Gwinnett Transportation

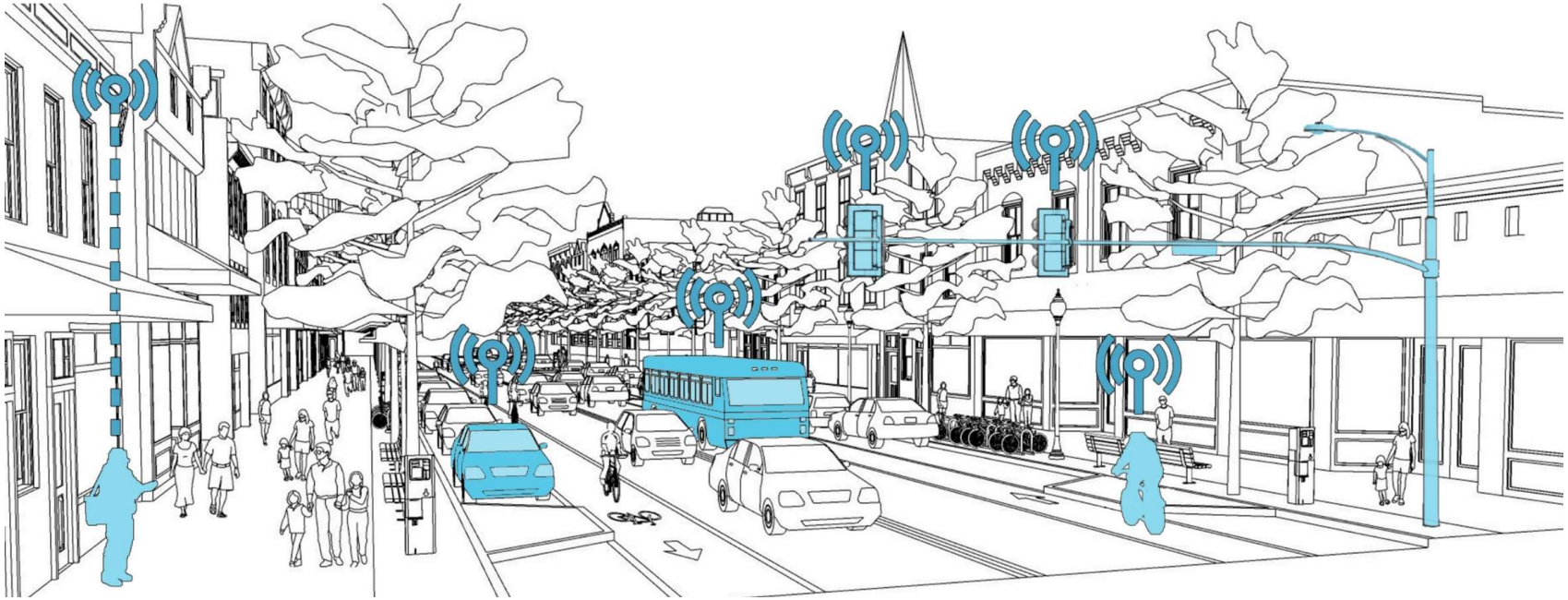
Connected Vehicle Technology Master Plan

September 5, 2019

Why Should We Pursue Connected Vehicle Technology?

- Safety benefits for first responders
- Automakers are planning to produce vehicles with this technology
- Safety benefits for all road users
- Potential to improve traffic flow
- GDOT is deploying this technology on state routes in metro Atlanta

https://www.its.dot.gov



“Connected Vehicles Can Sense and Communicate Things Drivers Cannot” - USDOT

Definitions

Automated Vehicles are vehicles that are capable of sensing their environment and navigating without human input.

Connected Vehicles are vehicles that use wireless communication technologies to communicate with roadside infrastructure, the driver, other cars on the road, and other devices, such as mobile phones.

Source: USDOT. Connected Vehicles Pilot Deployment Program

Vehicles to Infrastructure (V2I)

- Red Light Warning
  - Driver Alert
- Pedestrian in Crosswalk Alert
  - Driver Alert
- Restricted Lane Warning
  - Driver Alert
  - Agency Response and Safety
- Emergency Vehicle Signal Preemption
  - Agency Response, Safety, and Coordination
  - Driver Alert

Gwinnett Transportation

Connected Vehicle Technology Master Plan

Why create this plan?

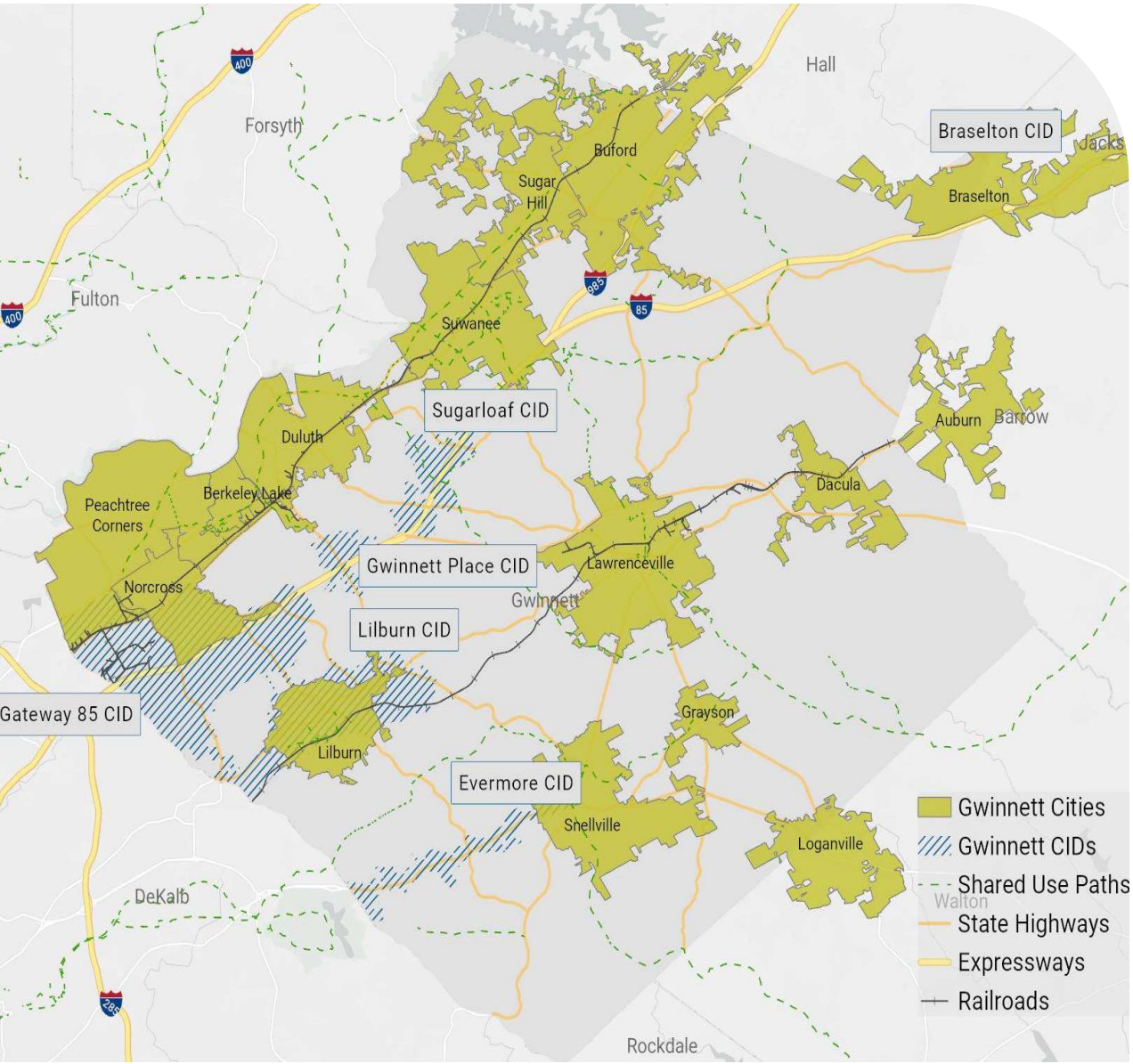
- Supplement the County's existing transportation plans by focusing on connected vehicle infrastructure
- Identify the potential safety and mobility benefits available with deployment of connected vehicle infrastructure
- Understand the current state of the technology and the plans of automakers
- Prepare for the Smart Corridor pilot located along PIB
- Provide guidance for future projects

How to develop the plan?

- Awarded one of the inaugural Georgia Smart Communities Challenge grants
- Matched with County SPLOST funds
- Included research and data analysis conducted by Georgia Tech faculty

Goals for the plan

- Have broad applicability across the County, Atlanta region, and the State of Georgia
- Understand the needs and challenges to ensure regional and statewide compatibility for road users
- Establish guidelines for deploying a new and evolving technology
- Set the standard for the implementation of connected vehicle technology for a local government



Gwinnett Transportation

Project Team

- Gwinnett County:
- AECOM:
- Georgia Tech:
- Stakeholders:
  - Public Safety
  - GDOT
  - Cities
  - Community Improvement Districts

Project Timeline

- September 2018: Project initiation (Georgia Tech Workshop)
- October 2018: **Local stakeholder kick-off meeting**
- November 2018: Technology review meeting
- January 2019: CV applications identification meeting
- March 2019: CV applications completion meeting
- April 2019: **Regional CV stakeholder workshop as part of Ga Smart site visit**
- June 2019: Data collection and evaluation
- August 2019: Connected Vehicle Technology Master Plan completion
- September 2019: **Final presentation at Georgia Tech**

Stakeholder Meetings

- Location and nature of the transportation issues
- Priority

Project Actions

- Interviewed peer agencies that had already installed or are planning to install connected vehicle infrastructure
  - RenewATL
  - City of Marietta
  - Cobb County DOT

Project Actions

- Meetings with GDOT to coordinate on technical issues and standards
- GDOT-funded opportunities
  - Connected vehicle software
  - Roadside Unit (RSU) device testing
  - Expansion of GDOT's deployment of roadside units in Gwinnett County by 56 intersections

Source: GDOT

Benefits of the process

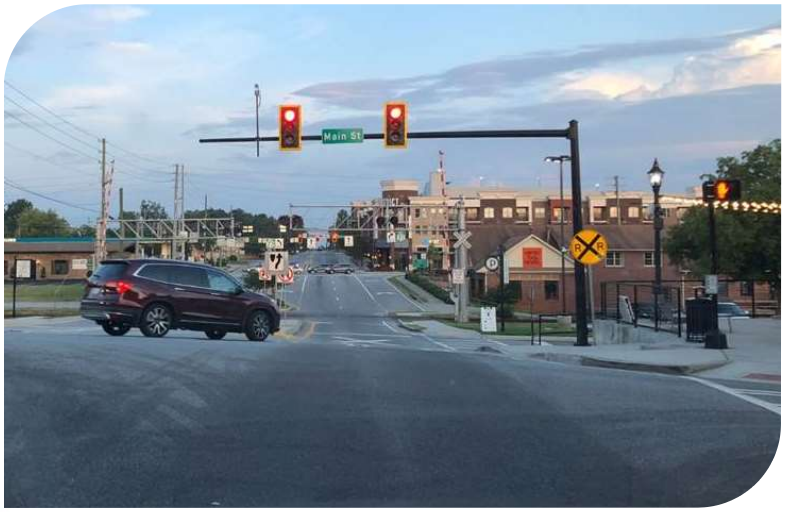
- Learned about transportation challenges from stakeholders
- Explained the technologies and systems at a conceptual level
- Provided overview of industry trends and opportunities
- Developed a 5 year deployment plan for connected vehicle applications and technologies
- Refined the scope of the Smart Corridor pilot project
  - Expansion from PIB signals to more roads west of I-85
  - Status of the desired connected vehicle applications

5-Year Deployment Plan

Application	2020 Smart Corridor project	2021-2022 In Coordination with ARC, GDOT	2023-2024 In Coordination with GDOT
Signal Phase and Timing (SPaT) Information	• Enable red light warning, phase termination/next signal phase, and green band speed applications	• Monitor benefits of safety applications related to fleet penetration of RSUs and cellular OBUs	• Monitor benefits of safety applications related to fleet penetration of DSRC/cellular OBUs
Emergency Vehicle Preemption (EVP)	• Enable EVP • Install OBUs on fire trucks	• State-wide; manage EVP conditional priority requirements	• Alerts for excessive transition time
Transit Signal Priority (TSP)	• Enable TSP • Install OBUs on transit vehicles	• Manage TSP conditional priority • Test schedule adherence conditional priority • Test bus occupancy conditional priority	• County-wide system development • Alerts for excessive transition time

- Identification of connected vehicle applications that could be deployed in pilot project
- Understanding of which applications would need support from other parties and more development

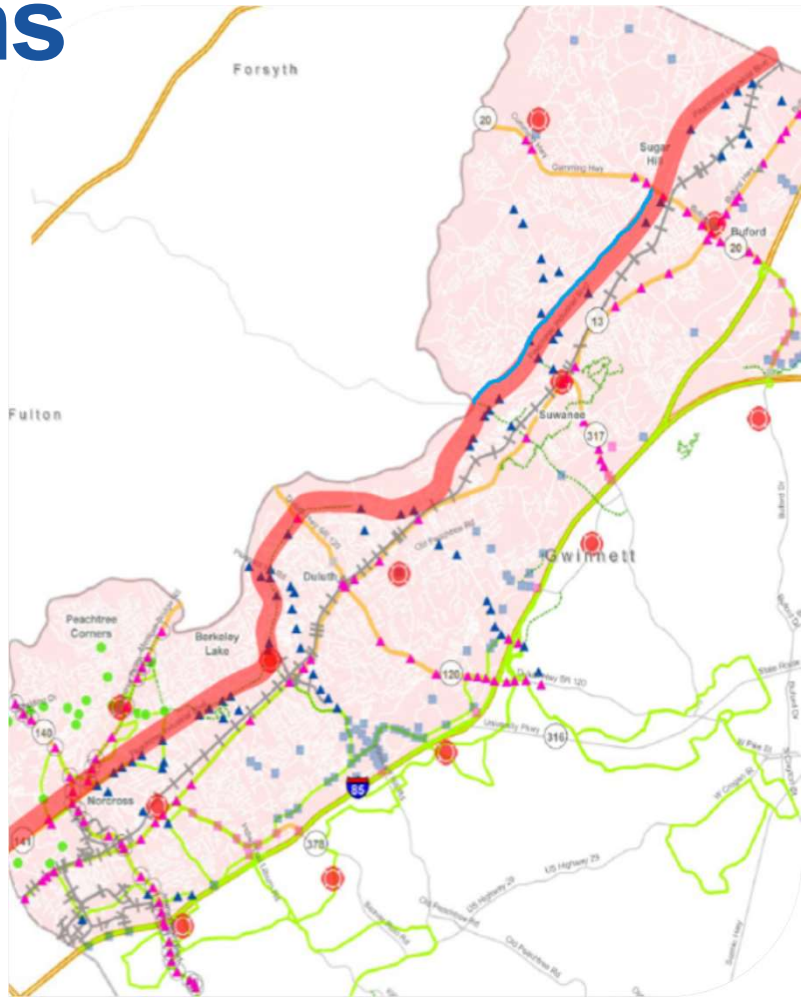
Connected Vehicle Applications for Smart Corridor Pilot Project



- Emergency vehicle preemption
- Transit signal priority
- Pedestrian presence notification
- Railroad crossing status
- Construction and maintenance activity notification
- Signal timing and phasing information

Project Recommendations

- Solve real problems
- Coordinate with GDOT, since connected vehicle functions should be boundary-less
- Recognize that plan flexibility is necessary due to the speed of technology evolution
- Budget time and finances for system field testing, O&M, and security certification

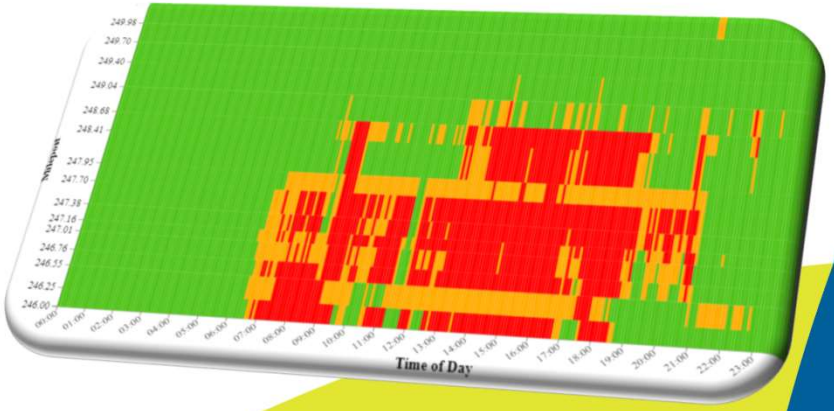


Gwinnett Transportation

Georgia Tech Research Actions & Results

Research Focus

- Evaluate the potential for improvements in safety and response time for emergency vehicles
- Focus on fire apparatus at stations within the pilot project area
- Develop strategies for maximizing benefits and minimizing impacts



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Emergency Vehicle Preemption

Traffic Signal controller receives a message from an emergency vehicle as it approaches intersection

- Signal transitions to green light
- Limited to line of sight

Preemption using connected vehicle technology

- Potential for multi-signal preemption
- Clear traffic in advance of emergency vehicle arrival
- Minimize impacts to normal traffic flow

Photo credits
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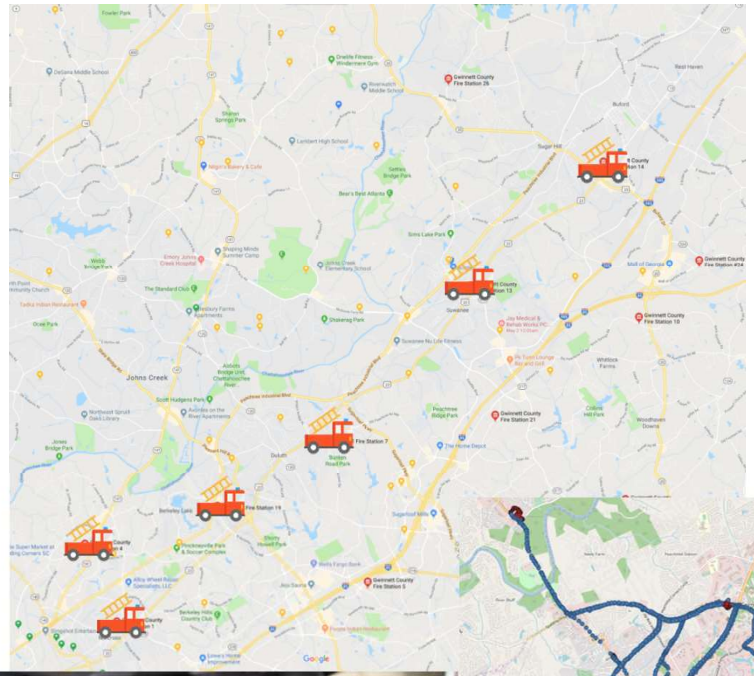
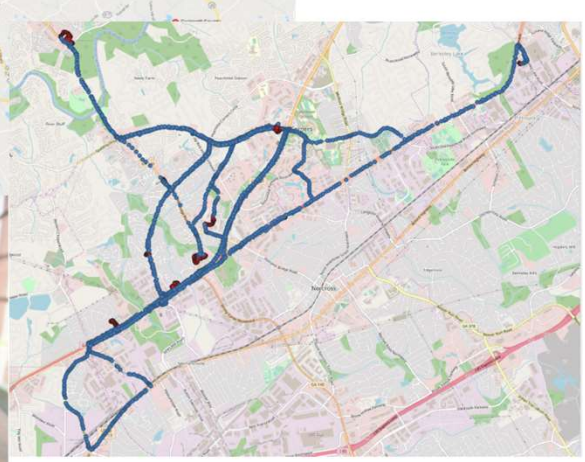
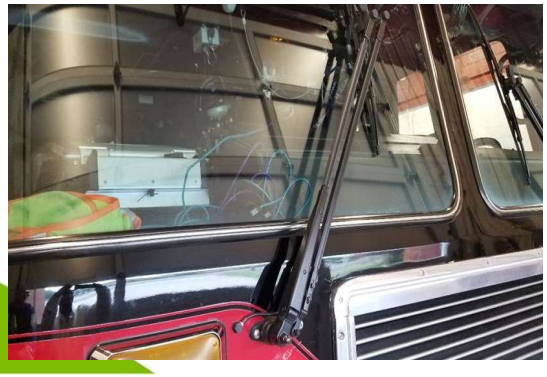
Data

- GPS data collection on 17 trucks/engines/med-units from 6 Fire Stations
- GT equipment deployed on Gwinnett county fire vehicles
- 1 month of second by second location data







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Georgia Tech Student Engagement

Smart Community Corps student

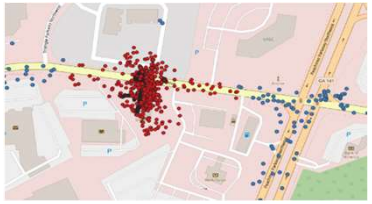
- On-site placement at the Gwinnett County DOT Traffic Control Center
- Streamlined the process for data transfer for high resolution (massive volume) traffic signal data from Gwinnett to GT on a regular basis
- Developed data fusion API for GPS and Signal status data

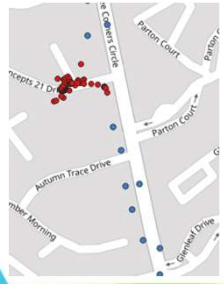
Civic Data Science team

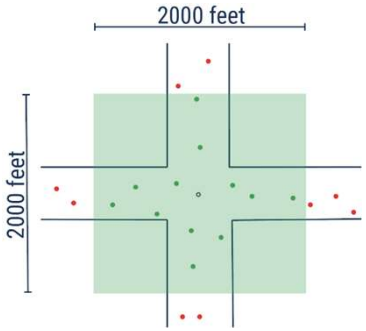
- Performed Bottleneck Analysis using GPS and Signal data
  - Developed data quality checks
  - Developed data transformation protocols for GPS data
- Identified Intersections contribution to maximum delay for Emergency Vehicles

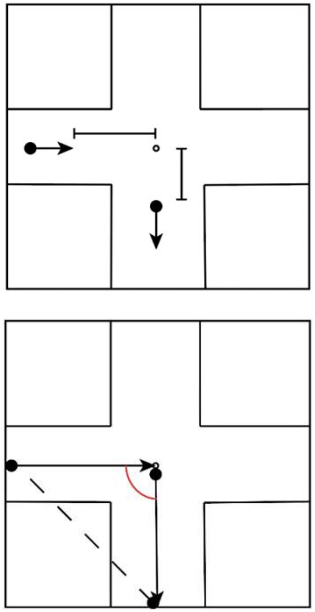
Data Processing

Off-route filter → Intersection filters → Intersection association → Approaching / receding determination → Signal light association









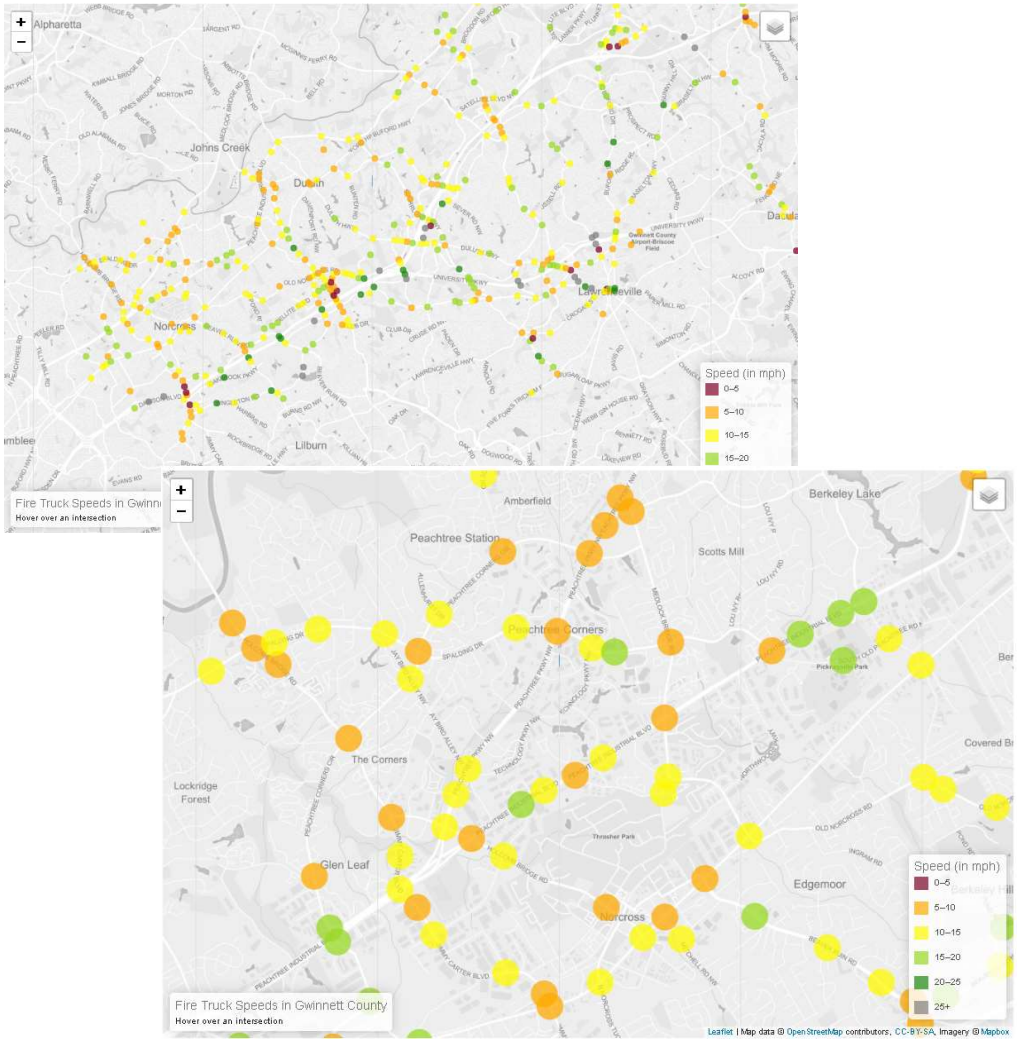
Approach Direction + Turn — Traffic Signal status

Results

Average Speed Near Intersections

Top 10 intersections

Intersection	Speed
PLEASANT HILL RD	7
HOWELL FERRY RD	8
MCGINNIS FERRY RD	8
NORTH BERKELEY LAKE RD	8
PEACHTREE HILL S/C / DUNKIN DONUTS	8
ALTON TUCKER BLVD / FIRST AVE	9
SUWANEE DAM RD	9
MEDLOCK BRIDGE RD	9
SR 20 / NELSON BROGDON BLVD	9
REPS MILLER RD	10



Results

Average Speeds on Approach

Top 10 intersections

Intersection	Speed	%Red
PLEASANT HILL RD	7	57%
MCGINNIS FERRY RD	7	63%
HOWELL FERRY RD	8	90%
NORTH BERKELEY LAKE RD	8	86%
PEACHTREE HILL S/C / DUNKIN DONUTS	8	81%
SUWANEE DAM RD	8	74%
ROGERS BRIDGE RD	9	33%
MEDLOCK BRIDGE RD	9	46%
REPS MILLER RD	9	40%
ALTON TUCKER BLVD / FIRST AVE	9	84%

FS 19 Driveway ~1,100 feet From PIB

Results

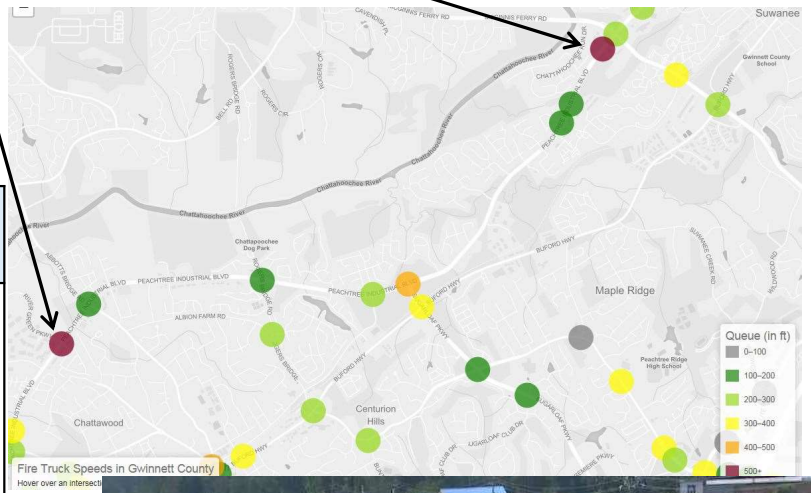
Average Queue Length

Top 10 intersections

Intersection	Queue Length	Occurrences
SUWANEE WALK AVE (~670 FEET SOUTH OF MCGINNIS FERRY RD)	734	13
RIVERGREEN PKWY (NORTH)	622	19
SUMMITT RIDGE PKWY / SWEETWATER CENTER	378	113
PEACHTREE HILL S/C / DUNKIN DONUTS	364	36
ALTON TUCKER BLVD / FIRST AVE	344	36
REPS MILLER RD	331	71
SUWANEE DAM RD	319	87
PLEASANT HILL RD	299	118
SR 20 / NELSON BROGDON BLVD	299	190
WEST PRICE RD	289	12

Suwanee Walk Ave

Rivergreen Pkwy



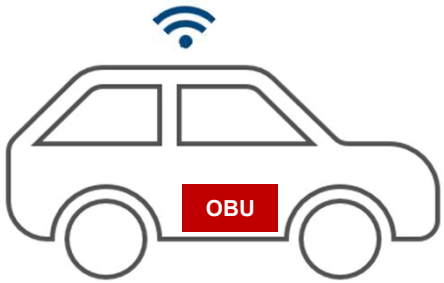
Next Steps in Analysis

- Deeper analysis of data
- Quantify total observed delay
- Identify critical signal phases for emergency vehicles at each intersection
- Evaluate forward looking preemption feasibility
- Collect more before-deployment data in Fall 2019
- Post-deployment analysis (2020-2021)

Process Improvement, Data, & Automation

- Greater understanding of how connected vehicle technology will support the goals of improved mobility and safety

- GDOT coordination improves the opportunities for connect vehicle technology to be applied state-wide



Process Improvement, Data, & Automation

- Connected vehicle application selection that will benefit the full spectrum of transportation users

- Data evaluation provides a detailed understanding of where emergency vehicles are experiencing delays

Research Recommendations

- The emergency response community is welcoming CV technology. Demonstration and quantification of benefits, through pilot field applications, will be critical to inducing acceptance from the public and convergence from the manufacturers that are both necessary for widespread success of CV in improving mobility, safety and sustainability.
- Lessons learned: Identifying key data needs early in the project is critical to success of short term data-heavy projects

Impact of Connected Vehicles

- Safety benefits to first responders and all road users
- Compatibility with GDOT connected vehicle technology can create a regionwide system

https://www.its.dot.gov

Project Team Contact Information

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