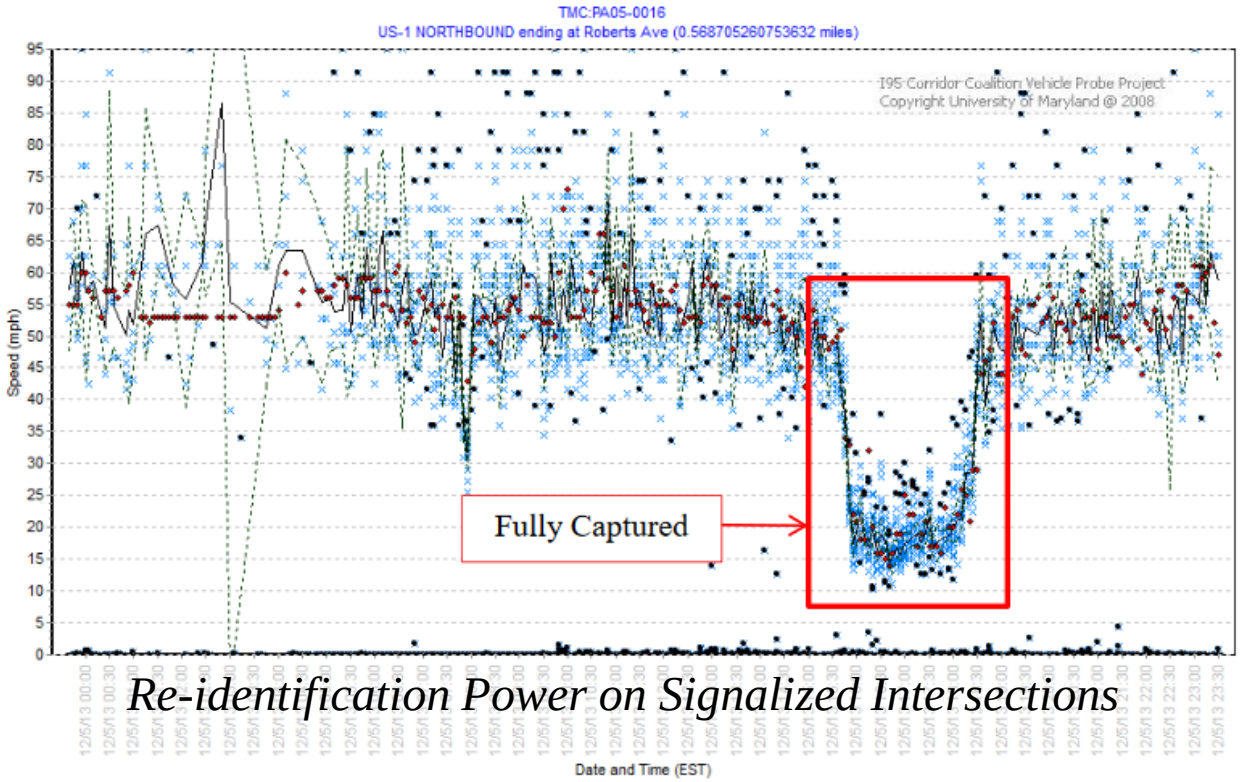
Applications

- Re-identification Data
  - Fully characterizes signalized arterial congestion
  - As a travel time sensor – can precisely capture impacts of signal retiming



Before/After Study for Signal Timing



Re-identification Power on Signalized Intersections

HRCD (High-Resolution Controller Data)

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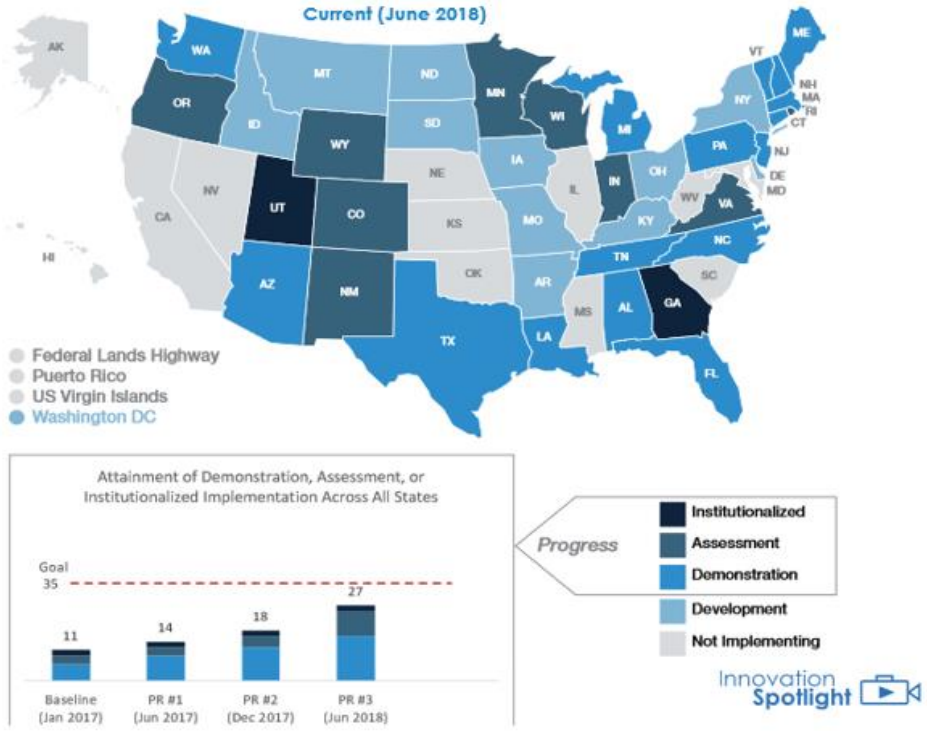
- **Useful Applications: Signal Performance Studies (ATSPMs)**

High-Resolution Controller Data

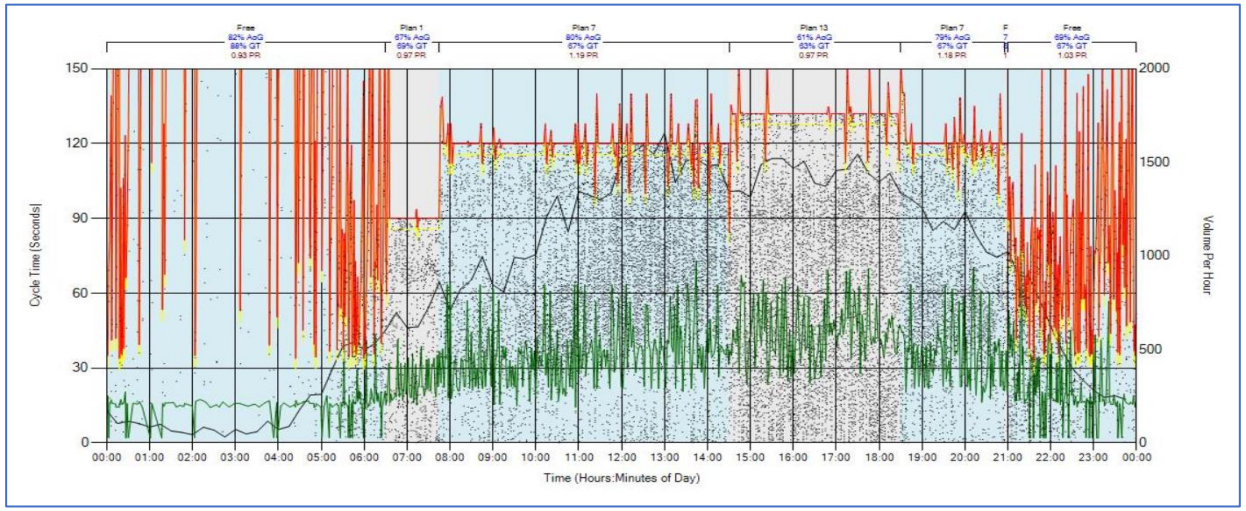
- Unleashes the data in the traffic signal cabinet
  - Signal Phase and Timing
  - All actuation and Sensor data
  - Enabled by low-cost communications, and server-side storage and processing
- Led to development of Automatic Traffic Signal Performance Measures (ATSPMs)
  - High quality, timely traffic signal assessment for management of critical corridors
  - Made data available for other applications
- Leading to ATSPMs from vehicle trajectory data

High-Resolution Controller Data

- Ushered in Automated Traffic Signal Performance Measures (ATSPMs)
  - Major signal controllers adopted & states getting on board



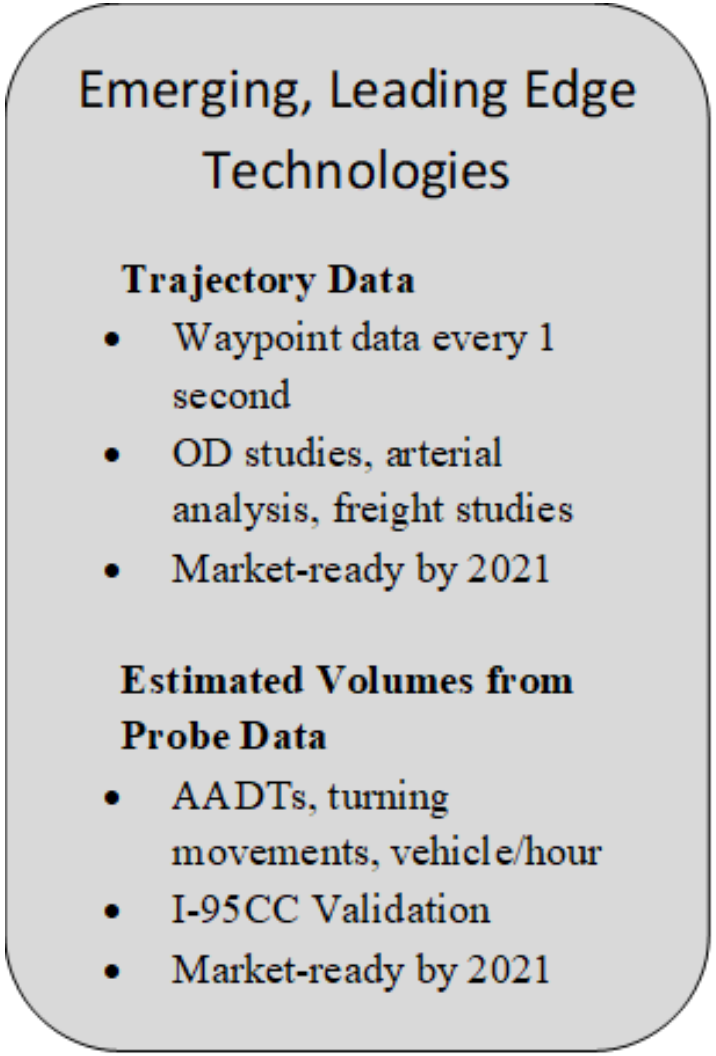
Adoption of Advanced Signal Metrics



Purdue Coordination Diagram

Emerging, Leading Edge Technologies

- **Trajectory Data –**
  - Not just aggregations- but the ‘bread-crumb trail’ of latitude longitude point
  - High-Resolution Sample of vehicle/traveler behavior
  - Detailed OD Studies, **sensor-less ATSPMs**, Energy-Mobility high-resolution modeling
  - In 2020 – **EXPLODED: COVID-19 Mobility Impacts**
- **Volumes from Probe Data**
  - Density and scale of ‘Way Point’ data now leading to volume data services
  - Hurricane Evac Volume Estimation POC in 2020
    - **Stay Tuned for POC Lessons Learned Briefing in 2021**



Questions?

Stan Young

Advanced Transportation and Urban Scientist

National Renewable Energy Laboratory

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New Traffic Monitoring (and decision-making) Opportunities

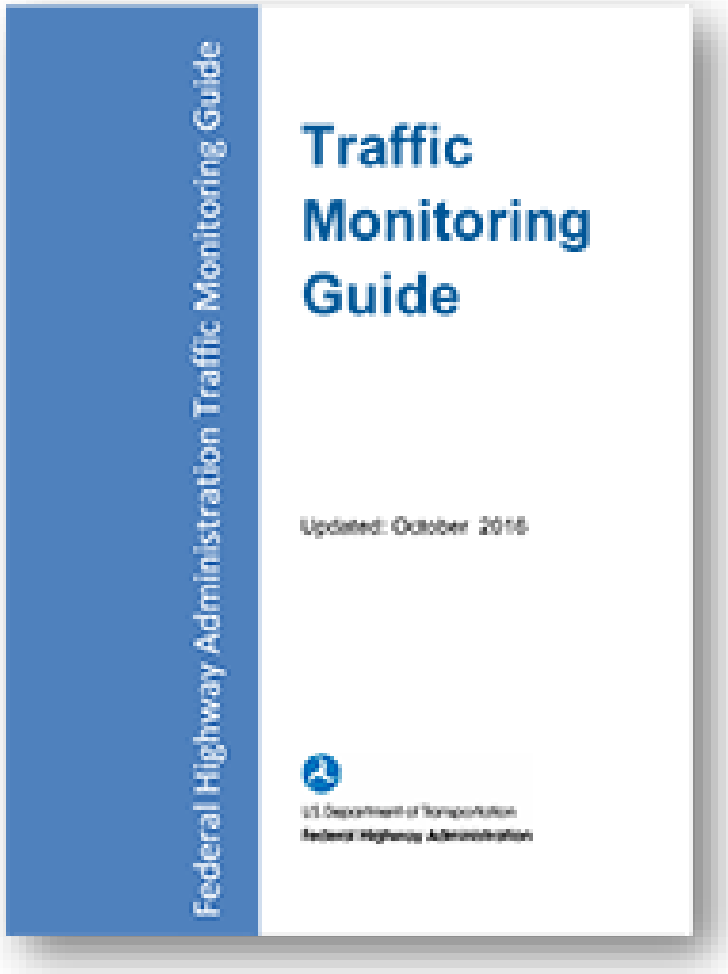
Michael Pack, Director
University of Maryland CATT Laboratory

New Traffic Monitoring (and decision-making) Opportunities

Michael Pack, Director of CATT Laboratory

An overview of works-in-progress that will inform and guide agencies in acquiring and using data in innovative ways.

TMG background



- Provides guidance to state highway agencies for traffic monitoring
  - Policies
  - Standards
  - Procedures
  - Equipment
- **Last updated in October 2016**
- Latest version being developed by the following team:
  - USDOT Office of Highway Policy Information
  - CASE
  - ARA
  - Marlin engineering
  - MMV consulting
  - Synthosys
- A few things have changed
  - Data sources
  - Data sensors
  - Business models
  - Smart data management

TMG Chapter 6

TMG Chapter 6 acquiring third party traffic data, new technology, and data analysis

Chapters

Emerging data acquisition and collection options

Purchasing data – opportunities and challenges

TM

Use cases

Data acquisition collection planning

Smart data management

Purpose driven data collection

TMG Chapter 6: Emerging Data

Emerging data acquisition and collection options

Connected and autonomous vehicles

Commercially available probe vehicle data

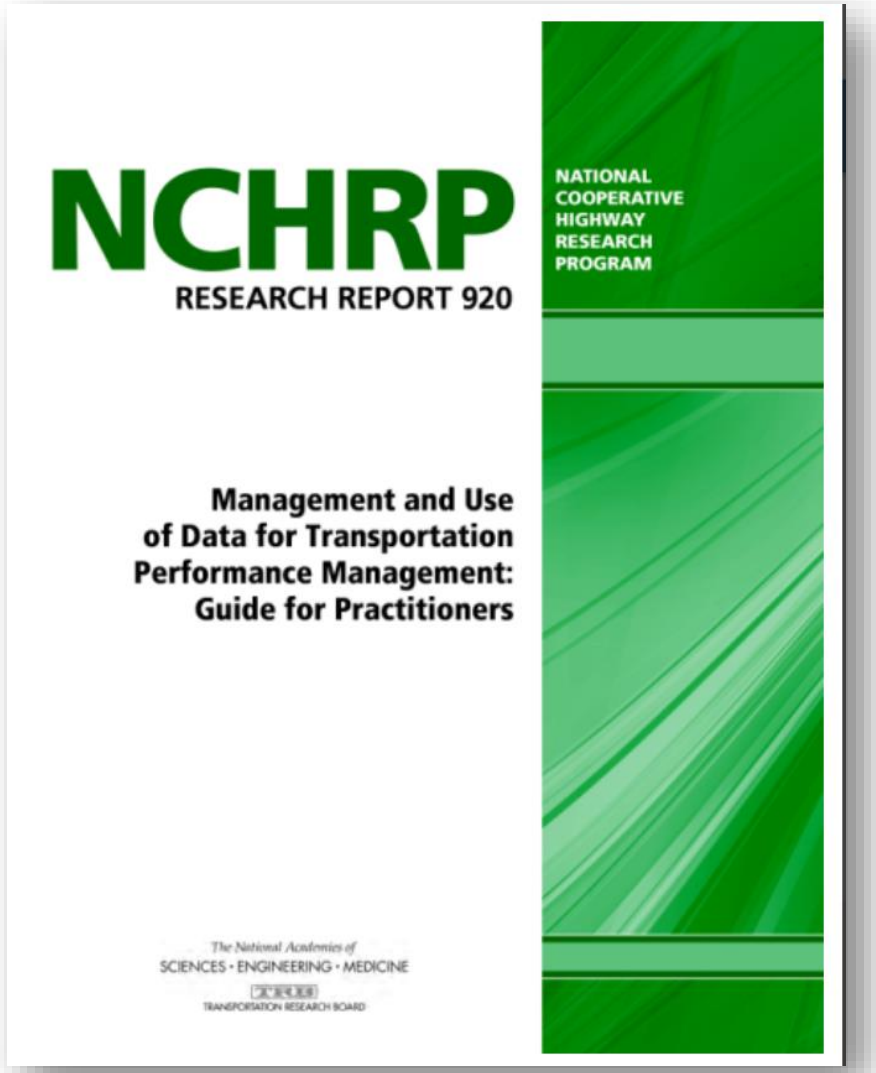
Location intelligence data

Additional Resources

Other “Emerging Data” Resources

- 14 new-ish data sources
- List of providers and where they get their data
- Applications of data shown at a high level
- Available here

Managing the data



- TPM Focused, but still relevant to ops
- Includes 11 use-cases or "vignettes" that show real-world example of how agencies are managing their data.

Managing the data

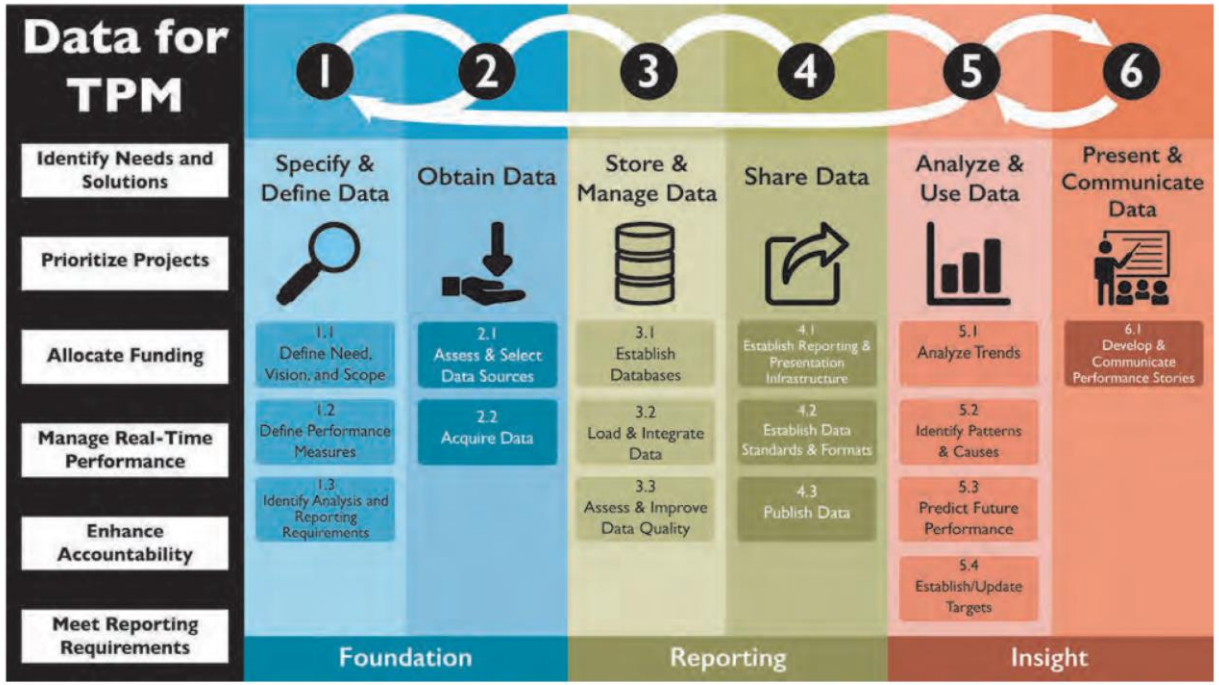


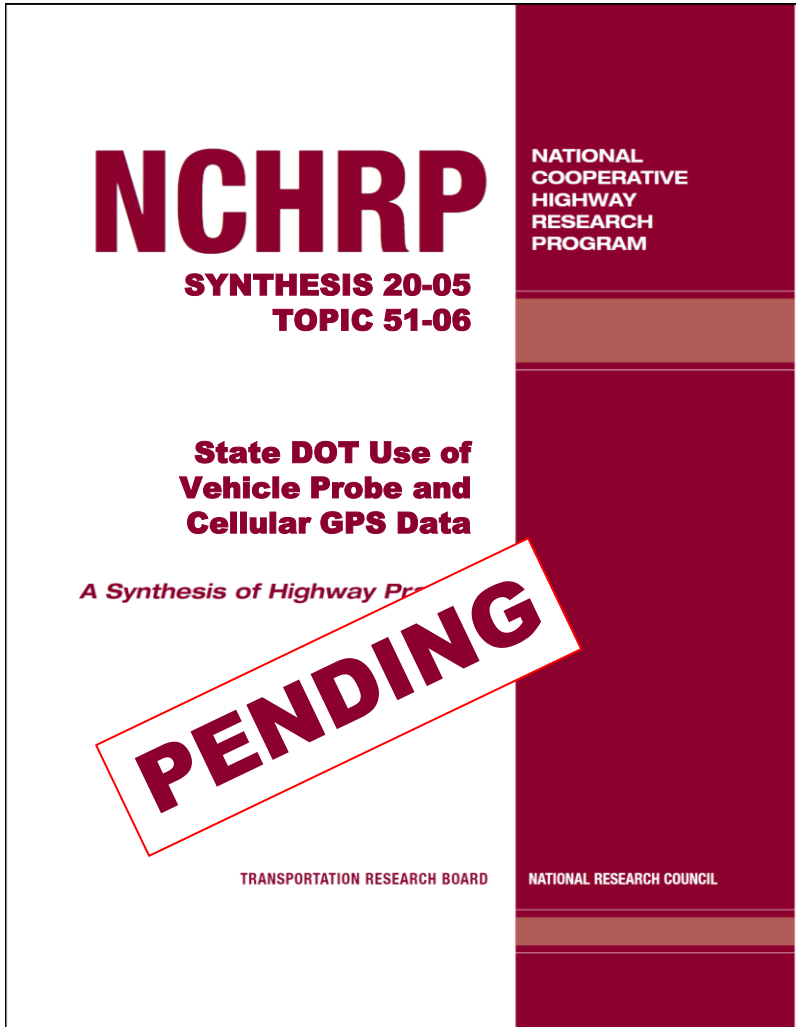
Figure 3. Framework for improving data utilization for TPM.

- Discusses six stages of managing and using data.
- Available here

Data, data, data….

But what about applications????

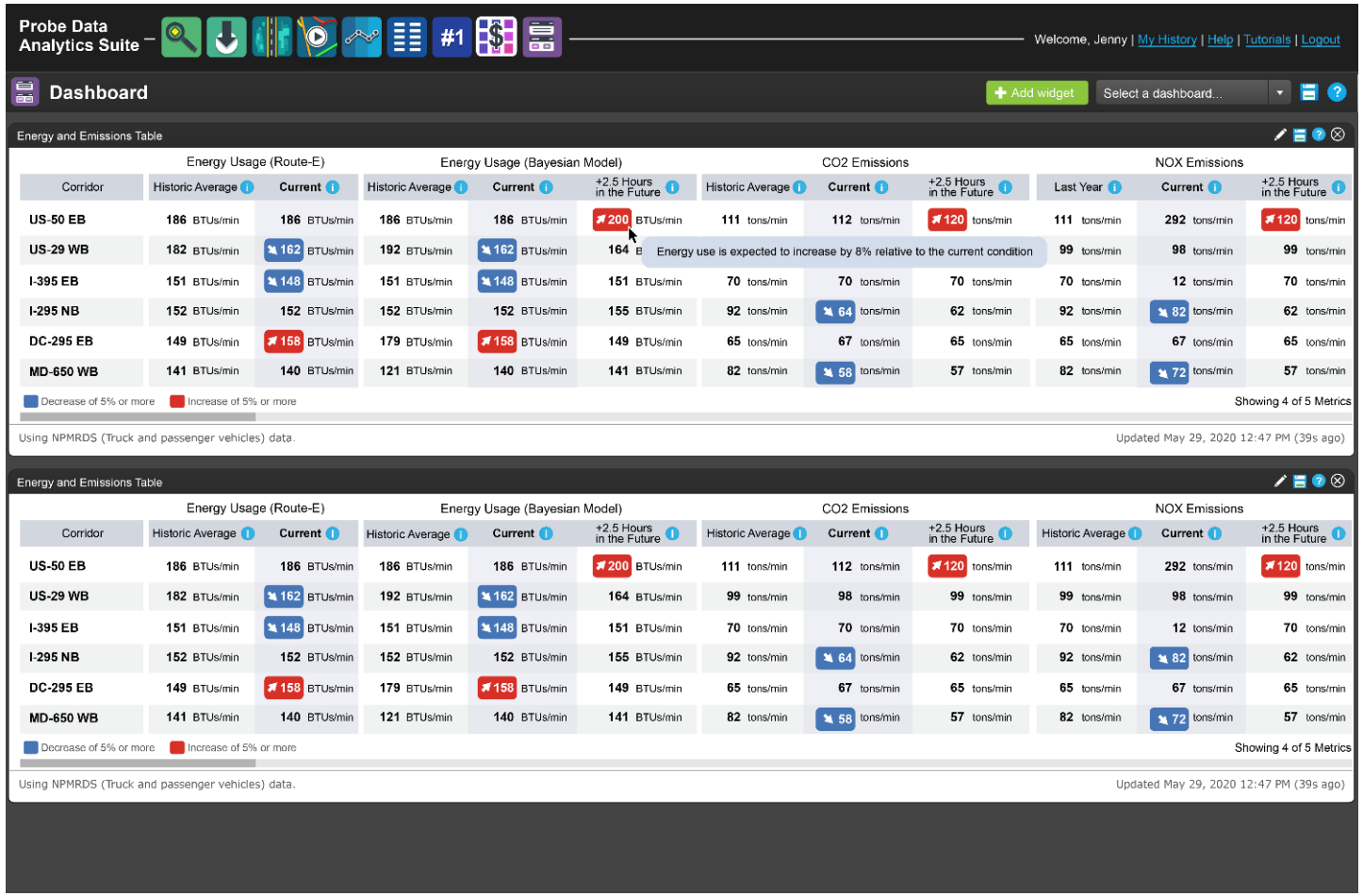
Innovative Use-cases for Emerging Data



- NCHRP Synthesis 20-05, Topic 51-06
- State DOT Use of Vehicle Probe and Cellular GPS Data
- Includes 19, short use-case write-ups
  - 12 cover speed-related data
  - Seven of the nineteen cover LBS and/or People Movement data
    - CV/OEMs
    - LBS
    - other

Monitoring the Climate, Emissions, and Driver Behavior

- 2 year DOE Funded Project wrapping up now.
- NREL + UMD CATT
- MORPC + MWCOG
- Probe-based Speed Data + Vehicle Registration Data
- Real-time and Predictive Energy Usage, Emissions, Fuel Consumption, etc.
- Visual of Vehicle Ownership



Dashboard

Add widget | Select a dashboard...

Energy and Emissions Table

	Energy Usage (Route-E)		Energy Usage (Bayesian Model)			CO2 Emissions			NOX Emissions		
Corridor	Historic Average	Current	Historic Average	Current	+2.5 Hours in the Future	Historic Average	Current	+2.5 Hours in the Future	Last Year	Current	+2.5 Hours in the Future
US-50 EB	186 BTUs/min	186 BTUs/min	186 BTUs/min	186 BTUs/min	↗ 200 BTUs/min	111 tons/min	112 tons/min	↗ 120 tons/min	111 tons/min	292 tons/min	↗ 120 tons/min
US-29 WB	182 BTUs/min	↘ 162 BTUs/min	192 BTUs/min	↘ 162 BTUs/min	164 B	99 tons/min	98 tons/min	99 tons/min	99 tons/min	98 tons/min	99 tons/min
I-395 EB	151 BTUs/min	↘ 148 BTUs/min	151 BTUs/min	↘ 148 BTUs/min	151 BTUs/min	70 tons/min	70 tons/min	70 tons/min	70 tons/min	12 tons/min	70 tons/min
I-295 NB	152 BTUs/min	152 BTUs/min	152 BTUs/min	152 BTUs/min	155 BTUs/min	92 tons/min	↘ 64 tons/min	62 tons/min	92 tons/min	↘ 82 tons/min	62 tons/min
DC-295 EB	149 BTUs/min	↗ 158 BTUs/min	179 BTUs/min	↗ 158 BTUs/min	149 BTUs/min	65 tons/min	67 tons/min	65 tons/min	65 tons/min	67 tons/min	65 tons/min
MD-650 WB	141 BTUs/min	140 BTUs/min	121 BTUs/min	140 BTUs/min	141 BTUs/min	82 tons/min	↘ 58 tons/min	57 tons/min	82 tons/min	↘ 72 tons/min	57 tons/min

Energy use is expected to increase by 8% relative to the current condition

Decrease of 5% or more Increase of 5% or more

Showing 4 of 5 Metrics

Using NPMRDS (Truck and passenger vehicles) data.

Updated May 29, 2020 12:47 PM (39s ago)

Energy and Emissions Table

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I-395 EB	151 BTUs/min	↘ 148 BTUs/min	151 BTUs/min	↘ 148 BTUs/min	151 BTUs/min	70 tons/min	70 tons/min	70 tons/min	70 tons/min	12 tons/min	70 tons/min
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Updated May 29, 2020 12:47 PM (39s ago)

Energy Use and Emissions Matrix - I-270 Northbound between I-270 (SPUR) and MD-121

Sunday, August 16, 2015 to Friday, August 21, 2015

Vehicle Type: All (All, Passenger, Commercial, Hybrid, Electric)

Display: Total Energy Use (Route-E)

Total Energy Usage (BTUs)

0k — 10k — 60k — 80k — 90k — 90k+

No data

Energy Use in BTUs

Using the Route-E Model

	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 AM	1 PM	2 PM	3 PM	4 PM	5 PM	6 PM	7 PM	8 PM	9 PM	10 PM	11 PM	Daily Totals
Sun 8/16/15	0.2k	0.1k	0.1k	0.1k	0.1k	0.2k	0.2k	0.0k	0.1k	0.0k	0.1k	10.4k	0.1k	0.2k	14.4k	0.5k	0.5k	18.6k	21.1k	14.3k	22.5k	10.8k	40.1k	50.2k	Sun 27.7k
Mon 8/17/15	0.4k	0.1k	0.1k	0.2k	0.1k	0.1k	0.3k	22.7k	18.8k	0.3k	0.2k	0.0k	0.1k	0.2k	0.3k	18.0k	12.3k	17.5k	15.4k	0.0k	0.1k	0.2k	0.2k	0.2k	Mon 58.5k
Tue 8/18/15	0.1k	0.2k	0.1k	0.0k	0.0k	11.1k	0.0k	0.0k	5.2k	0.2k	0.1k	0.3k	0.1k	0.4k	0.1k	13.0k	19.3k	85.0k	19.2k	0.0k	0.1k	0.1k	0.2k	0.1k	Tue 49.6k
Wed 8/19/15	0.1k	0.1k	0.1k	0.1k	0.0k	0.2k	0.2k	17.7k	9.6k	0.9k	0.2k	0.1k	0.1k	0.1k	11.7k	10.0k	19.8k	19.0k	19.3k	15.9k	0.2k	0.2k	0.3k	0.2k	Wed 71k
Thu 8/20/15	0.1k	0.0k	0.1k	0.2k	0.2k	15.7k	10.5k	12.3k	19.2k	12.0k	0.2k	0.4k	17.1k	18.7k	13.7k	85.2k	86k	93.1k	90.4k	81.2k	12.8k	0.3k	0.2k	0.1k	Thu 315.7k
Fri 8/21/15	0.1k	0.0k	0.1k	0.0k	0.0k	0.1k	0.1k	83.7k	82.1k	13.2k	10.6k	10.6k	11.1k	17.6k	81k	85.7k	69.4k	83.9k	12k	15.3k	0.2k	0.2k	0.4k	0.2k	Fri 197.6k
Hourly Totals	0.9k	0.6k	0.6k	0.6k	0.4k	3.6k	11.3k	36.4k	55k	6.5k	1.3k	1.9k	8.8k	17.1k	26.1k	72.1k	107.3k	192.2k	134.3k	32.8k	5.9k	1.8k	1.3k	0.9k	Grand Total 720, 071

Probe Data Analytics Suite

Welcome, Jenny | My History | Help | Tutorials | Logout

Energy Use and Emissions Trend Map

Display:

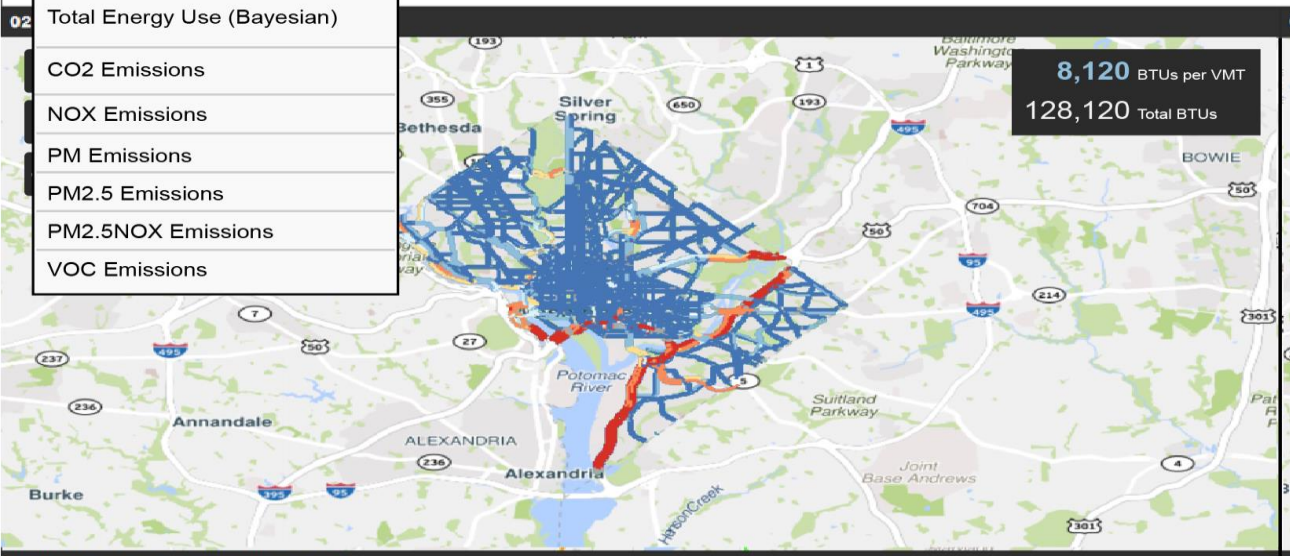
Total Energy Use (Route-E)

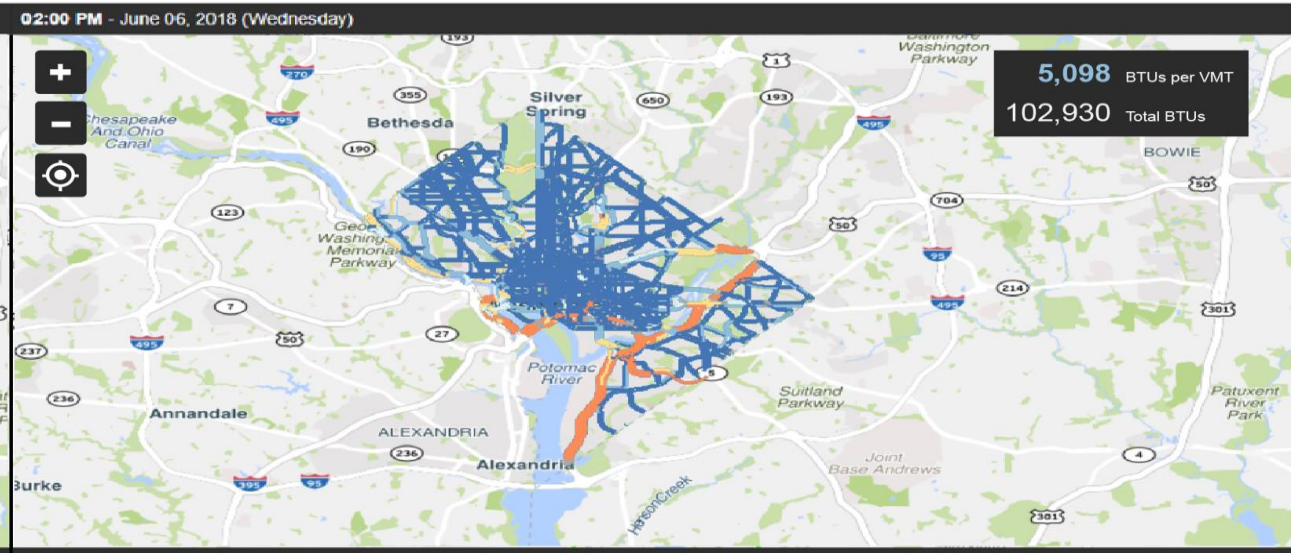
- Total Energy Use (Route-E)
- Total Energy Use (Bayesian)
- CO2 Emissions
- NOX Emissions
- PM Emissions
- PM2.5 Emissions
- PM2.5NOX Emissions
- VOC Emissions

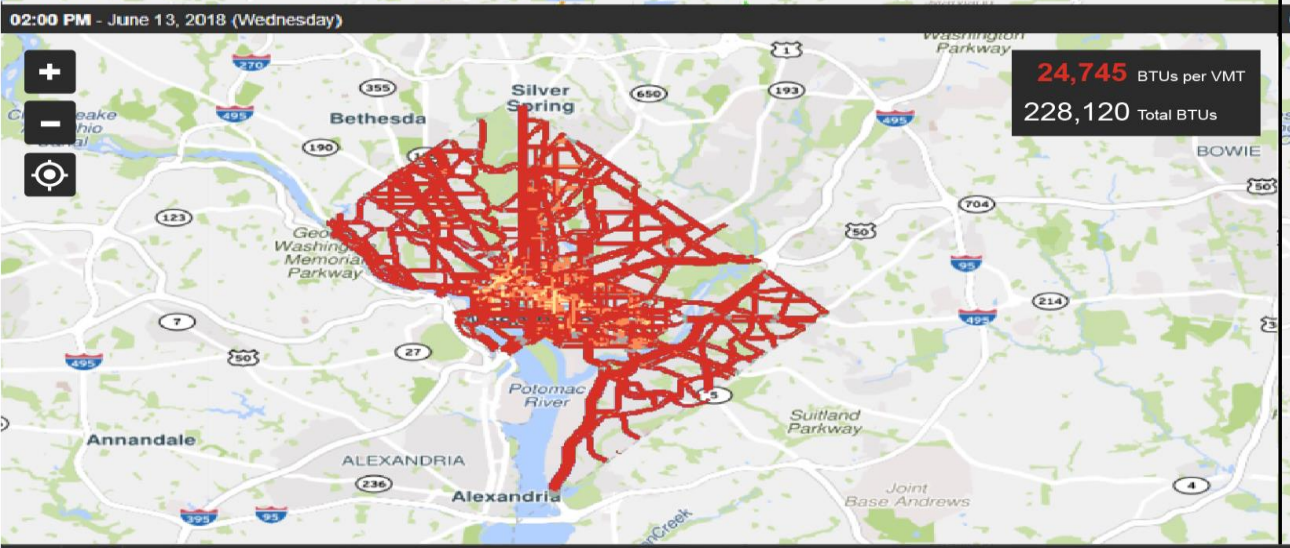
Color thresholds

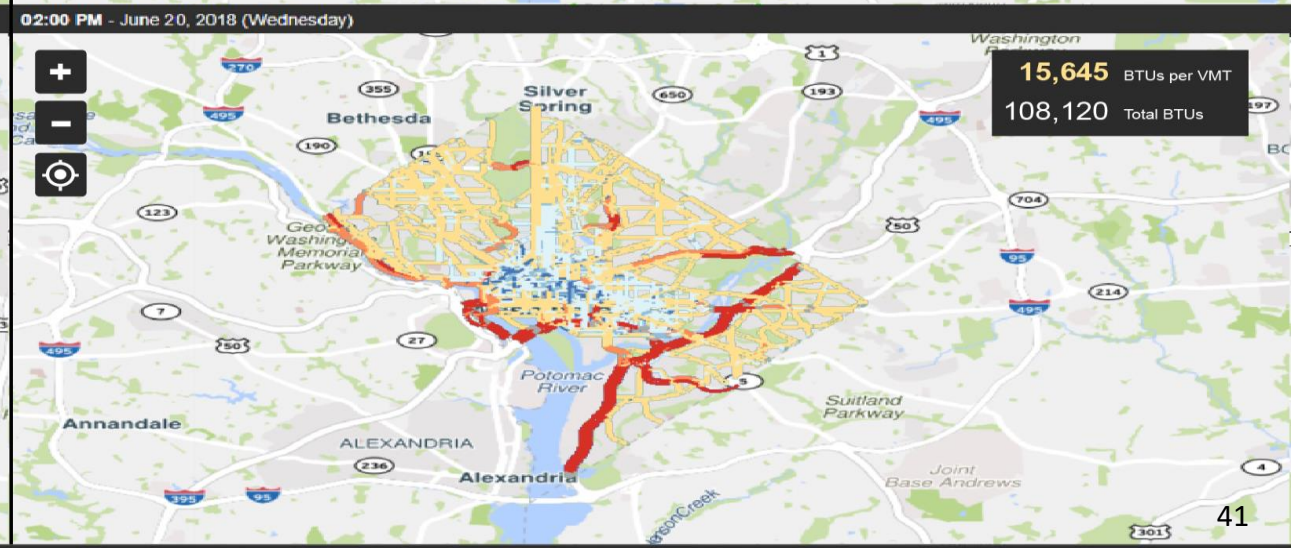
5,000 BTUs per VMT — 25,000 BTUs per VMT

5,000 | 10,000 | 15,000 | 20,000 | 25,000







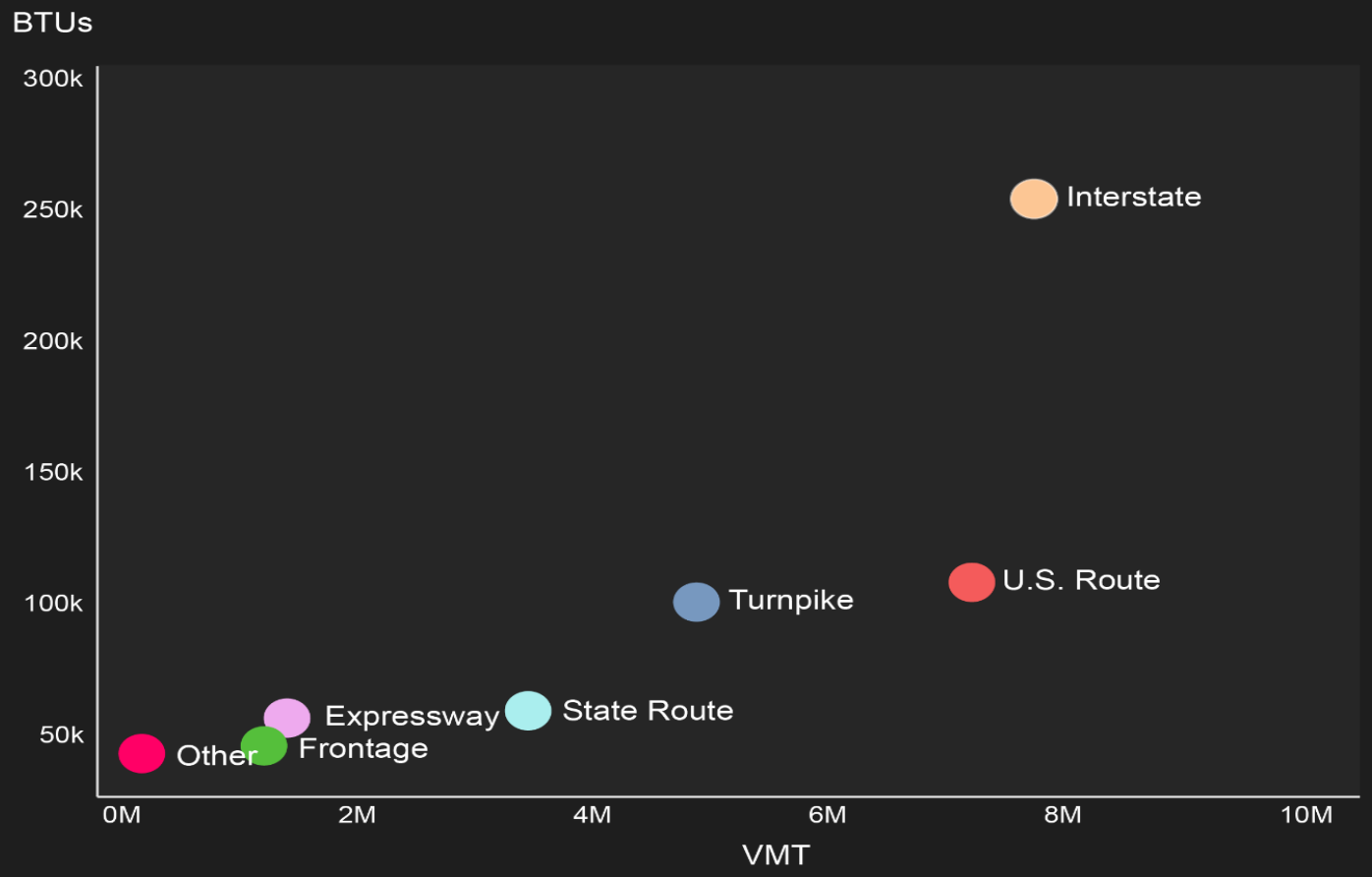


Energy Use and Emissions Charts - I-270 Northbound between I-270 (SPUR) and MD-121

Sunday, August 16, 2015 to Friday, August 21, 2015 (6 Days)

Y Axis: Total Energy Use (Route-E) | X Axis: VMT | Breakdown By: Road Class

Total Energy Use in BTUs (Route-E) / VMT by Road Class



Road Class	Road Mileage	BTUs	VMT	BTUs / VMT
Interstate	1,320.1 mi	287.18k	8,348,613	27,300
U.S. Route	874 mi	99.2k	6,345,657	13,142
Turnpike	431 mi	79.2k	4,296,231	7,060
State Route	212 mi	29.2k	3,213,132	3,470
Expressway	123.1 mi	23.2k	1,252,800	1,410
Frontage	87 mi	24.4k	1,123,472	1,400
Other	32 mi	21.3k	732,300	982

Vehicle Ownership Charts

Layout

Y axis label

Above axis Centered on axis

Map

Show Map...

Tooltips

Clicking a chart item will lock tooltips at that interval on each chart.

Remove all tooltips

Chart data

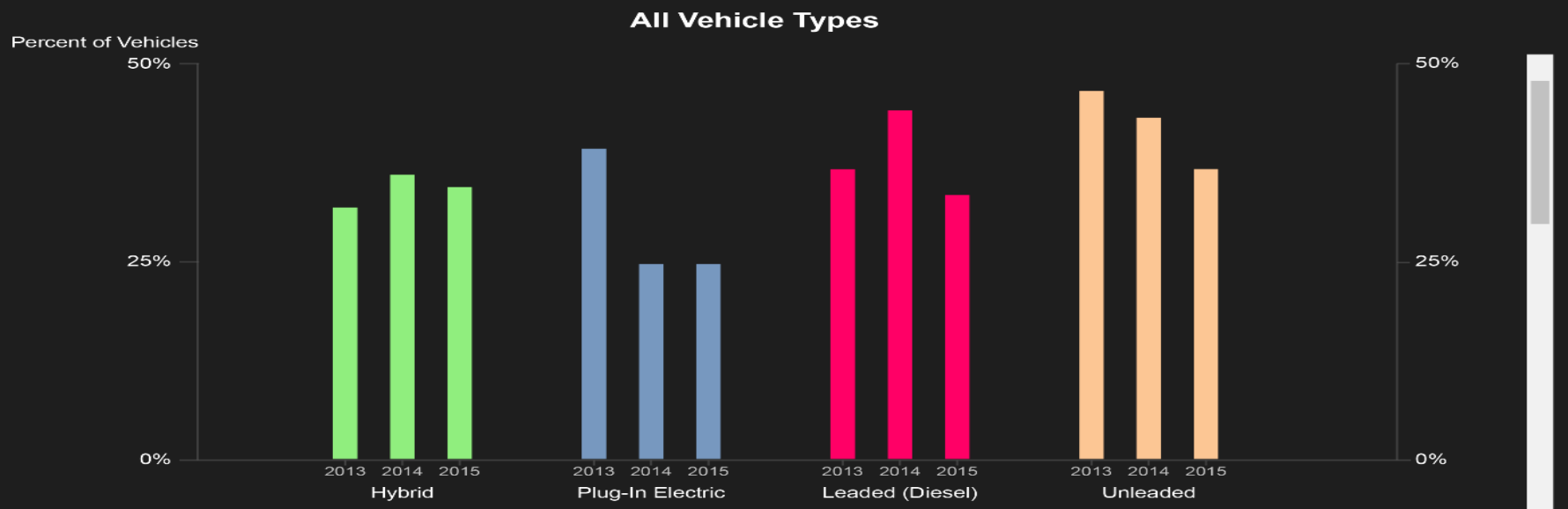
- [x] Hybrid
- [x] Plug-In Electric
- [x] Leaded (Diesel)
- [x] Unleaded

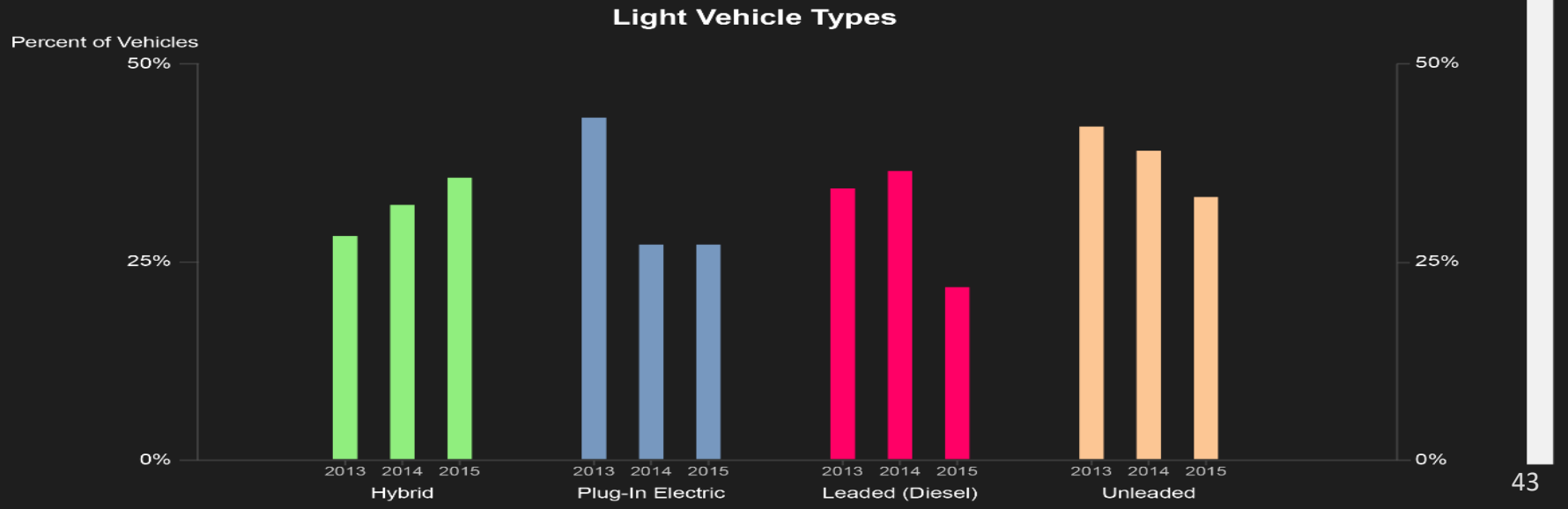
Charts

- [x] All Vehicle Types
- [x] Light Vehicles
- [x] Medium Vehicles
- [x] Heavy Vehicles

20876

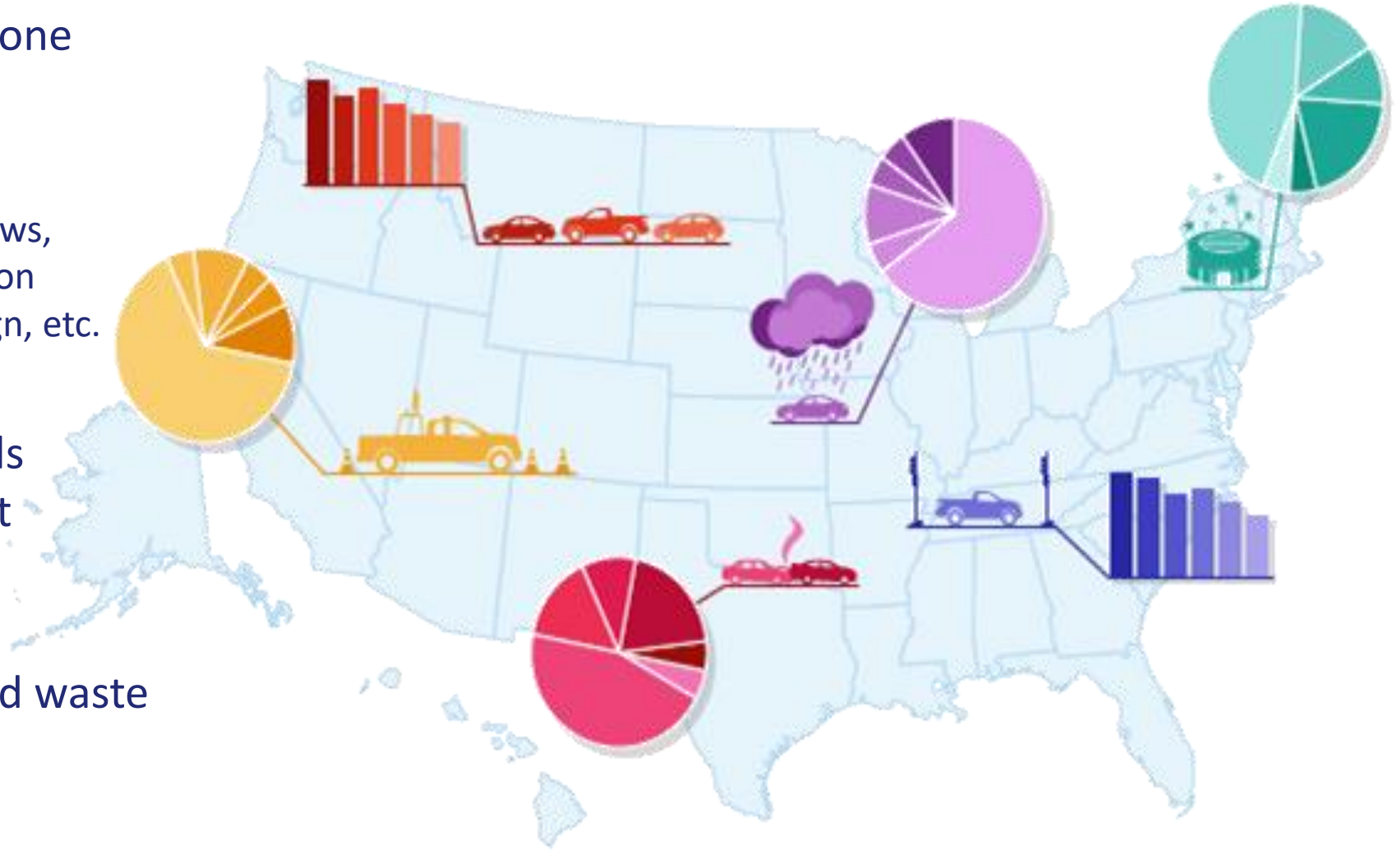
Averaged yearly from 2013 to 2015



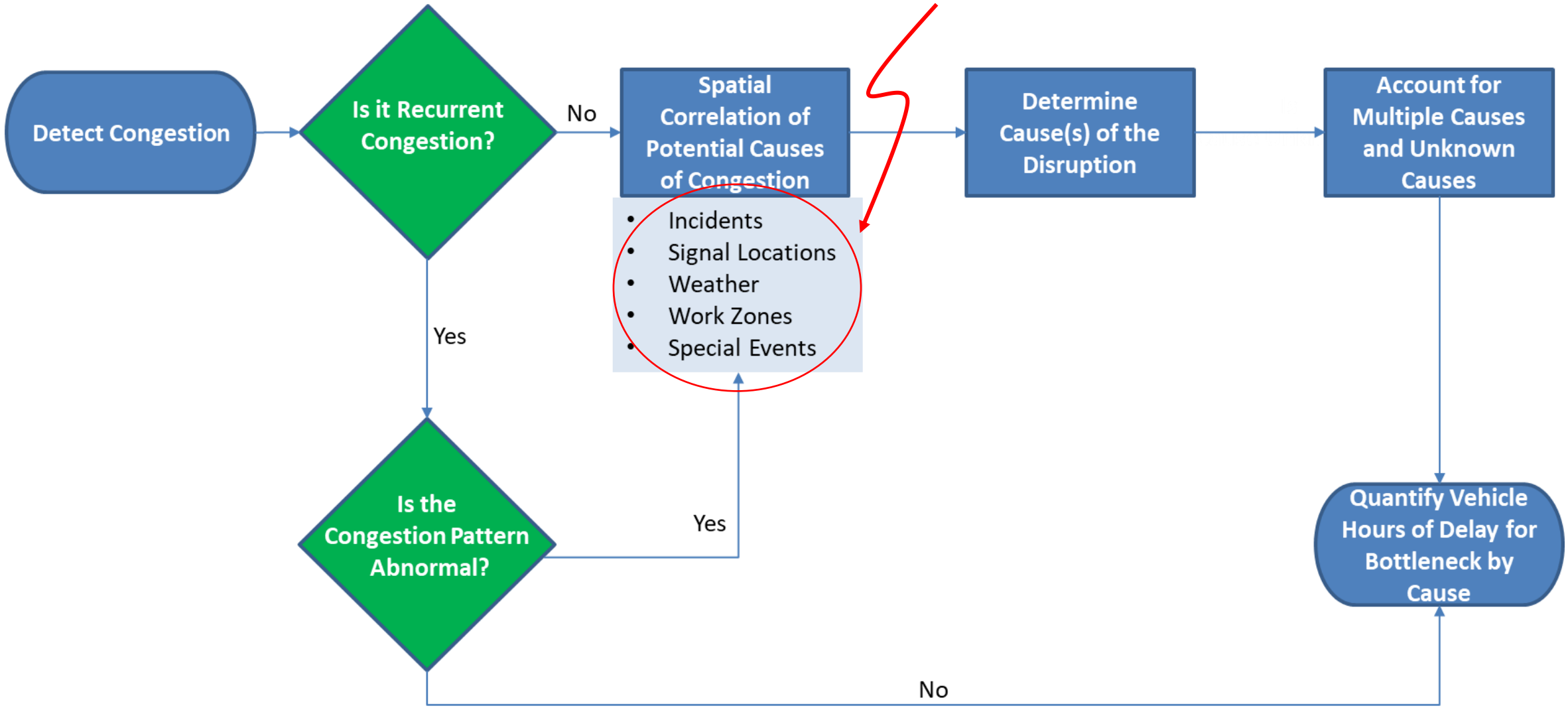


The *Causes of Highway Congestion* pie chart…

- One stat can't represent everyone
- Many regional factors:
  Climate, demographics, policies, laws, infrastructure conditions, population density, technology, roadway design, etc.
- Wise decision-making demands current and regionally-relevant information.
- Accountability through reduced waste & improved results



Integration of Disparate Traffic Data



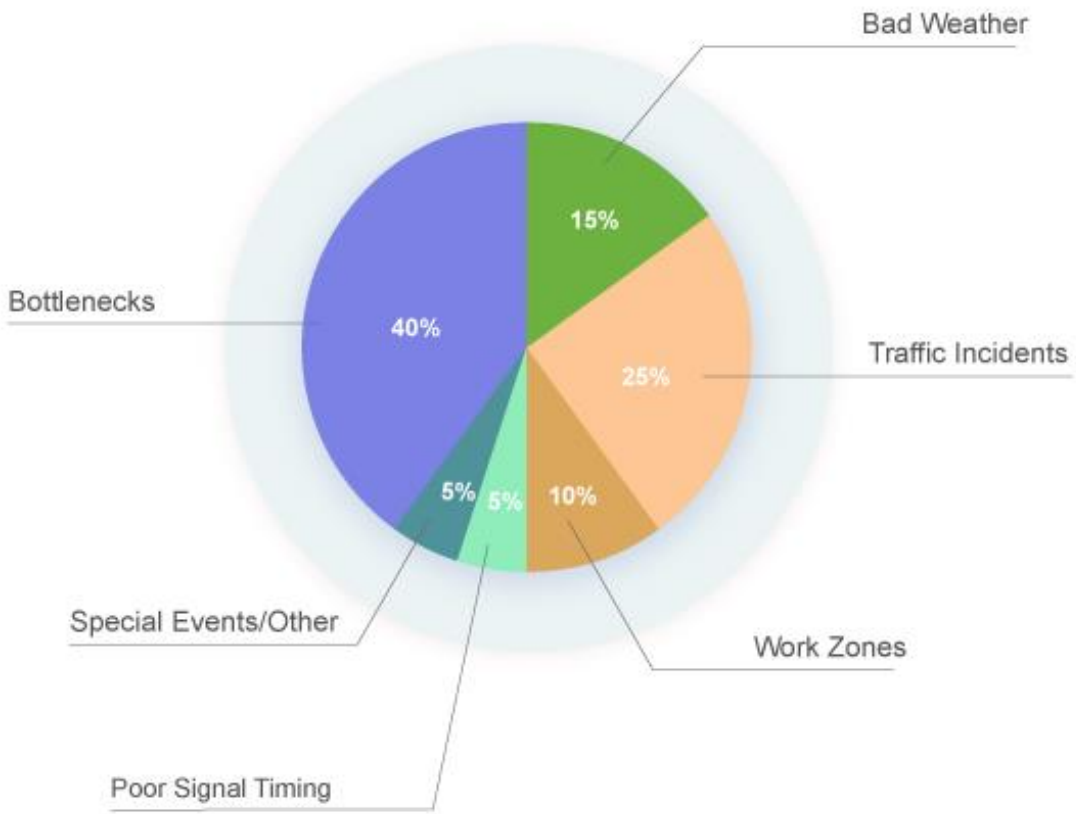
Select Year 2018

Select a state

Sort By State Name A to Z

Sources of Congestion **Nation Wide** in 2018

Rated by Vehicle Miles Traveled



Month-by-month and County-by-County Strategizing for Countermeasures and Investments

Alabama

Rated by Vehicle Miles Traveled

Alaska

Rated by Vehicle Miles Traveled

Arizona

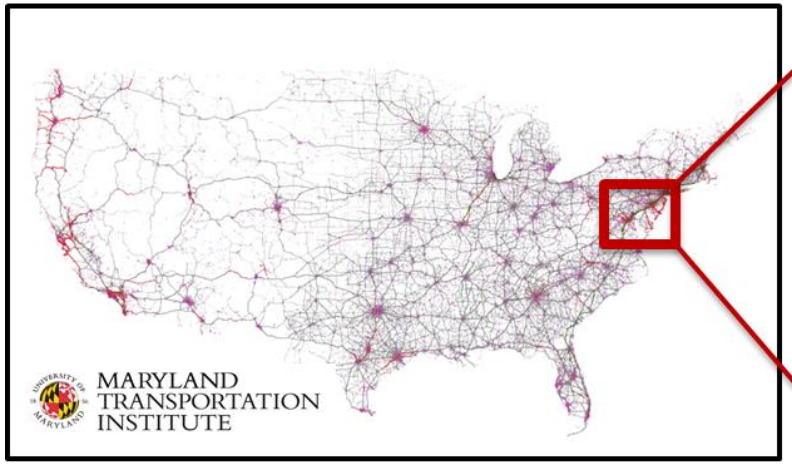
Rated by Vehicle Miles Traveled

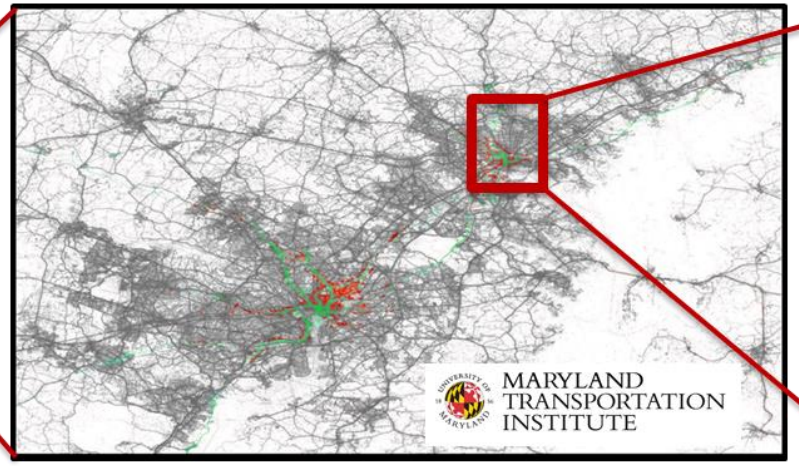
Arkansas

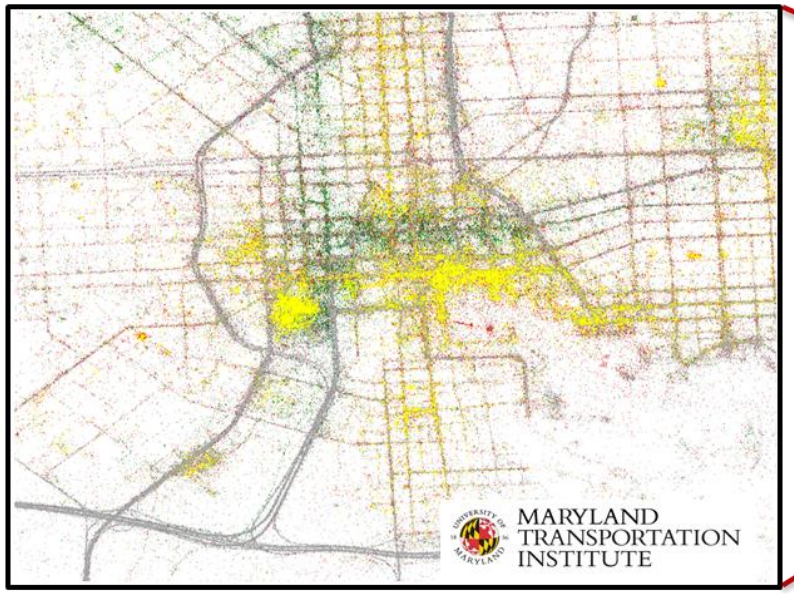
Rated by Vehicle Miles Traveled

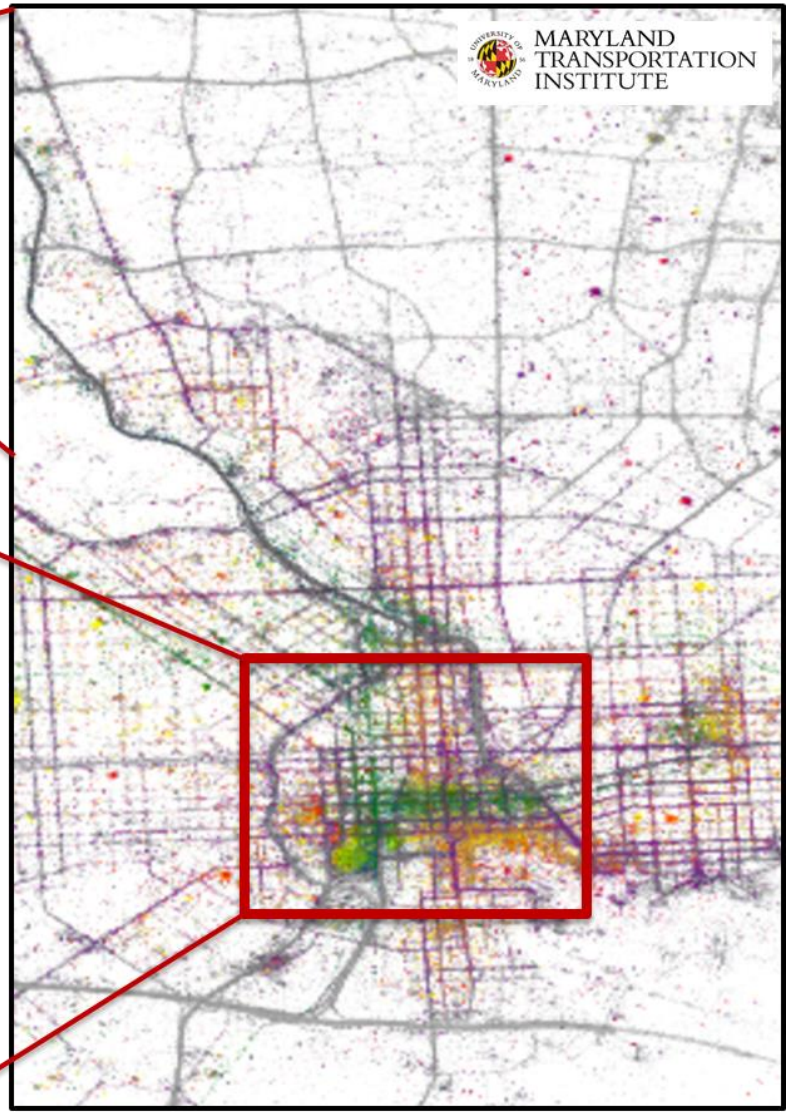
LBS, OEM, CV data, and more

LBS, OEM CV data, and more









Gray: Driving

Purple: Air

Green: Rail

Red: Bus

Yellow: Bike/Walk

University of Maryland
COVID-19 Impact Analysis Platform

About | Tutorial | Findings | Contact us at data-covid@umd.edu

MARYLAND TRANSPORTATION INSTITUTE

CATT LABORATORY

Mode: Default Metrics | Geographic Breakdown: Country States Counties | Zoom to and select a country, state, or county... | Filters | Visualization Panels

Show Date Range: From Apr 19 2020 to Apr 25 2020 | Include: Sun Mon Tue Wed Thu Fri Sat | Time Aggregation: Daily | Previous Day | Apr 19 Sun 2020 | Next Day

Bar Charts | Metrics Displayed in Charts 03 of 38

Selected Geography: **United Sates of America** Average: - - - -

Social Distancing Index

Apr 19 Sun 2020 **59**

Trips per person

Apr 19 Sun 2020 **4.417**

New COVID Cases

Apr 19 Sun 2020 **45.321**

Choropleth Map | Show Metric: Social Distancing Index

Date: **Apr 19 Sun 2020** S M T W T F S

Selected Geography: **United States of America**

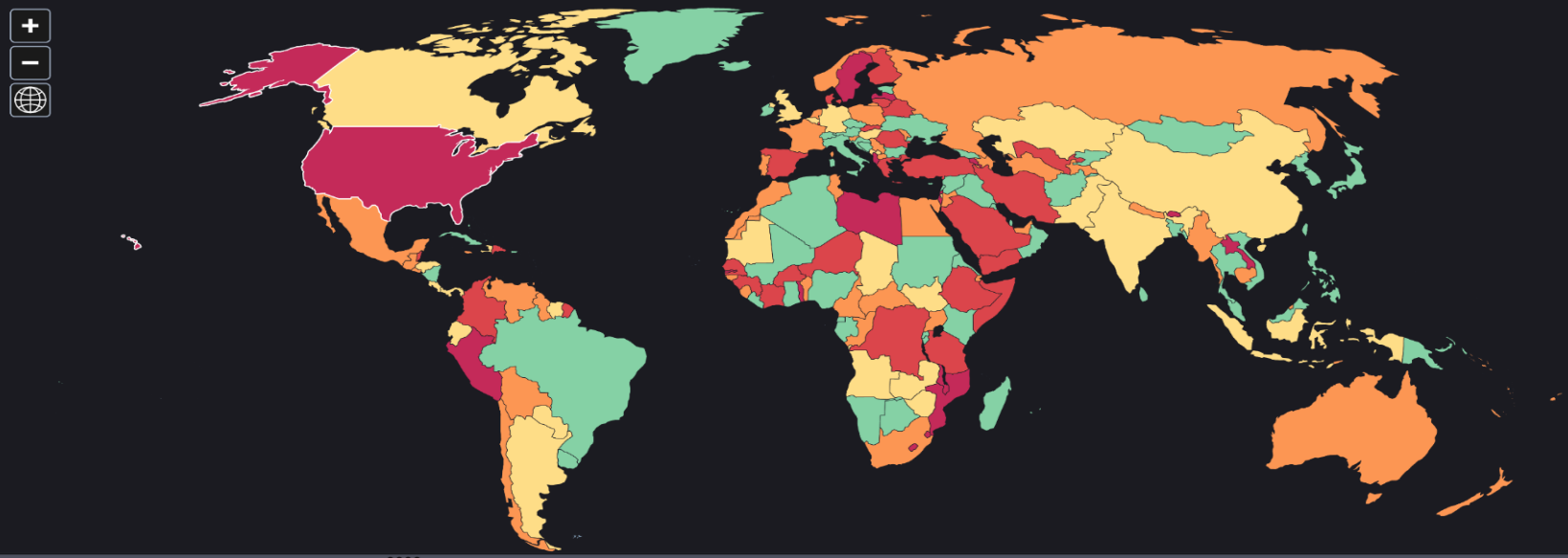


Table | Date: **Apr 19 Sun 2020** S M T W T F S | Metrics Displayed in Table 10 of 38

State	New COVID cases	Social distancing index	% Staying home	Trips per person	% Out-of-town trips	Miles traveled per person	Work trips per person	Non-work trips per person	Population	Unemployment
United States of America	45.321	59	40%	4.417	0.054	45.321	4.417	0.054	45.321	45.321
Change since previous day	75th Percentile ↑ 1.345 Increase	12th Percentile ↑ 1 Increase	34th Percentile ↑ 5% Increase	48th Percentile ↑ 2.863 Increase	25th Percentile ↓ 0.012 Decrease	82th Percentile ↑ 03.464 Increase	25th Percentile ↓ 3.394 Decrease	39th Percentile ↑ 0.002 Increase	39th Percentile 0	61st Percentile ↑ 22.356 Increase
United Kingdom	45.321	59	40%	4.417	0.054	45.321	4.417	0.054	45.321	45.321
Uganda	45.321	59	40%	4.417	0.054	45.321	4.417	0.054	45.321	45.321
Ukraine	45.321	59	40%	4.417	0.054	45.321	4.417	0.054	45.321	45.321
Uzbekistan	45.321	59	40%	4.417	0.054	45.321	4.417	0.054	45.321	45.321
United Arab Emirates	45.321	59	40%	4.417	0.054	45.321	4.417	0.054	45.321	45.321

UNIVERSITY OF MARYLAND

COVID-19 Impact Analysis Platform

MARYLAND TRANSPORTATION INSTITUTE

CATT LABORATORY

States | Counties

From August 27, 2020 to August 27, 2020

Select metrics: Mobility and Social Distancing | COVID and Health | Economic Impact | Vulnerable Population

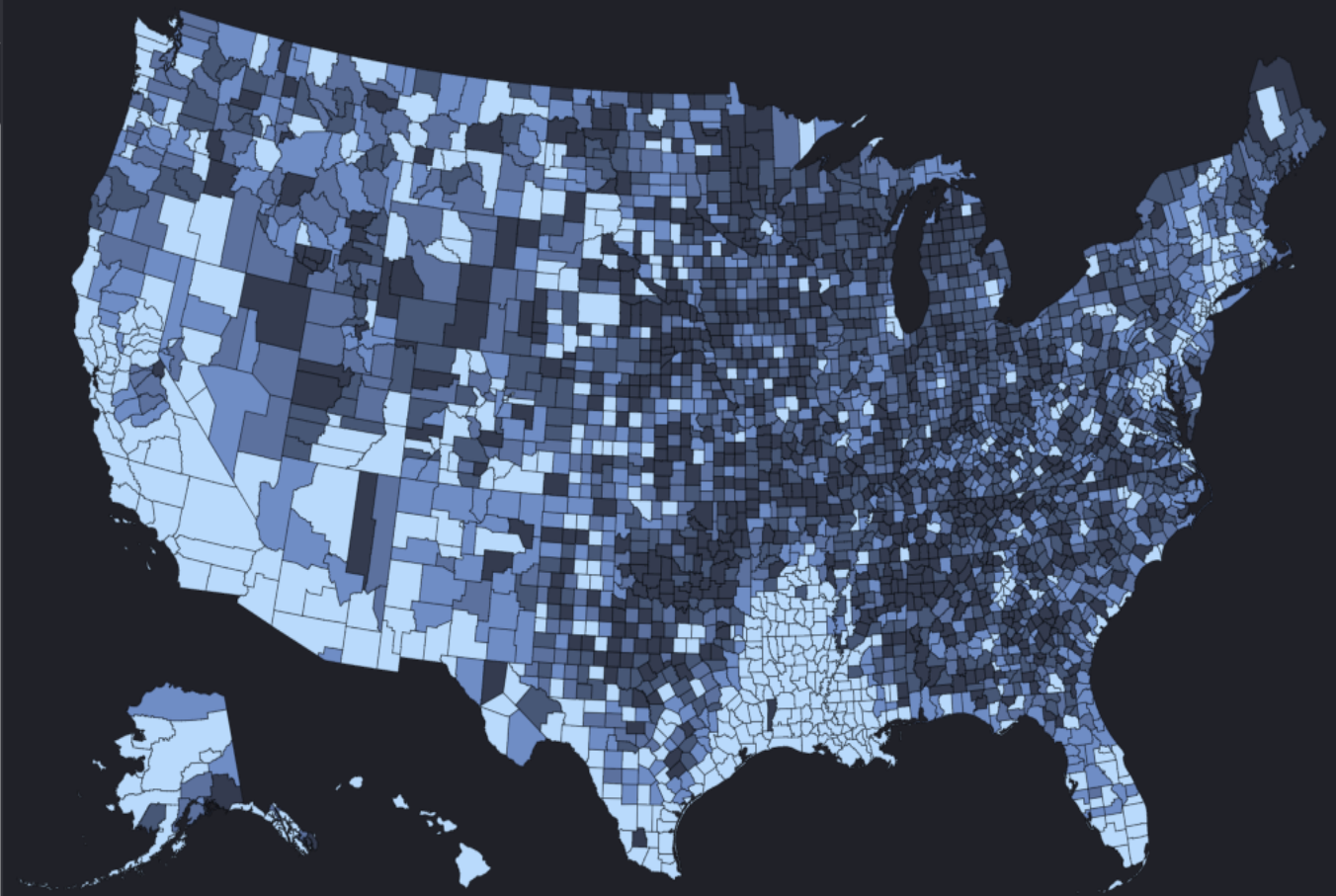
Search for a county

County ▲	Social distancing index	% staying home	Imported COVID cases	% change in consumption	COVID death rate	
Abbeville County, South Carolina	15	18%	173	13.7%	1.68%	SERA
Acadia Parish, Louisiana	44	32%	401	-20.7%	2.49%	SERA

Accomack County, Virginia 10 18% 75 0.2% 1.65% SERA

Zoom to All states | Show Social distancing index | Show National Statistics

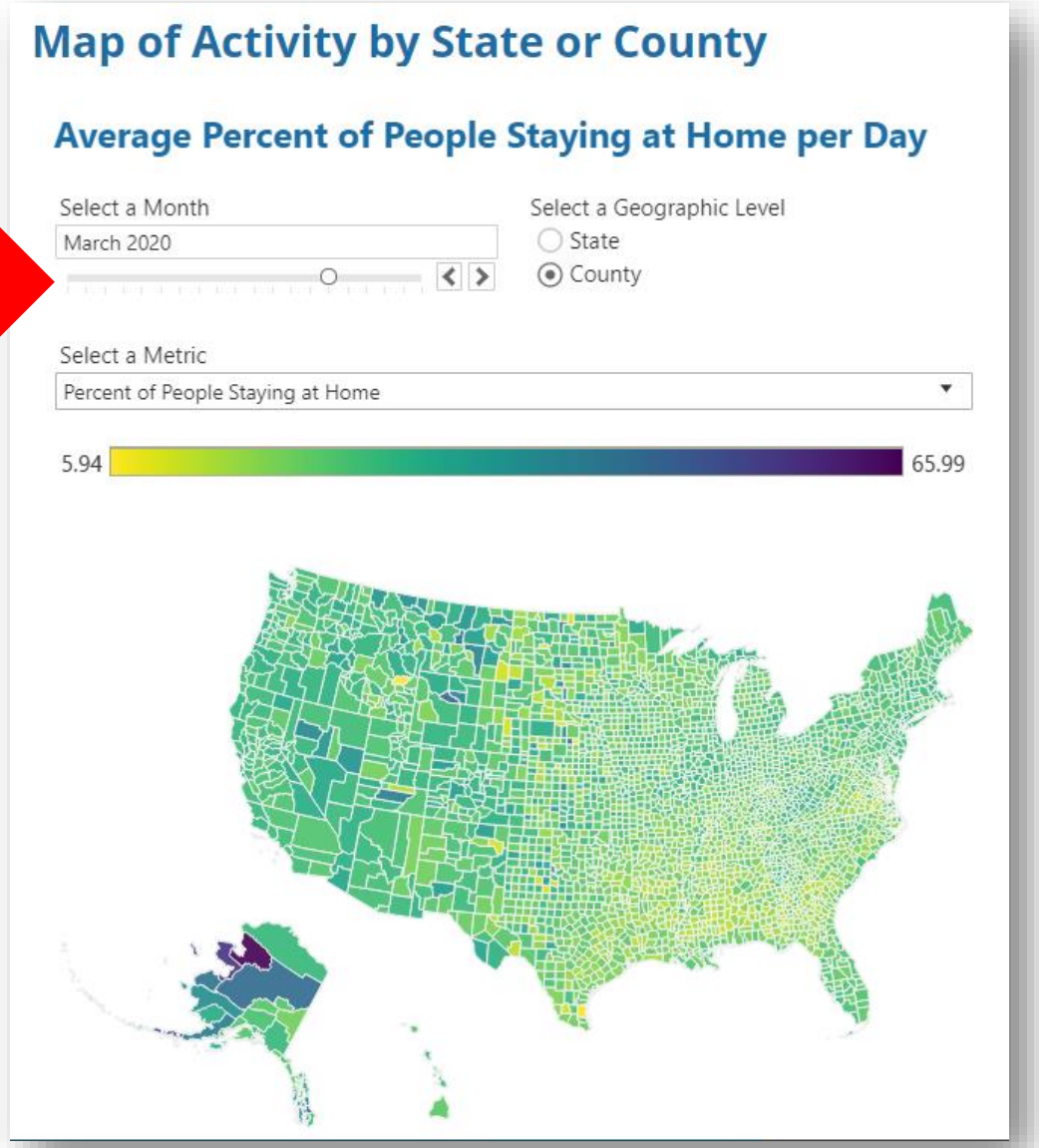
Showing data for August 27, 2020

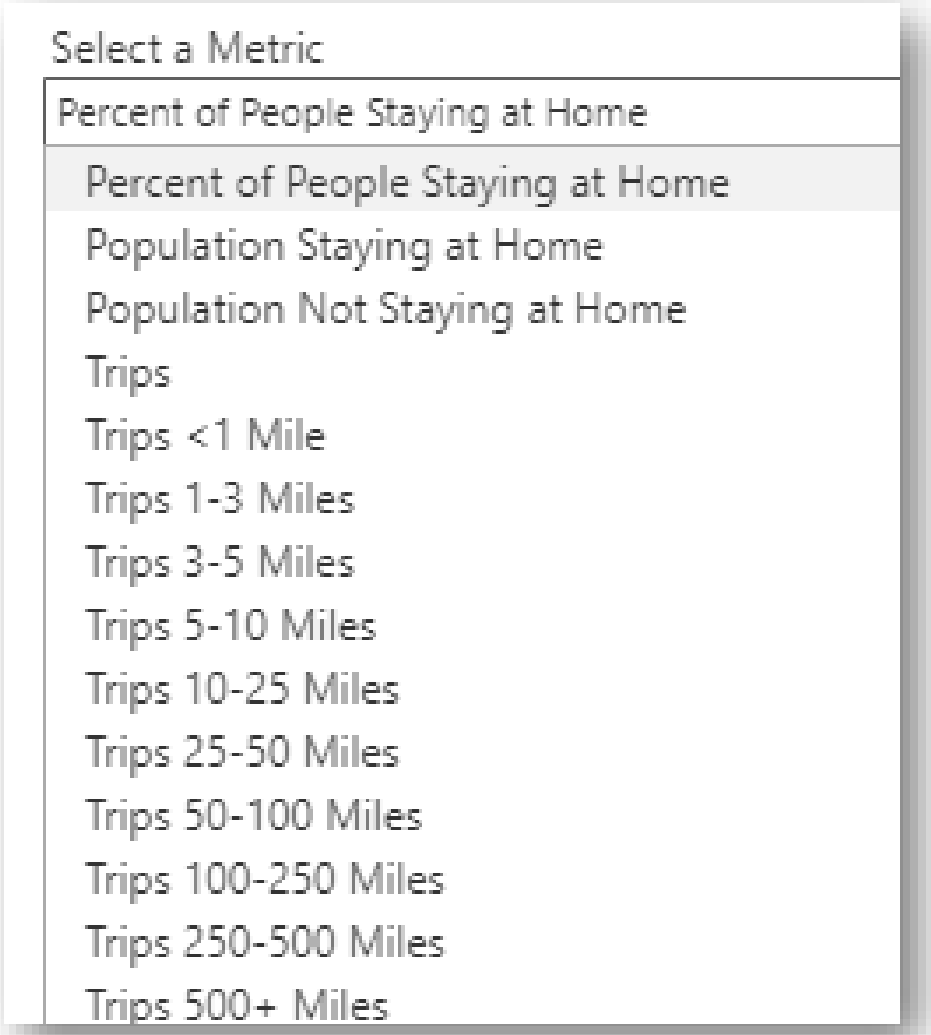


Social distancing index

0	18	21	24	29+

LBS used to understand daily trip distances





Segment Analysis

Using the RI data set
I-95 Northbound between Woodville Alton Rd/Exit 2 and Woodville Alton Rd/Exit 2; Sub-county to Sub-county; Heavy vehicles; Started and ended: July and August 2018, All days of week, 12 AM - 12 AM

Map Controls | Trip Filters | Time Range

Road Selection

Search for road...

Your selected roads | Remove all

I-95 Northbound between Woodville Alton R...

Directions:

☐ Eastbound ☑ Northbound
☐ Southbound ☐ Westbound

○ Entire (572 interchanges) ◉ Partial

From: Intersection

WOODVILLE ALTON RD/EXIT 2

To: Intersection

WOODVILLE ALTON RD/EXIT 2

3.71 miles of roadway selected (2 TMC codes)

Data is returned only for trips that travelled **all** selected road segments.

Geographic resolution

Sub-county

For trips through selected road segment, show the...

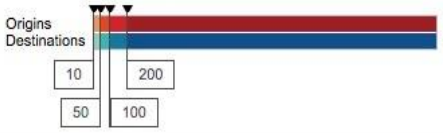
◉ Origins and destinations
○ Origins
○ Destinations

Data appearance

☑ Show values on map
◉ Sample counts
○ Percentages

Color legend...

☑ Enter exact values
☑ Hide lowest color range



View Matrix | Submit

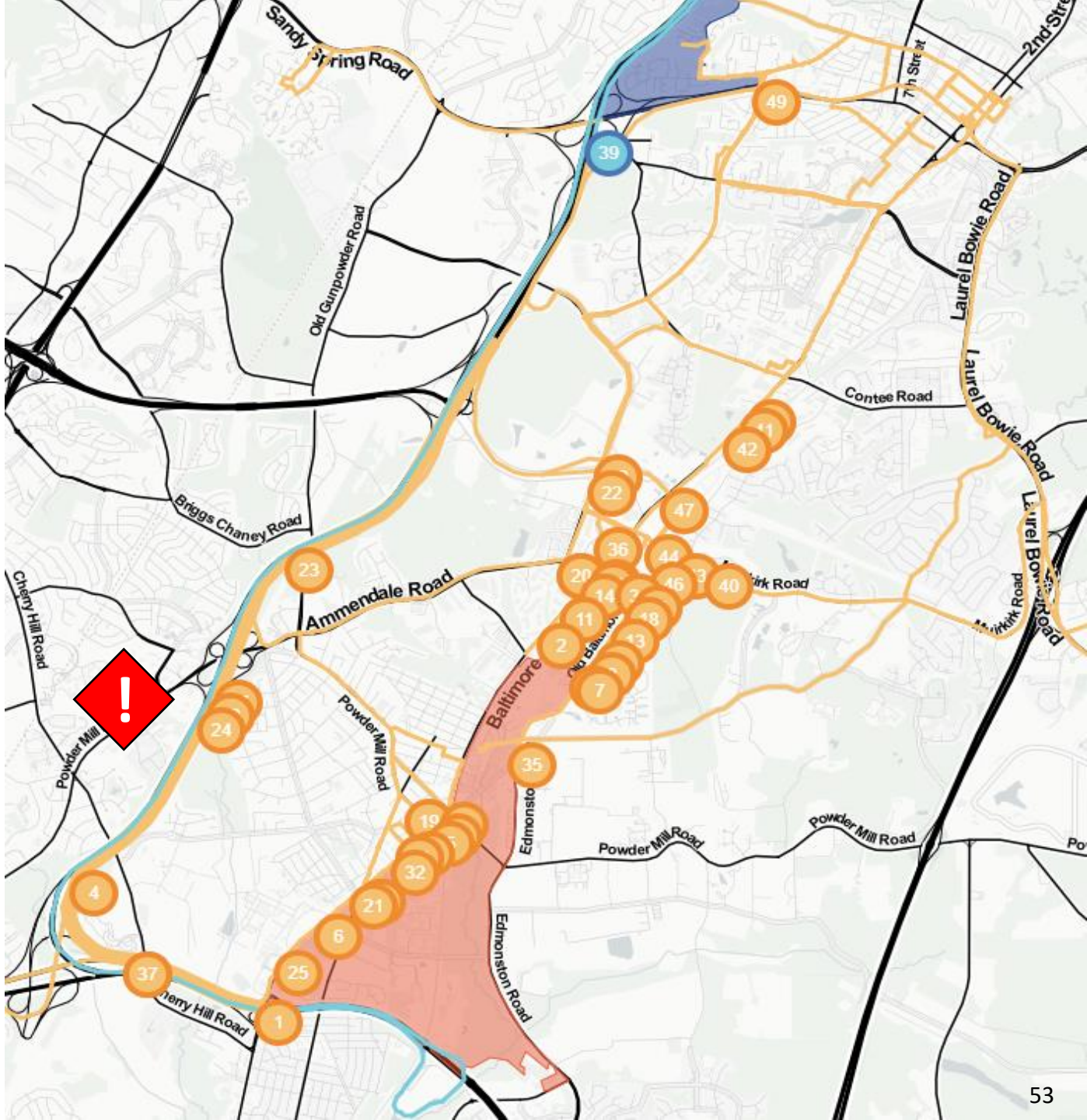
OD Zone Map for heavy trucks crossing from Connecticut into Rhode Island via I-95 during the two summer months of 2018

Destinations

Origins

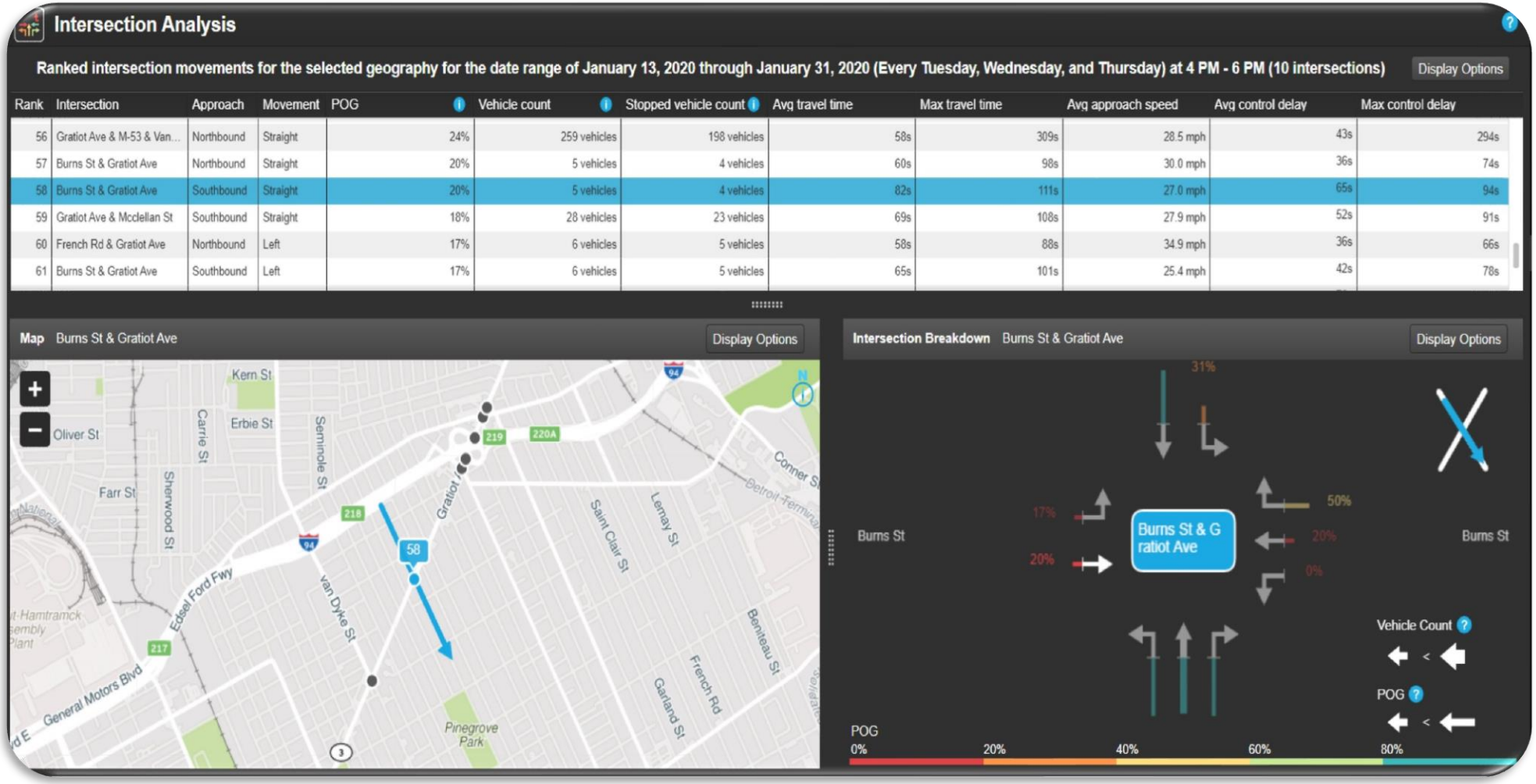
Selected link for spatial filtering of trips

Ops Detour Analysis & Planning



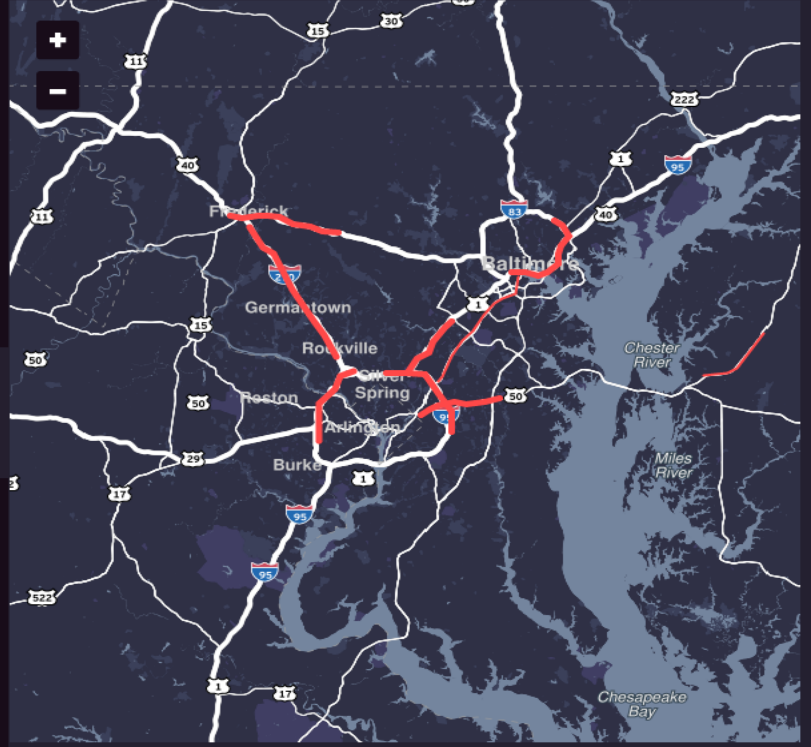
ATSPM without any infrastructure investments

- Signal Systems Performance Measures and turning movements using high-frequency connected-vehicles data



Merging Disparate Data – Multimodal TSMO

5:00 PM
03/28/19



Roads Experiencing Delay

I-495 — Worse than avg

42°F 40°F 41°F

Outerloop →

Innerloop →

2 PM	3 PM	4 PM	Now	Cost of Delay
$36.7K	$73K	$99.9K	$114.5K	

$0.0K — $50.0K+

I-270 — Worse than avg

42°F 40°F 41°F

Southbound →

← Northbound

2 PM	3 PM	4 PM	Now	Cost of Delay
$36.7K	$73K	$99.9K	$114.5K	

$0.0K — $50.0K+

US-1 — Worse than avg

42°F 40°F 41°F

Southbound →

← Northbound

2 PM	3 PM	4 PM	Now	Cost of Delay
$36.7K	$73K	$99.9K	$114.5K	

$0.0K — $50.0K+

MD-97 — Worse than avg

42°F 40°F 41°F

Outerloop →

Innerloop →

2 PM	3 PM	4 PM	Now	Cost of Delay
$36.7K	$73K	$99.9K	$114.5K	

$0.0K — $50.0K+

US-29 — Worse than avg

42°F 40°F 41°F

Southbound

Northbound

2 PM	3 PM	4 PM	Now	Cost of Delay
$36.7K	$73K	$99.9K	$114.5K	

$0.0K — $50.0K+

I-95 — Worse than avg

42°F 40°F 41°F

Outerloop →

Innerloop →

2 PM	3 PM	4 PM	Now	Cost of Delay
$36.7K	$73K	$99.9K	$114.5K	

$0.0K — $50.0K+

I-295 | I-395 | US-50 | I-70

Roads
Real Time Data Feed

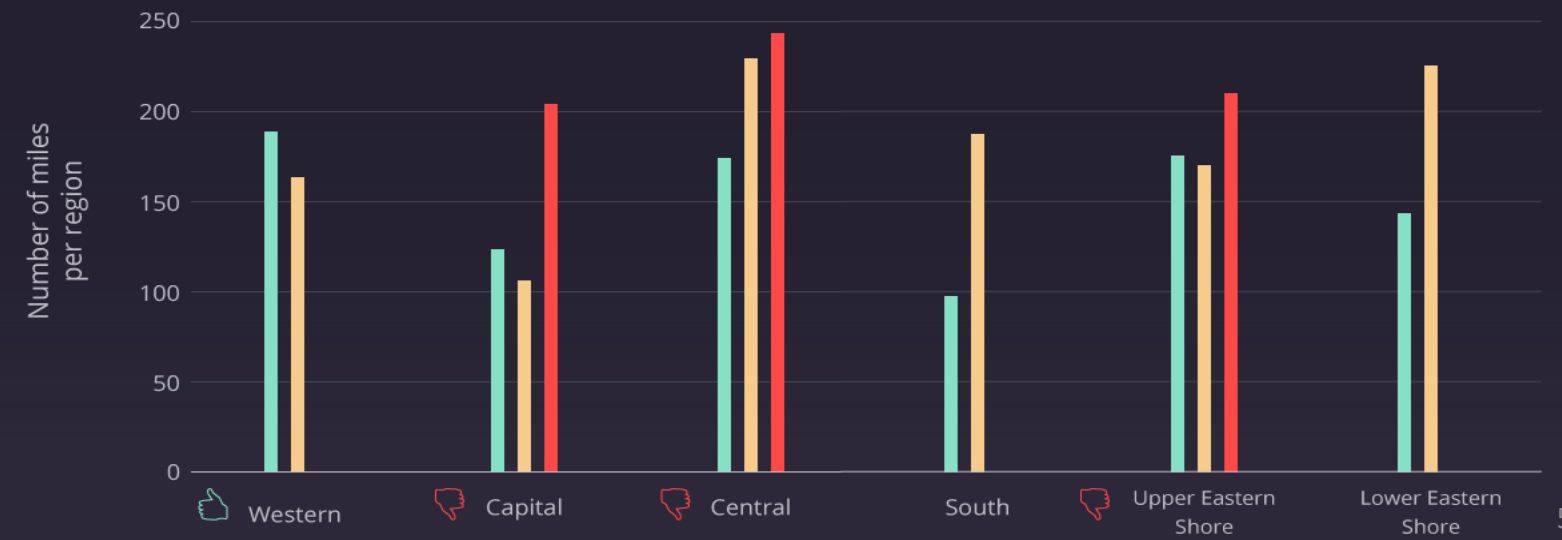
☑ All Feeds

Maryland 511 Feed — 20s
@MD511
Tanker truck overturned on beltway innerloop. Leaking gasoline. All lanes closed.

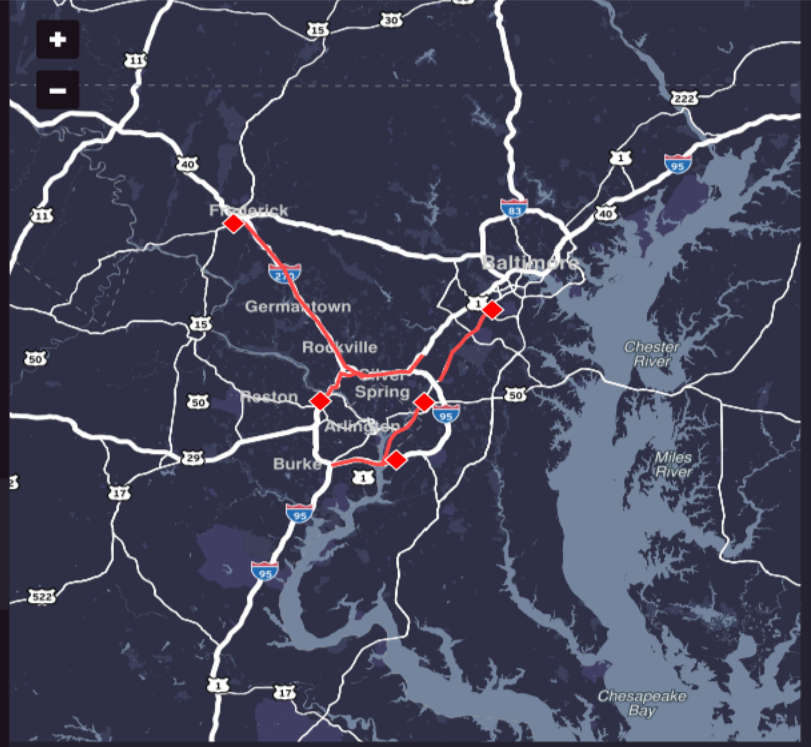
MTA Maryland — 1m
@MTAMaryland
MARC Brunswick 893 - Departure Delay -- Brunswick Line 893 (5:20 dpt Wash) is expected to experience a departure delay of 10-15 minutes due to Amtrak switch issues. More updates to follow. https://mta.maryland.gov/service-alerts

Maryland 511 Feed — 2m
@MD511

Road performance by Region



5:00 PM
03/28/19



Transit

MTA | WMATA

Local Bus

Bus Fleet

21%	125	Early
37%	224	Late
39%	233	On Time
3%	18	Out of Service

Early · Late · On Time · Out of Service

5 Services Canceled of 600

Events Impacting Routes

160 | 74 | 85 | 90 | 56

I-695 Counterclockwise @ MD-170/CAMP MEADE RD/EXIT 6

Outerloop · Innerloop

37 | 64 | 51

I-83 Southbound @ MD-25/FALLS RD/EXIT 8

Westbound · Eastbound

Commuter Bus

Bus Fleet

16%	6	Early
19%	8	Late
58%	21	On Time
7%	1	Out of Service

1 Services Canceled of 36

Events Impacting Routes

204 | 335 | 706

I-495 INNER LOOP SOUTH OF MP 42.1 (AMERICAN LEGION BRIDGE)

Outerloop · Innerloop

Light RailLink

Train Fleet

0%	0	Early
100%	1	Late
0%	0	On Time
0%	0	Out of Service

All vehicles in service

Events Impacting Routes

No Events

Metro SubwayLink

Train Fleet

0%	0	Early
0%	0	Late
100%	1	On Time
0%	0	Out of Service

All vehicles in service

Events Impacting Routes

No Events

MARC

Train Fleet

0%	0	Early
0%	0	Late
100%	7	On Time
0%	0	Out of Service

All vehicles in service

Events Impacting Routes

No Events

Transit

Real Time Data Feed

All Feeds

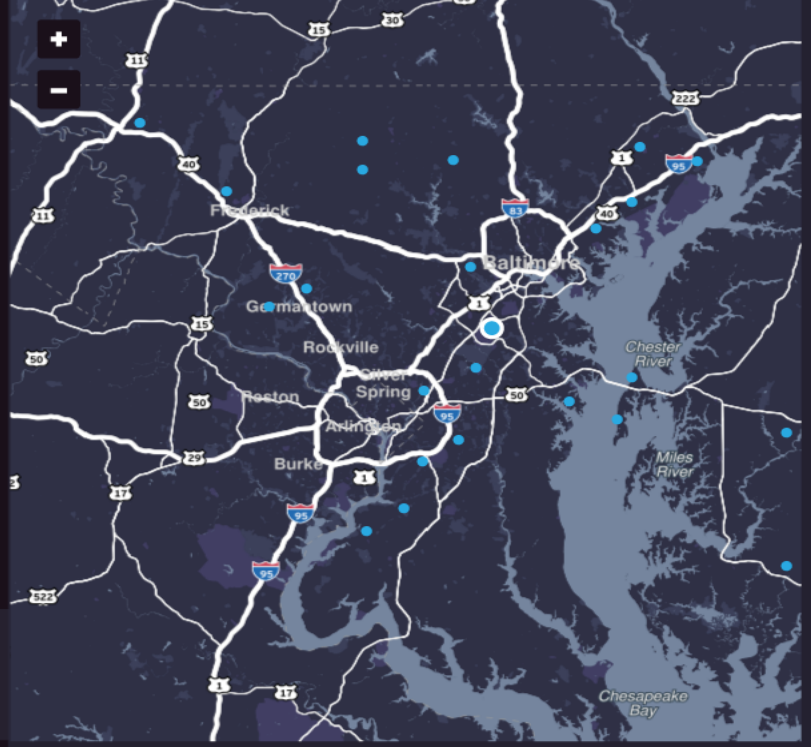
MTA Maryland — 20s
@MTAMaryland

Update: MARC Brunswick 893 - Departure Delay -- Brunswick Line 893 (4:50 dpt Wash) has departed and is operating with a 6-8 minute delay. https://mta.maryland.gov/service-alerts

MTA Maryland — 1m
@MTAMaryland

MARC Brunswick 893 - Departure Delay -- Brunswick Line 893 (5:20 dpt Wash) is expected to experience a departure delay of 10-15 minutes due to Amtrak switch issues. More updates to follow. https://mta.maryland.gov/service-alerts

MTA Maryland — 6m



Aviation BWI

FAA Status

Normal

General Arrival/Departure delays are 15 minutes or less.

Weather Advisories

None

Arrival/Departure Flights

3,589	5,439
Total arrivals	Total departures
More than avg	More than avg

Roads to and from Airport

I-195

Queue Length
10.4 miles — **Normal**

Wait Time
15 m 31s — **Normal**

170

Queue Length
4.4 miles — **Better than Avg**

Wait Time
07 m 09s — **Better than Avg**

Parking Availability

Hourly Garage	41%
Daily Garage	31%
Express Parking	0%
Long Term Parking A	8%
Long Term Parking B	8%

Aviation
Real Time Data Feed

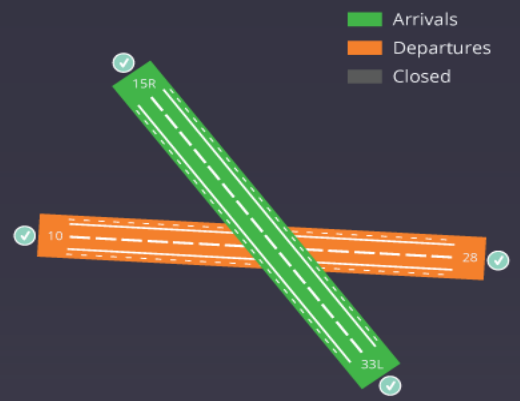
All Feeds

FAA News Feed — 3h
@FAANewsFeed
BWI traffic is experiencing gate hold and taxi delays lasting 15 minutes or less.

FAA News Feed — 1 day
@FAANewsFeed
Small Aircraft Weather Advisory from 2PM to 10PM

FAA News Feed — 1 day
@FAANewsFeed
Small Aircraft Weather Advisory from 1:45PM to 3AM

Runways



Passenger Waiting Time

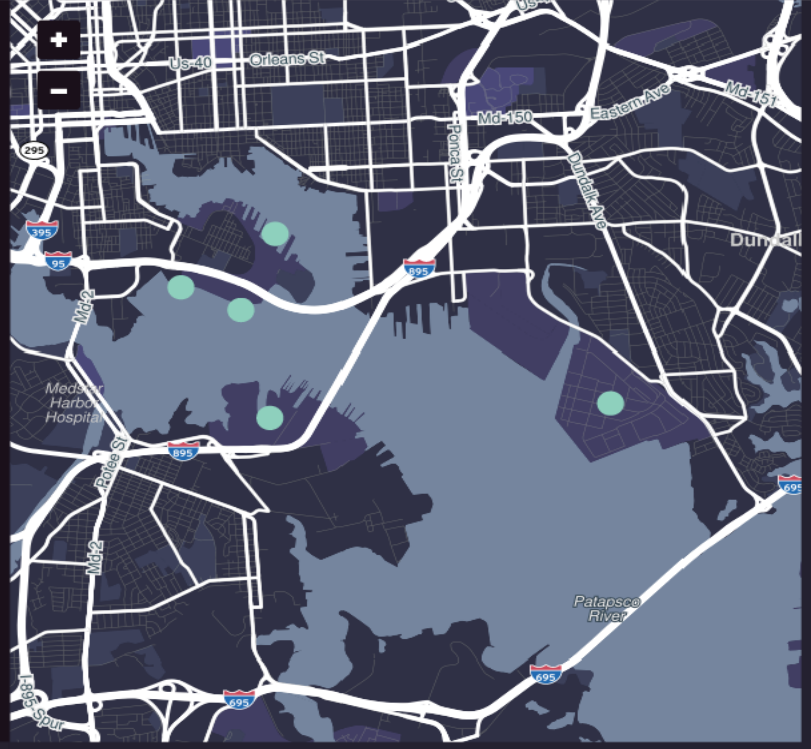
Arrivals Log

Flight No.	Updates	Sched.
2462 Southwest	8:50 AM On Time	8:50 AM Gate: A9
1607 Southwest	8:35 AM At Gate	8:50 AM Gate: B14
1080 Southwest	8:40 AM Bags In	8:50 AM Gate: B15

Departures Log

Flight No.	Updates	Sched.
2462 Southwest	8:50 AM Departed	8:50 AM Gate: A9
1607 Southwest	8:35 AM Departed	8:50 AM Gate: B14
1080 Southwest	8:40 AM Departed	8:50 AM Gate: B15

5:00 PM
03/28/19



Port of Baltimore

Aviation Page

Seagirt Terminal Open

Trucks in Terminal

00:40:19 Turn Time

00:05:21 Queue Time

Compared to Last Week

Turn Time

Historic

Queue Time

Historic

Roads to Terminal

Inbound

Outbound

Berths

MARSEC Levels

Level 1

minimum appropriate security measures shall be maintained at all times

Weather Advisories

None

Vessel Status

29 Vessels Departing

36 Vessels Docked

Other Terminals

		Roads to Terminal: Inbound	Roads to Terminal: Outbound	Berths
Dundalk (DMT)	Open	1.3 TTI	0.8 TTI	
North Locust Point (NLP)	Open	1.3 TTI	0.8 TTI	
South Locust Point (SLP)	Open	1.3 TTI	0.8 TTI	
Cruise Maryland (CMT)	Open	1.3 TTI	0.8 TTI	
Fairfield (FMT)	Open	1.3 TTI	0.8 TTI	

Ports

Real Time Data Feed

All Feeds

Port Authority Feed 3m
@MDPAFeed
Small craft weather advisory in port

Port Authority Feed 1 day
@MDPAFeed
Small craft weather advisory in port

Port Authority Feed 1 day
@MDPAFeed
Small craft weather advisory in port

Data vs. Systems

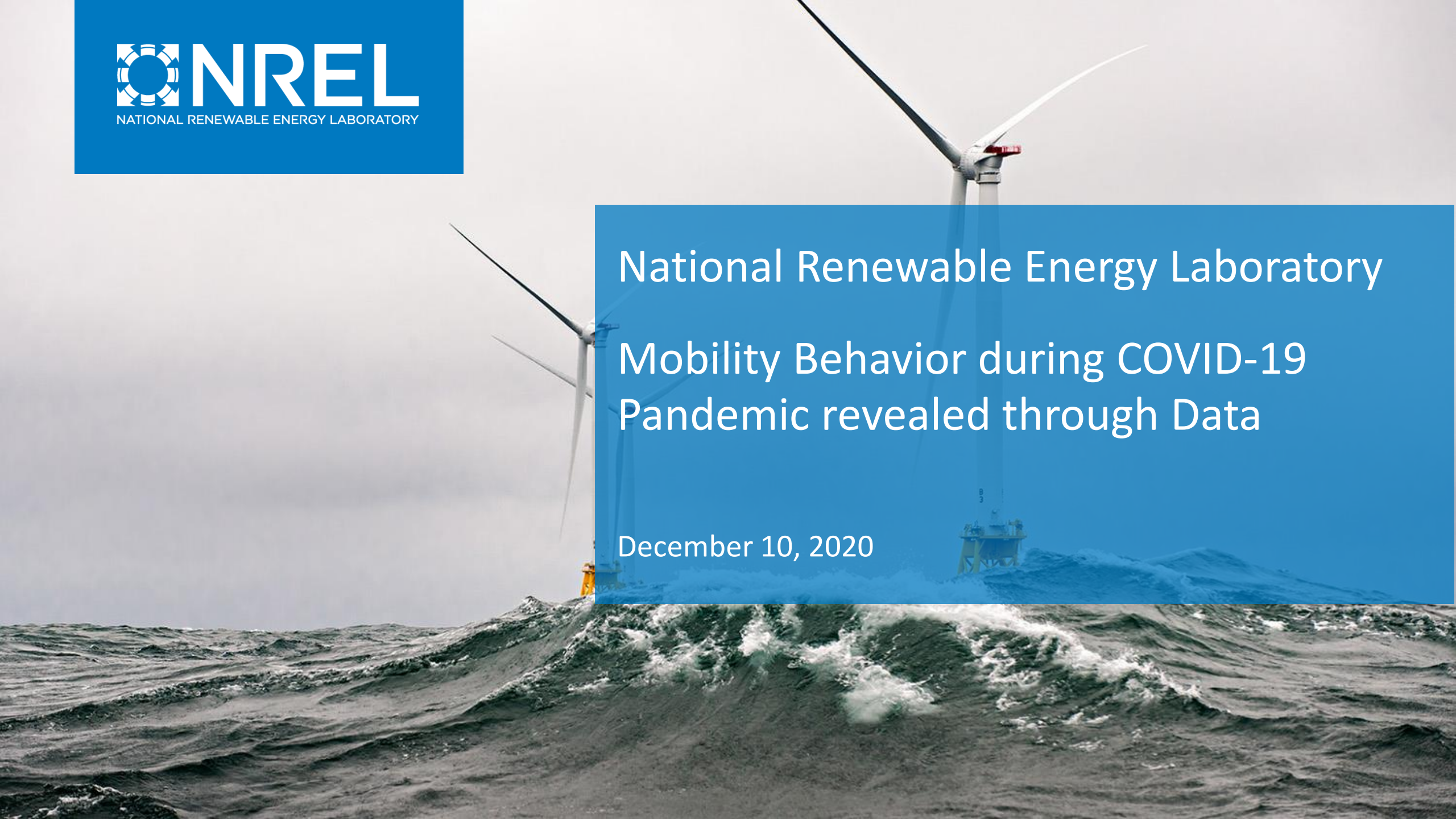
- Disparate systems
- Operations and operator overload
- Human factors focus
- Focus on integration!
- Share Resources! Don't have every state integrate in isolation.
- Re-imagine your ATMS

How many is too many?

Michael Pack, Director
PackML@umd.edu

Monitoring COVID-19 Mobility Impacts

Stan Young, Advanced Transportation and Urban Scientist
National Renewable Energy Laboratory (NREL)



National Renewable Energy Laboratory

Mobility Behavior during COVID-19 Pandemic revealed through Data

December 10, 2020

Acknowledgement and Appreciation

- NREL Team
  - Andy Duvall, Matt Moniot, Gary Zhong, Brennan Borlaug, Alana Wilson, Nicholas Reinicke, Bingrong Sun, Jordan Perr-Sauer, Kyungsoo Jeong, Stanley Young
- Collaboration / Data Exchange
  - NY MTA, PANYNJ, NJTransit NYC EDC, NYC DOT
  - USDOT, INRIX, TSA, IATA
- Funding provided by USDOE, Office of Vehicle Technologies

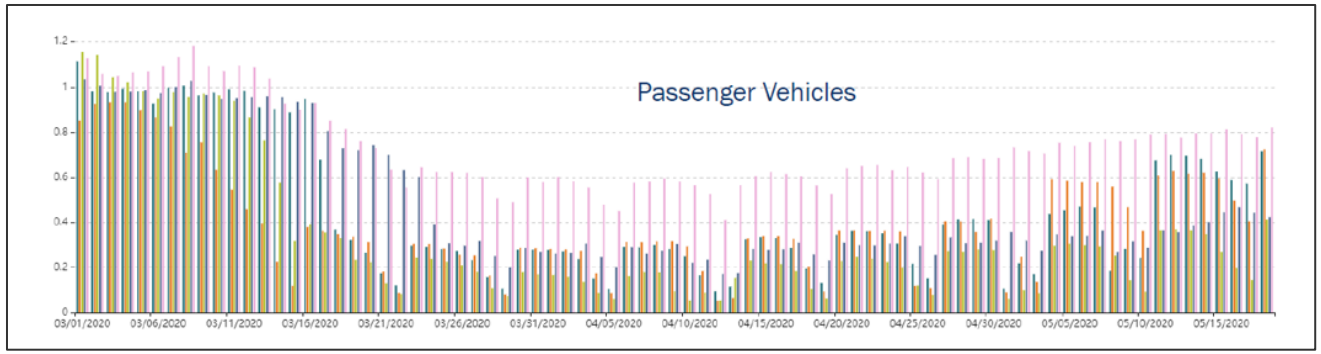
Industry Travel Data Curation, Validation and Analysis

Can crowd-sourced data provided by industry from cell phones and vehicles provide mobility insights reliability across the entire US?

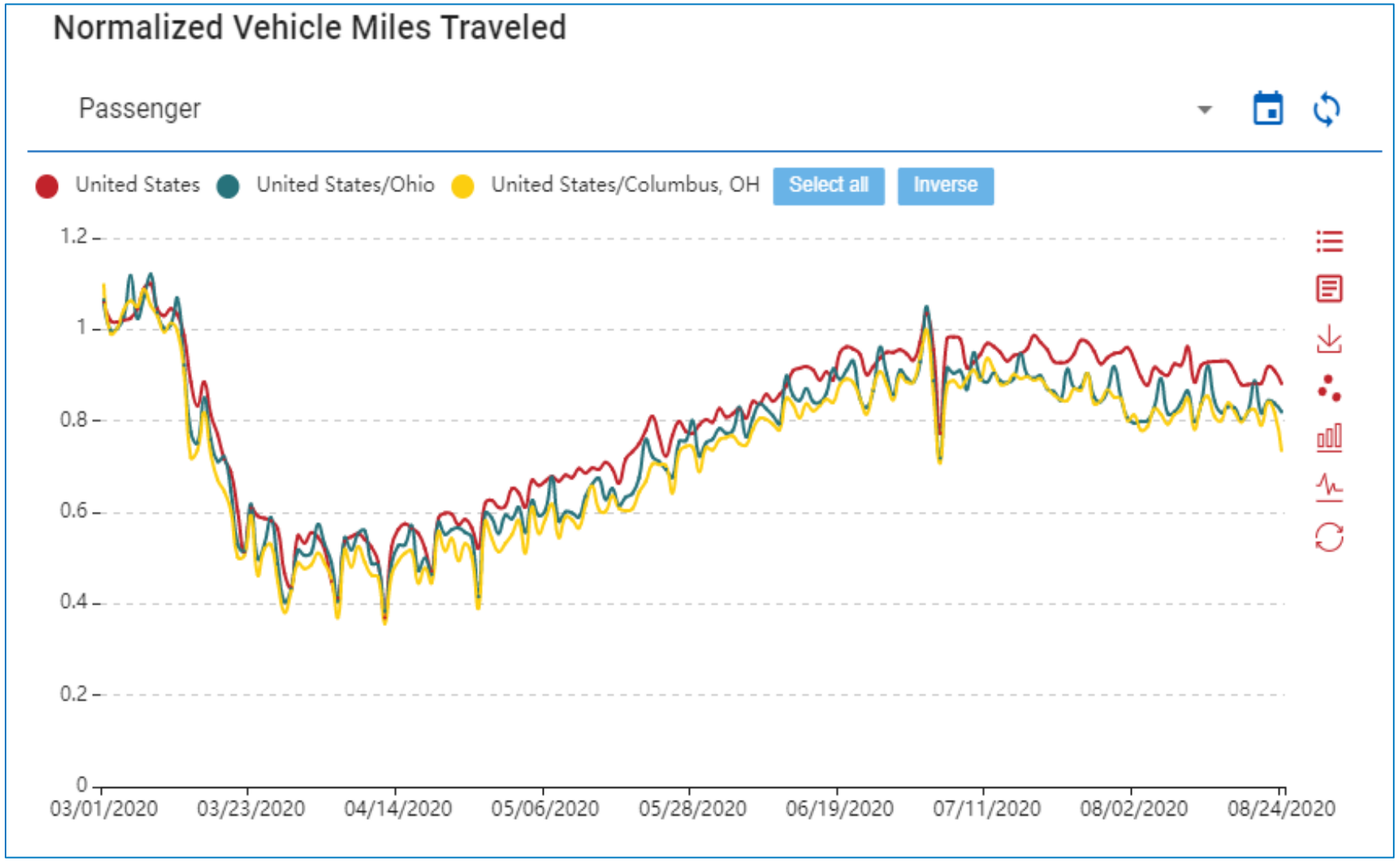
Gary Zhong & Kyungsoo Jeong, NREL

USDOE / USDOT Collaborative Data Procurement

- In cooperation with USDOT, USDOE Industry Sourced Data for COVID-19 Mobility Data
  - ~100M trips/day, 10% Sample across US
  - Light-, Medium-, Heavy-Duty vehicle
- **INRIX® Traffic Volume Trends Dashboard to Federal Agencies**
  - Seasonally adjusted
  - National scale, state, metro
  - 200 Federal seat licenses
- **2020 National Trip Data:**
  - Multi-TB data sets
  - O-D travel behavior analysis
  - Supports COVID and EEMS Research
  - Distributed through EEMS Livewire



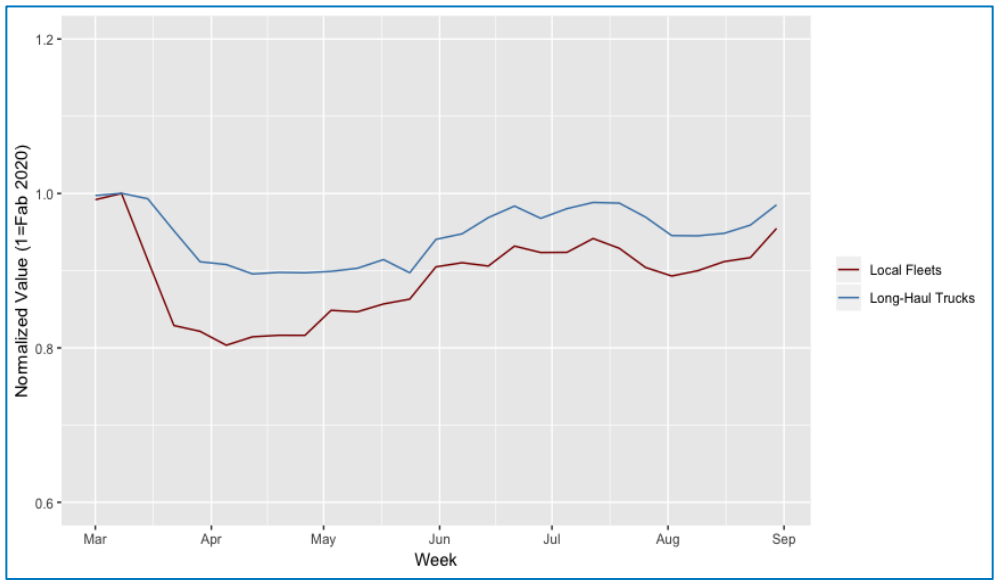
Trips Trends Portal : Light Duty Analysis

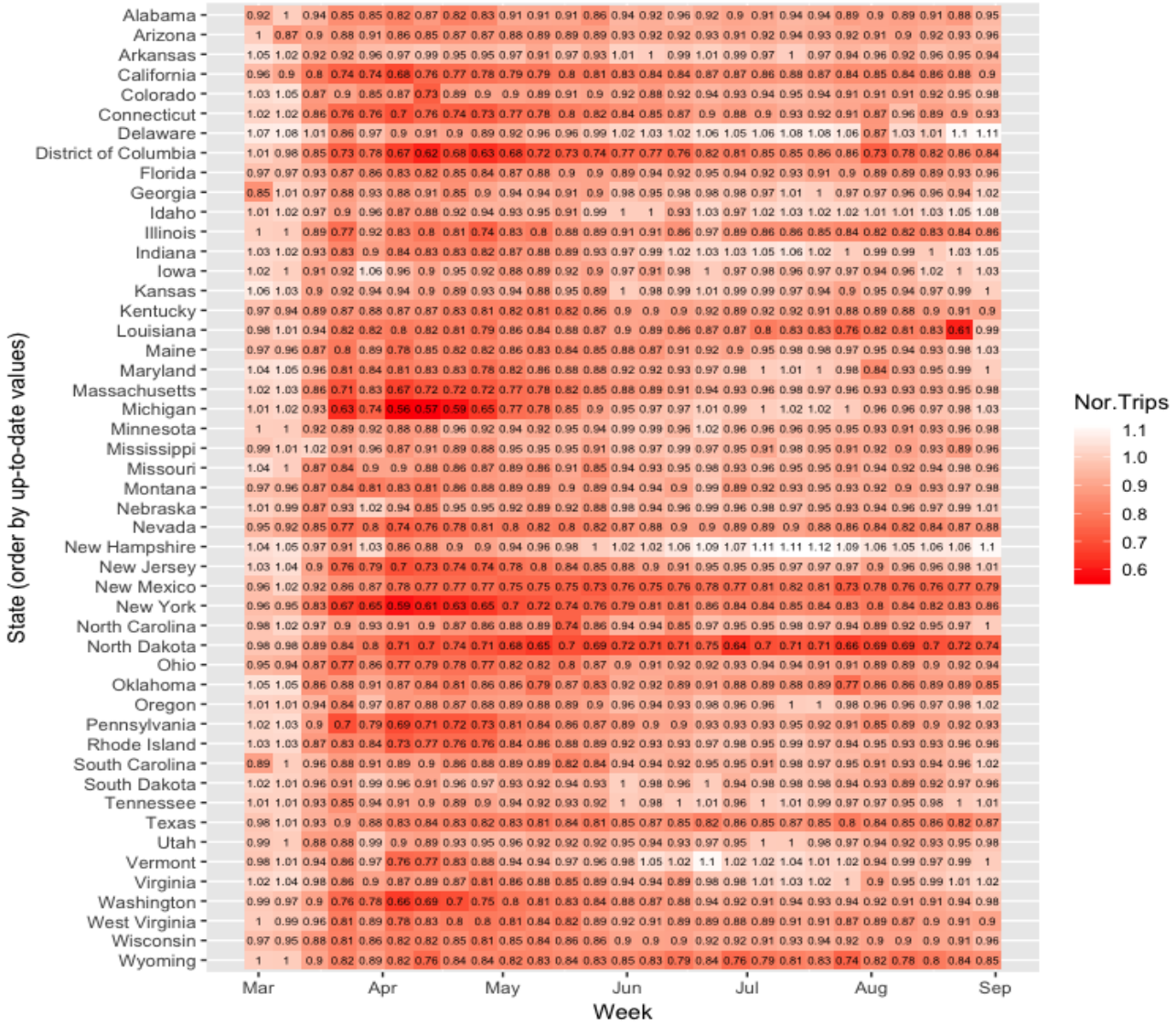


- Light-Duty, Medium Duty, Heavy Duty vehicles
- Fully adjusted for seasonal trends
- Downloadable data
- Updated daily

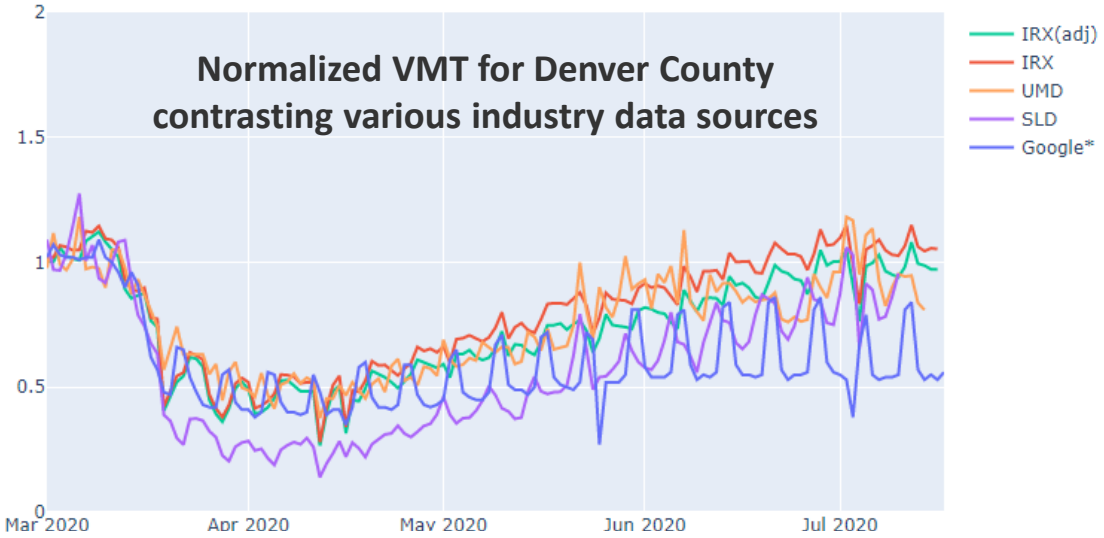
Trips Trends Portal : Medium and Heavy Duty

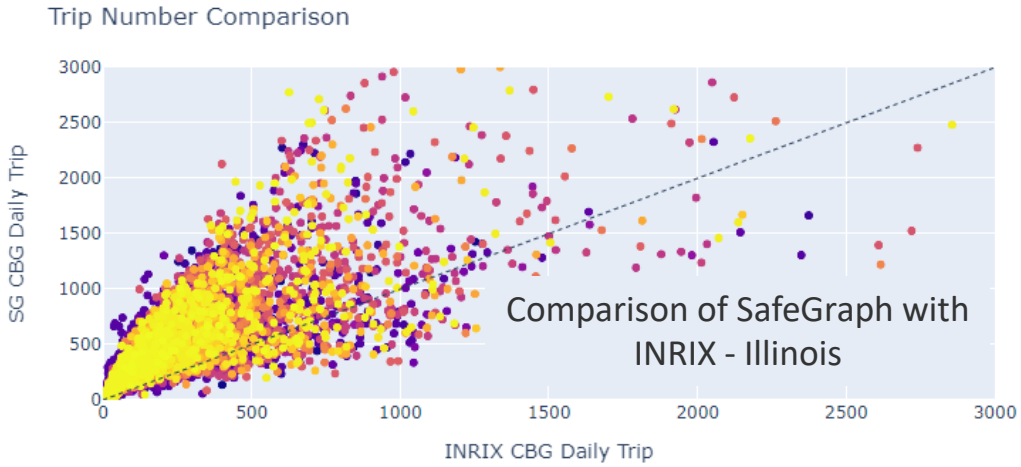
- Only source of national freight-specific data
- Data reflected economic and physical (hurricane) impacts

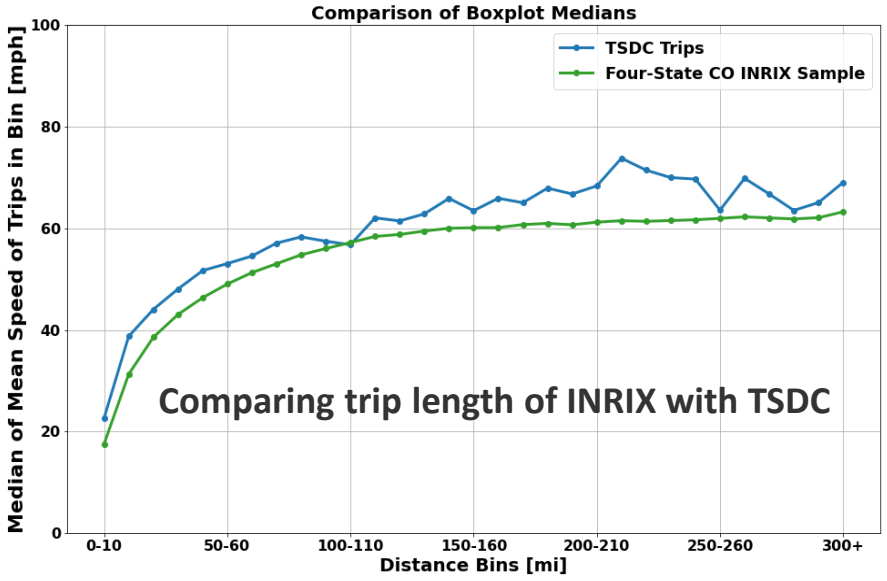


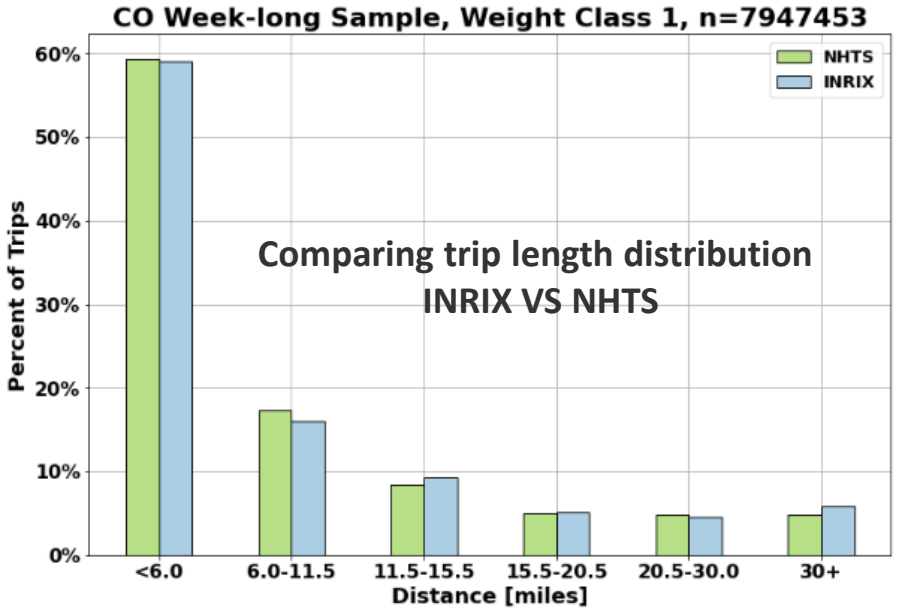


Validation of Industry Data Sources

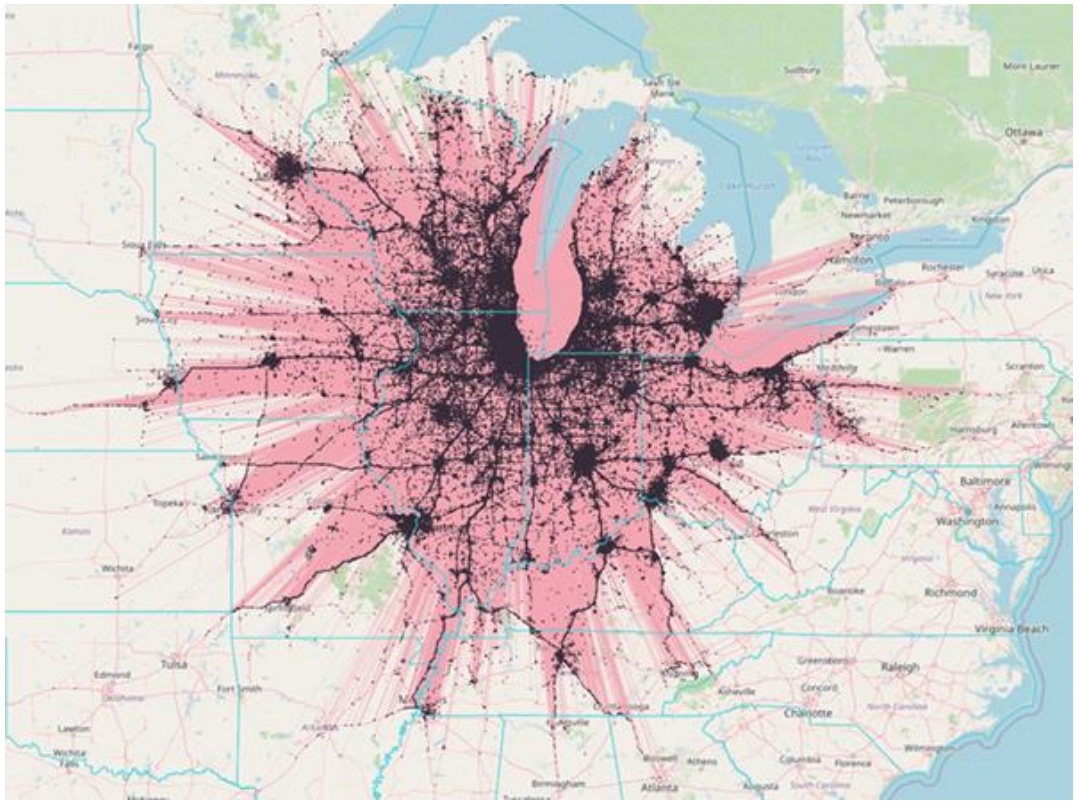








Origin-Destination Analysis for Vehicle Trips



Trip spatial distribution from/to Cook County, IL (2~16 hr.)

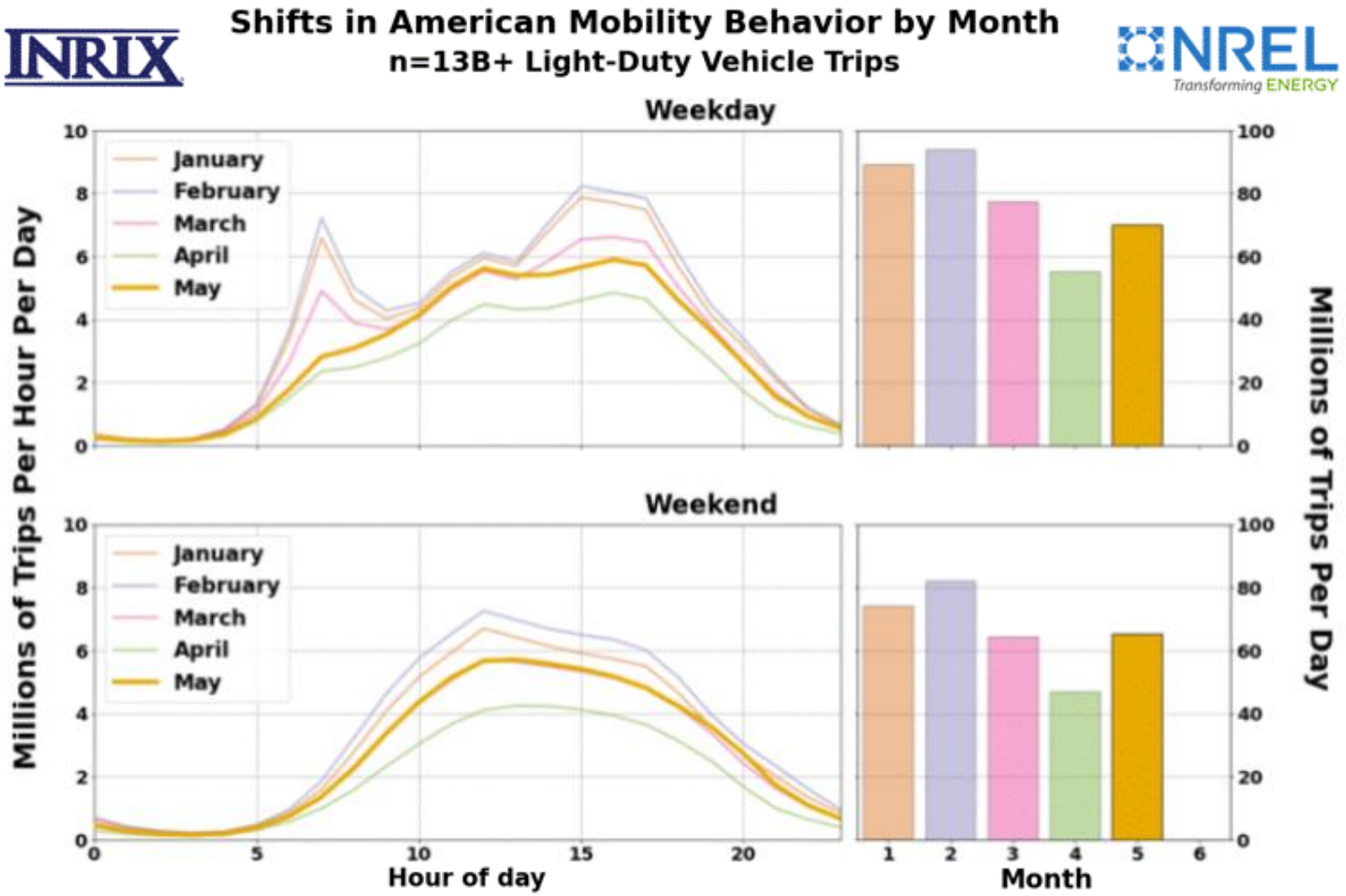
- All trip data spatially associated with census, zip-code, and Land-Scan grids
- Distributed O/D data for COVID disease modeling teams with customed spatial-temporal aggregations
- Trip purpose inferred with joined Bureau of Labor Statistics land use (NAICS) and employment (LODES) data
- Nationwide people movement trend data developed in-house at NREL

Temporal Analysis of Mobility Behavior Changes

What are the temporal changes with respect to vehicle trip patterns?

Matt Moniot, Brennan Borlaug, Nicholas Reinicke, Gary Zhong

Trip Counts Over Time, Novel Emergent Behaviors

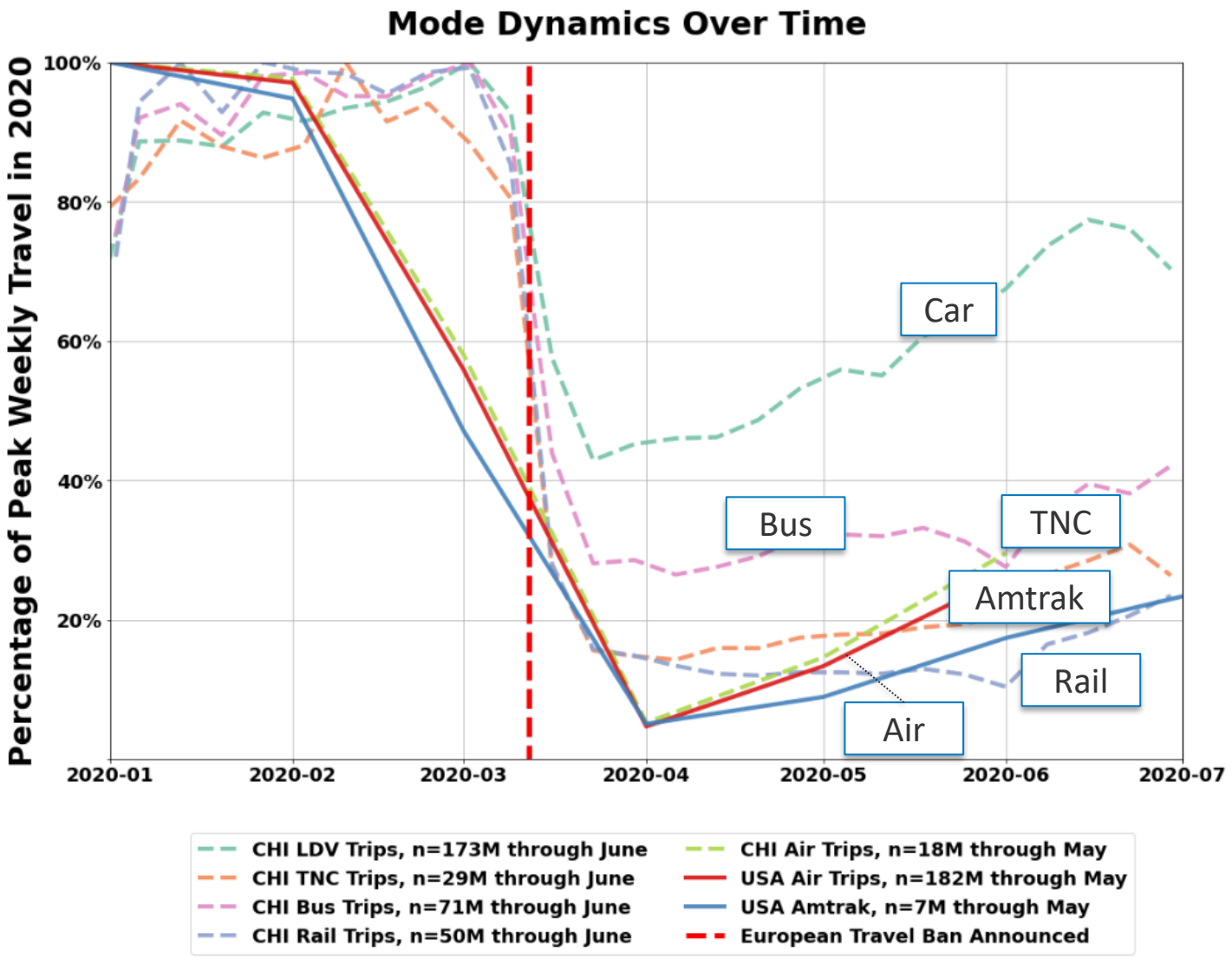


Differential Modal Impacts of COVID-19

Has the COVID-19 had differential impact on modes of travel? Across cities? What factors determine this?

Matt Moniot, Zijia (Gary) Zhong, Alana Wilson, Bingrong Sun

Recovery Across Modes is Different



- Trip counts shown to reduce across all modes, although post-pandemic behaviors vary
- Light-duty vehicle mode shown to recover the fastest

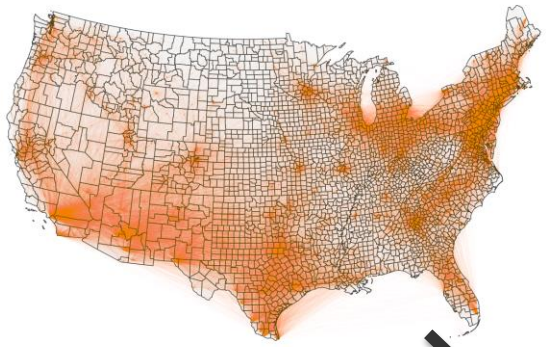
Population Flow Dynamics

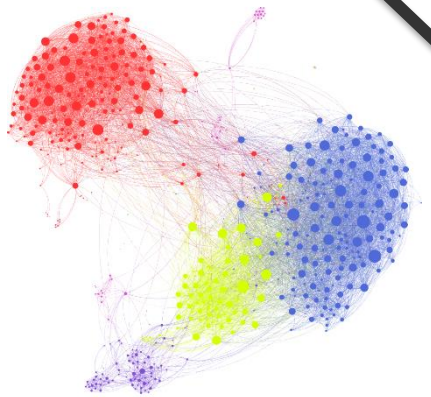
What are the national grouping of states with respect to vehicular travel?

How has COVID-19 changed when and where people dwell?

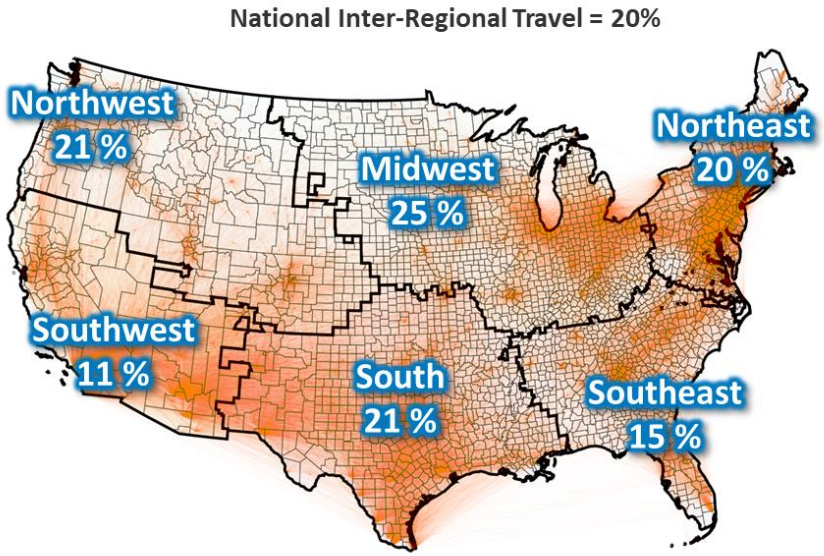
Matt Moniot, Brennan Borlaug, Nicholas Reinicke

Community Clustering, Revisited





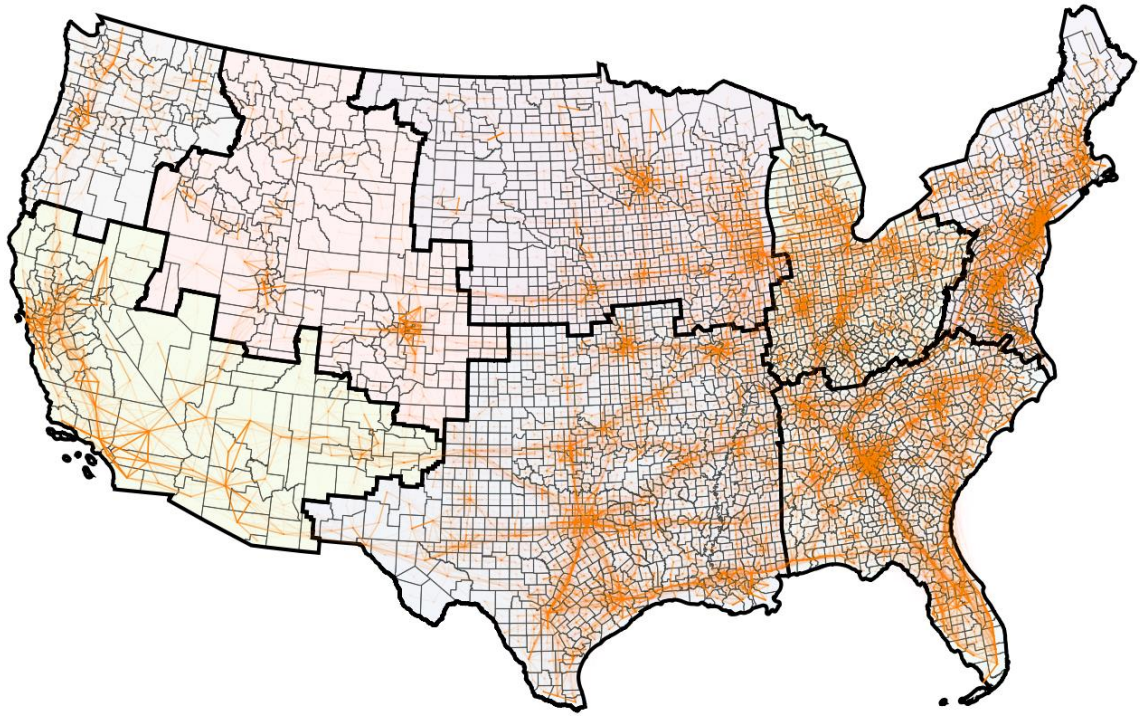
- Applied community detection algorithms used to produce regions which minimize inter-regional travel
- Originally used the TAF dataset (>100 mile trips only, end-point to end-point)
- Successfully applied methodology to OD-pairs derived from INRIX data



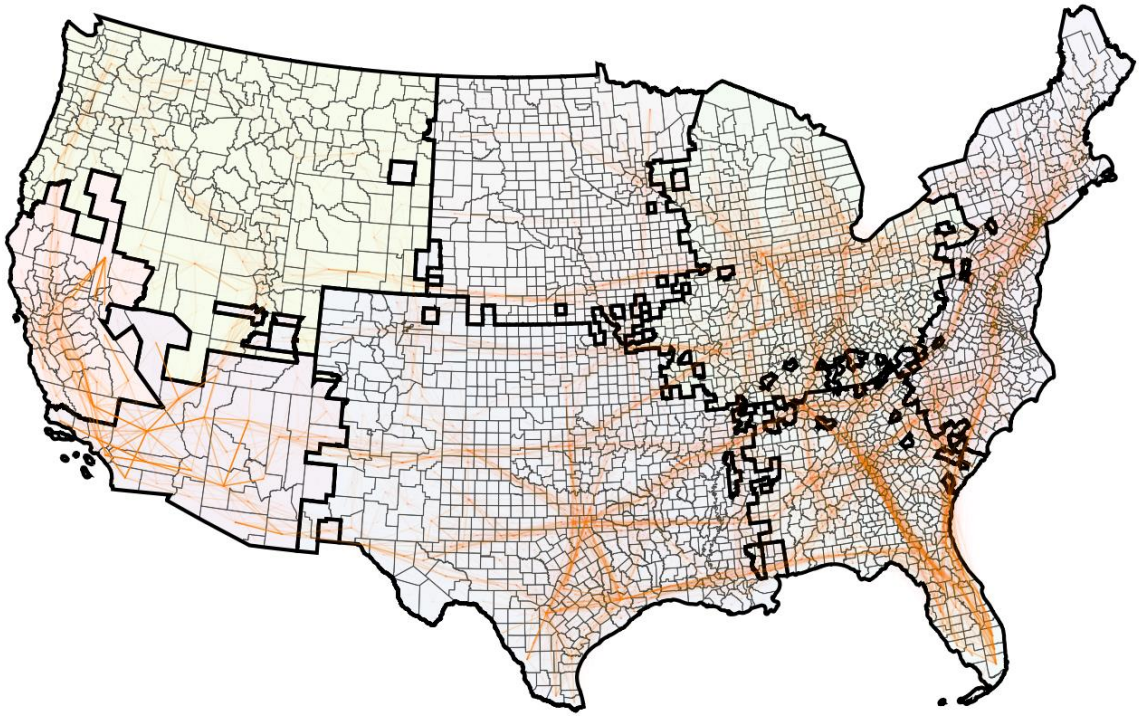
Community Clustering, Revisited, cont.

Week 1 Maps

Week 1 - 2020 - All Travel

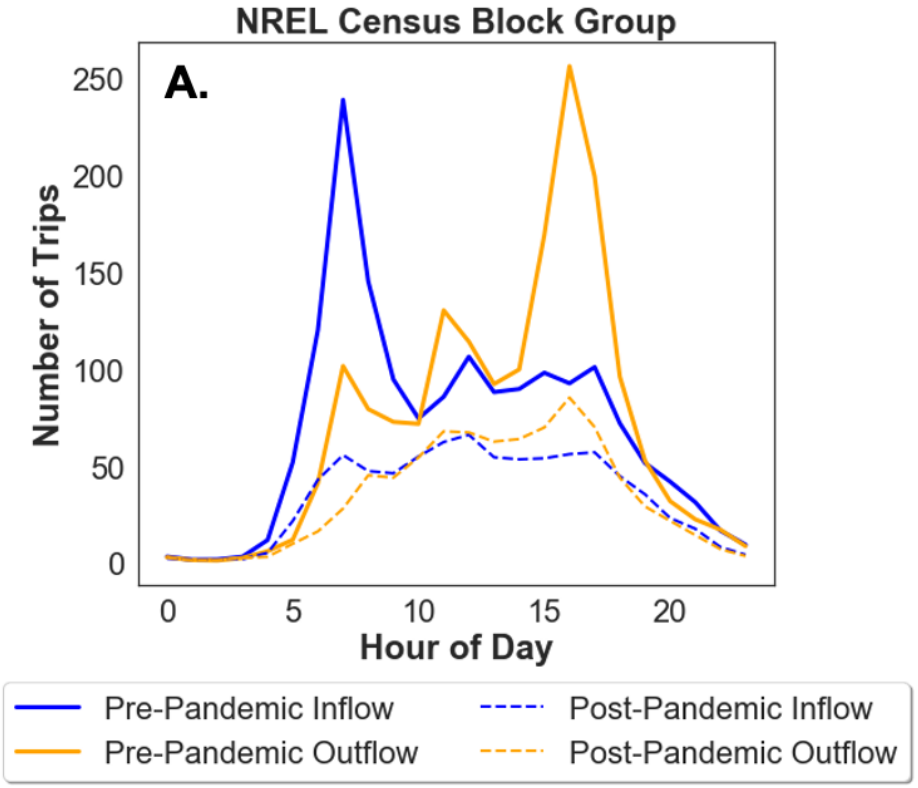


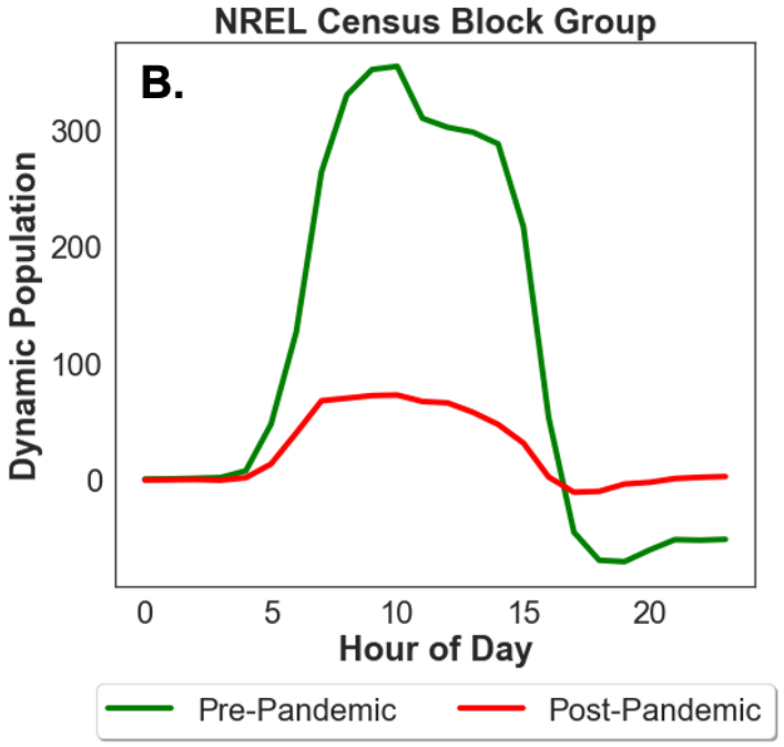
Week 1 - 2020 - >100 Mile Travel



Location Analysis – Disaggregating High-Level Trends

- System-level counts are interesting but without context
- Began exploring locations familiar to us: NREL census block group on workdays
- **Arrivals & departures used to infer where people spend time**

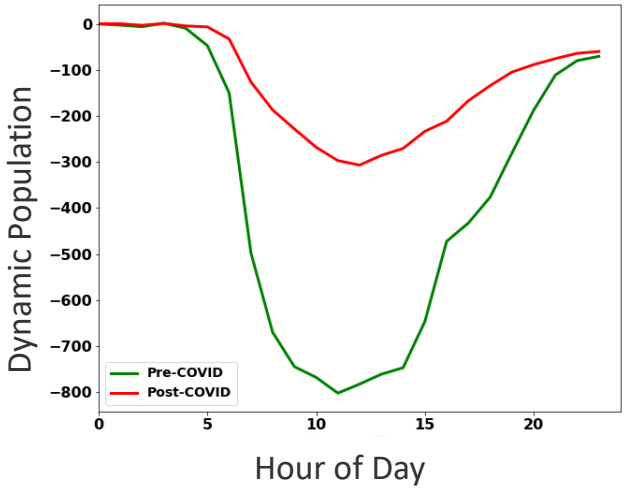




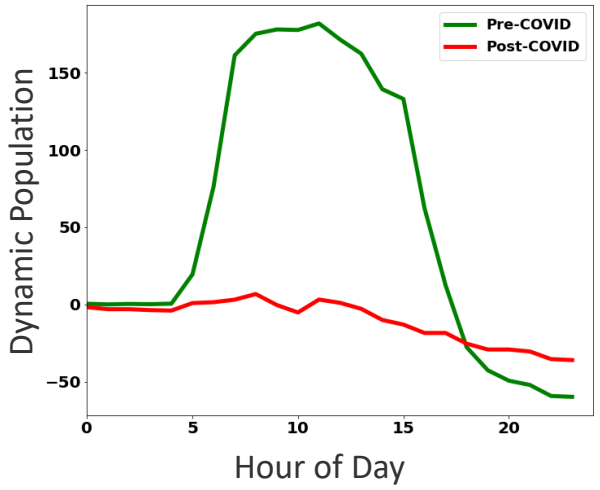
Automating Analysis of Behavior Change

- Devised metrics to compare diurnal population curves to infer changes in how people spend time
  - Magnitude: changes in quantity of person-hours
  - Correlation: changes in when people interact with a location
- Classified census block groups using employment data from the Bureau of Labor Statistics

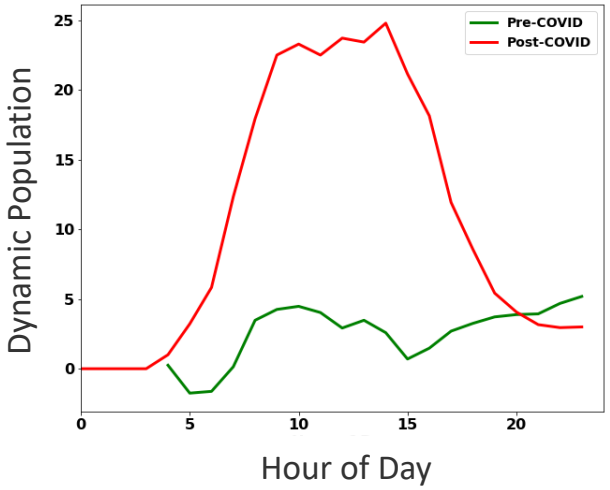
Residential



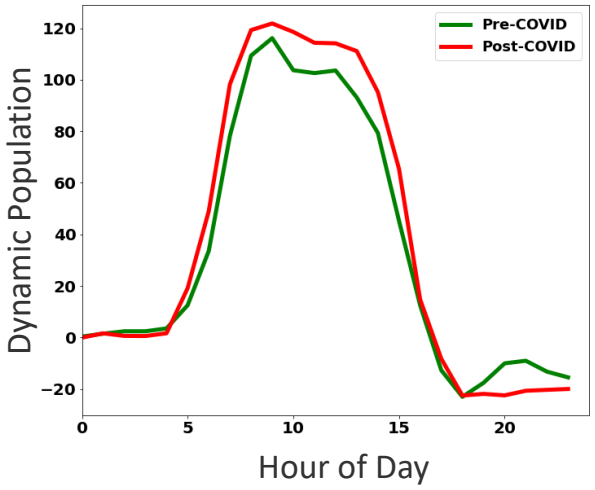
"Information"



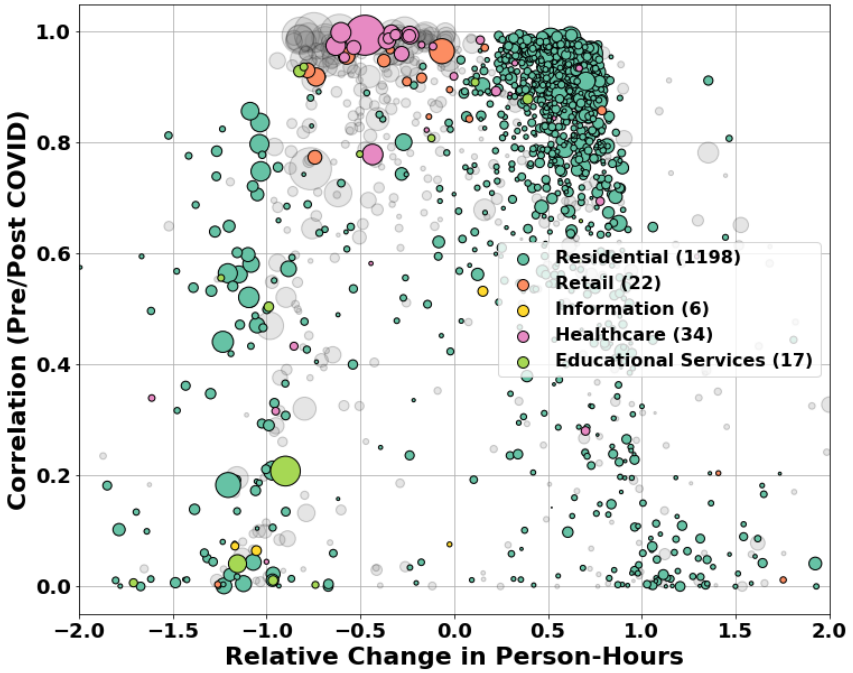
"Recreational"



"Healthcare"

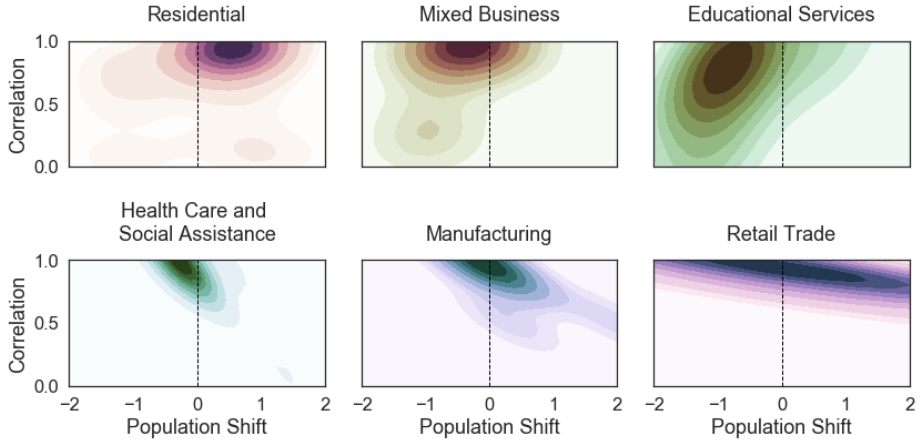


Mapping Changes in Dwell Behavior Within & Across Metros



Louisville, KY

Des Moines, IA



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NATIONAL RENEWABLE ENERGY LABORATORY

Thank you for your time!

Questions?

Stan Young

Advanced Transportation and Urban Scientist

National Renewable Energy Laboratory

Stanley.Young@nrel.gov

Additional Questions?

Remaining Questions from the CHAT Box

Wrap Up

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

In Closing….

Thank you for joining today

For additional information, please contact:

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dmarkow@tetcoalition.org

THE EASTERN TRANSPORTATION COALITION

CONNECTING FOR SOLUTIONS

Resources

- Optimal Traffic Monitoring Page (Report & One-pager)
- USDOT - FHWA Traffic Monitoring Guide - 2016 Edition
- NCHRP Research Report (920) on Mgmt. and Use of Data for TPM
- USDOT - Bureau of Transportation Statistics: Travel Stats Data page
- USDOT - FHWA Considerations of Current and Emerging Transportation Management Center Data report - July 2019
- NCHRP Synthesis 20-05, Topic 51-06: Not yet published.