



## Hurricane Traffic Volumes Pilot with Real-time Connected Vehicle Data

May 19, 2021



**Stan Young**  
*Advanced Transportation  
& Urban Scientist*  
National Reliable Energy Laboratory



# Background



*An existing partnership has been researching the viability of accurate traffic volumes derived from probe data*



■ Past studies include:

- Florida
- Maryland
- Colorado
- New Hampshire
- Pennsylvania
- Massachusetts
- Tennessee
- USDOT Pooled Fund Study for non-traditional sources for AADT



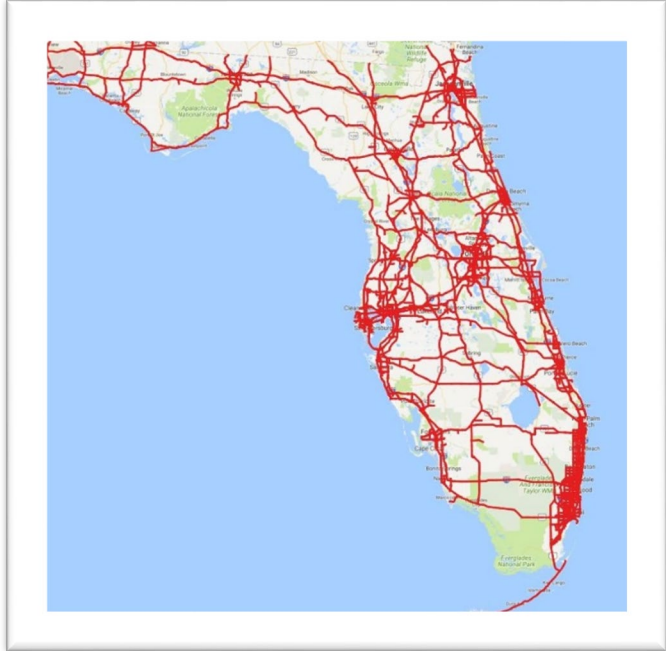


# Background



**HISTORIC volumes are viable.**

**But what about REAL TIME volume!**



**Real-time volumes are the second dimension  
(along side travel time & speed)  
for full operational awareness.**

# Hurricane Proof of Concept for The Eastern Transportation Coalition September – November 2020

## Problem Statement:

Can connected vehicle data help monitor hurricane evacuation traffic and generate volume estimates in near real-time?

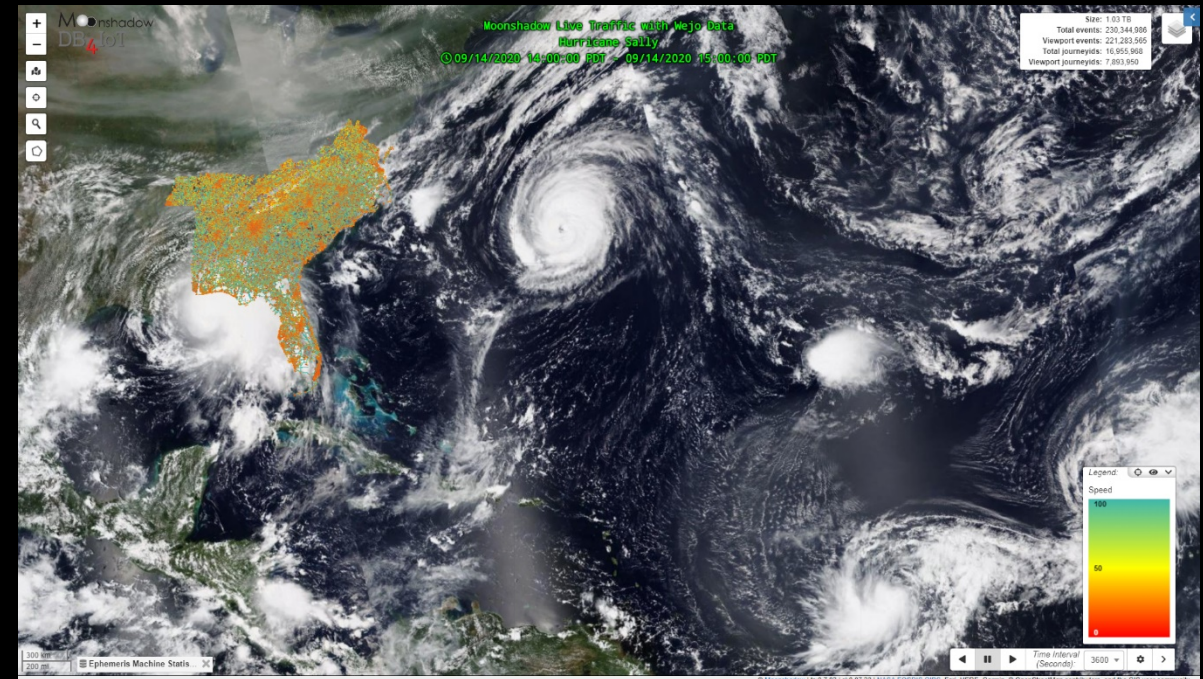
## Six States:

Alabama, Florida, Georgia, North Carolina, Tennessee, Virginia

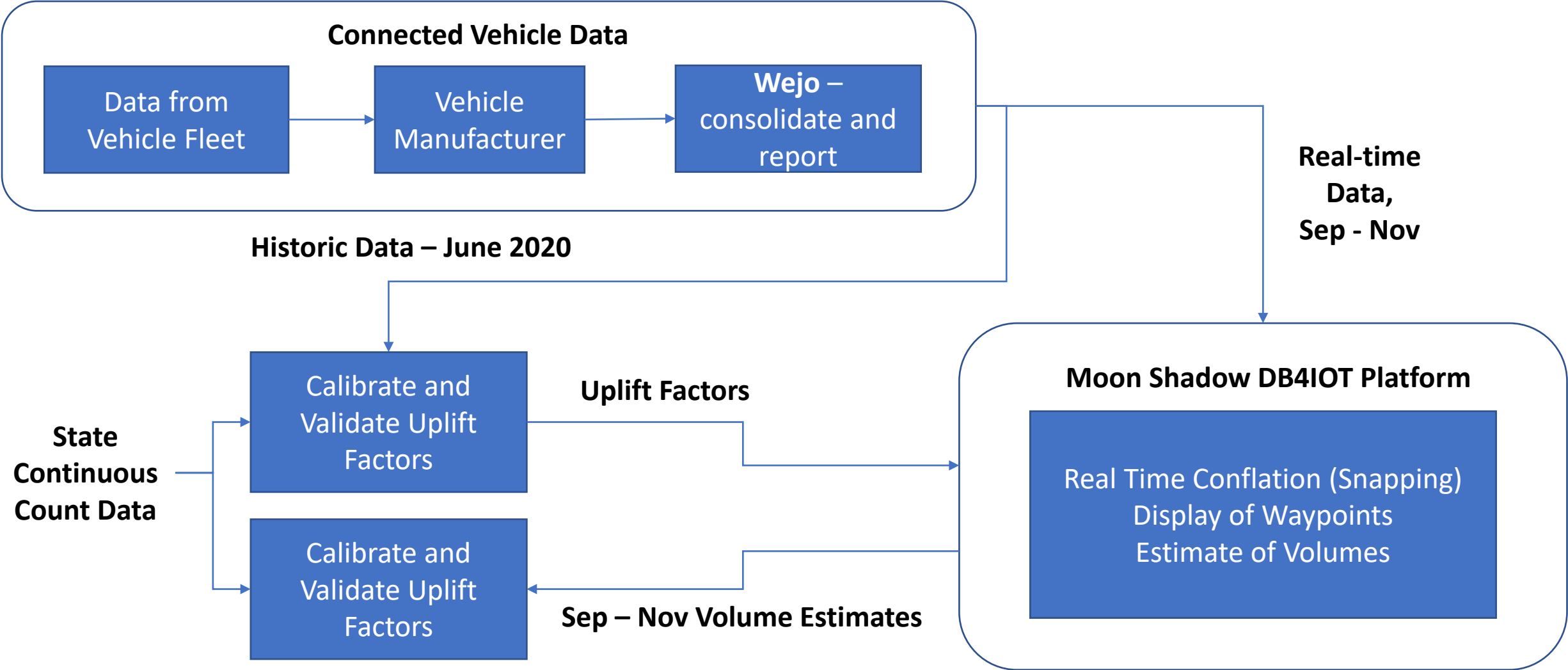
Three Months: September 1 – November 30, 2020

## Technology:

Moonshadow **Live** Traffic with Wejo Data



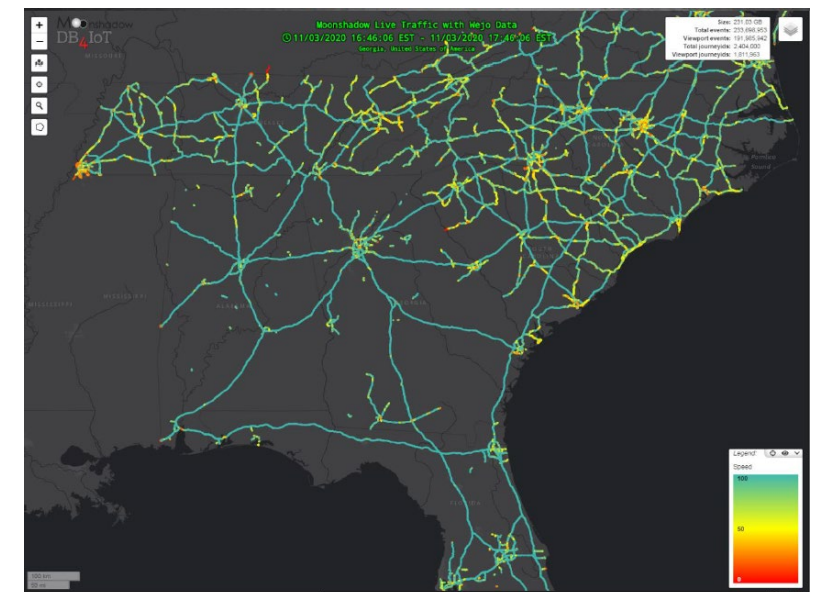
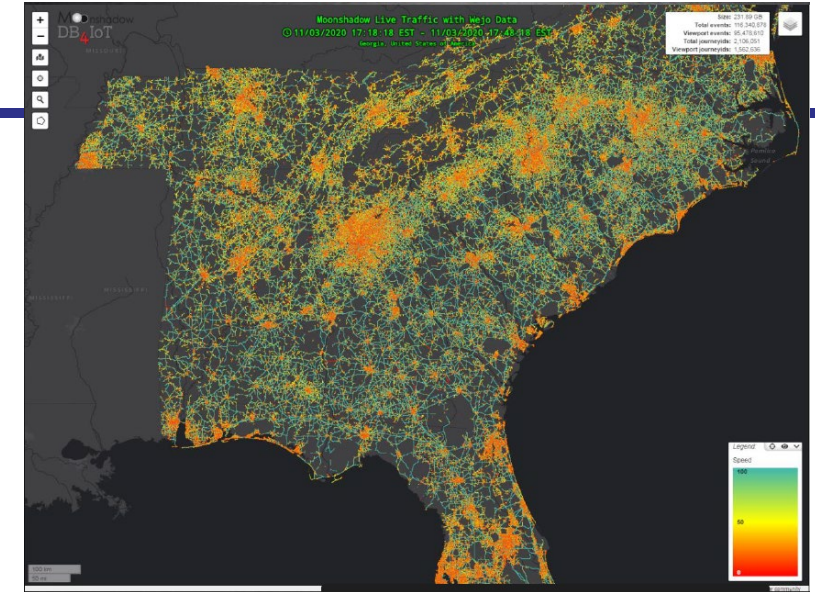
# Data Flow Framework





# Goals & Objectives

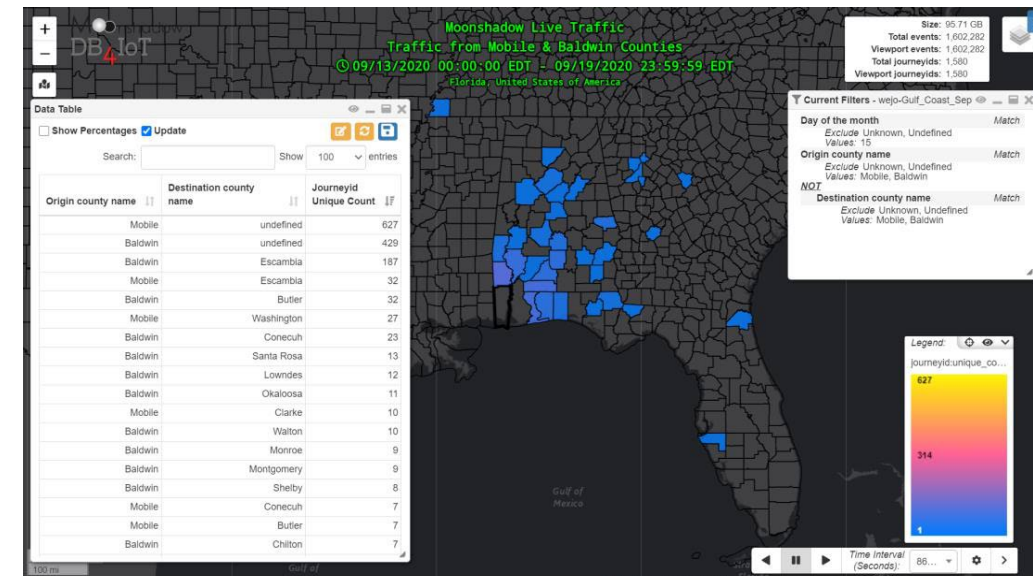
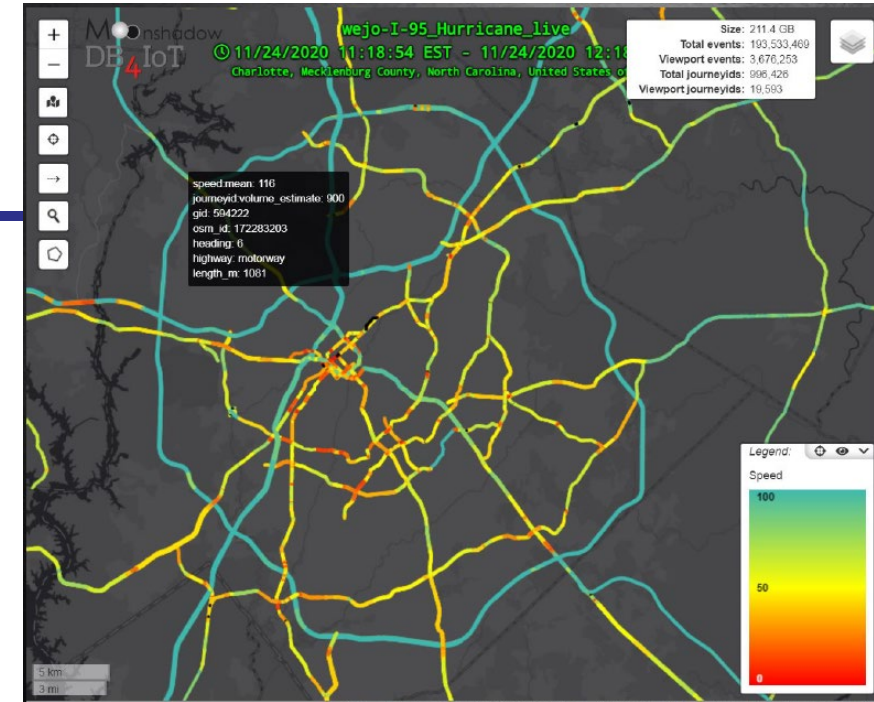
1. Demonstrate that **real-time connected vehicle data** representative of about 3% of all vehicular traffic across all seven states can be delivered and visualized in real-time.
2. **Process observed CV trips in real time**, assigning them to appropriate roadway segments, and obtained counts of probe vehicles from which to estimate traffic volume.





# Goals & Objectives

3. **Assess meaningful Volume Measures** from the live data streams by calibrating to known journey penetrations rates, and relative to nominal traffic volume conditions.
4. **Show that the mobility patterns of people,** where they go and when, change significantly in the event of a major storm.



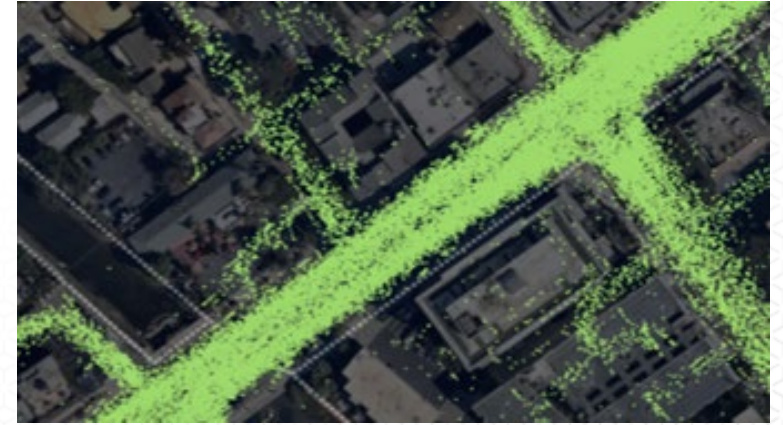
# The Power of CVD: Unlocking Real Value

It's faster, more in-depth and offers new levels of information

3 second capture rate with 30 second latency



High volume of journeys tracked: 1.3 billion per month



Accurate to 3 meters, which helps identify highway lanes and parking spots



Data from historical events gives insights about incident hotspots, harsh braking or acceleration, speeding and more

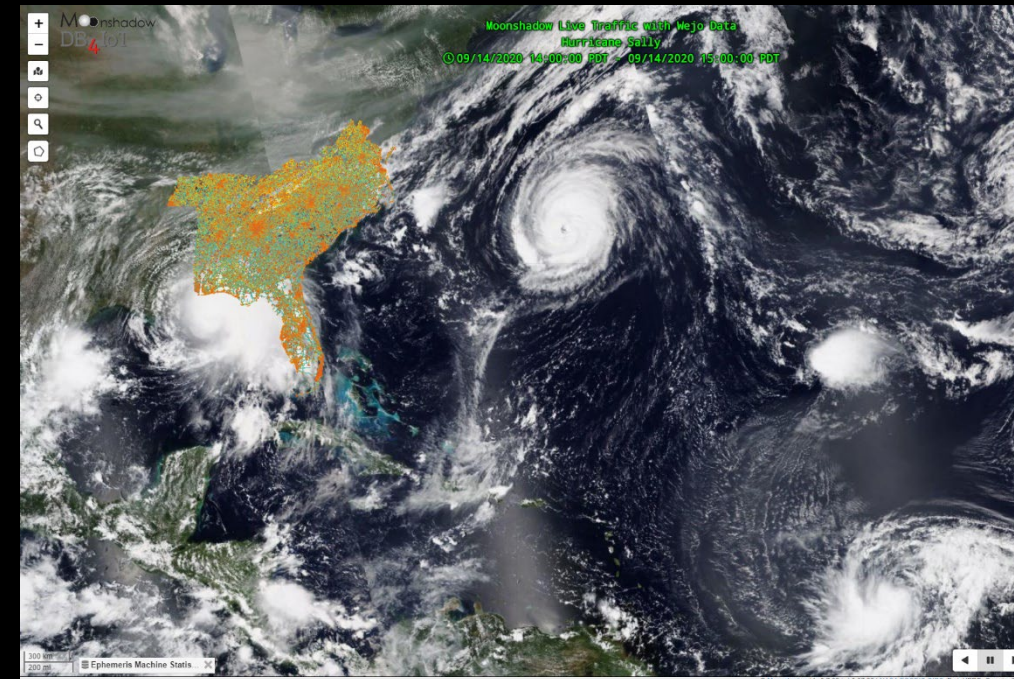




# Hurricane Proof of Concept for The Eastern Transportation Coalition

## September – November 2020

Waypoints/Day	2,500,000,000
Trips/Day	7,500,000
Vehicles/Day	2,500,000
Peak Hour Vehicle Updates per Second	100,000
Files per Hour	40,000
Gigabytes/Day	50
Average Vehicle to User Map Latency (seconds)	45
Average User Map Update Frequency (seconds)	30
Vehicle Update Frequency (seconds)	3

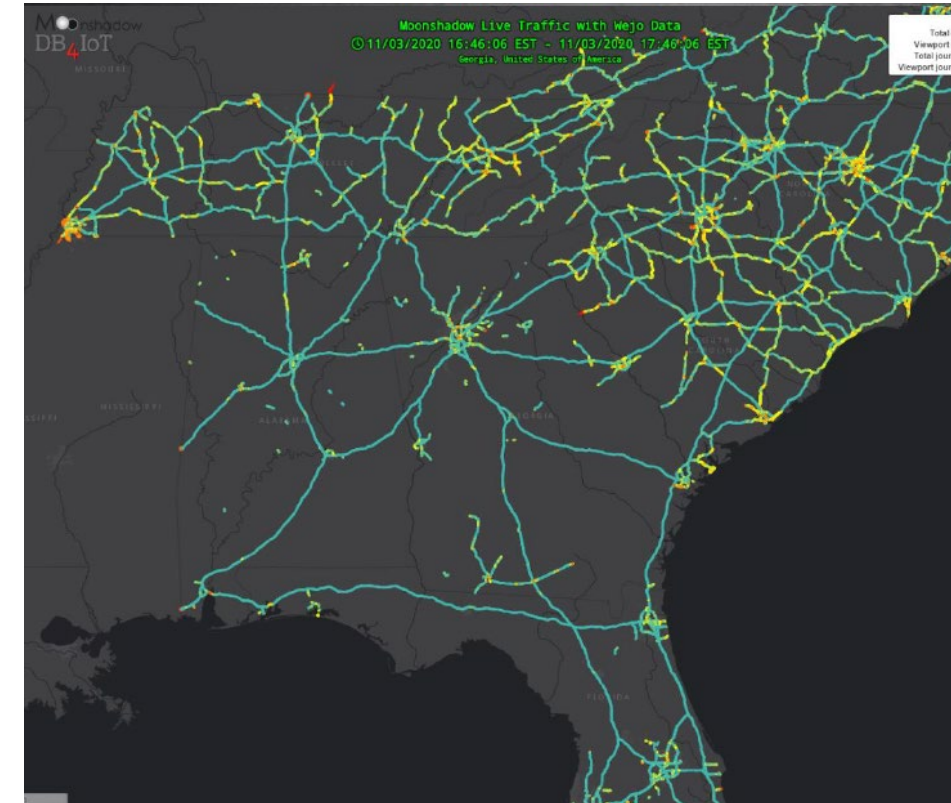


Understanding and monitoring dwell time around POIs to determine length of stay and purpose of visit



# Proof of Concept Goal #2

**Process observed CV trips in real time**, assigning them to appropriate roadway segments, and obtained counts of probe vehicles from which to estimate traffic volume.





## Goal #2 – Lessons Learned

---

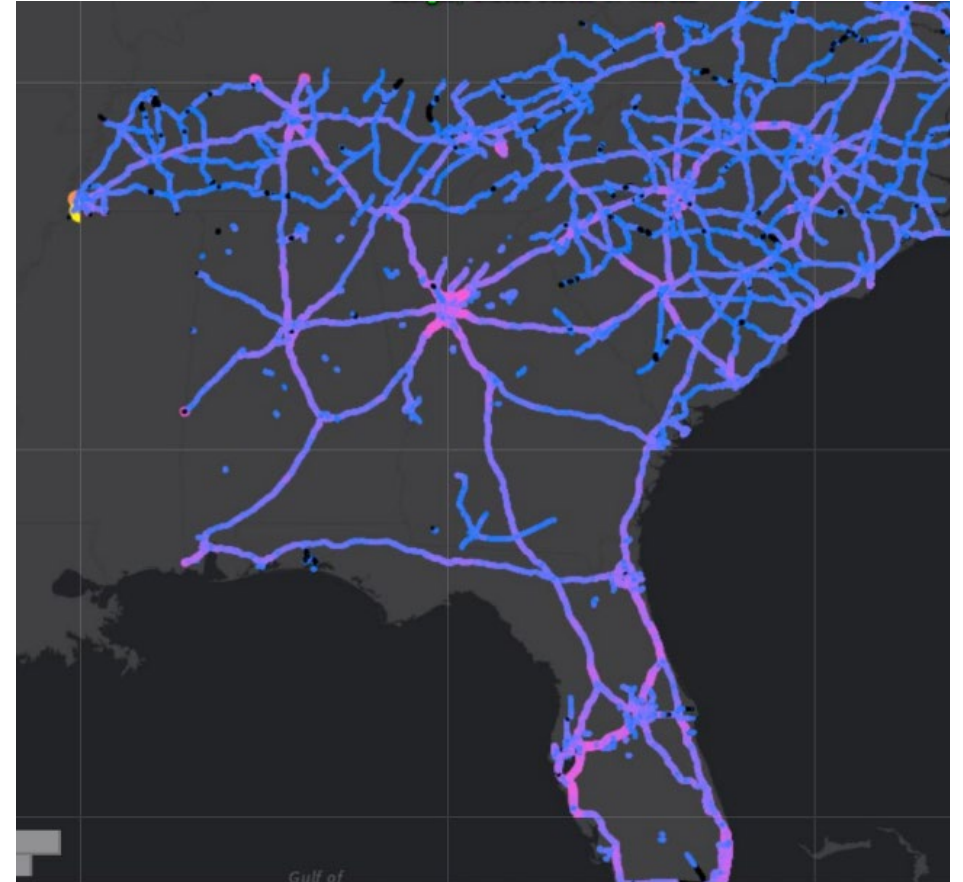
- ❑ Real-time CV data is intuitive, but volume estimates requires aggregation to segment levels
- ❑ Conflating data to map segments (OSM) in real-time is challenging, but doable
- ❑ DB4IOT, though robust, required data science skill  
- need to work toward ‘Easy Buttons’
- ❑ Need to bridge language between traffic engineering with data science / IT
- ❑ Approximately 30 seconds measured latency



# Proof of Concept Goal #3

---

**Assess meaningful Volume Measures** from the live data streams by calibrating to known journey penetrations rates, and relative to nominal traffic volume conditions.



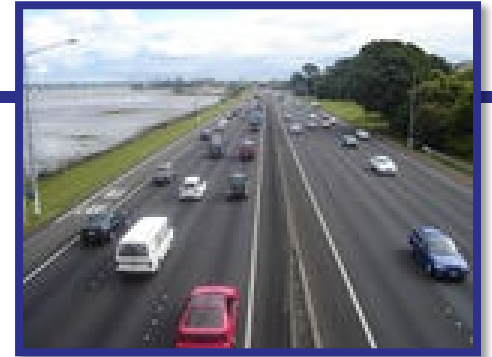


# The Uplift Factors

- **States**
  - Florida, North Carolina, Virginia
- **Functional Road Class (FRC) 1-3**
  1. Motorway
  2. Trunk
  3. Primary
- **Time of Day (TOD)**
  - 15-minute time intervals
  - 96 time intervals per day (0-95)

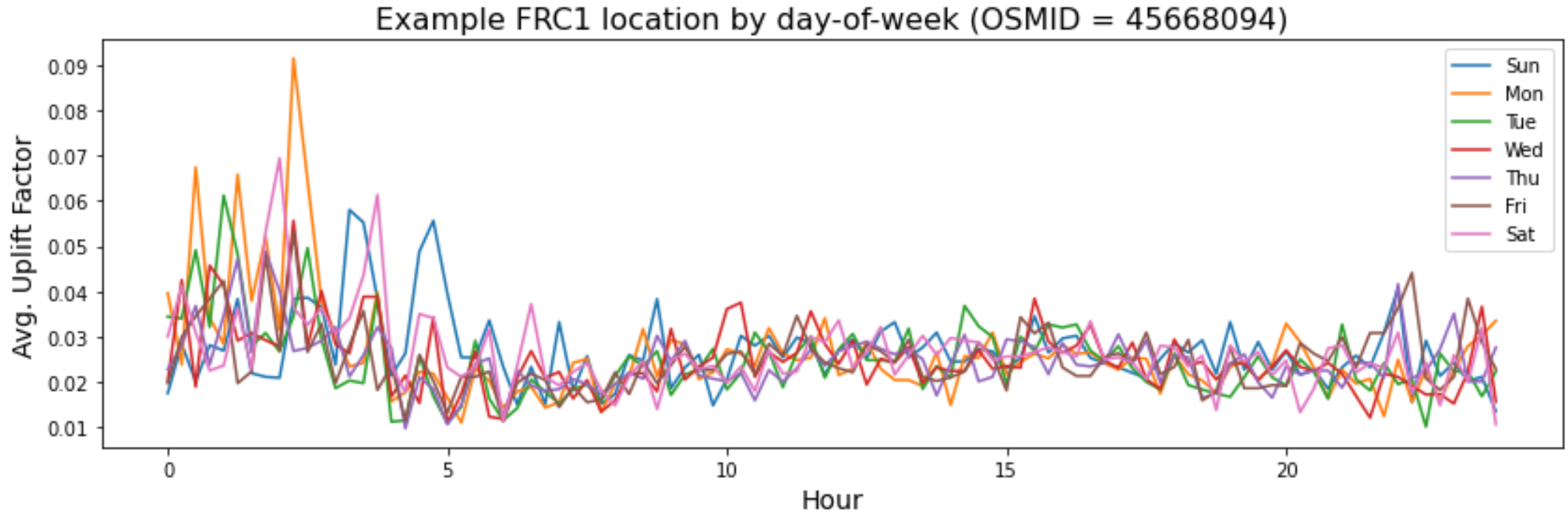
## Day of Week (DOW)

0. Sunday
1. Monday
2. Tuesday
3. Wednesday
4. Thursday
5. Friday
6. Saturday





# Results – Florida – Functional Road Class 1 OSM / DOW / TOD

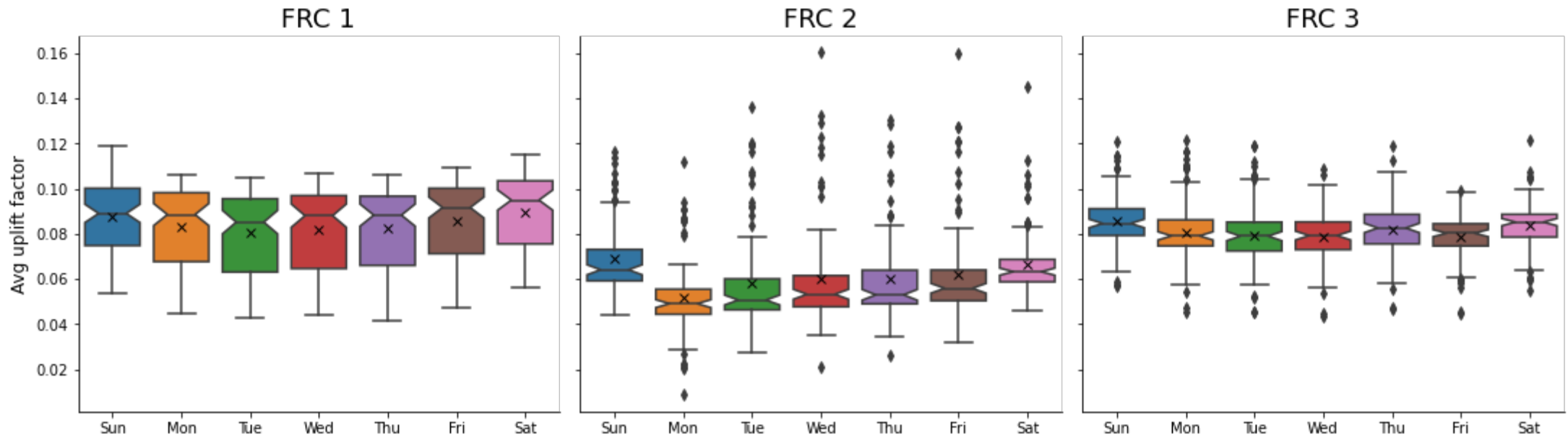


- On a tech level, this slide summarizes results. CV is consistent enough to provide meaningful volume in real-time



# Uplift Factors – Florida FRC / DOW

Florida Average Uplift Factors by Day-of-Week



- There is some fluctuation by DOW, and the box plot provide indication of variance (in turn expected accuracy)
- The Inter-Quartile Range is typically 1% - 4%, providing for reasonable accuracy



## Summary – Was the POC Successful?

---

- Despite the data processing challenges, analysis to date indicates that ...
  - Volumes of reasonable accuracy for operations are feasible in real-time through connected vehicle data
  - Simple factoring (DOW, TOD, State) provides a workable solution – more advanced ML/AI techniques may only improve
  - Sheer size and velocity of data will require efficient calibration, calculation, and conflation techniques –
- **OVERALL – the POC indicated that real-time CV data is sufficient to provide workable real-time Volume Estimates!**





# State Feedback – Summary

Real-time display of CVD (moving vehicles) incredibly intuitive

- Confirms contraflow, incidents, etc.
- Platform initially glitchy, but stabilized

Volume display

- Only provided probe count (till Nov) – required specialized query
- Visually the density of vehicle re-enforced ability to provide volumes
- Demo provided ample evidence that real-time probe volumes is within reach
- Raw CVD data requires specialized resources to consume



# Proof of Concept Overall Take-Aways

---

- ❑ CV data is viable now and will only grow in size and velocity
- ❑ Managing CV data at scale is challenging for industry, but doable
- ❑ Visualization of CVD (individual vehicles) brings intuitive value
- ❑ **Real-time volume estimates from CV data appears viable for implementation**
- ❑ Proof of Concept provided valuable insight to ...
  - Specifications for operational systems in terms of use and functionality
  - Bridge the language between Traffic and Information Technology
  - Blaze new ground to visualize real-time volume and O&D



# Next Steps

---

- Base CV data is being procured through the TETC Traffic Data Marketplace
- The POC will result in draft Framework, Specifications, and Approach for implementation within the Coalition
- Forming Coalition committee for guidance, oversight, and vision of the ETC Traffic Volume Project
- Expect additional information in Q2/3 of 2021



— THE EASTERN  
TRANSPORTATION  
COALITION

CONNECTING FOR SOLUTIONS



# Thank You!

For additional information, please contact:

**Denise Markow**, TSMO Director

The Eastern Transportation Coalition

301-789-9088, [dmarkow@tetcoalition.org](mailto:dmarkow@tetcoalition.org)