MEETING SUMMARY

NC Fully Autonomous Vehicle (FAV) Committee
First Quarterly Meeting – Calendar Year 2025

February 12, 2025
2:00 – 3:30 p.m. ET
McKimmon Center
Raleigh, NC 27606

Meeting Purpose

Provide the committee and guests with updates on NCDOT's progress on key activities to reengage the FAV Committee and to establish its Connected and Automated Vehicles (CAV) program, federal and national updates, presentations from guest speakers, and the opportunity for open discussion and Q&A.

Committee Members Present (* indicates virtual attendance)	
Name	**Organization**
John Congleton*	NC Department of Justice
Mark Ezzell*	NC Governor's Highway Safety Program
Wayne Goodwin*	NC Division of Motor Vehicles
Michael Langley*	Pepsi Bottling Ventures
Robert Mays*	NC Department of Insurance
Thomas Moore	Cardinal Government Affairs on behalf of General Motors
Justin Owens*	UNC Highway Safety Research Center
Debbie Smith*	City of Charlotte
Committee Members Absent	
Name	**Organization**
Charles Blackwood	Orange County Sheriff's Office
Chris Blue	Town of Chapel Hill
Ryan Brumfield	NC Department of Transportation
John Hardin	NC Commerce
Stephanie Harmon	Peanut Belt Rural Planning Organization
Tom McInnis	NC Senate
Phil Shepard	NC House of Representatives
Ariel Wolf	Venable LLP on behalf of the Autonomous Vehicle Industry Association
Guests Present (* indicates virtual attendance)	
Name	**Organization**
Peter Ashley*	Applied Information, Inc.
Daniell Bagley	NC Department of Transportation
Jeff Barghout*	Robocist, Inc.
Eskedar Bayissa	NC Department of Transportation
Thad Caldwell*	Temple, Inc.
Amna Cameron	NC Department of Transportation
Matthew Carlisle	NC Department of Transportation
Thomas Chase	NC Department of Transportation
Danjue Chen	NC State University
Torrey Dixon	NC Department of Justice

Guests Present (* indicates virtual attendance)	
Name	**Organization**
Amanda Good*	Kimley-Horn and Associates
Ali Hajbabaie	NC State University
Liam Hogan-Rivera	NC Department of Transportation
Ben Hughes	NC Department of Transportation
Joe Hummer	NC Department of Transportation
David Jones*	HNTB
Dagoberto Juarez Pozos	NC Department of Transportation
Ali Karimoddini	North Carolina A&T State University
Martin Kinnamon*	City of Charlotte
Kendra Klemann	NC Department of Transportation
Francesca Lea	NC Department of Transportation
Joe Milazzo	Regional Transportation Alliance
Zachary Pugh*	NC State University
Shoaib Samandar	NC State University
Robert Sawyer	NC Division of Motor Vehicles
Judy Schmidinger*	NC Division of Motor Vehicles
Jason Schronce	NC Department of Transportation
Nishant Shah	NC Department of Transportation
John Shaw	Institute for Transportation Research and Education
David Spencer*	Town of Cary
Paul Tosch	NC Department of Transportation
Ed Turlington*	Brooks Pierce
Julie White*	NC Department of Transportation
Brittany Wilborn	NC Department of Transportation
Deshong Xu	Institute for Transportation Research and Education
Leila Yahyapour	SAS
Lei Zhu	UNC Charlotte

Call to Order

The North Carolina Fully Autonomous Vehicle (FAV) Committee convened for its first quarterly meeting of calendar year 2025 on February 12, 2025 at the McKimmon Center in Raleigh, NC and on Microsoft Teams.

Sarah Searcy welcomed attendees to the meeting and introduced the meeting's agenda. The meeting included the following topics: NCDOT's progress on key activities to reengage the FAV Committee and to establish its Connected and Automated Vehicles (CAV) program, federal and national updates, presentations from guest speakers, and the opportunity for open discussion and Q&A.

NCDOT Updates

FAV Committee's Duties and Membership

After the call to order and opening remarks, **Sarah Searcy** reviewed how the FAV Committee was established, its membership composition, and its expected duties. The committee was established by law in July 2017 when the North Carolina General Assembly enacted Session Law 2017-166 (House Bill 469) as

Article 18 in Chapter 20 of the North Carolina General Statues (G.S. § 20-400 – 403). The law regulates the operation of FAV and creates an FAV Committee within the Department of Transportation.

The FAV Committee is required to meet at least four times a year to:

- *Consider matters relevant to fully autonomous vehicle technology,*
- *Review State motor vehicle law as they relate to the deployment of fully autonomous vehicles onto the State highway system and municipal streets,*
- *Make recommendations concerning the testing of fully autonomous vehicles,*
- *Identify and make recommendations for DOT traffic rules and ordinances, and*
- *Make recommendations to the General Assembly on any needed changes to State law.*

The law further specifies that the Department of Transportation will provide staff and meeting space from reasonably available resources to the committee. The law defines the committee membership based on 15 different designations as follows:

1. *Secretary of Transportation, or the Secretary's designee.*
2. *The Secretary of Commerce, or the Secretary's designee.*
3. *The Commissioner of Insurance, or the Commissioner's designee.*
4. *A representative of the Highway Patrol, designated by the Commander.*
5. *A representative of the North Carolina Association of Chiefs of Police, designated by its Executive Director.*
6. *A representative of the North Carolina Sheriffs' Association, designated by its President.*
7. *A representative of the University of North Carolina Highway Safety Research Center, designated by the Director.*
8. *At least two representatives from the autonomous vehicle industry, designated by the Secretary of Transportation.*
9. *A representative of the Attorney General's Office, designated by the Attorney General, who is familiar with motor vehicle law.*
10. *A representative of local law enforcement, designated by the Secretary of Transportation.*
11. *A representative of the trucking industry, designated by the North Carolina Trucking Association.*
12. *A planner from an urban area, designated by the North Carolina League of Municipalities.*
13. *A planner from a rural area, designated by the North Carolina Association of County Commissioners.*
14. *Two members of the North Carolina Senate, designated by the President Pro Tempore of the Senate.*
15. *Two members of the North Carolina House of Representatives, designated by the Speaker of the House.*

Reengaging the FAV Committee

Sarah Searcy summarized how NCDOT is reengaging the FAV Committee and making changes that are informed by feedback from the committee and its friends and review of past meetings and activities.

Sarah met one-on-one with 12 appointed members and four public sector friends of the committee since the last committee meeting that was held on December 12, 2024 to learn what is working well and what could work better with the committee.

Aspects of the committee that are working well include: collaborations and connections with diverse professionals across sectors; information exchange and updates about NC-specific projects; forum for committee members to learn; university partnerships; and on-site and in-person meetings. Among those who participated in the one-on-one meetings, there was a general consensus that the committee is important and needed.

Aspects of the committee that could work better include: well-defined roles, responsibilities, and expectations; clear vision, mission, direction, goals, and focus areas; more active participation by the committee to accomplish activities; workplans with problem statements, assignments, timelines, and deliverables; direct connection between the committee's work to a strategic plan and action items; more consistent communication and contact; more in-person meetings; more public engagement; national and international updates; and sharable resources and documentation.

In addition to the one-on-one meetings, Sarah reviewed historic records that were produced through past committee meetings and activities to establish a baseline and determine areas for improvement so the committee can work more effectively and accomplish their duties as stated in law. The committee convened 13 times from March 2018 through December 2024. Two meetings were completed per year on average and seven were in person. The committee has never convened at a minimum of four times a year as required. In the committee kickoff meeting in March 2018, working groups were established in the areas of infrastructure, operations, business, research, and legislative. Each held separate kickoff meetings to develop recommendations and action items, but deliverables were not produced based on available records, and the groups were not maintained. Meeting summaries captured excitement about what could be accomplished by the working groups and some ideas were documented, but no outcomes were produced.

Documentation from the first committee meetings that were held in 2018 indicated concerns that North Carolina may not be ready or prepared enough for automated vehicle technology and emphasized the importance of the committee to stay ahead of the technology. There were discussions by the committee around developing guidance for law enforcement interaction with automated vehicles (including emergency response protocols), a formalized testing regime, and standards for remote operations in the state, but none were developed. The committee was made aware of NC-specific legislation but was not actively involved with its development. The committee provided comments on the Manual on Uniform Traffic Control Devices (MUTCD) Part 5 revisions in 2021 and on the Uniform Operation of Vehicles Act and a potential amendment to the state's FAV law in 2020.

Starting in 2021, the FAV Committee was engaged around an update to the 2016 NCDOT CAV Roadmap. The committee's input on gaps, disruptions, mitigations, and opportunities were captured through surveys and workshops. Work on the strategic plan update was paused in early 2024 while NCDOT worked to establish a dedicated lead and resources for CAV and FAV initiatives, including the creation of the position that Sarah currently serves in to provide more consistent support.

Based on the feedback gathered in the one-on-one meetings with appointed members and public sector friends of the committee and review of the committee's historic records, Sarah shared recommendations and next steps for the FAV Committee with accompanying deadlines.

- **February 2025**
  - Update and confirm committee membership, including providing letters of appointment with periodic recommitment.
  - Create web-based resources, including a webpage for committee members and guests to access meeting agendas, summaries, and other documentation related to the committee's work.
- **May 2025 (draft), August 2025 (final)**
  - Create a charter to document the purpose of the committee, the roles and responsibilities of its members, how the committee is structured and organized, and the logistics for accomplishing work.*
  - Complete the strategic plan update.*
  - Transition to a task force model by establishing subcommittees or working groups with workplans informed by the strategic plan update and charter.*
- **Ongoing**
  - Improve industry outreach.
  - Improve public engagement.
- **February each year**
  - Publish an annual report that captures what the committee has accomplished during the previous calendar year.*

Items marked with an asterisk (*) are deliverables that will be prepared by NCDOT and reviewed by committee members prior to finalizing. Sarah will be in contact with committee members through email with reminders of the progress on these items between committee meetings.

For the item related to improving industry outreach, Sarah shared that she has met with 12 companies so far to familiarize them with the committee and NCDOT's CAV program.

FAV Committee Meetings: Schedule for 2025

Sarah Searcy provided the schedule of FAV Committee meetings for the remainder of calendar year 2025. NCDOT will hold three additional FAV Committee meetings for a total of four meetings. While November 11 was initially proposed as the final meeting of the year, feedback during the committee meeting indicated that this date is a state and federal holiday. The final meeting of the year will instead be held on December 9 at a location to be determined.

- **Tuesday, May 6** – Virtual on Microsoft Teams.
- **Tuesday, September 2** – N.C. Transportation Summit in Raleigh, NC.
- **Tuesday, December 9** – Location TBD.

State Initiatives

Demonstrations and Pilots

Sarah Searcy provided updates on state-level demonstrations and pilots.

- **October 2024**
  - Under the FY 2023-2024 USDOT Advanced Transportation Technology and Innovation (ATTAIN) Program, FHWA announced more than $96.5 million in grants to 16 states for 20 projects. (press release)
    - NCDOT-led *Connected, Rural, Equitable, and Autonomous Transportation for Everyone (CREATE)* was not awarded.
    - NCDOT-led *Smart Signals in Our Communities* was awarded.
- **January 2025**
  - NCDOT published a program development report that summarizes overall conclusions and lessons learned from the Connected Autonomous Shuttle Supporting Innovation (CASSI) program to date. (program webpage)
  - NCDOT launched a $2 million connected vehicle (CV) technology pilot project to improve safety and mobility around N.C. State University. (press release, project webpage, public input webpage)
  - Under the FY 2022-2023 USDOT Rural Autonomous Vehicle (RAV) Research Program, USDOT announced a $15 million grant to a team led by the University of Wisconsin-Madison for research on the integration of automated vehicles into passenger transport and a $10 million grant to a team led by the University of California, Berkeley for research toward improving the efficiency and safety of autonomous freight vehicles, particularly focusing on rural logistics and supply chain enhancements in the Southwest. (press release)
    - The N.C. A&T State University-led *Sustainable Tribal and Rural Equitable Transportation Through Automated Mobility (STREAM)* was not awarded.
- **February 2025**
  - N.C. A&T State University concluded its NCDOT-funded Technology Transfer project that supported a one-month pilot of its automated shuttles on public streets from Sep. 18-Oct. 13, 2023 (RP 2023-35).
  - N.C. A&T State University kicked off its NCDOT-funded Technology Transfer project to develop and demonstrate a teleoperations platform for remote control of its automated shuttles (TT 2025-05).

Research

Sarah Searcy provided updates on state-level research projects.

- *NC Transportation Center of Excellence on Connected and Autonomous Vehicle Technology (NC-CAV)* (TCE 2020-03) led by N.C. A&T State University was extended to December 31, 2025.
- *Guidance on Considering CAVs in Travel Demand Models* (RP 2023-11) led by N.C. State University closed out in July 2024 with a final report forthcoming.
- *Review the State-of-the-Art Studies on the Public's Perception of ADAS (…)* (TA 2025-07) led by N.C. State University kicked off in January 2025.

Federal and National Updates

After concluding the state-level updates, **Sarah Searcy** provided several federal and national updates.

- National Highway Traffic Safety Administration (NHTSA)'s Notice of Proposed Rulemaking (NPRM): Automated Driving System (ADS)-Equipped Vehicle Safety, Transparency, and Evaluation Program (AV STEP)
    - AV STEP would establish a national program for ADS-equipped vehicles that operate or may operate on public roads in the United States, create a voluntary review and reporting framework for participating ADS-equipped vehicles, and be open to all companies that operate or plan to operate compliant ADS-equipped vehicles on public roads and to those requiring NHTSA exemptions to operate non-compliant vehicles.
    - Committee members are invited to review and provide feedback on the NPRM via a survey by March 3, 2025.
        - See NHTSA's press release (December 20, 2024), NPRM as published in the Federal Register (January 15, 2025), and rulemaking docket with supporting and related material (Docket No. NHTSA–2024–0100) (January 17, 2025).
- NCHRP 20-68D U.S. Domestic Scan 23-02: "Recent Experiences in Advancing and Deploying of Automated Vehicle Technologies" (project webpage)
    - In November 2024, 13 state DOTs including NCDOT shared their approaches and key findings from their automated vehicle programs through a week-long virtual workshop with some states sharing their experiences with connected vehicle technology.
    - The final report synthesizing outcomes from the workshop, a desk scan, and a survey of state DOTs will be published in spring 2025.
    - Findings will be shared at a future FAV Committee meeting.
- NCHRP 20-24(147): "Peer Exchange and Research to Identify Best Practices for Testing, Monitoring and Deployment of Automated Transportation Solutions to Support Safety, Equity and Operational Efficiency"
    - In March 2025, a multi-state in-person peer exchange will be held in Austin, TX and a document will be developed that identifies a set of best practices and lessons learned through the peer exchange to help inform DOTs in making practical and feasible technology investment and policy decisions.
    - Sarah and three staff from NCDOT and NC Division of Motor Vehicles will attend, and findings will be shared at a future FAV Committee meeting.
- National Transportation Safety Board (NTSB)'s Automation in Transportation: Lessons For Safe Implementation (event webpage)
    - In March 2025, the NTSB will host a two-day in-person public forum in Washington, DC with a virtual option led by Chair Jennifer Homendy with participation by all Board Members that will focus on safety issues related to automation in all transportation modes: aviation, highway, rail, transit, pipeline, and marine.

Sarah shared several national resources.

- **American Association of Motor Vehicle Administrators (AAMVA)** – "Guidelines for Regulating Vehicles with Automated Driving Systems, Edition 4" (March 2024) (report)
    - AAMVA Resources (webpage)

- **NCHRP LRD 91** – "Multistate Coordination and Harmonization for AV Legislation" (June 2024) (report)
- **J.D. Power** – "2024 US Mobility Confidence Index Study" and "US Technology Experience Index Study" (October 2024) (report, report)
- **Federal Transit Administration (FTA)** – "Transit Bus Automation Quarterly Update Q3 2024" (November 2024) (report)
    - Transit Automation Research Resources (webpage)
- **Autonomous Vehicle Industry Association (AVIA)** – "Securing American Leadership in Autonomous Vehicles" (January 2025) (report)
- **United States Department of Transportation (USDOT)** – "Transforming Transportation Advisory Committee (TTAC) Report on Artificial Intelligence, Automated Driving, Project Delivery, and Innovation for Safety" (January 2025) (report)

Guest Speaker: Ali Karimoddini – Aggie Auto Shuttles

After providing the state, federal, and national updates, **Sarah Searcy** welcomed **Dr. Ali Karimoddini**, Professor at N.C. A&T State University, to provide an update on his team's Aggie Auto automated shuttles.

Project Evolution and Milestones

Early development of the Aggie Auto automated shuttles began in 2016 with a small 1:10 scale automated car and progressed through 1:3 scale models to full-scale vehicles. In 2019, the team ranked second in the SAE AutoDrive Challenge and received funding from NCDOT to establish the North Carolina Transportation Center of Excellence on Connected and Autonomous Vehicle Technology (NC-CAV). The team subsequently secured funding from the National Science Foundation (NSF) and additional funding from NCDOT through sponsored research projects to support the development of their rural test track, fleet of automated shuttles, and pilot deployment between the university and downtown Greensboro.

Test Track and Pilot Implementation

The team established a dedicated test track at Gateway Research Park in Browns Summit, NC. The track served as a proving ground for safely transitioning the team's lab prototypes to real-world operations. The team successfully piloted automated shuttles on public streets in downtown Greensboro. The shuttles provided free rides to the public on a one-mile route that connected the university's engineering research complex to the Greensboro Children's Museum. The team used a fleet of three automated shuttles that operated at a maximum speed of 25 mph. The team documented 250 trips, 180 passengers, 162 miles covered, and 71 manual driver interventions during the one-month pilot period from September 18 through October 13, 2023.

Technical Enhancements and Operational Improvements

Through the process of preparing the automated shuttles for the pilot deployment, the team identified and implemented multiple sensor and computing upgrades. The team evolved the single-camera system to a robust suite including multiple 3D cameras and four LiDAR sensors to enhance perception capabilities and improve safety by better detecting pedestrians, obstacles, and curbside hazards. The team upgraded the computing power to efficiently process the increased sensor data and accommodate critical software upgrades. The team implemented operational adjustments including developing

advanced adaptive cruise control and refined responses for intersections, stop lines, and tight parking scenarios. The team engaged extensively with local stakeholders, including city officials, police, and local businesses, to plan the route and deliver the pilot operations.

Future Directions

The team's future work includes enhancing vehicle-to-cloud connectivity and further integration of infrastructure, piloting remote operational capabilities with a remote backup driver as a safety fallback, and continued refinement of both technical systems and stakeholder engagement practices.

Guest Speaker: Jason Schronce – Advance Mobility NC Strategic Plan and Implementation

Sarah Searcy next introduced **Jason Schronce**, NCDOT Division of Aviation's Deputy Director of Programs and Planning, to provide updates on the Advance Mobility NC strategic plan and implementation.

Strategic Plan Overview

The Advance Mobility NC strategic plan was completed in April 2024 and led by a team including key NCDOT leaders. The plan is publicly accessible via the NCDOT website. The plan emphasizes a multimodal approach that integrates advanced air mobility (AAM) with last-mile ground connectivity. The plan's vision and goals focus on leveraging innovative mobility technologies and platforms to enhance quality of life, foster economic opportunity, and position North Carolina as a transportation trailblazer.

Success Factors

The Advance Mobility NC strategic plan proposes a regulatory and policy framework that streamlines processes to remove barriers and ensures that innovative ideas can be evaluated effectively. The plan recommends identifying and documenting lessons learned from current pilot programs and developing key performance indicators (KPIs) to gauge progress and effectiveness and to ensure technical readiness. The plan recommends industry and public engagement and partnership building especially around workforce development. The plan recommends best practices for strategic funding opportunities including proactively identifying champions and developing high level budgets and project scopes in advance of funding announcements.

Implementation Focus Areas

The Advance Mobility NC strategic plan implementation includes an innovation process and playbook to evaluate emerging technologies and use cases to ensure alignment with NCDOT's mission, vision, and values. Additional focus areas include strengthening collaboration with local airports and the Federal Aviation Administration (FAA) regarding land use, zoning, and infrastructure improvements and addressing initiatives such as clean fuel toolkits, electric charging station deployment (notably at Raleigh Jetport), and alternative energy solutions for underutilized airport spaces. Implementation will further prioritize the integration of air and ground mobility by bridging AAM with connected and automated vehicle initiatives and leveraging lessons from the automated vehicle sector to inform broader transportation strategies.

Next Steps

Next steps include ongoing work to refine regulatory processes and document pilot outcomes and continued stakeholder engagement and collaboration to prepare for future funding and innovation opportunities. The Advanced Mobility NC strategic plan will serve as a foundational reference for developing updates to the CAV strategic plan.

Guest Speaker: Matt Carlisle – Modernization of NCDOT Traffic Signals

Sarah Searcy next introduced **Matt Carlisle**, NCDOT's State ITS and Signals Management Engineer, to provide updates on NCDOT's signal modernization and connected vehicle pilot projects. Matt opened his presentation by expressing enthusiasm for Sarah's leadership of the committee, noting that her guidance is bringing much-needed structure and organization.

Traffic Signal Modernization Overview

North Carolina has the second largest signal system in the United States with approximately 10,000 state-owned traffic signals. Around 6,000 signals are maintained by the state with the assistance of 100 signal technicians across 14 highway divisions, while around 4,000 signals are located within 18 citywide signal systems across the state and are maintained and operated by cities under reimbursable agreements.

The state traffic signal system had been operating on a custom-developed software platform for about two decades. Starting in 2018, NCDOT began the process of procuring new software. NCDOT awarded a new software contract in 2022 that provides local controller software installed in the field cabinets and central signal system software that integrates the signals into a statewide network. The software has connected vehicle application functions and high-resolution data collection for improved traffic management. Only 3% of existing hardware can run the new software, so NCDOT's signal modernization project aims to upgrade approximately 5,000 state-maintained signals across multiple phases to migrate from the old to the new software, connect closed-loop systems to the central system, and then focus on isolated (mostly rural) signals.

The first upgraded signal was achieved in June 2023. As of December 2024, over 1,200 signals are online with approximately 1,000 on the new system. Additional funding has allowed the schedule to accelerate with target completion now about 1.5 years earlier than originally planned. Plans now include expanding upgrades to city-maintained, state-owned signals.

ATTAIN Grant: "Smart Signals in Our Communities"

NCDOT was awarded a $12 million ATTAIN grant from FHWA that expands the modernization effort to cover over 7,000 signals, extending beyond state-maintained systems to include municipal networks. The grant will support upgrading controllers and installing roadside units (RSUs) at approximately 1,100 signals; establishing connectivity using multiple technologies like fiber optic, radio communications, and 4G modems for isolated locations; creating a connected vehicle cloud feed for data aggregation and potential sharing with third-party providers; and implementing a signal prioritization dashboard to optimize signal retiming investments. Construction is anticipated to begin in the third quarter of 2025 with a planned duration of two years.

Multimodal Connected Vehicle Pilot (MMCVP) Project

The MMCVP project was funded through an Advanced Transportation and Congestion Management Technologies Deployment (ATCMTD) grant from FHWA that was initially awarded to NCDOT in 2019. The project focus area is centered around N.C. State University. The grant will support upgrading 27 signals along key corridors (including Avent Ferry Road, Hillsborough Street, and Western Boulevard). Upgrades will include controller updates, RSU installation, enhancements to vehicle detection (such as shifting from intrusive loop sensors to advanced non-intrusive methods), and pedestrian detection improvements at selected locations. Installation of onboard units (OBUs) on 35 Wolfline buses will support transit signal priority. A smartphone app is being deployed to deliver real-time information such as signal phase and timing, transit signal priority, pedestrian crosswalk warnings, red light violation alerts, and speed warnings.

The project objectives are to enhance mobility for motorists and transit riders, improve safety for all road users, and reduce environmental impacts. Evaluation metrics include travel times and delays, scheduled adherence and arrivals on green for transit, crash frequency and severity, and red light violations. The overall purpose of the project is to demonstrate a positive return on investment and build a business case for scaling these technologies to a larger portion of the state's 10,000 traffic signals.

Open Discussion and Q&A

Matt Carlisle answered two questions from attendees.

Question: For NCDOT's signal modernization work, will local (municipal) staff have the same level of access to the new centralized traffic signal system as state staff?

Answer: Yes, local (municipal) staff will have the same level of access to the same central system as state staff facilitated by a cloud-hosted solution. Staff will be able to access the system anywhere across different kinds of devices with the right credentials.

Question: For the MMCVP project, can scooter users get notifications from the traffic signal or warnings through the app?

Answer: There are no applications specifically targeted for scooter users, but there are for walking pedestrians.

Action Items

Sarah Searcy closed the meeting by recapping action items for the committee.

- NCDOT expects to issue official letters of appointment to new and reappointed committee members in February 2025.
    - Committee members will be expected to serve two-year terms with a touchpoint at the one-year mark.
- NCDOT will develop a draft charter and draft update to the strategic plan by May 2025 to be finalized by August 2025.

    - Committee members are expected to review and provide comments on the draft deliverables.
    - Sarah will be in contact with committee members through email with reminders of the progress on these items and the timeline for review between committee meetings.
- Committee members are invited to provide comments on NHTSA's proposed AV STEP NPRM via a survey by March 3, 2025.
    - Sarah will provide a reminder to committee members via email in advance of the deadline.

Sarah reminded attendees that the committee's name represents an aspiration that dates to when the committee first formed in 2017. There are no fully autonomous vehicles available now. The work of the committee will include automated vehicle technology that is currently available, its capabilities and limitations, and how the state prepares for the technology in its current stage and as it develops.

Sarah thanked the committee for putting their trust in her and for their patience as NCDOT completes the foundational groundwork that is needed to be effective as a committee.

Adjournment

Sarah Searcy adjourned the meeting.

Attachment A: Presentation Slides

NORTH CAROLINA
Department of Transportation

NC Fully Autonomous Vehicle Committee

February 2025 Meeting

Last updated: February 12, 2025

Connecting people, products and places safely and efficiently with customer focus, accountability and environmental sensitivity to enhance the economy and vitality of North Carolina

Agenda

Meeting Overview

2:00 p.m. **NCDOT updates** – including progress on key activities to reengage the FAV Committee and establish the Connected and Automated Vehicles (CAV) program.

2:15 p.m. **Federal and national updates** – including the National Highway Traffic Safety Administration (NHTSA)'s proposed voluntary national framework for vehicles with Automated Driving Systems (ADS).

2:30 p.m. **Invited speakers.**

- **2:30 p.m.** **Ali Karimoddini** (N.C. A&T State University) – updates on Aggie Auto and demonstration of the remote teleoperation of an Aggie Auto shuttle.
- **2:45 p.m.** **Jason Schronce** (NCDOT Division of Aviation) – updates on the Advance Mobility NC strategic plan and implementation.
- **3:00 p.m.** **Matt Carlisle** (NCDOT Transportation Mobility and Safety Division, ITS & Signals Management Section) – overview of NCDOT's traffic signal modernization project, recent Advanced Transportation Technology and Innovation (ATTAIN) grant award, and update on the Multimodal Connected Vehicle Pilot (MMCVP) Project.

3:15 p.m. **Open Discussion and Q&A**

3:30 p.m. **Adjournment**

NCDOT Updates

ncdot.gov

FAV Committee’s Duties and Membership

Duties of the FAV Committee

2017

July

NC General Assembly enacts
SL 2017-166
(HB 469)

SL 2017-166 (HB 469) enacted Article 18 in Chapter 20 (G.S. § 20-400 – 403) to:

- Regulate the operation of fully autonomous vehicles (FAV) and
- Create an FAV Committee within the Department of Transportation.

Duties. – The Committee shall meet regularly, and at a minimum four times a year, to:

- Consider matters relevant to fully autonomous vehicle technology,
- Review State motor vehicle law as they relate to the deployment of fully autonomous vehicles onto the State highway system and municipal streets,
- Make recommendations concerning the testing of fully autonomous vehicles,
- Identify and make recommendations for Department of Transportation traffic rules and ordinances, and
- Make recommendations to the General Assembly on any needed changes to State law.

Staff. – The Department of Transportation shall provide staff and meeting space, from reasonably available resources, to the Committee.

2018

March

FAV Committee Convenes

FAV Committee Membership

Membership. – The following persons shall serve on the Committee:

1. Secretary of Transportation, or the Secretary's designee.
2. The Secretary of Commerce, or the Secretary's designee.
3. The Commissioner of Insurance, or the Commissioner's designee.
4. A representative of the Highway Patrol, designated by the Commander.
5. A representative of the North Carolina Association of Chiefs of Police, designated by its Executive Director.
6. A representative of the North Carolina Sheriffs' Association, designated by its President.
7. A representative of the University of North Carolina Highway Safety Research Center, designated by the Director.
8. At least two representatives from the autonomous vehicle industry, designated by the Secretary of Transportation.
9. A representative of the Attorney General's Office, designated by the Attorney General, who is familiar with motor vehicle law.
10. A representative of local law enforcement, designated by the Secretary of Transportation.
11. A representative of the trucking industry, designated by the North Carolina Trucking Association.
12. A planner from an urban area, designated by the North Carolina League of Municipalities.
13. A planner from a rural area, designated by the North Carolina Association of County Commissioners.
14. Two members of the North Carolina Senate, designated by the President Pro Tempore of the Senate.
15. Two members of the North Carolina House of Representatives, designated by the Speaker of the House.

Reengaging the FAV Committee

FAV Committee – One-on-One Meetings

Met with (12) appointees and (4) public sector friends of the committee.

What is working well?

- Collaborations and connections with diverse professionals across sectors.
- Information exchange and updates about NC-specific projects.
- Forum for committee members to learn.
- University partnerships.
- On-site and in-person meetings.
- Committee is important and needed.

What could work better?

- Well-defined roles, responsibilities, and expectations.
- Clear vision, mission, direction, goals, and focus areas.
- More active participation to accomplish activities.
- Workplans with problem statements, assignments, timelines, and deliverables.
- Directly connect committee's work to strategic plan and action items.
- More consistent communication and contact.
- More in-person meetings.
- More public engagement.
- National and international updates.
- Sharable resources and documentation.

FAV Committee – Historic Review

Past Meetings and Activities

(13) meetings completed since March 2018 – (2) meetings per year on average, (7) in person.

- Infrastructure, Operations, Business, Research, and Legislative working groups established in kickoff meeting.
    - Each held separate kickoff meetings to develop recommendations and action items, but deliverables were not produced, and groups were not maintained.
- Early concerns that NC may not be ready or prepared enough for automated vehicle technology and the importance of the committee to stay ahead of the technology.
- Discussions around developing guidance for law enforcement interaction with automated vehicles including emergency response protocols, formalized testing regime, and standards for remote operations in NC, but none developed.
- Committee was made aware of NC-specific legislation but was not actively involved with its development.
- Committee provided comments on MUTCD Part 5 revisions (2021), Uniform Automated Operation of Vehicles Act (2020), and potential amendment to NC's FAV law (2020).

FAV Committee – Historic Review

Past Meetings and Activities

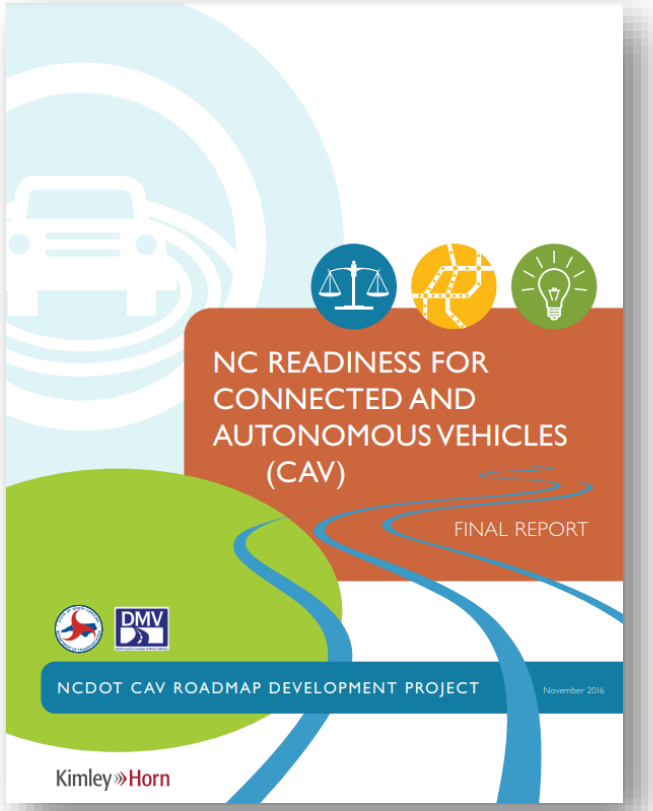
(13) meetings completed since March 2018 – (2) meetings per year on average, (7) in person.

- Committee was engaged starting in 2021 around update to 2016 NCDOT CAV Roadmap.
- Committee's input on gaps, disruptions, mitigations, and opportunities were captured through surveys and workshops.
- Work on the strategic plan update was paused in early 2024 while a dedicated lead and resources were established for CAV and FAV initiatives.

FAV Committee – Next Steps

Recommendations Based on Committee Feedback

- Update and confirm committee membership.
  - Letters of appointment with periodic recommitment.
- Web-based resources.
- Charter.
- Strategic plan update.
- Task force model with workplans.
- Industry outreach.
- Public engagement.
- Annual report.



Updates to NCDOT's first CAV roadmap will inform subcommittee workplans

FAV Committee – Next Steps

Recommendations Based on Committee Feedback

- Update and confirm committee membership.
  - Letters of appointment with periodic recommitment. **Feb. 2025**
- Web-based resources.

- Charter.*
- Strategic plan update.* **May 2025** (draft) **Aug. 2025** (final)
- Task force model with workplans.*

- Industry outreach.
- Public engagement. **Ongoing**

- Annual report.* **Feb. each year**

Action Item: Committee members will be expected to provide review and feedback on draft deliverables marked with an asterisk (*).

FAV Committee Meetings: Schedule for 2025

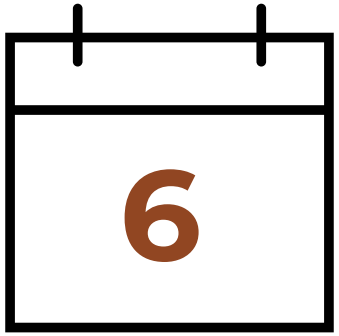
Feb.

Wed

NCDOT Research & Innovation Symposium @ the McKimmon Center

On-Site Technology Demos on Feb. 11

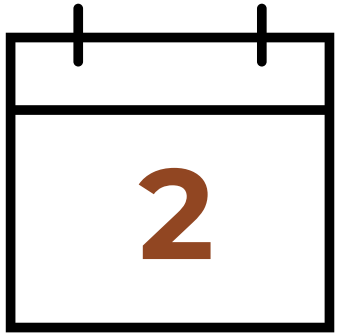
May



Tues

Virtual on Microsoft Teams

Sep.

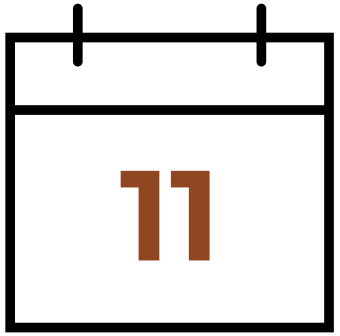


Tues

N.C. Transportation Summit

Sep. 3-4

Nov.



Tues

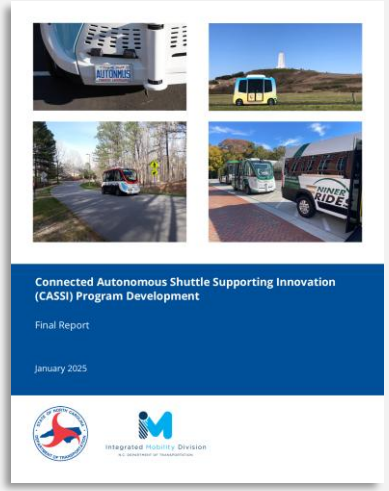
Location To Be Decided (TBD)

State Initiatives

State – Demonstrations and Pilots

Connected Autonomous Shuttle Supporting Innovation (CASSI) Program

Jan. 2025: NCDOT published a program development report that summarizes overall conclusions and lessons learned from the CASSI program to date. (program webpage)



- **Documents the process, partnerships, and progress** from testing and evaluating automated shuttles across multiple projects and communities in the state.
- **Provides lessons learned from other organizations** that have tested similar automated shuttles.
- **Recommends Automated Driving System (ADS)-equipped conventional vehicles**, including full-size buses, cutaways, and passenger vans, for future pilots based on findings and Request for Information (RFI) results.

N.C. A&T State University's Aggie Auto

Feb. 2025: NC A&T concluded its NCDOT-funded Technology Transfer project that supported a one-month pilot of its automated shuttles on public streets from Sep. 18-Oct. 13, 2023 (RP 2023-35).

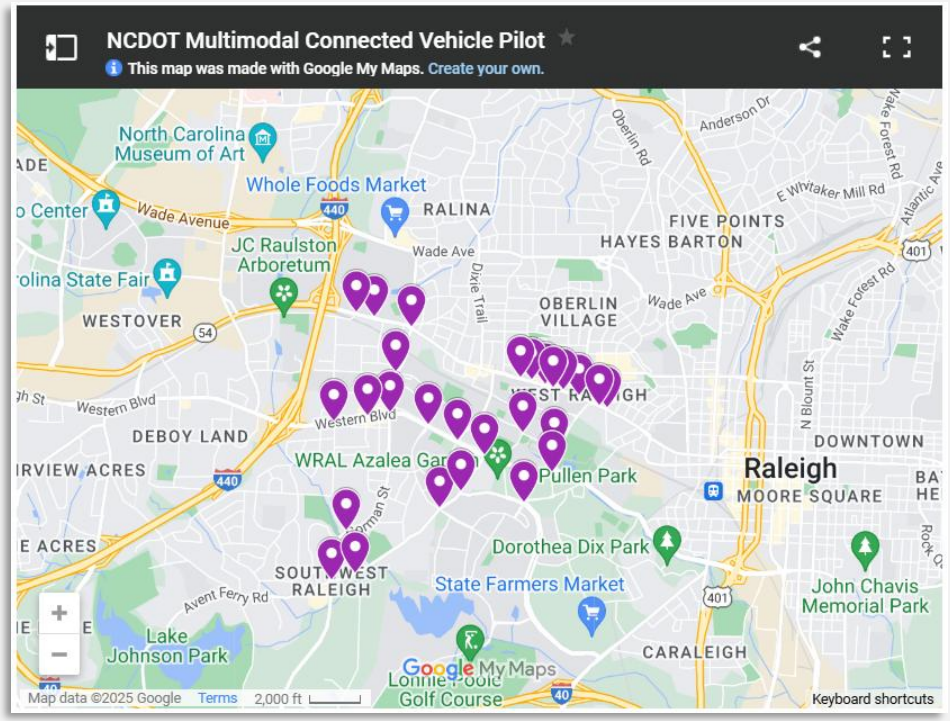
Feb. 2025: NC A&T kicked off its NCDOT-funded Technology Transfer project to develop and demonstrate a teleoperations platform for remote control of its automated shuttles (TT 2025-05).

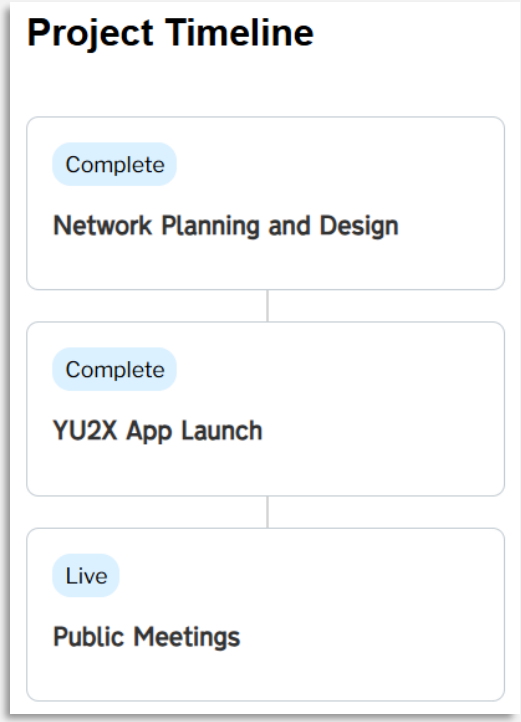
State – Demonstrations and Pilots

Multimodal Connected Vehicle Pilot (MMCVP) Project

Jan. 2025: NCDOT launches a $2 million project to improve safety and mobility around NC State University.

The pilot uses CV technology to enhance safety, reduce traffic congestion, and promote environmental sustainability on key roadways around campus including Hillsborough Street and Western Boulevard. (press release, project webpage, public input webpage)





State – Demonstrations and Pilots

FY 2023-2024 USDOT Advanced Transportation Technology and Innovation (ATTAIN) Program

Oct. 2024: FHWA announced more than $96.5 million in grants to 16 states for 20 projects. (press release)

- **NCDOT-led *Connected, Rural, Equitable, and Autonomous Transportation for Everyone (CREATE)* was not awarded.**
- **NCDOT-led *Smart Signals in Our Communities* was awarded.**

FY 2022-2023 USDOT Rural Autonomous Vehicle (RAV) Research Program

Jan. 2025: USDOT announced a $15 million grant to a team led by the University of Wisconsin-Madison for research on the integration of automated vehicles into passenger transport and a $10 million grant to a team led by the University of California, Berkeley for research toward improving the efficiency and safety of autonomous freight vehicles, particularly focusing on rural logistics and supply chain enhancements in the Southwest. (press release)

- **NC A&T-led *Sustainable Tribal and Rural Equitable Transportation Through Automated Mobility (STREAM)* was not awarded.**

State – Research

NC Transportation Center of Excellence on Connected and Autonomous Vehicle Technology (NC-CAV) (TCE 2020-03)

NC A&T (lead), UNC Charlotte, NC State

Extended to Dec. 31, 2025.

- **Project #1:** CAV Impacts on Traffic Intersection Capacity and Transportation Revenue
- **Project #2:** Assessing North Carolina Readiness for CAVs in Traditional and Emerging Infrastructure Needs
- **Project #3:** Developing and Implementing CAV-UAV Collaboration for Advancing the Transportation Systems

Guidance on Considering CAVs in Travel Demand Models (RP 2023-11)

NC State (lead)

Closed out in July 2024, final report forthcoming.

Review the State-of-the-Art Studies on the Public's Perception of ADAS (…) (TA 2025-07)

NC State (lead)

Kicked off in Jan. 2025.

Federal & National Updates

Notice of Proposed Rulemaking (NPRM): ADS-Equipped Vehicle Safety, Transparency, and Evaluation Program (AV STEP)

Jan. 15, 2025: NHTSA issued a NPRM for a **voluntary framework** for the evaluation and oversight of motor vehicles equipped with automated driving systems (ADS).

AV STEP would:

- Establish a national program for ADS-equipped vehicles that operate or may operate on public roads in the United States.
- Create a voluntary review and reporting framework for participating ADS-equipped vehicles.
- Be open to all companies that operate or plan to operate compliant ADS-equipped vehicles on public roads, as well as those requiring NHTSA exemptions to operate non-compliant vehicles.

Source: NHTSA's press release (December 20, 2024), NPRM as published in the Federal Register (January 15, 2025), and rulemaking docket with supporting and related material (Docket No. NHTSA–2024–0100) (January 17, 2025).

Action Item: Committee members asked to provide comments via a survey by March 3, 2025.

NCHRP NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP 20-68D U.S. Domestic Scan 23-02: "Recent Experiences in Advancing and Deploying of Automated Vehicle Technologies"

The scan team will be tasked to review the experience of DOTs or other agencies by examining a representative sample of ADS tests, pilots, and deployments that have been notably successful to explore the institutional and management changes credited for the success and to extract lessons that can inform other agencies' development. (project webpage)

Nov. 2024: **13 state DOTs** shared their approaches and key findings from their automated vehicle programs through a **week-long virtual workshop** with some states sharing their experiences with connected vehicle technology.

Washington DOT & Seattle DOT	NJ Transit	Texas DOT	Florida DOT	Maryland DOT
Utah DOT	Colorado DOT	Pennsylvania DOT	Georgia DOT	California DOT
	North Carolina DOT	Ohio DOT	Minnesota DOT	

NCHRP NATIONAL COOPERATIVE HIGHWAY RESEARCH PROGRAM

NCHRP 20-24(147): "Peer Exchange and Research to Identify Best Practices for Testing, Monitoring and Deployment of Automated Transportation Solutions to Support Safety, Equity and Operational Efficiency"

March 2025: **Multi-state in-person peer exchange** will be held and a document will be developed that identifies a set of best practices and lessons learned through the peer exchange to help inform DOTs in making practical and feasible technology investment and policy decisions.

Held at TxDOT Stassney Office Building and Campus in Austin, TX

- AV Pooled Fund Meeting & AAMVA AV Subcommittee Meeting held during same week.
- On-site AV demonstrations during the afternoon before peer exchange.

Automation in Transportation: Lessons For Safe Implementation

March 2025: **Two-day in-person public forum in Washington, DC with virtual option.**

The forum, led by NTSB Chair Jennifer Homendy with participation by all NTSB Board Members, will focus on safety issues related to automation in all transportation modes: aviation, highway, rail, transit, pipeline, and marine. (event webpage)

Preliminary Agenda

Tuesday March 11, 2025
Welcome and Opening Remarks
Session 1: Current and Emerging Use of Automation in Transportation
Session 2: Lessons Learned from Early Implementations
Session 3: The Role of Humans in Automated Systems
Wednesday, March 12, 2025
Session 4: Assessing the Safety of Highly Automated Systems
Session 5: Post-Deployment Safety Assessments
Closing Remarks

National Resources

- **American Association of Motor Vehicle Administrators (AAMVA)** – "Guidelines for Regulating Vehicles with Automated Driving Systems, Edition 4" (March 2024) (report)
  - AAMVA Resources (webpage)
- **NCHRP LRD 91** – "Multistate Coordination and Harmonization for AV Legislation" (June 2024) (report)
- **J.D. Power** – "2024 US Mobility Confidence Index Study" and "US Technology Experience Index Study" (October 2024) (report, report)
- **Federal Transit Administration (FTA)** – "Transit Bus Automation Quarterly Update Q3 2024" (November 2024) (report)
  - Transit Automation Research Resources (webpage)
- **Autonomous Vehicle Industry Association (AVIA)** – "Securing American Leadership in Autonomous Vehicles" (January 2025) (report)
- **United States Department of Transportation (USDOT)** – "Transforming Transportation Advisory Committee (TTAC) Report on Artificial Intelligence, Automated Driving, Project Delivery, and Innovation for Safety" (January 2025) (report)

Guest Presenters

Questions?

Want to learn more about NCDOT's **CAV Program**?

Contact Us

Sarah Searcy – Emerging Technologies & Innovation Program Manager

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(919) 707-4694 (office)

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Aggie Auto Shuttles

Ali Karimoddini
akarimod@ncat.edu

ACCESS Laboratory

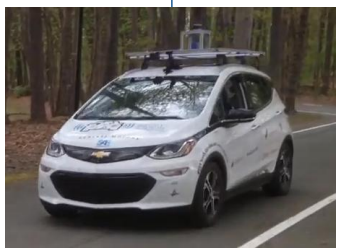
Autonomous Cooperative Control of Emergent Systems of Systems (ACCESS) Laboratory
North Carolina A&T State University

February, 2025

A journey toward creating a niche in transportation technology

2016

2017



2018

2019

NC-CAV

The NC Transportation Center of Excellence on Connected and Autonomous Vehicle Technology (NC-CAV)

2020
NSF MRI
NCDOT
GDOT
NCA&T

2021
NCDOT
CAV Testbed

2022
Rural track &
AV facility
unveiling

Public Deployment between NCA&T and downtown Greensboro

PROJECT AUTHORIZATION DOCUMENT
Authorized under Master Agreement Contract
For Research and Training Services between
THE NORTH CAROLINA DEPARTMENT OF TRANSPORTATION AND
THE UNIVERSITY (listed below)
(For new and other major revisions only)

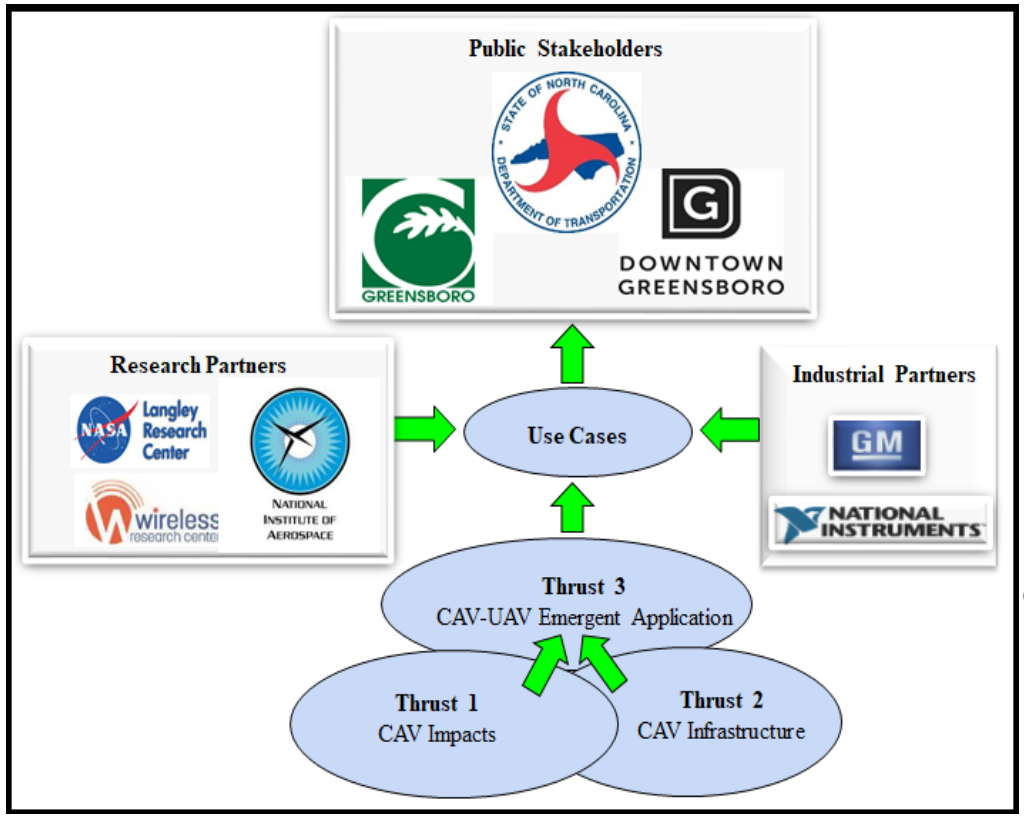
UNIVERSITY NAME:	NORTH CAROLINA A&T STATE UNIVERSITY
MASTER AGREEMENT NUMBER:	MA-2019-05
Research Project Number:	*RP 2023-35*
Revision Number:	*New PA*
Research Project Title:	*Microtransit Pilot Project in Greensboro, NC*
Period of Performance:	*April 15, 2023 - July 14, 2024*
Budget by Year including Total:	*Year 1: $159,011; Year 2: $13,238; Total: $172,250*

Heterogeneous Fleet of Connected Autonomous Vehicles

The first university research testbed of connected and autonomous self-driving shuttles!

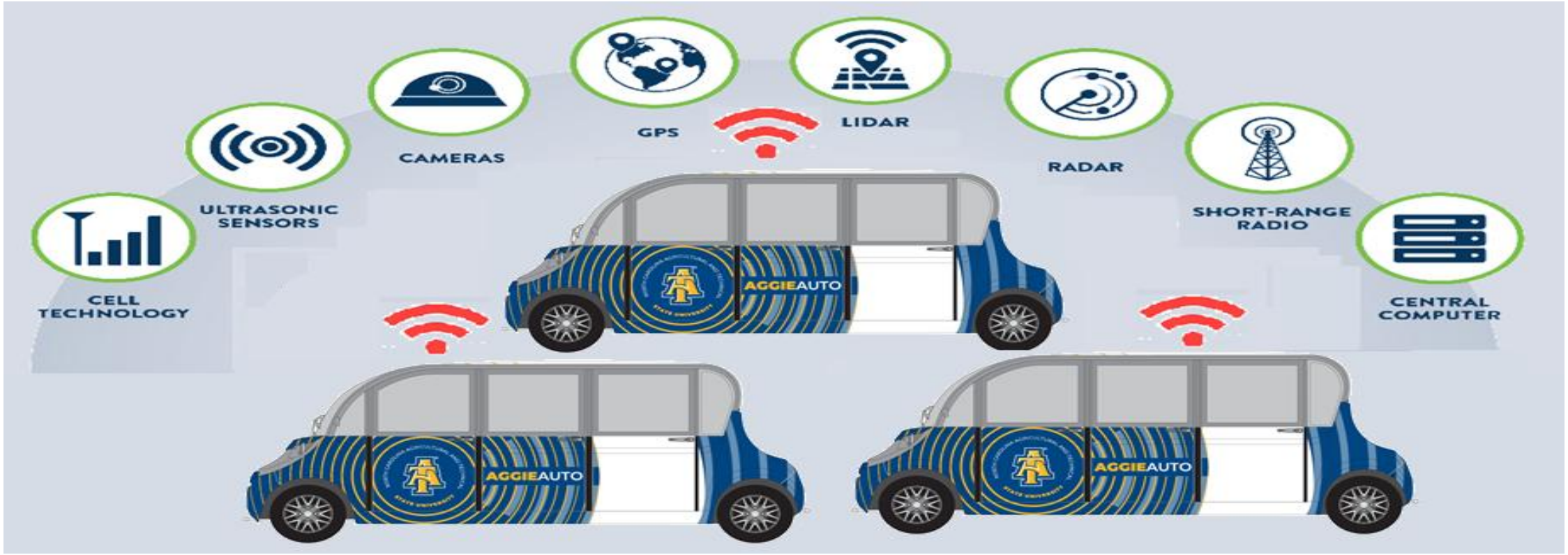
"NC-CAV Center of Excellence on Advanced Transportation Technology," North Carolina Department of Transportation (NCDOT), 2020-2025.

- **Thrust 1 (CAV Impacts)** investigates the impact of Connected and Autonomous Vehicle's (CAV) on North Carolina's transportation system and associated revenue.
- **Thrust 2 (CAV Infrastructure)** assesses North Carolina's readiness for CAVs in traditional and emerging transportation infrastructure.
- **Thrust 3 (CAV Applications)** explores emerging applications of CAVs and develops CAVs and Unmanned Arial Vehicles (UAVs) for advancing transportation systems.

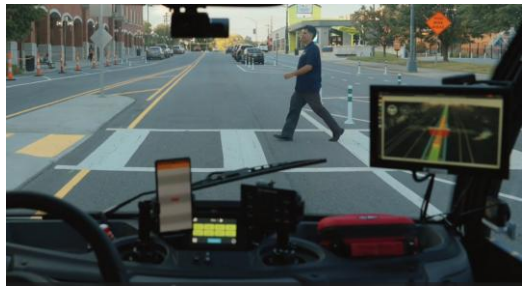


The NC Transportation Center of Excellence on Connected and Autonomous Vehicle Technology (NC-CAV)

"Developing and Operationalizing a Testbed of Connected Self-driving Shuttles to Test and Develop CAV Applications in North Carolina," North Carolina Department of Transportation (NCDOT), 2021-2023.



"Microtransit Pilot Project in Greensboro, NC," North Carolina Department of Transportation (NCDOT), 2023-2025.

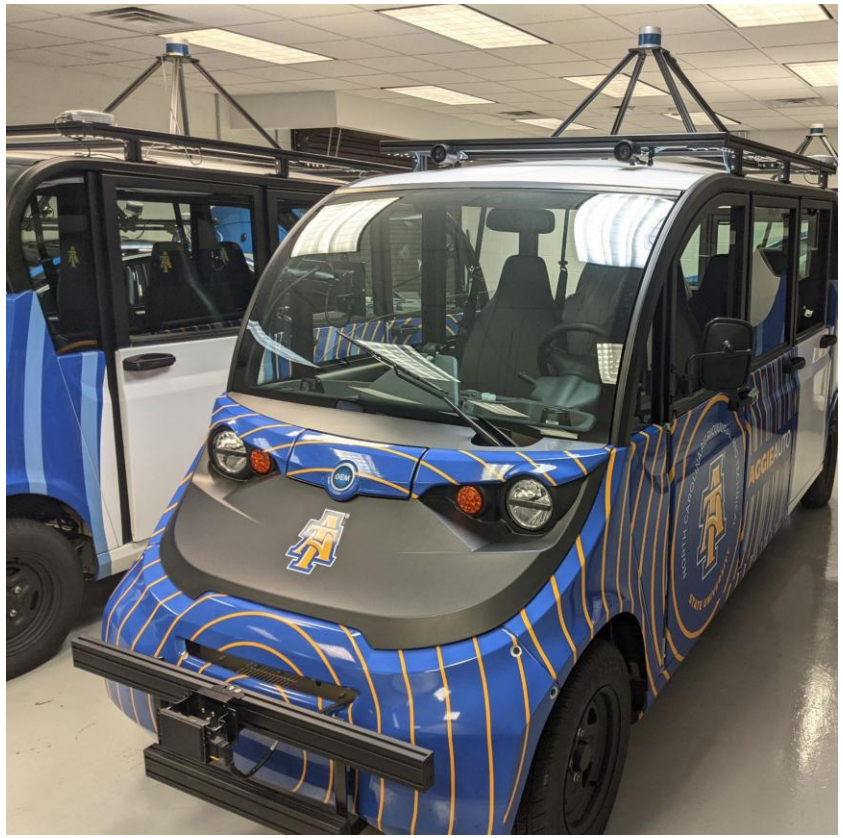


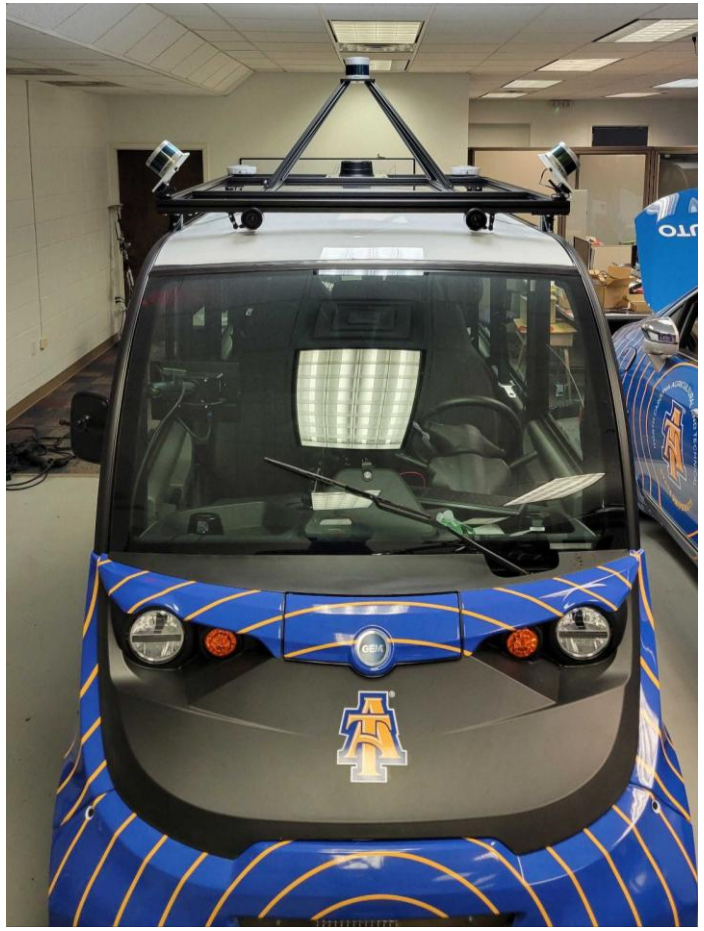
Laboratory Testing

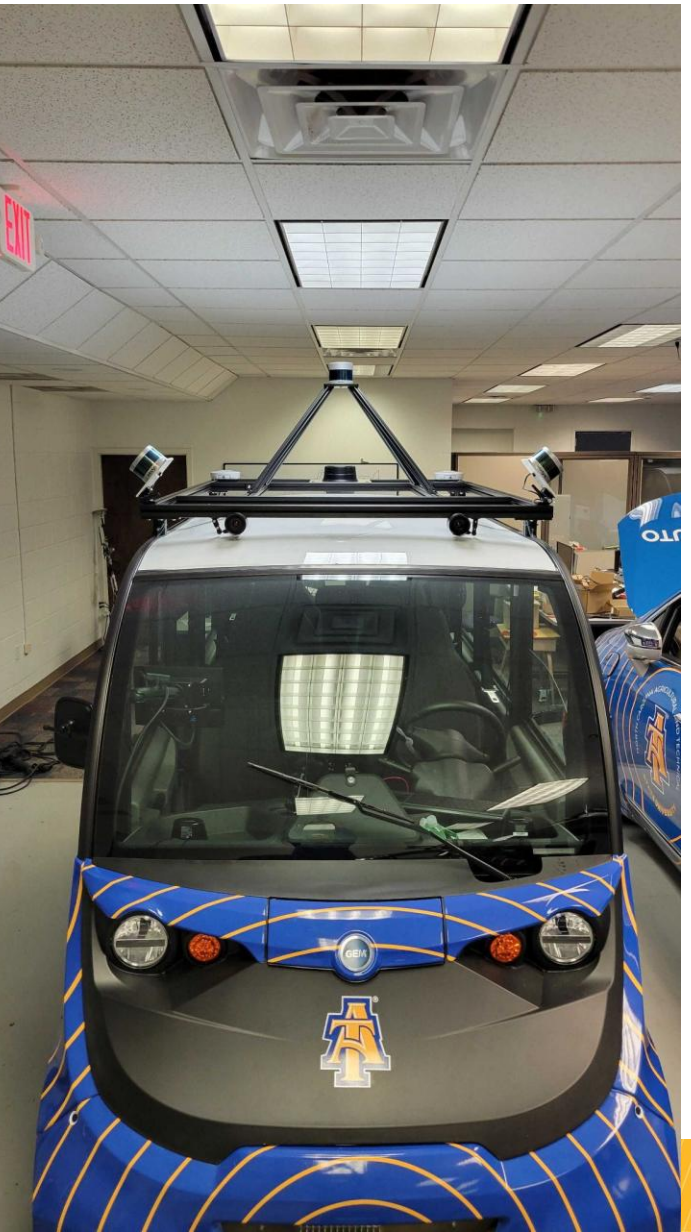
Closed-Track Testing

Public Street Testing

Giving Rides to the Public on Public Streets







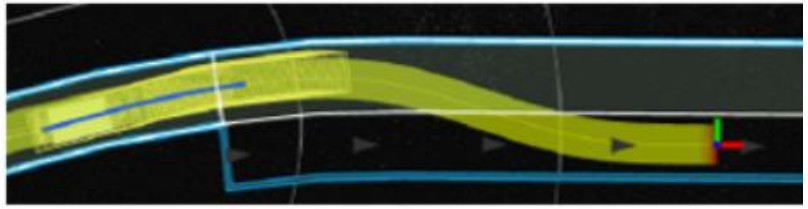
Upgrading the sensing system

Upgrading the computing unit

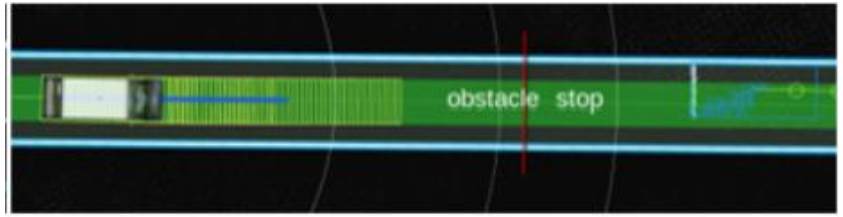
- Twice the performance
- Lower power draw

*Compared to current in-vehicle system

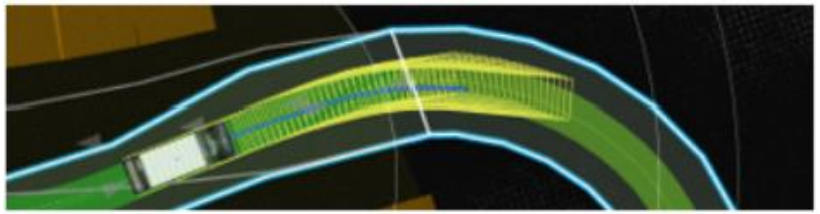
Upgrading the software
ROS 1 → ROS 2



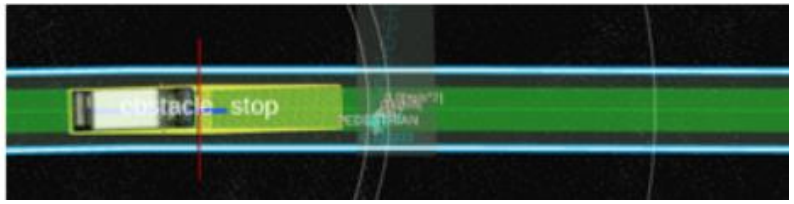
Pull-over



Adaptive cruise control

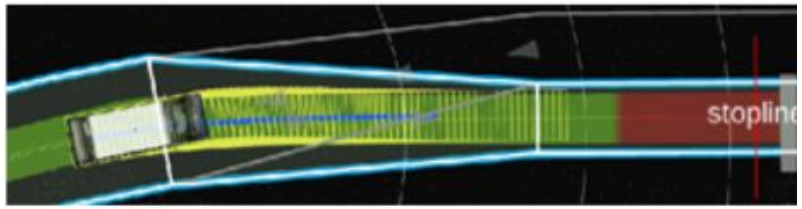


Curve deceleration



Crosswalk

Intersections



Stop lines

Task 1 – Identifying the route in coordination with stakeholders

Stakeholders:

- NCDOT, GDOT, City of Greensboro, Greensboro Police, Downtown Greensboro Inc.
- Industrial partners: Verizon, Volvo, Google, Waymo
- Local community: Local businesses (Funeral home , …)
- University (College of Engineering, University Relation, University Police, University Community Outreach, University Advancement, University External Affairs, University Parking Services)

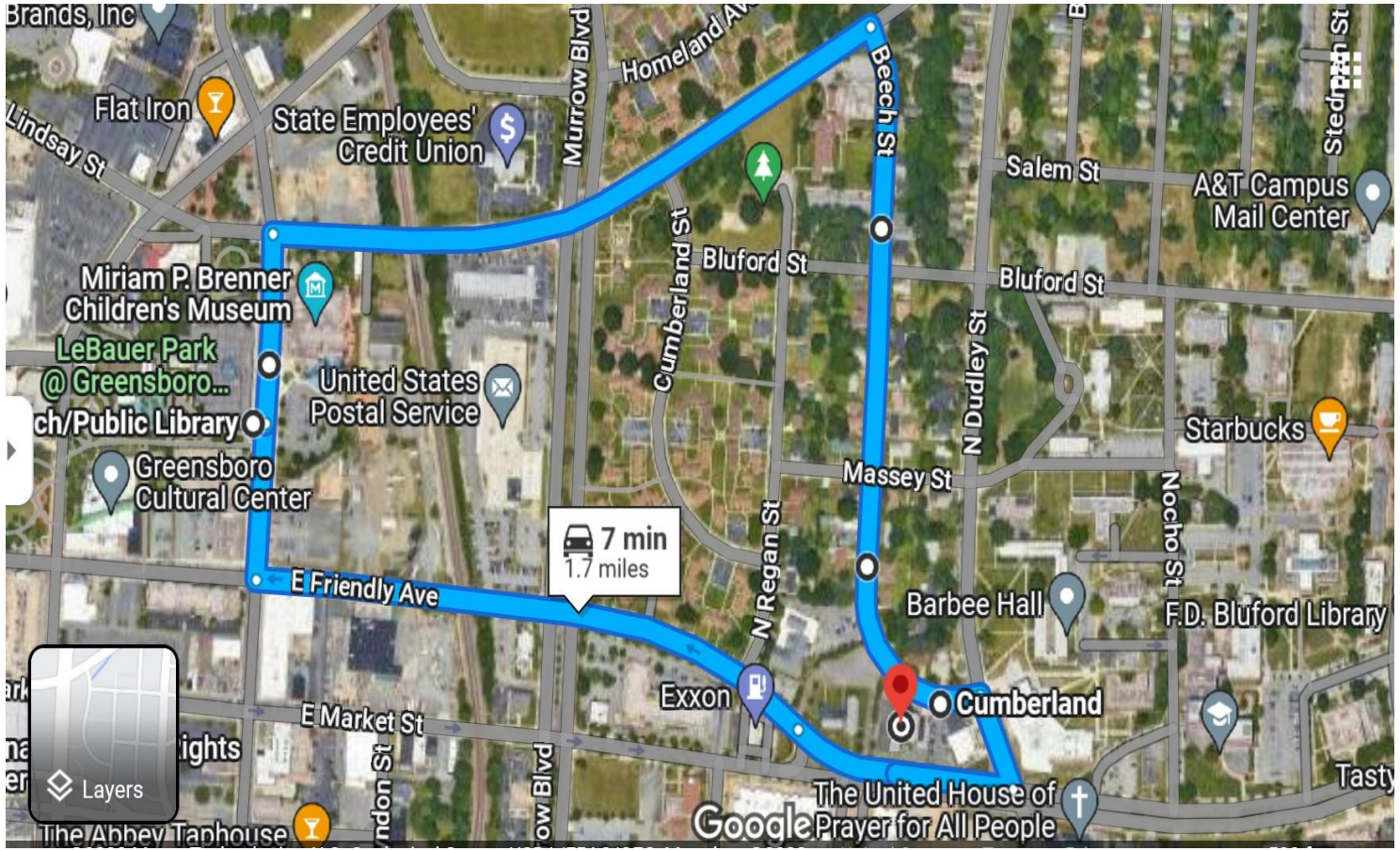
- Monthly meetings (on the Thursday of every month at 1:30 PM)

  Topics:
  - Compliance
  - Liability
  - Safety
  - Logistics
  - Incident management plan

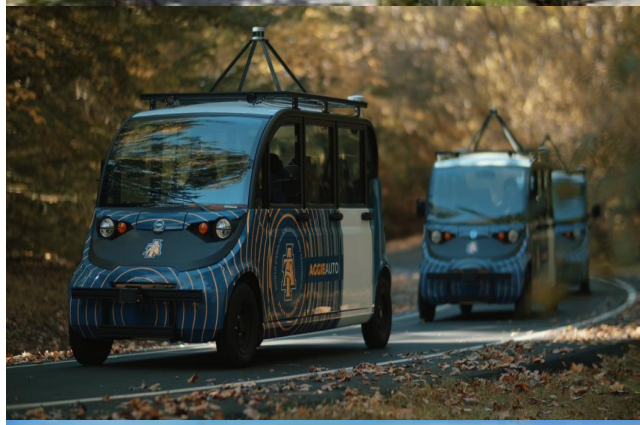
Risk reduction strategies

- The back up driver is always in place.
- The back up drivers are trained.
- Camera recording is conducted both inside and outside of the vehicles.
- As a part of the program, in collaboration with NCDOT, we involved police and first responders for risk management of autonomous vehicles.
- The vehicles maximum speed is 25mph and they do not have a hydraulic steering wheel, which makes them safe (avoiding sharp turns or high speed).
- The vehicles have been rigorously tested and their control can be taken over by driver in all conditions.
- A kill switch is added to disengage the autonomy at any time in case needed.
- Driver initiative moves at intersections (signalized and stop signs).
- No turn on red!

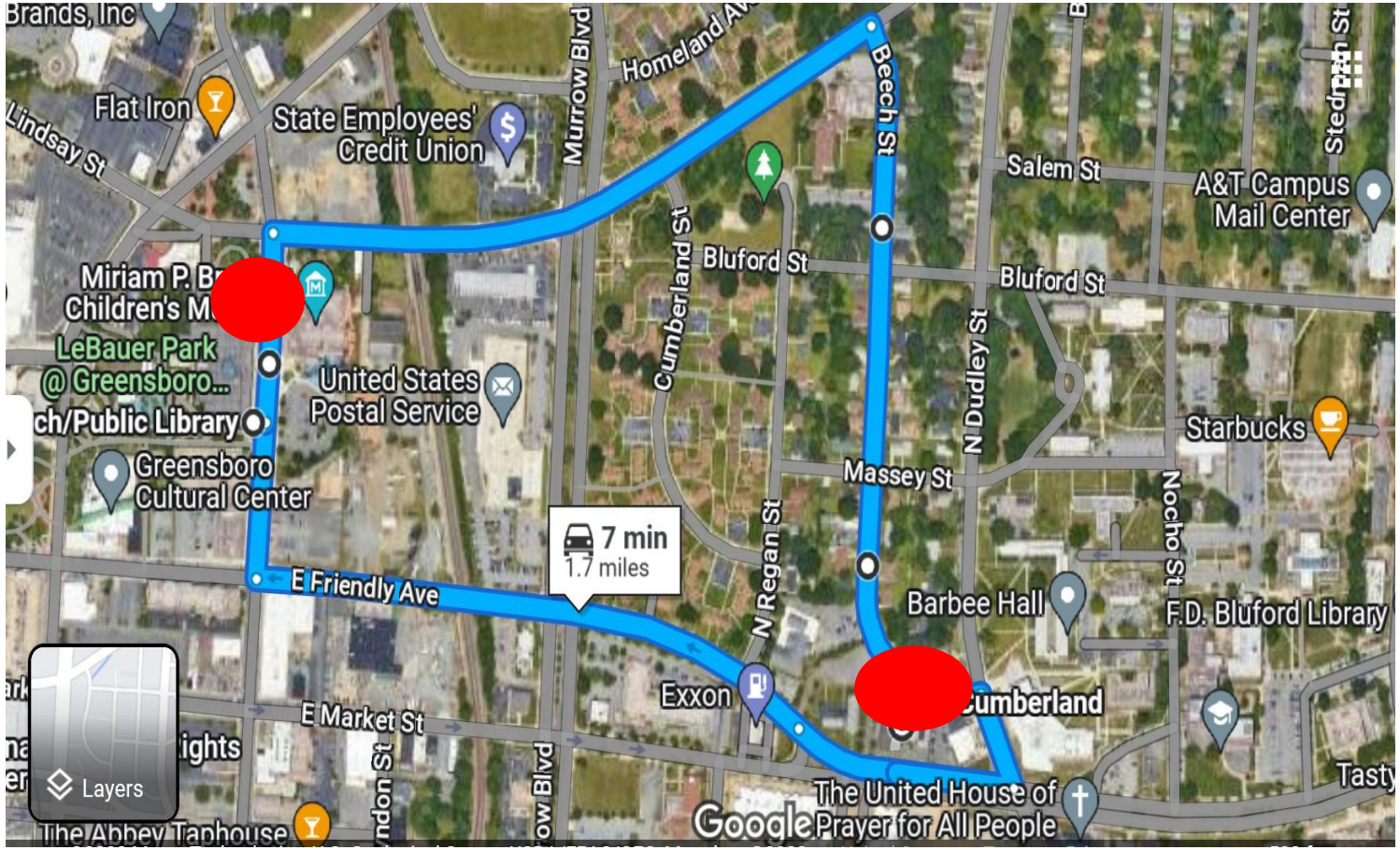
Identifying the route in coordination with stakeholders

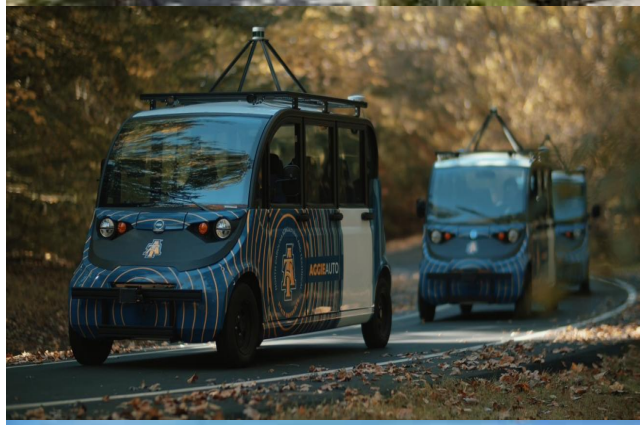


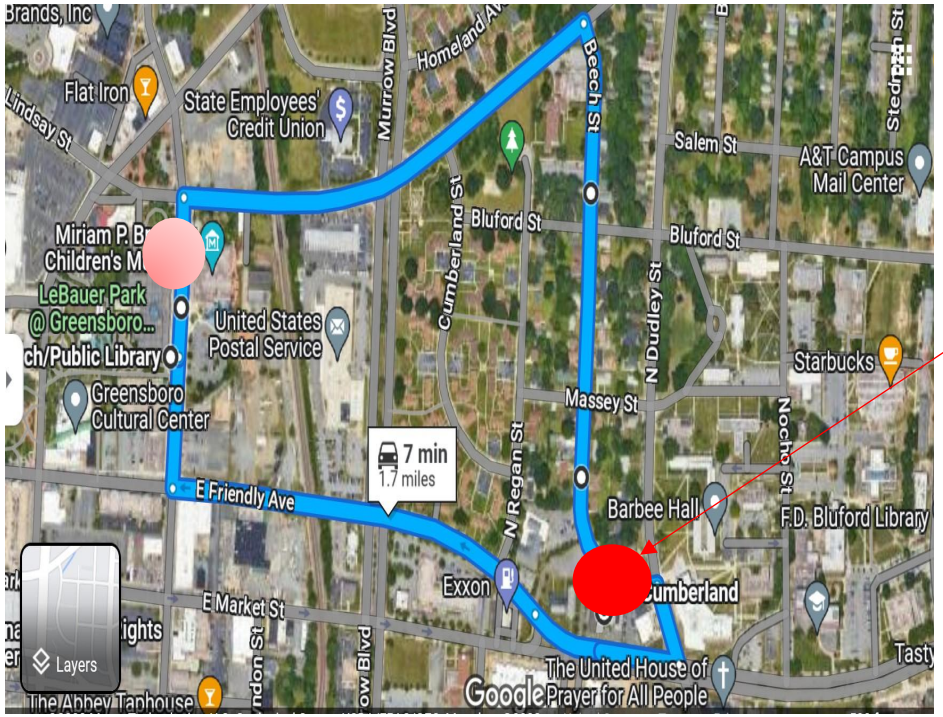
Selected Roue: http://shorturl.at/mvNRX



Identifying the stops in coordination with stakeholders

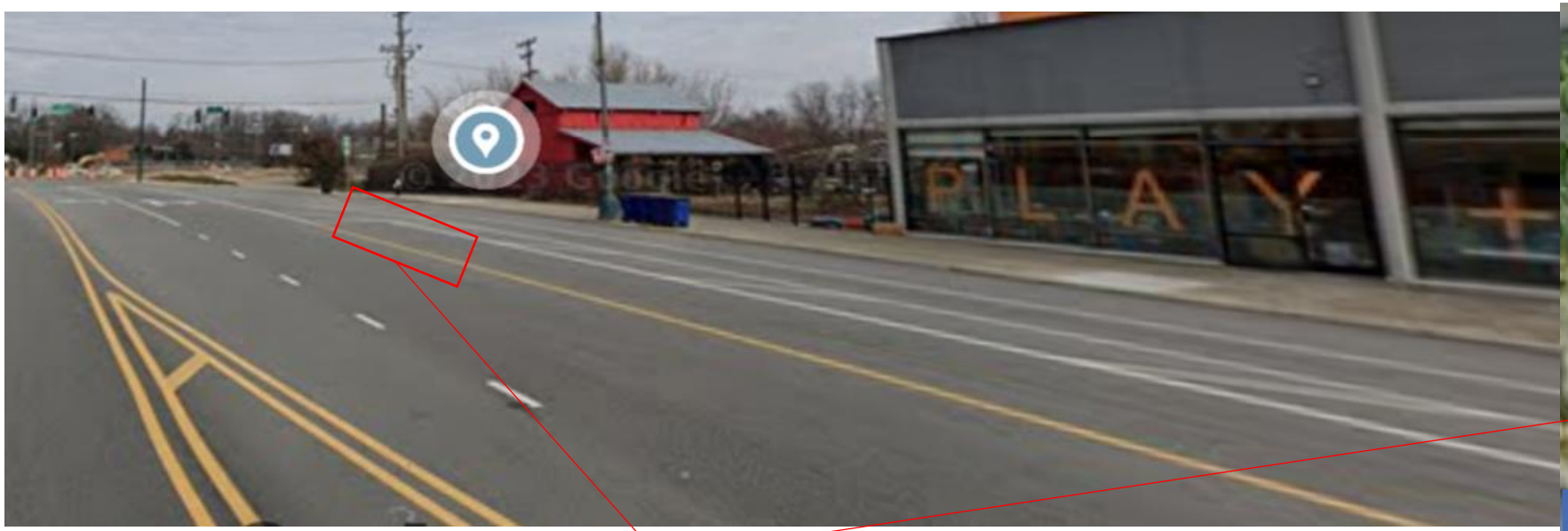


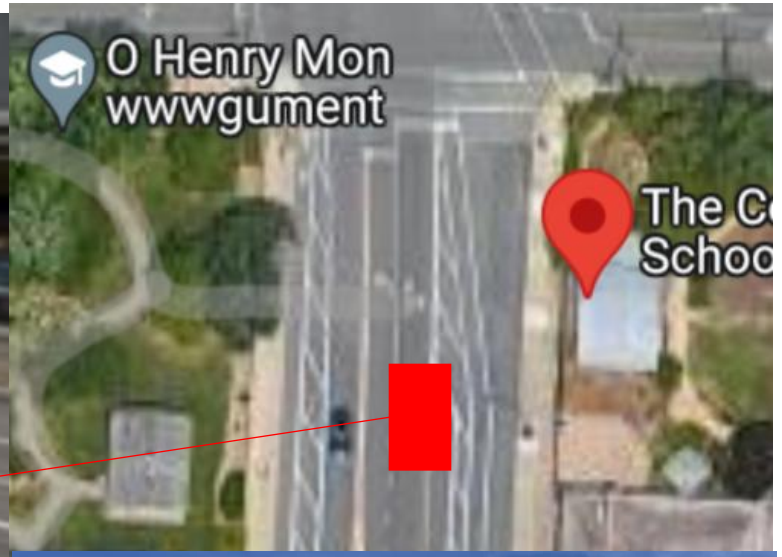




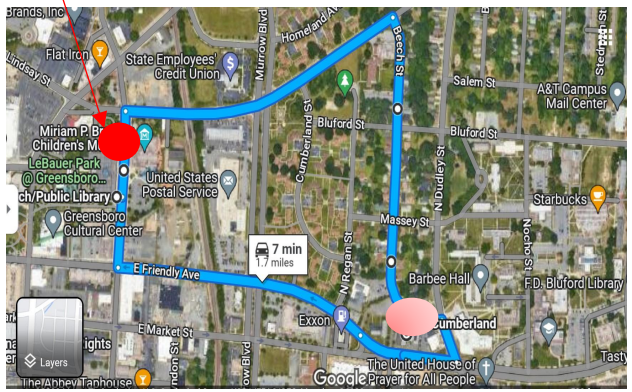
2-3 Bus stop

single Bus stop



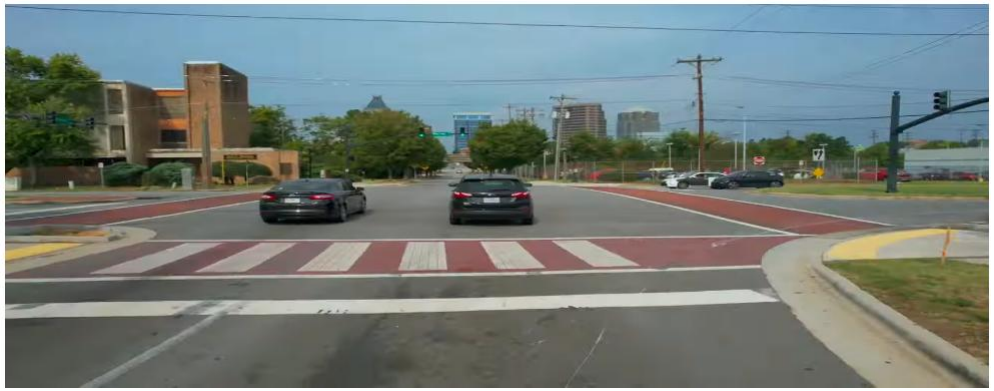


Created a dedicated bus stop at the end of the lane.



- Greensboro DOT assisted with repainting the area.
- Safety risk: getting of the bus in the middle of street from left and right doors!

Small intersections with marked pedestrian crossings



Large intersections with traffic lights and marked pedestrian crossings

Straight roads of one or multiple lanes with parking areas near the second shuttle stop

Narrow roads with parked cars on both sides

Two-way stop intersections with unmarked pedestrian crossings

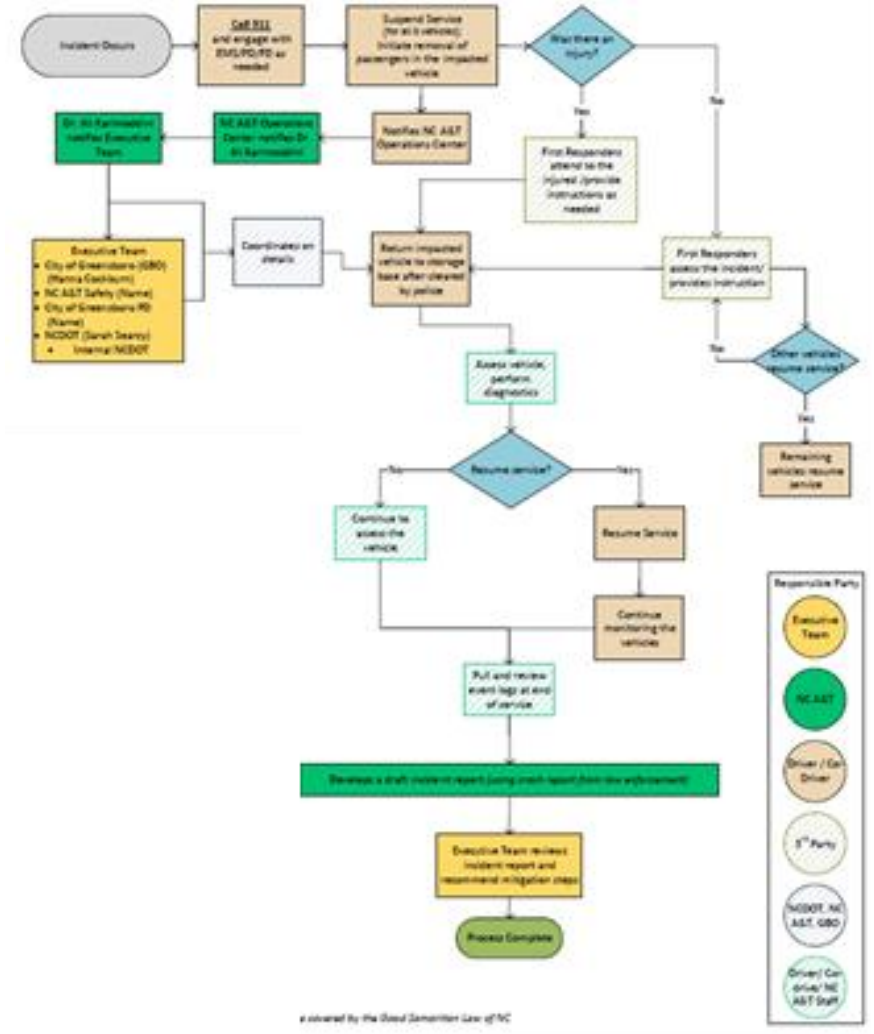
Curved roads with parking areas on the right side near the first shuttle stop

NC A&T Microtransit (Non-Emergency) Incident Response Plan (Level 1 or Level 2 Response)

This response plan pertains to any non-emergency incident whereby the vehicle has become immobilized for reasons that do not pertain involvement with another vehicle, pedestrian, or object.

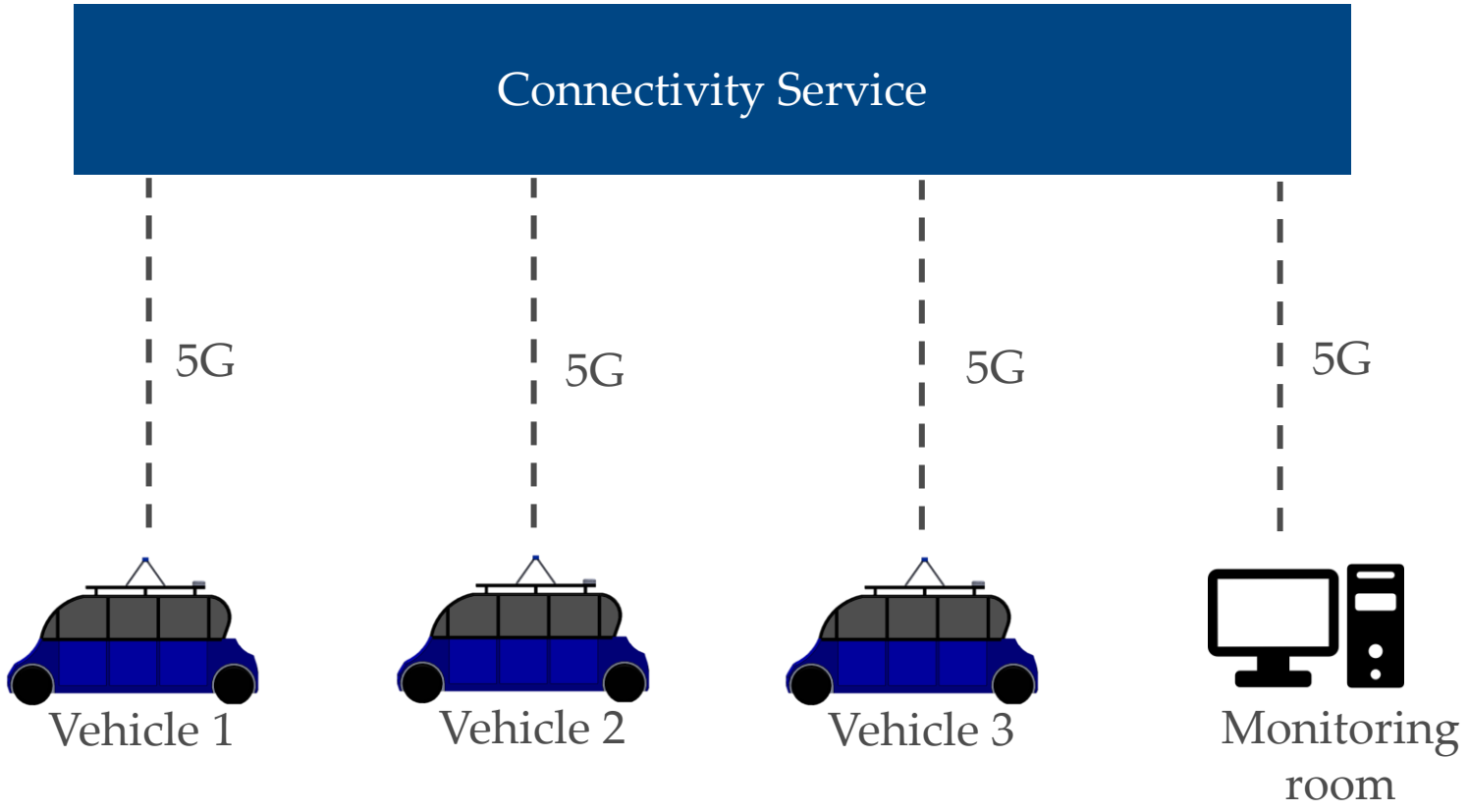
NC A&T Microtransit (EMERGENCY) Incident Response Plan (per level 3)

This response plan pertains to any EMERGENCY incident whereby the vehicle has struck or been struck by any object, car, or person, or an accident has occurred to jeopardize the safety of a person or inflicted damage to the vehicle.



Developing communication systems to connect AVs to a control room, to the cloud, and to the users

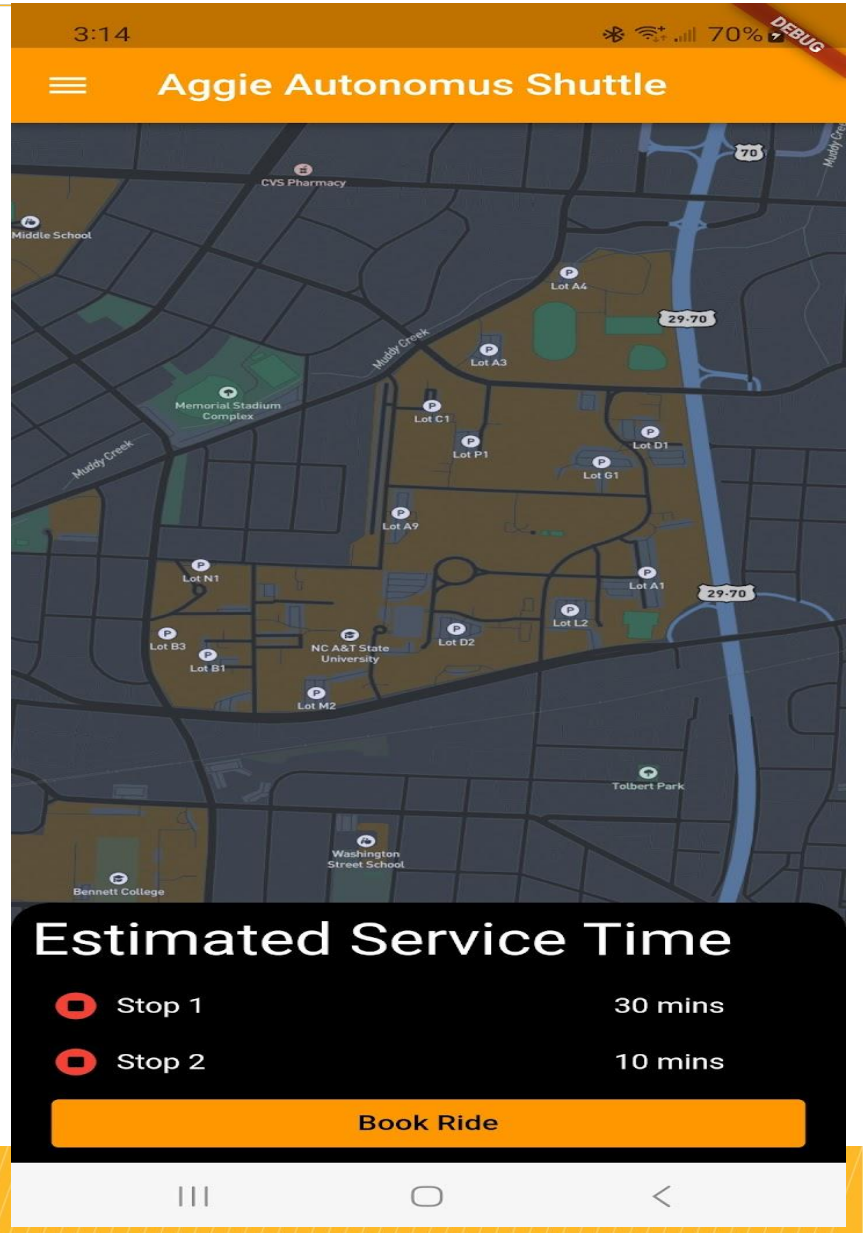
3 of Gem e6 can send data over 5G communication including speed, acceleration, location, and vehicle status to monitoring room.

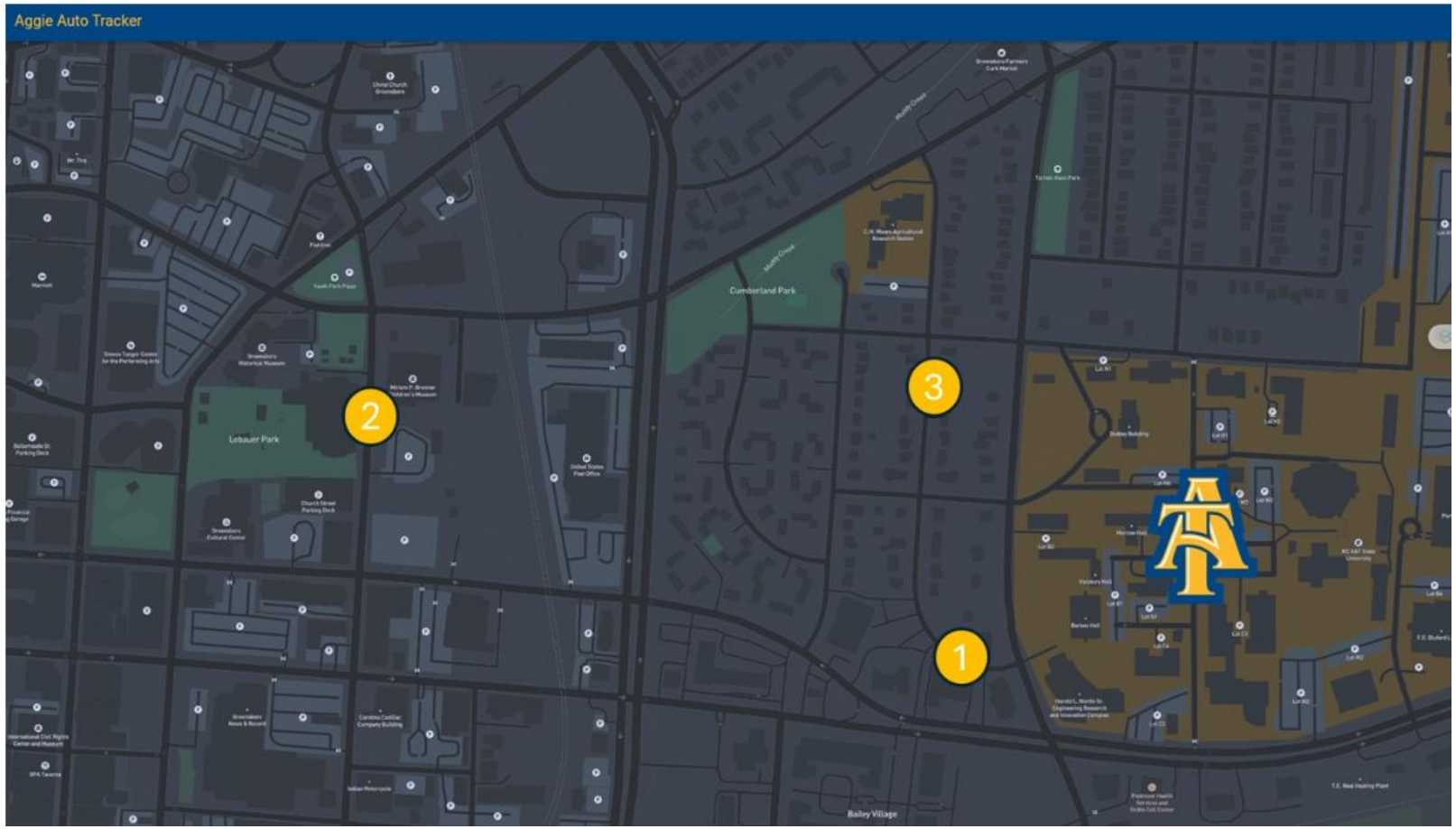


Developing a user-friendly application for users to request a ride and track the vehicles

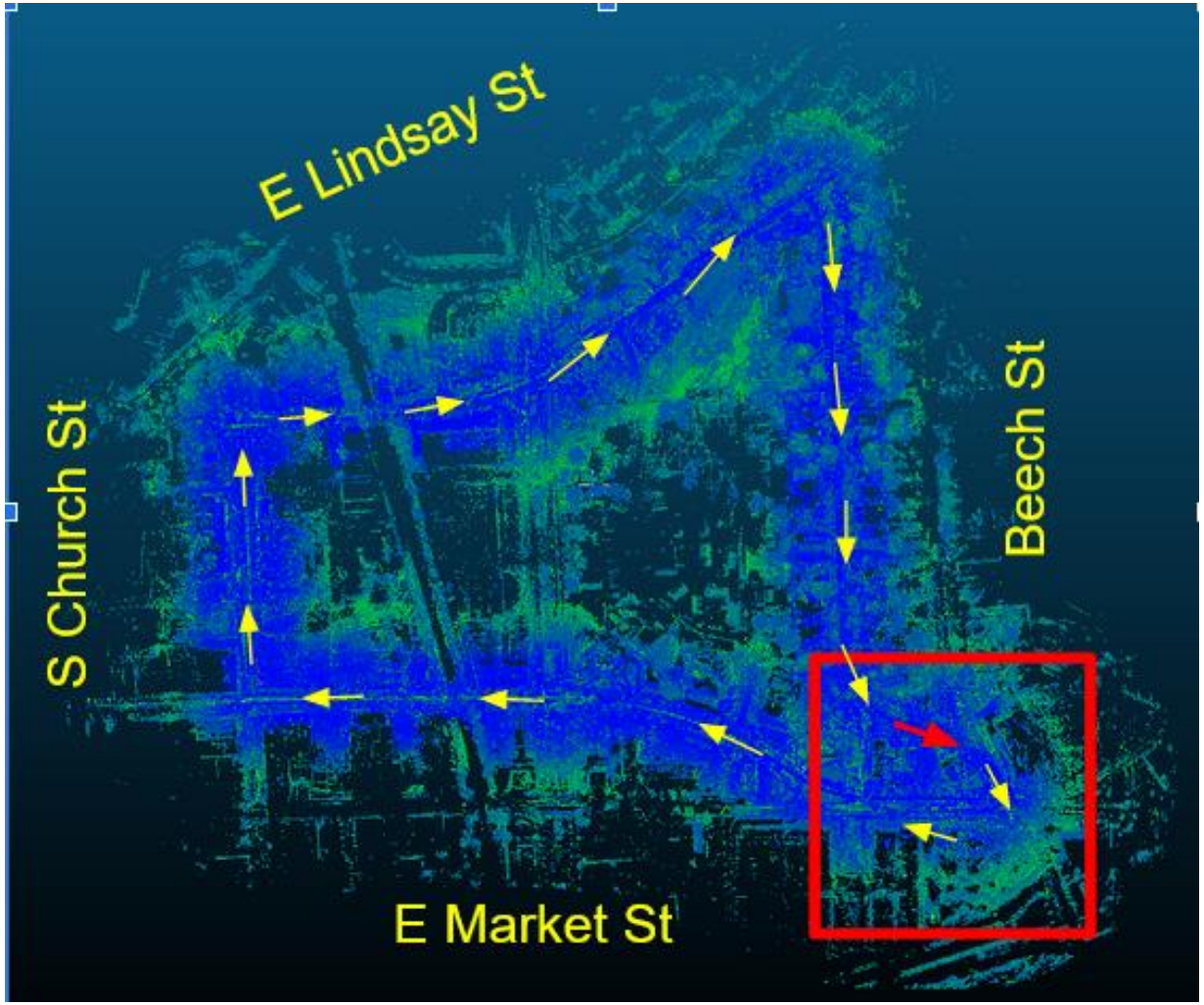
A user-friendly application software will be developed to present information about the vehicles and their route and to potentially allow the passengers to book a seat and view the vehicle's estimated arrival time.

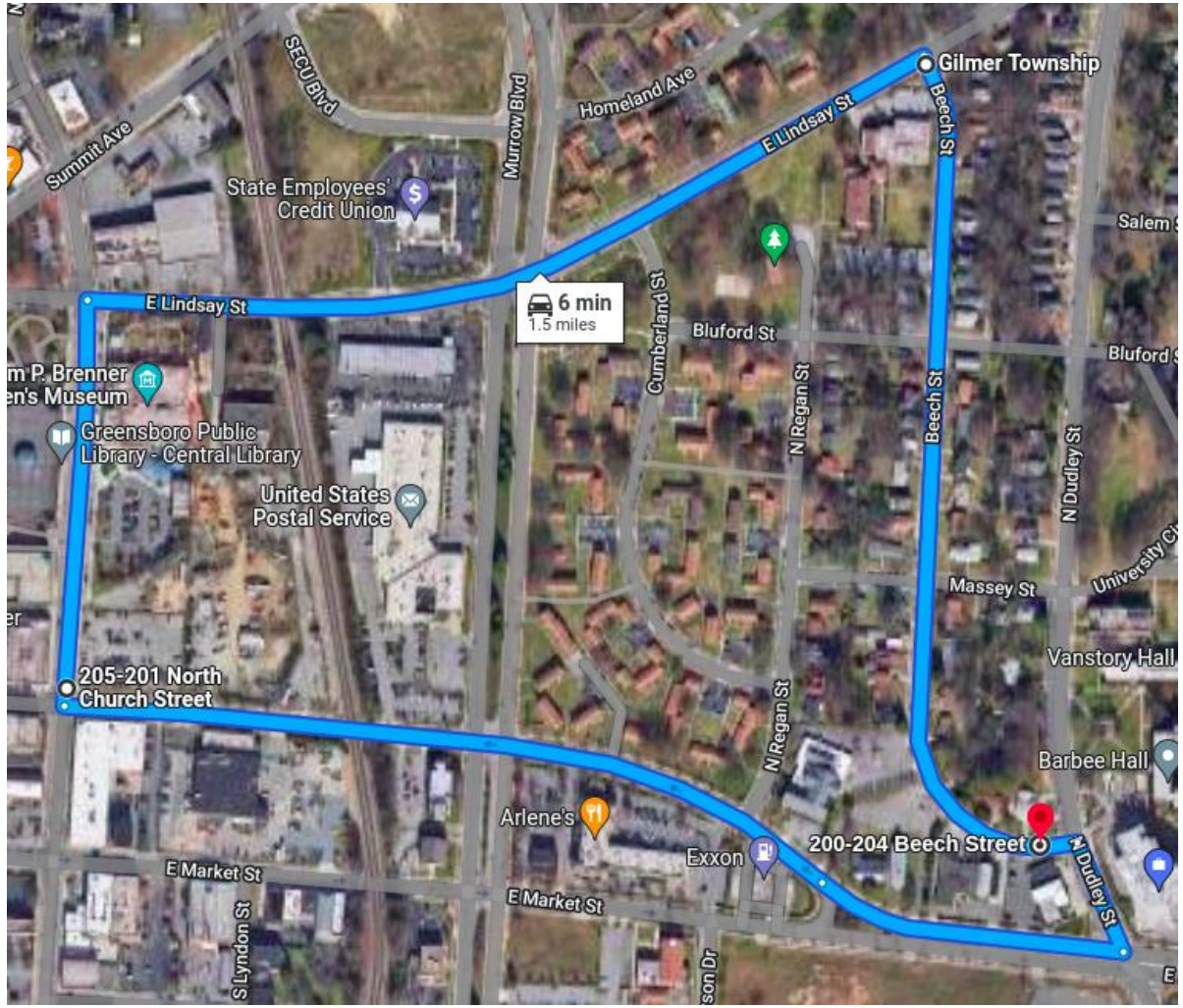
- Pre-ride survey and login
- Book ride
- Estimate ethe arrival time
- NCA&T history
- Greensboro History
- Downtown attractions
- Sponsors
- Post-ride survey
- Possible donations?



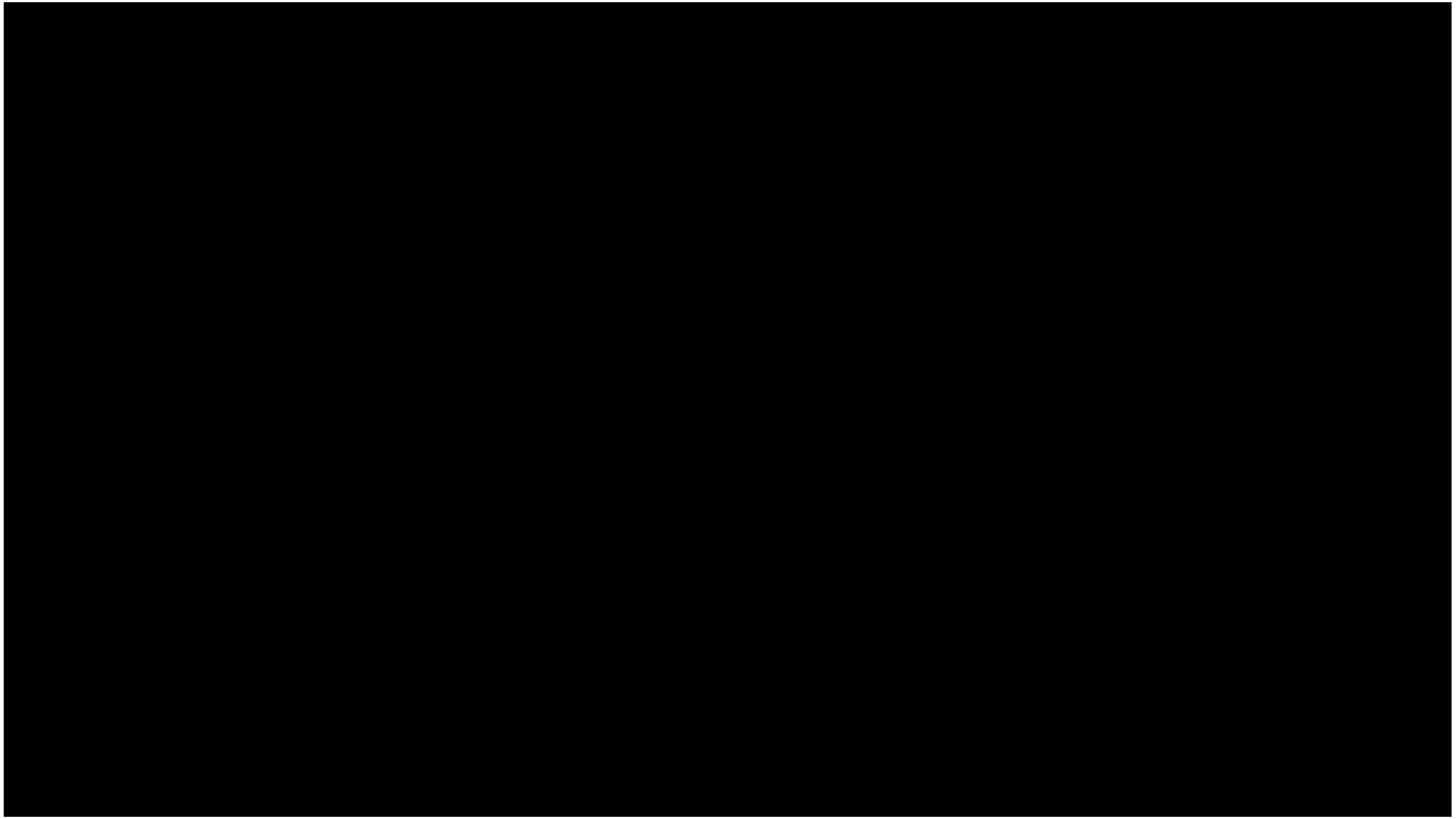


A snapshot of the application software for live tracking of the Aggie Auto Shuttles, where the orange circle and the associated numbers were showing the live location of shuttles.

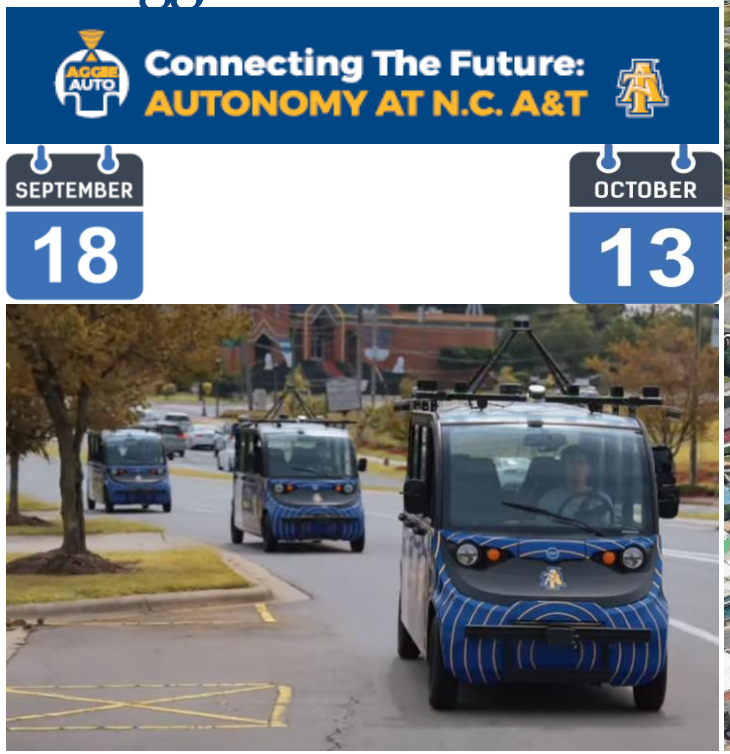

E Lindsay St
S Church St
Beech St
E Market St


Gilmer Township
Homeland Ave
SECU Blvd
Murrow Blvd
Summit Ave
E Lindsay St
Beech St
State Employees' Credit Union
6 min
1.5 miles
Cumberland St
Bluford St
N Regan St
N Dudley St
Salem
Bluford
m P. Brenner
en's Museum
Greensboro Public Library - Central Library
United States Postal Service
Massey St
Vanstory Hall
205-201 North Church Street
Barbee Hall
Arlene's
Exxon
200-204 Beech Street
E Market St
S Lyndon St

Point Cloud Map



Public Deployment of Aggie Auto Shuttles



"Technology Transfer (T^2): *Microtransit Pilot Project in Greensboro, NC,"* Sponsor: NCDOT, April 15, 2023- May 15, 2024.

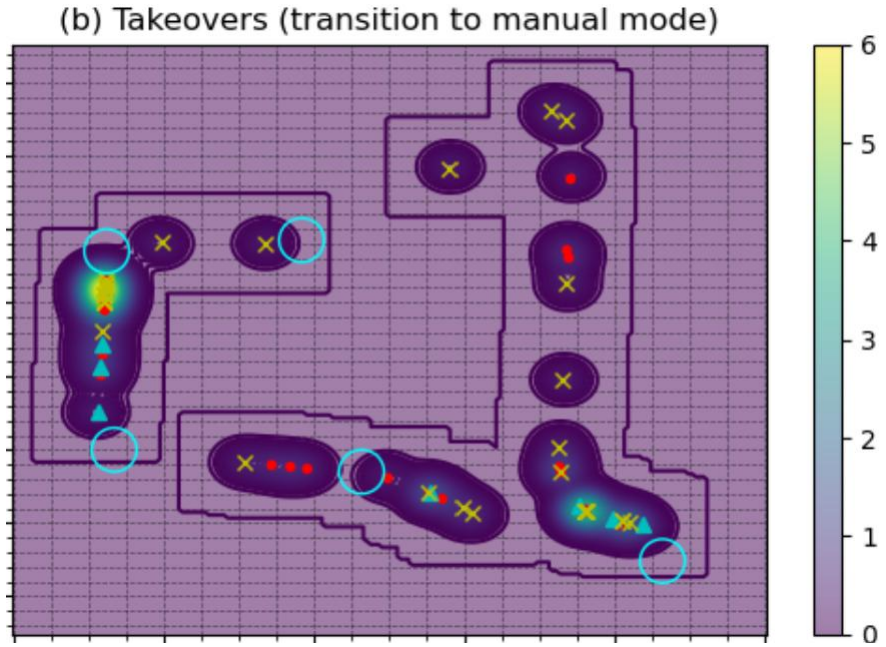
162.5 MILES (roundtrip is 1.3 miles)

71 Takeover maneuvers

180 PASSENGERS (not including the driver)

250 TRIPS

(125 roundtrips)



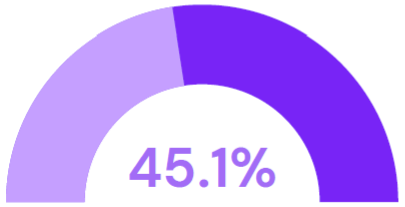
Relevant events leading to takeovers

		Urban					Suburban					Total				
		Shuttle			Total		Shuttle			Total		Shuttle			Total	
Module	**Relevant Event**	**1**	**2**	**3**	**#**	**%**	**1**	**2**	**3**	**#**	**%**	**1**	**2**	**3**	**#**	**%**
Perception	Object Boundary			1	1	2.3		1		1	3.6		1	1	2	2.9
Decision	Pull-Over Maneuver	7	5	12	24	55.8						7	5	12	24	35.3
	Oncoming Traffic						2	1	1	4	14.3	2	1	1	4	5.9
	Collision Avoidance	2			2	4.7			2	2	7.1	2		2	4	5.9
	Road Obstruction	1		3	4	9.3	3	1	5	9	32.1	4	1	8	13	19.1
	Object Near Stop Sign						3		2	5	17.9	3		2	5	7.4
	Unexpected Lane Change			1	1	2.3								1	1	1.5
	Emergency Vehicle Interaction			1	1	2.3								1	1	1.5
Control	Inadequate Speed Reduction	3		1	4	9.3						3		1	4	5.9
	Overly Gradual Acceleration	3			3	7.0						3			3	4.4
	Oversteering Issue	2			2	4.7						2			2	2.9
Actuation	Sudden Deactivation								1	1	3.6			1	1	1.5
	HMI Control Loss	1			1	2.3						1			1	1.5
Strategy	Passenger Drop-Off								2	2	7.1			2	2	2.9
	Unexpected Door Opening								1	1	3.6			1	1	1.5

Most takeovers, accounting for 74.9% of the total, were caused by two primary events: ‘Pull-Over Maneuver’ (55.8%) and ‘road obstructions’ (19.1%).

RESIDENT OF GREENSBORO

ANSWERED BY 102 PARTICIPANTS

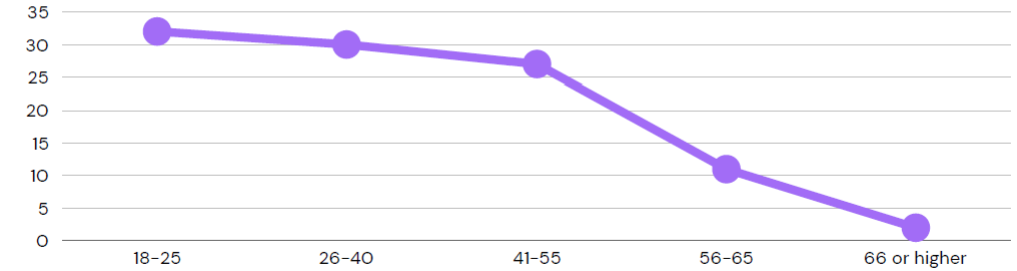


WOULD YOU RIDE THE SHUTTLE AGAIN?

ANSWERED BY 60 PARTICIPANTS

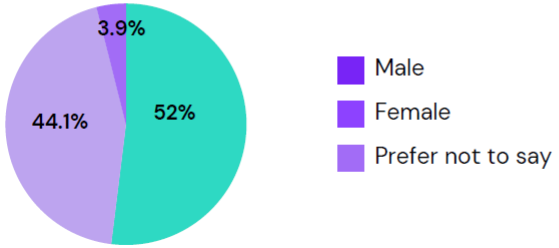
AGE

ANSWERED BY 102 PARTICIPANTS



GENDER

SURVEY QUESTION ANSWERED BY 102 PARTICIPANTS

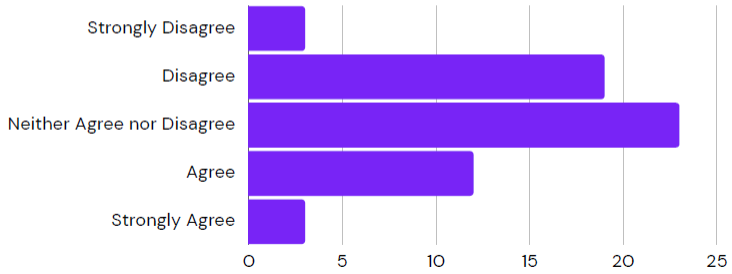


52%

The highest percentage of riders on the Aggie shuttle Identified as male.

I BELIEVE SAS WILL BE SAFER THAN CONVENTIONAL SHUTTLES

ANSWERED BY 60 PARTICIPANTS



23

Neither agree nor disagree with this statement

POST-RIDE FEEDBACK

ANSWERED BY 60 PARTICIPANTS

90% HAD A GOOD EXPERIENCE

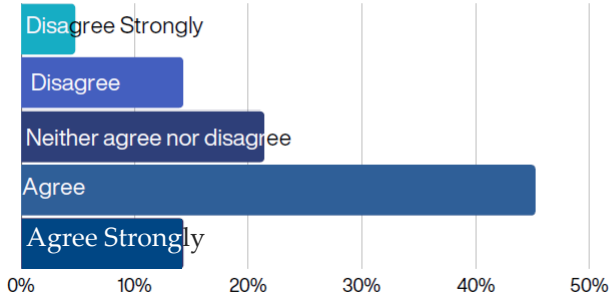
73% Were able to get to their destination on time

58% Feel that driverless vehicles are safe, after riding the shuttle

78% Think SAS can reduce the stress of driving

28% Will give priority to SAS over Using a car

After riding the shuttle, I feel that driverless vehicles are safe



25 Participants Positive Impression

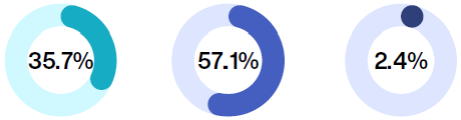
9 Participants Neutral Impression

8 Participants Negative Impression

How do participants feel about SASs

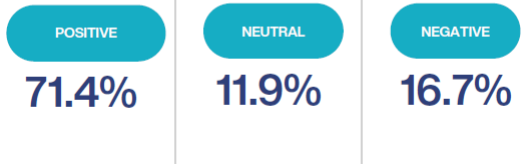
Concern SAS will be too expensive	17%	*Positive Sentiment*	43%	*Neutral Sentiment*	40%	*Negative Sentiment*
Concerned about losing fun In driving while riding In SASs	17%	*Positive Sentiment*	7%	*Neutral Sentiment*	76%	*Negative Sentiment*
Concerned SASs cannot endure various weather conditions and terrains	43%	*Positive Sentiment*	29%	*Neutral Sentiment*	29%	*Negative Sentiment*

Could be a good mobility solution for people who are Unable to drive like disabled persons or the elderly



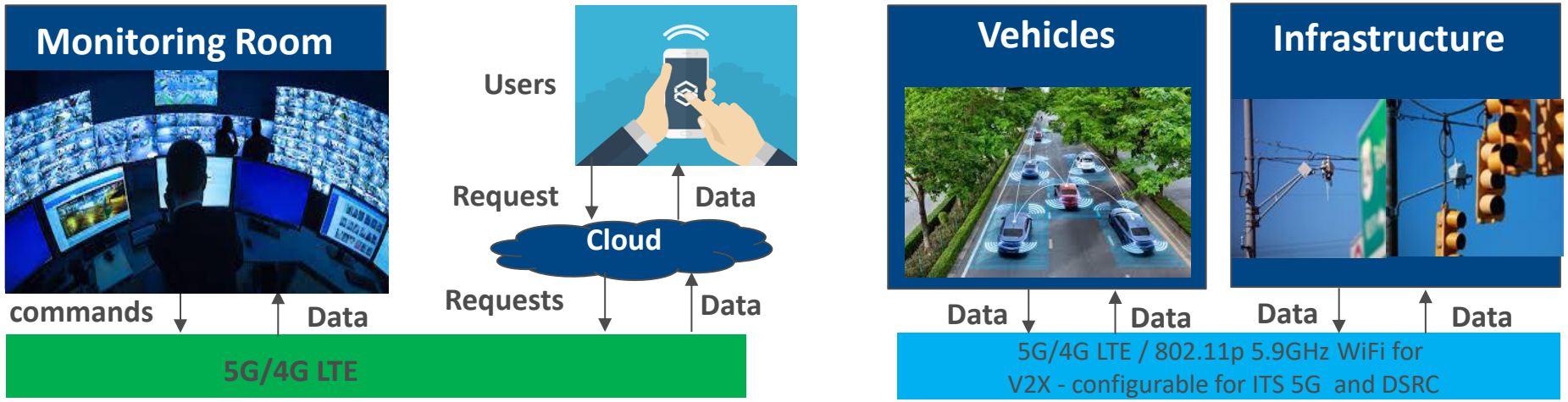
Positive Neutral Negative

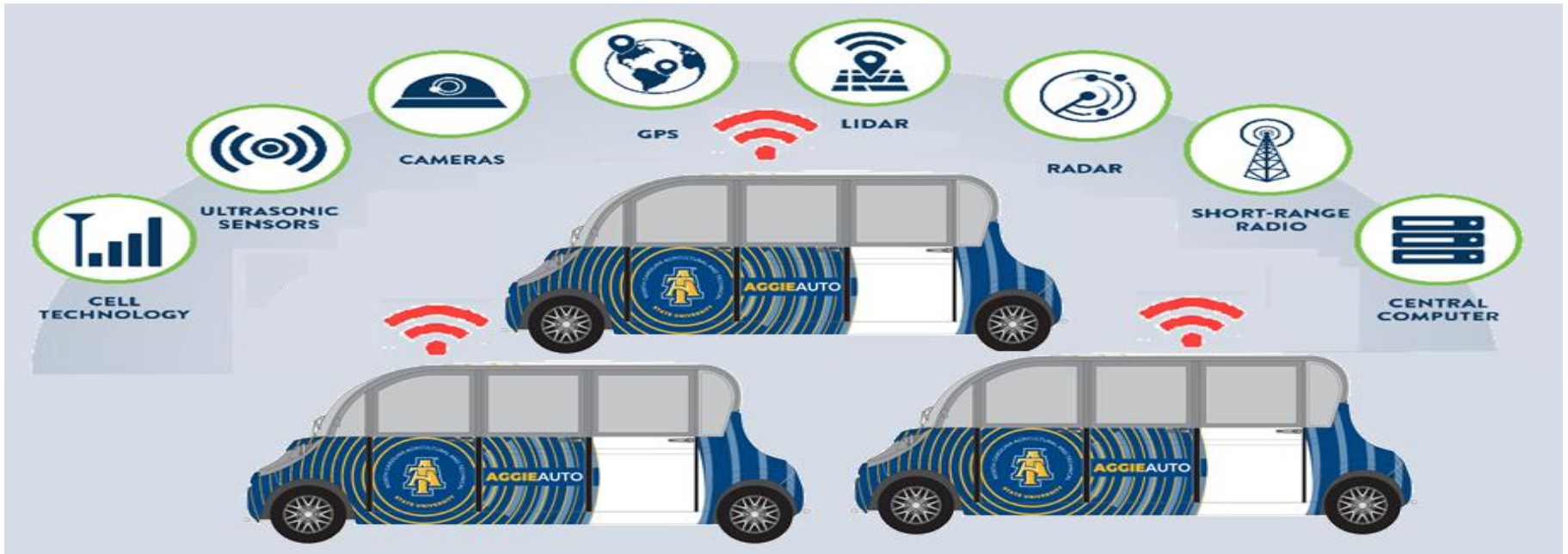
I would be happy to ride in an SAS




Autonomous Vehicle Incident Management
FIRST RESPONDERS Workshop
AGGIE AUTO
POLICE DEPARTMENT

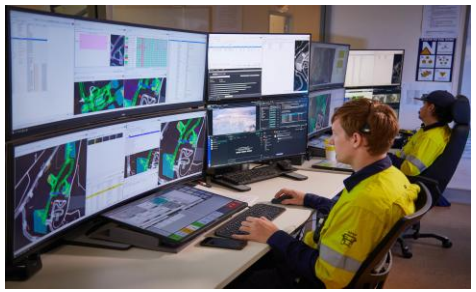
Future Directions


Monitoring Room
Users
Request
Data
Cloud
Requests
Data
commands
Data
5G/4G LTE
Vehicles
Infrastructure
Data
Data
Data
Data
5G/4G LTE / 802.11p 5.9GHz WiFi for
V2X - configurable for ITS 5G and DSRC


GPS
LIDAR
CAMERAS
RADAR
ULTRASONIC SENSORS
SHORT-RANGE RADIO
CELL TECHNOLOGY
CENTRAL COMPUTER
AGGIEAUTO
AGGIEAUTO
AGGIEAUTO

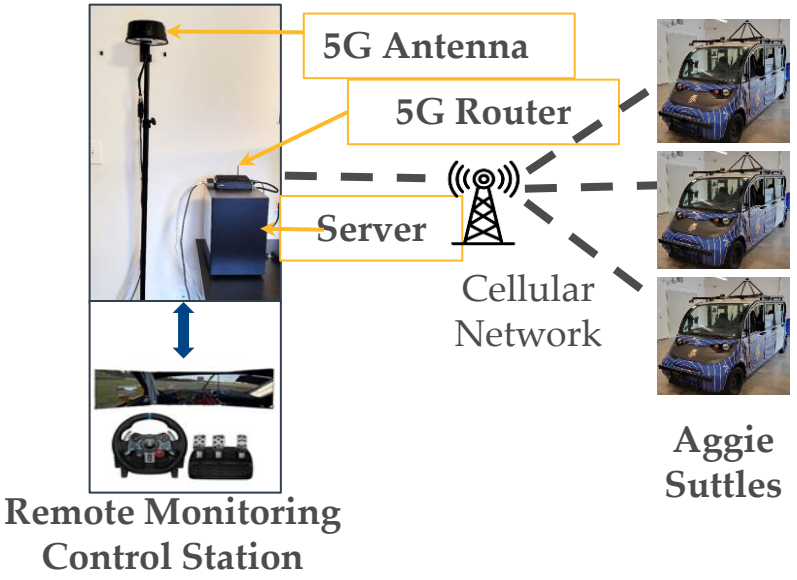
Driver Initiative

Autonomy Initiative



Near-Full Automation + Remote Operation (backup)

Full Autonomy



North Carolina Agricultural and Technical State University

Thank You

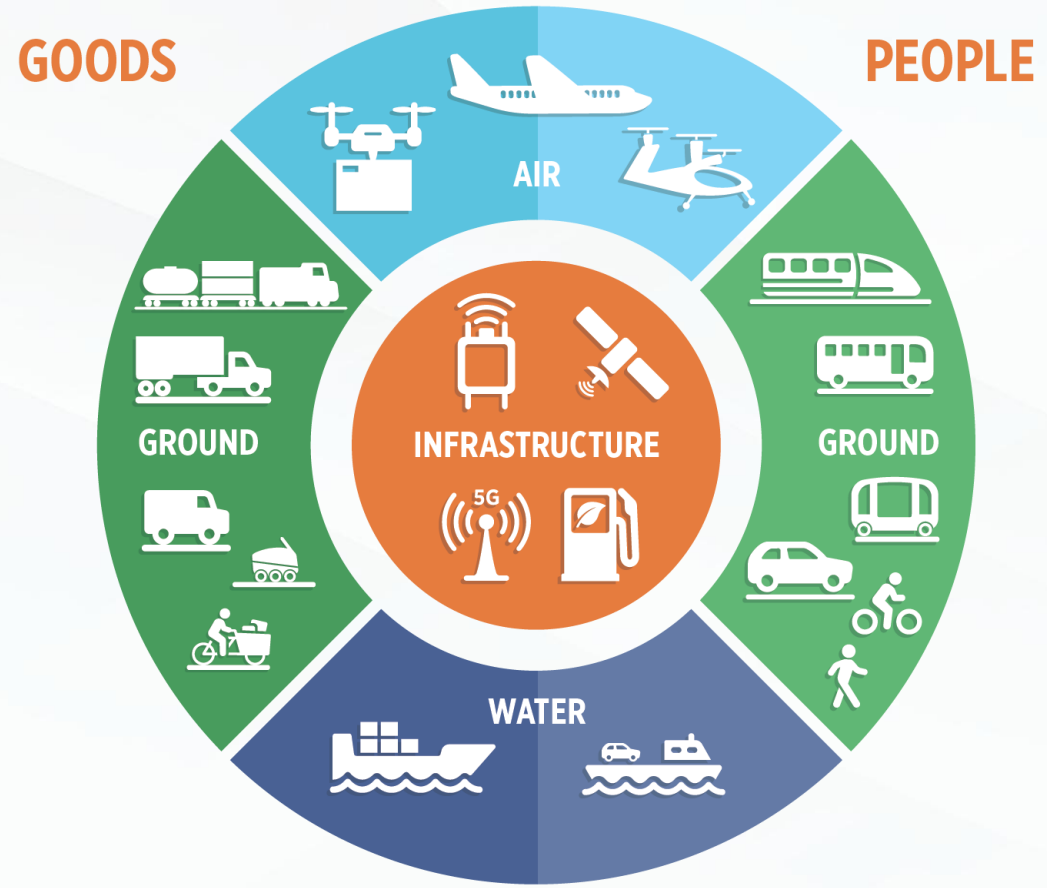
Aggie Auto Shuttles

ADVANCE MOBILITY NC UPDATES

February 2025

Scope of this Plan

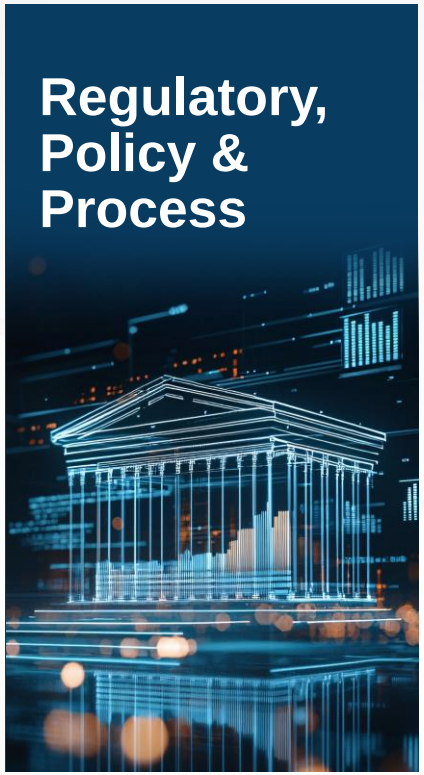
This Strategic Plan focuses on the advancement of key air and ground mobility technologies.

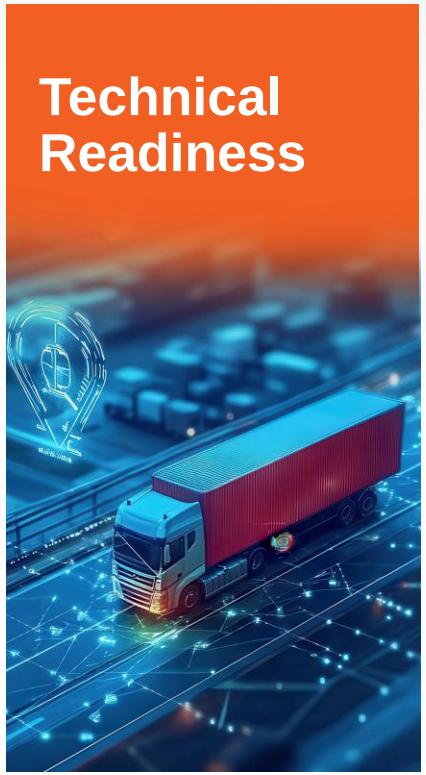


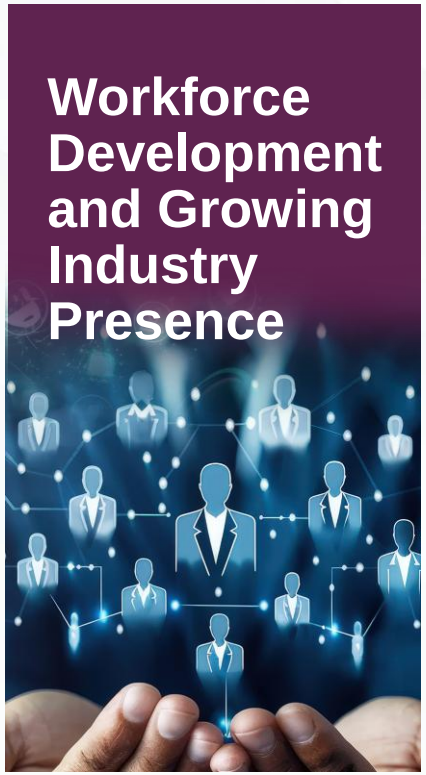
Vision and Goals

Leverage innovative mobility technologies and platforms to provide a safe, sustainable, efficient, resilient, and equitable transportation system that works for all North Carolinians.

Success Factors





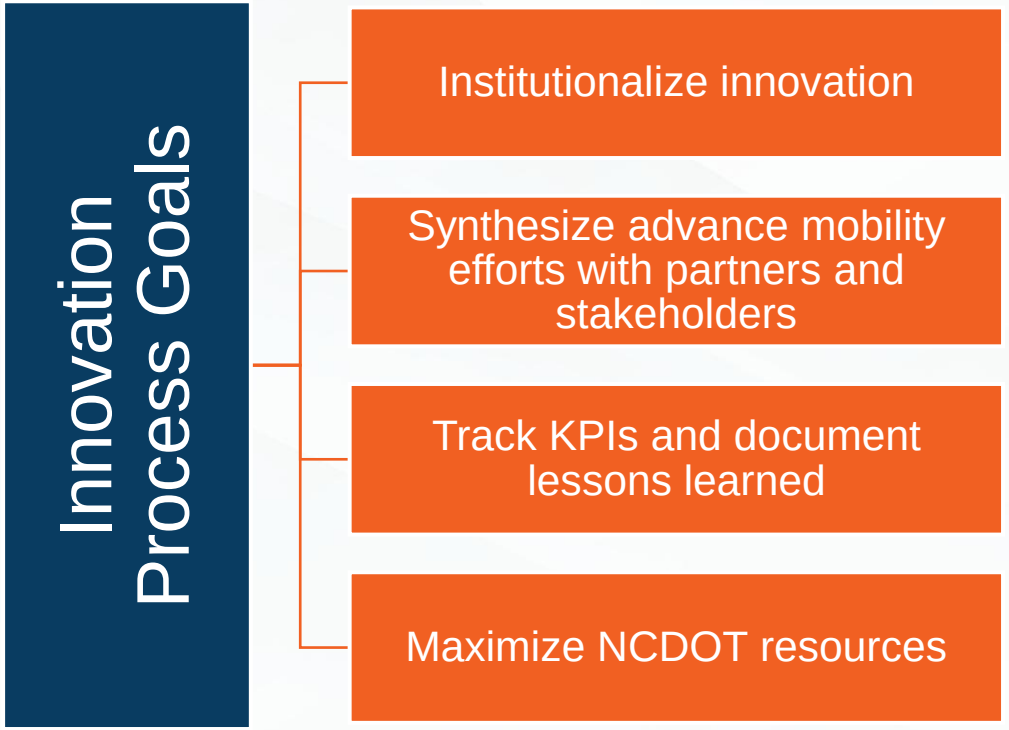


Regulatory, Policy, & Process

Process and Playbook for Innovation

A process is under development for incorporating advance mobility innovation at NCDOT.

Potential use case deployments that utilize innovative solutions will be submitted to NCDOT for review by internal staff or external partners.

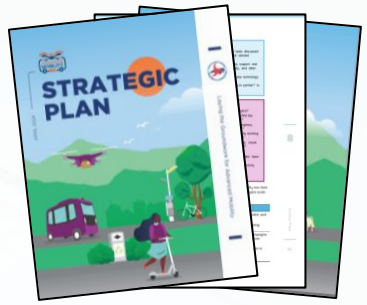


Process and Playbook for Innovation

Technologies and use cases will be evaluated based on their alignment with:

NCDOT's mission, vision, and values

Advance Mobility NC Strategic Plan



How will the use case:

- Make transportation safer
- Provide useful data to federal agencies involved in infrastructure policy
- Connect people, products, and places safely and efficiently
- Promote economic growth through better use of infrastructure
- Maintain NCDOT's role as a leader in innovative transportation solutions

How does the use case align with each key consideration/pillar:

- Transportation Needs
- Infrastructure Development
- Partnership Facilitation
- Economic and Workforce Development
- Policy Alignment

Air

Ground

- Layered multimodal services
- Mobility hub connections
- Complete Streets connections
- Mobility as a service integration

Process and Playbook for Innovation

The innovation use case review process outlines:

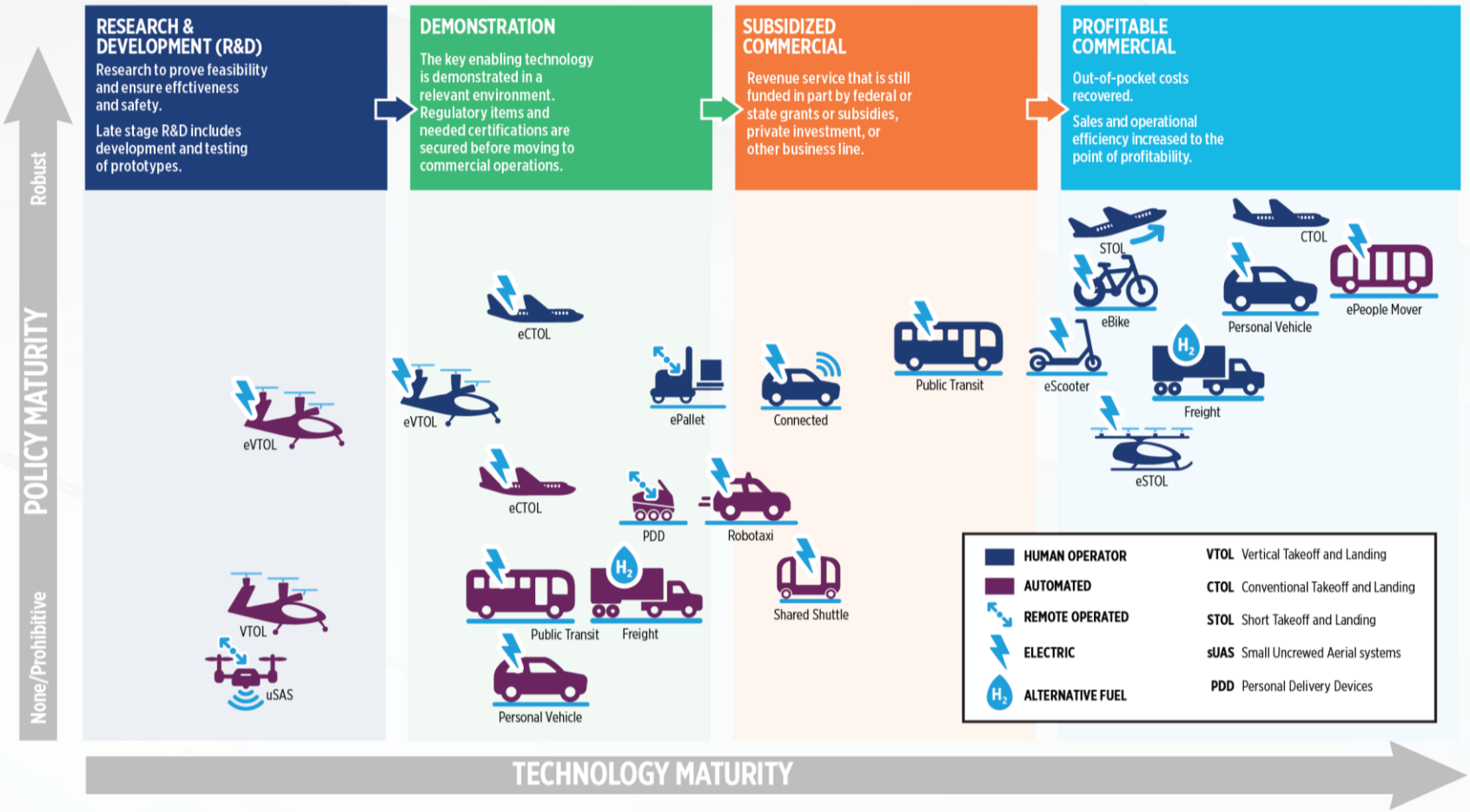
- Ideas
- Go/No-Go Decision
- Plan
- Implement
- Measure Performance

AAM Zoning Framework

North Carolina is leading the way in structured AAM Zoning

Technical Readiness

Where is Advanced Mobility Readiness today?



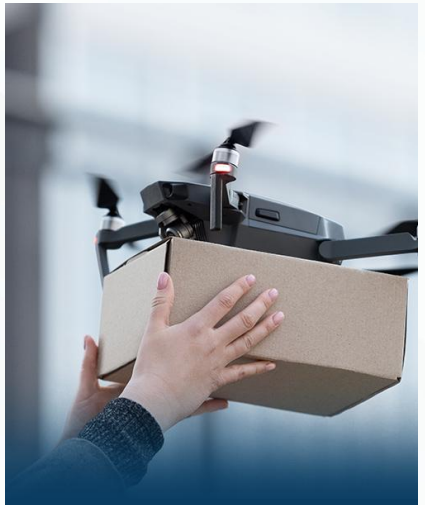
Context Sensitive Solutions

Personal Delivery Devices

Cargo Bikes

Access Management for Mobility Hubs

Curb Lane Management



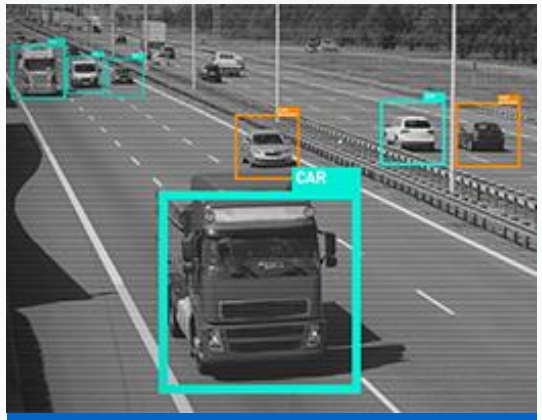
Package Delivery by Drone

AI Integration

NCDOT is exploring how artificial intelligence *(AI)* can be used to support its transportation system.

- Below are some key applications where AI can be effectively utilized.

Road Hazard Detection



Real-Time Traffic Monitoring

Public Engagement through AI-Powered Platforms

Industry and Public Engagement

NCDOT Advanced Mobility Implementation Outreach

Air

Ground

Workforce Development and Growing Industry Presence

Clean Fuel Toolkit for General Aviation Airports

Fuels

Vehicles/Aircraft

Infrastructure

Strategic Funding Opportunities

Strategic Funding Opportunities

Applying Best Practices in NC

GET A HEAD START

PLAN TO WIN

COMMUNICATE VALUE

THANK YOU

Jason Schronce, PE
Deputy Director of Programs and Planning
Division of Aviation
jbschronce@ncdot.gov

NORTH CAROLINA
Department of Transportation

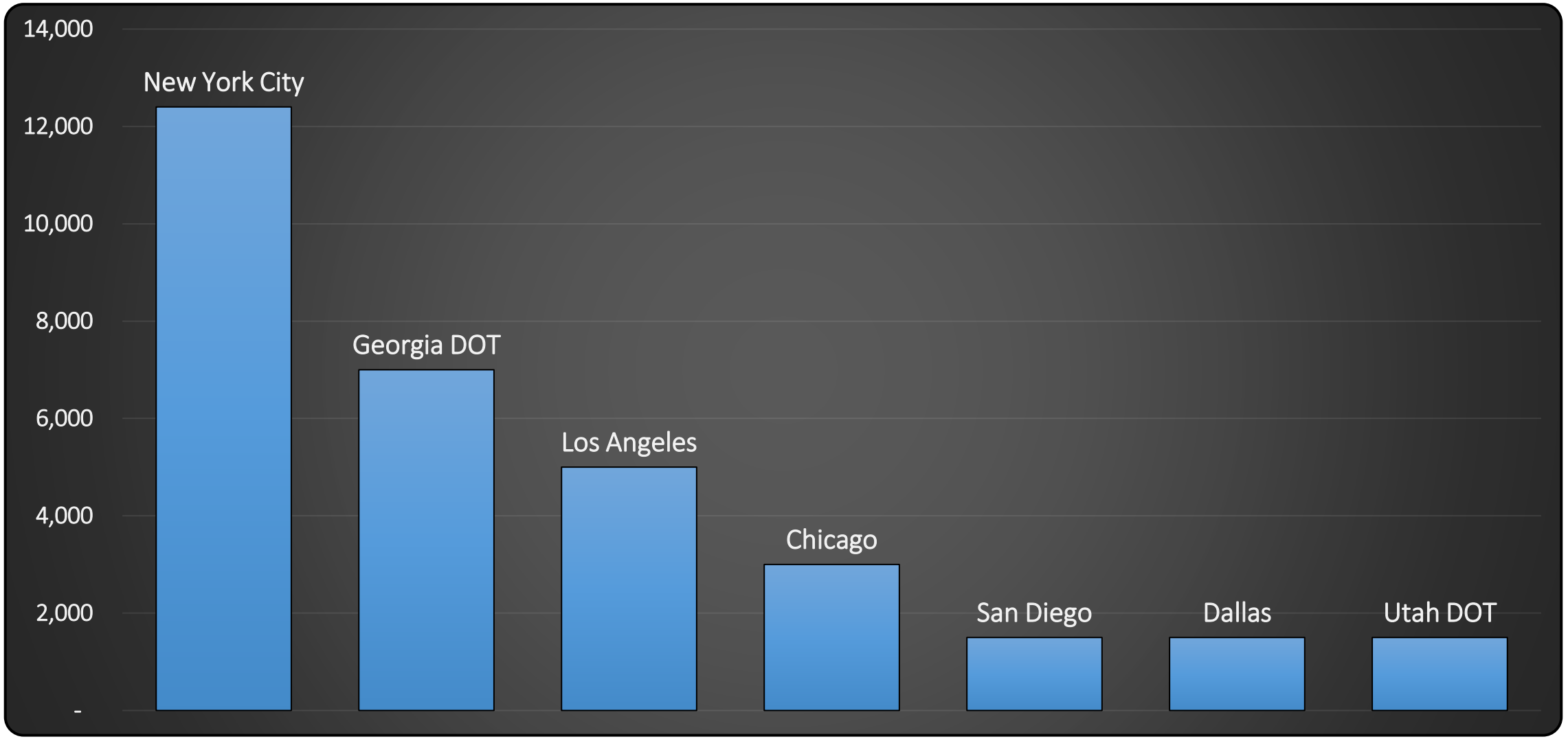
Modernization of NCDOT Traffic Signals

Matthew T. Carlisle, PE
State ITS & Signals Management Engineer

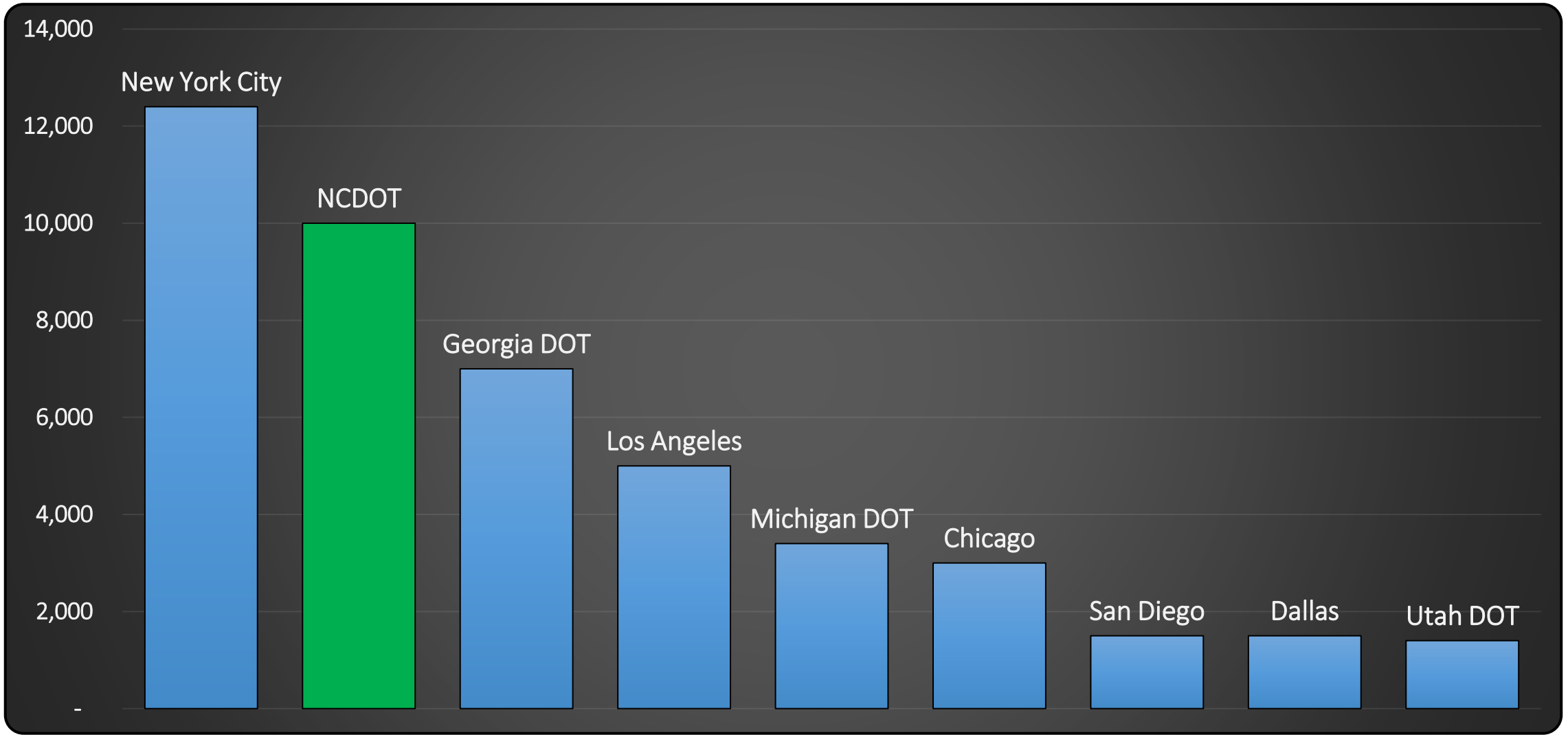
February 12, 2025

Connecting people, products and places safely and efficiently with customer focus, accountability and environmental sensitivity to enhance the economy and vitality of North Carolina

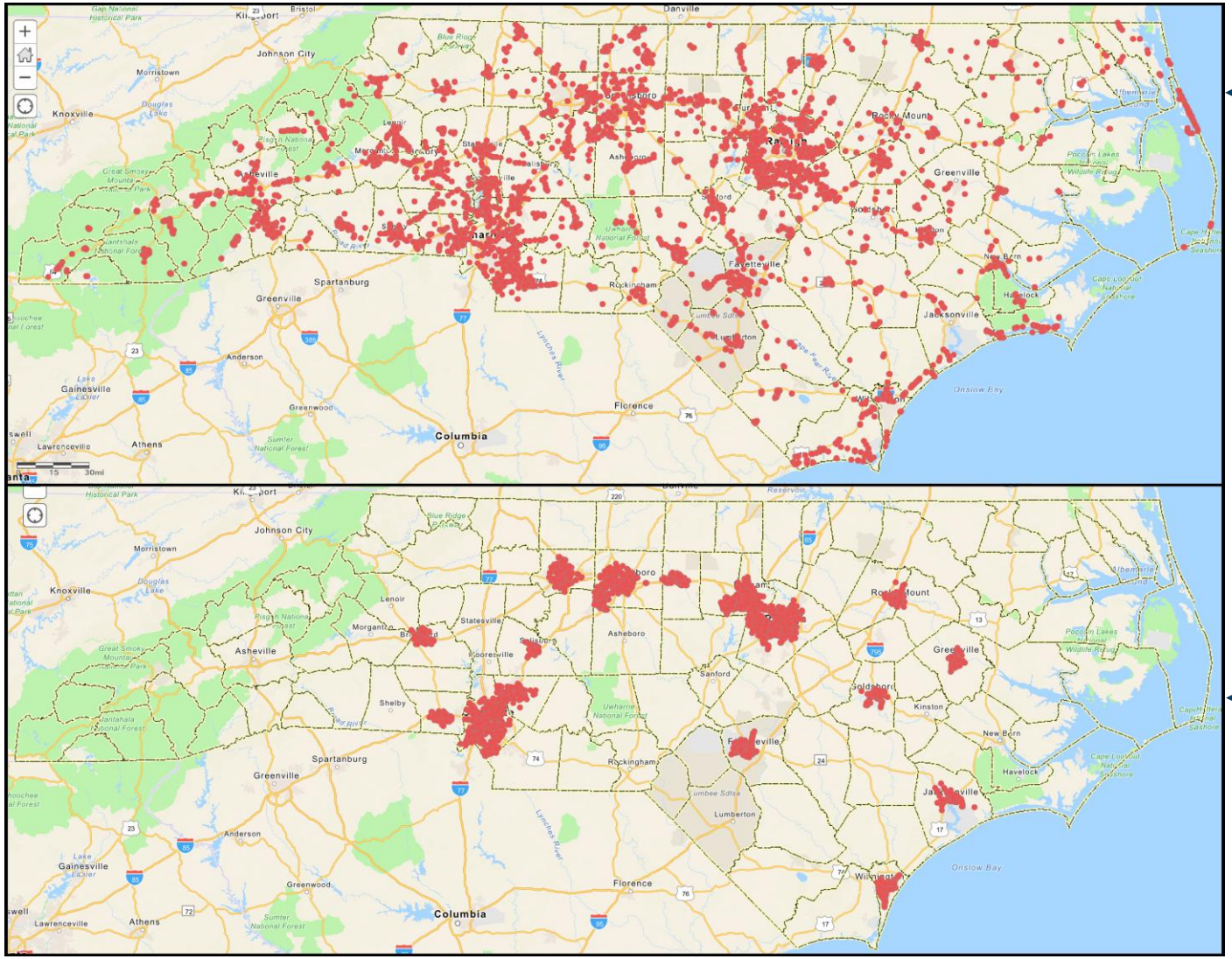
Largest US Signal Systems



Largest US Signal Systems



NCDOT Signal System – Scope & Scale



6,000 State-Maintained

5,000 traditional signals
+
1,000 flashers

10,000 State-Owned

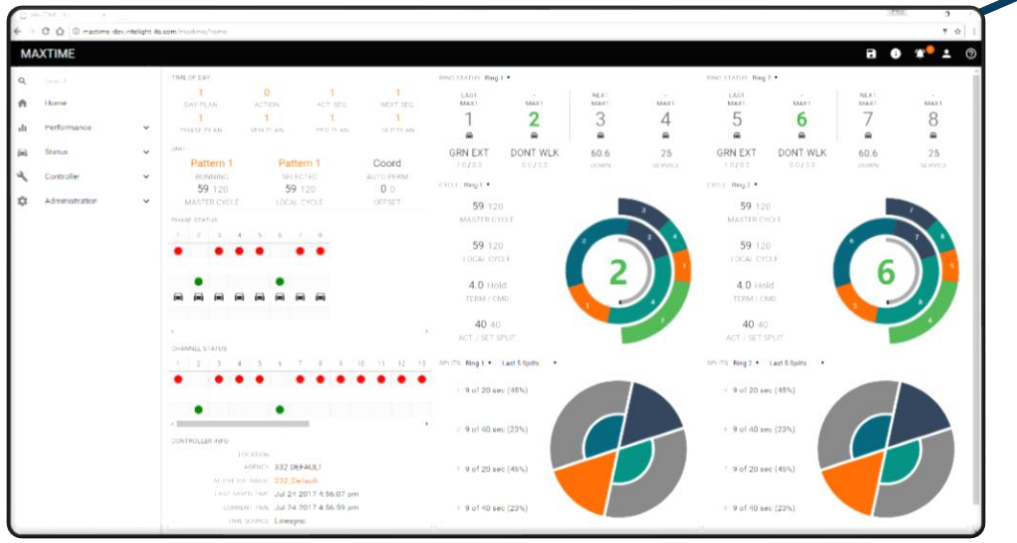
4,000 City-Maintained

+

1,500 City-Owned

NCDOT Signal System – New Software Contract (2022)

Q-FREE



MaxTime
(local)

Features

- Connected Vehicle capability
- High-Resolution Data capability
- More sophisticated logic processor
- Web-based editor
- Software updates without interruption
- Remote updates
- Integrated LPI support

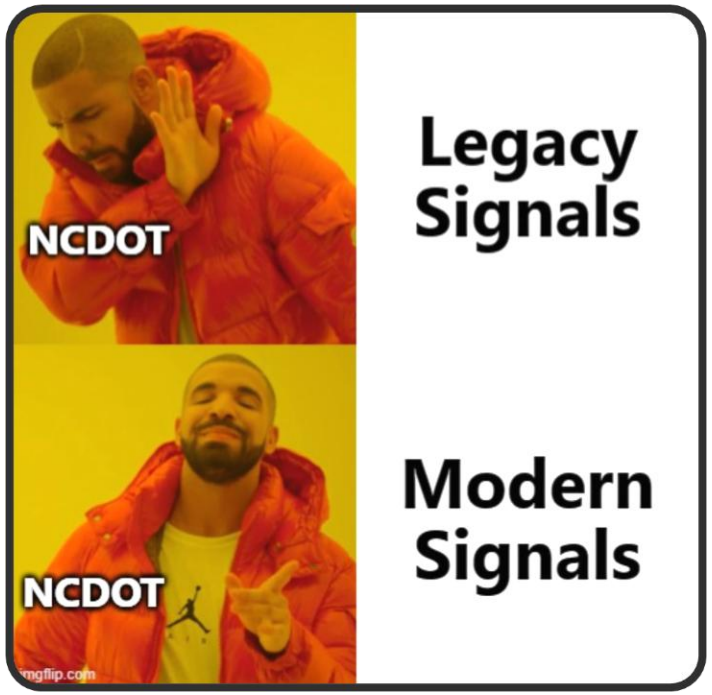
Kinetic Signals
(central)

Features

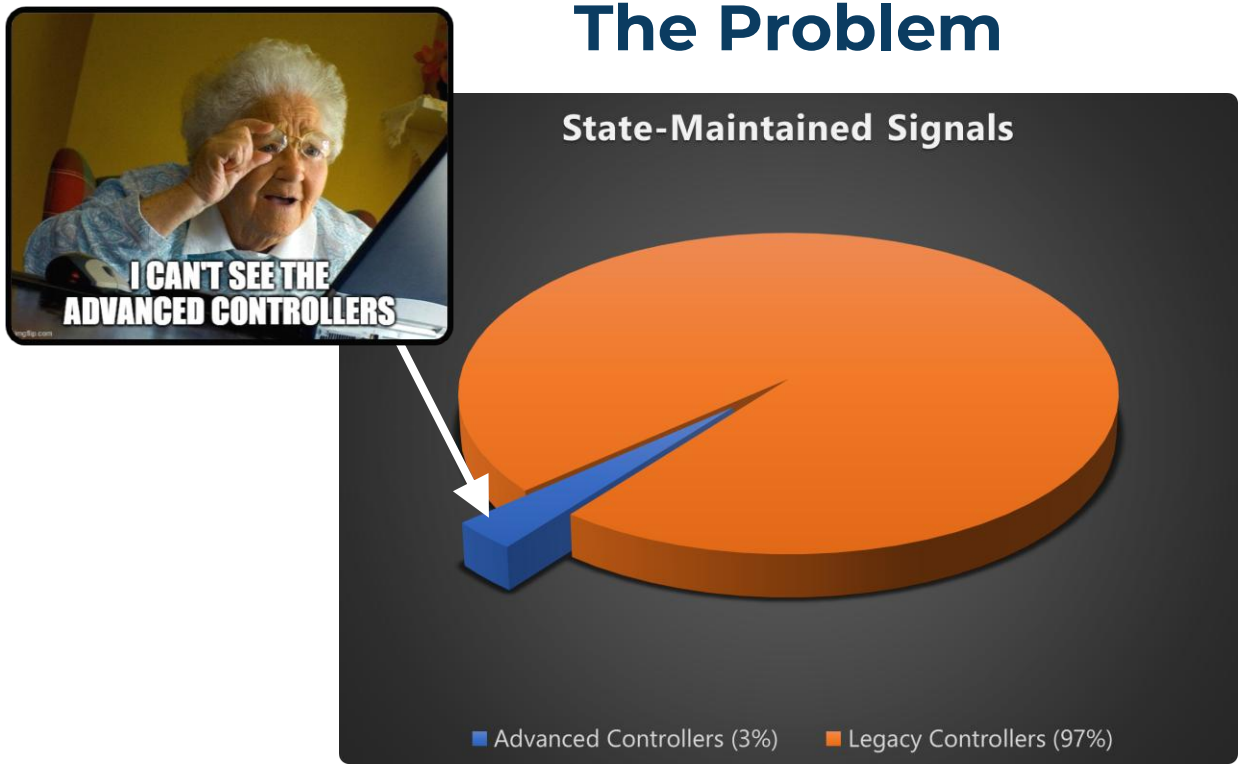
- Cloud-hosted
- Web-based user interface
- Seamless software updates
- Built-in ATSPM
- Bulk License Pricing

NCDOT Signal System

The Goal



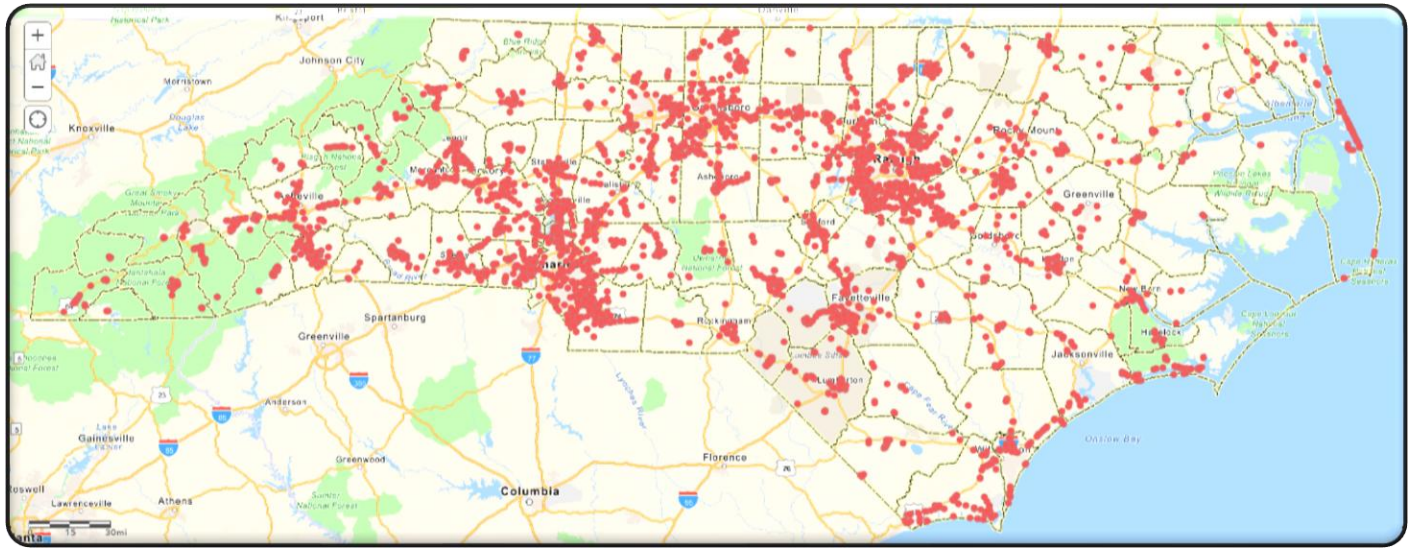
The Problem



Signal Modernization Project

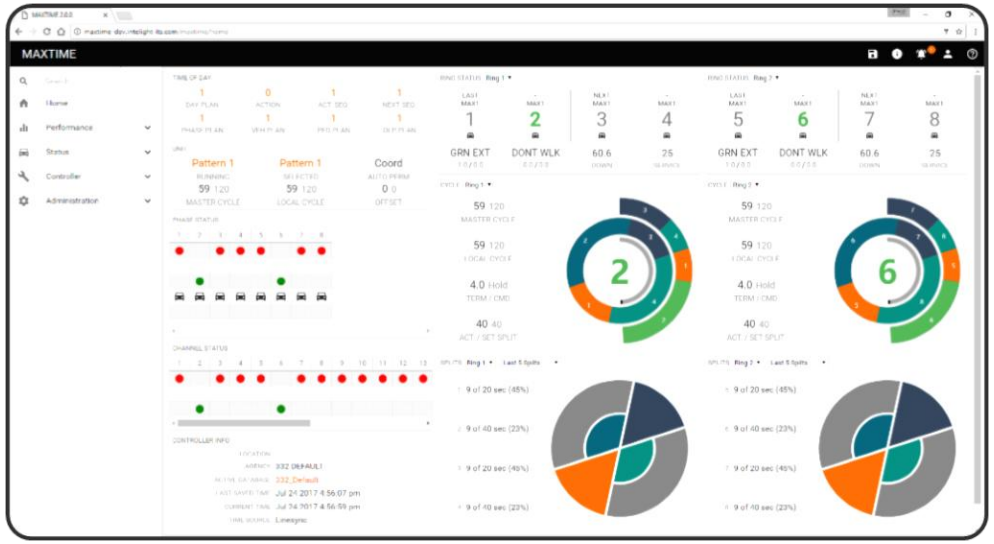
Signal Modernization Project Scope

2022



Upgrade of ***all*** State-maintained signals to run ***MaxTime***

Upgrade of ***all*** State-maintained signal systems to communicate with ***Kinetic Signals***



Signal Modernization Project – Upgrade Plan & Timeline

Block A

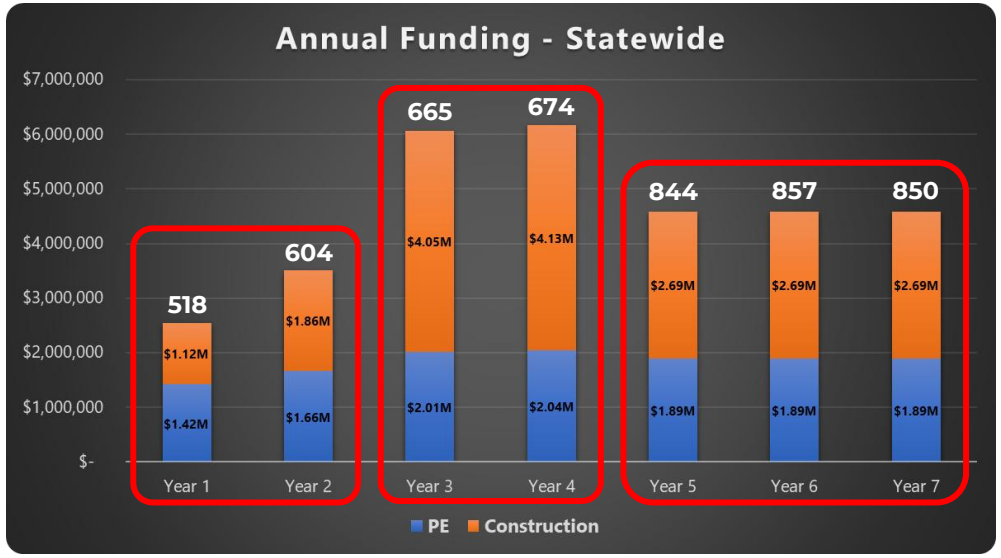
- Signals on Statewide Centracs
- Signals on ASC/3
- 1,122 intersections

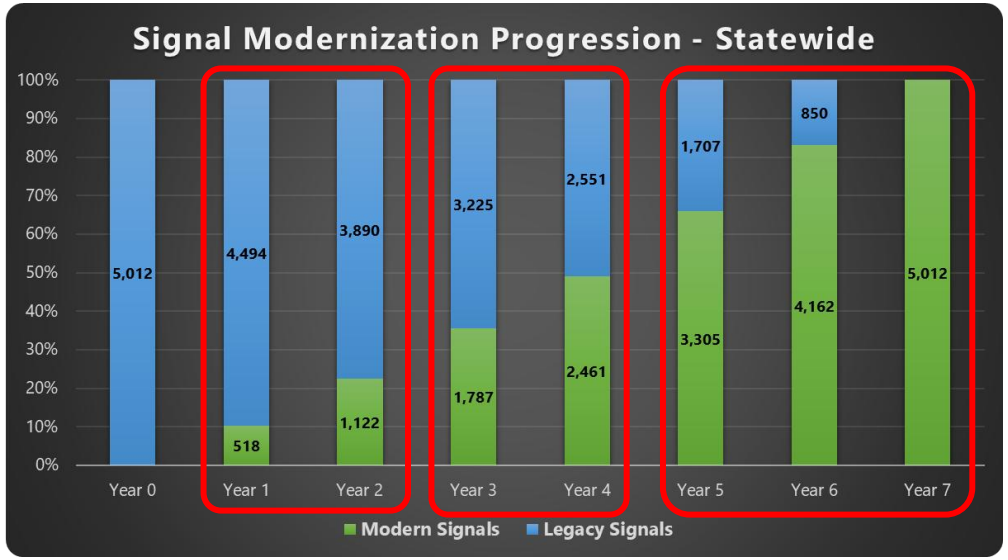
Block B

- Signals in closed loop systems
- Signals running coordination
- 1,339 intersections

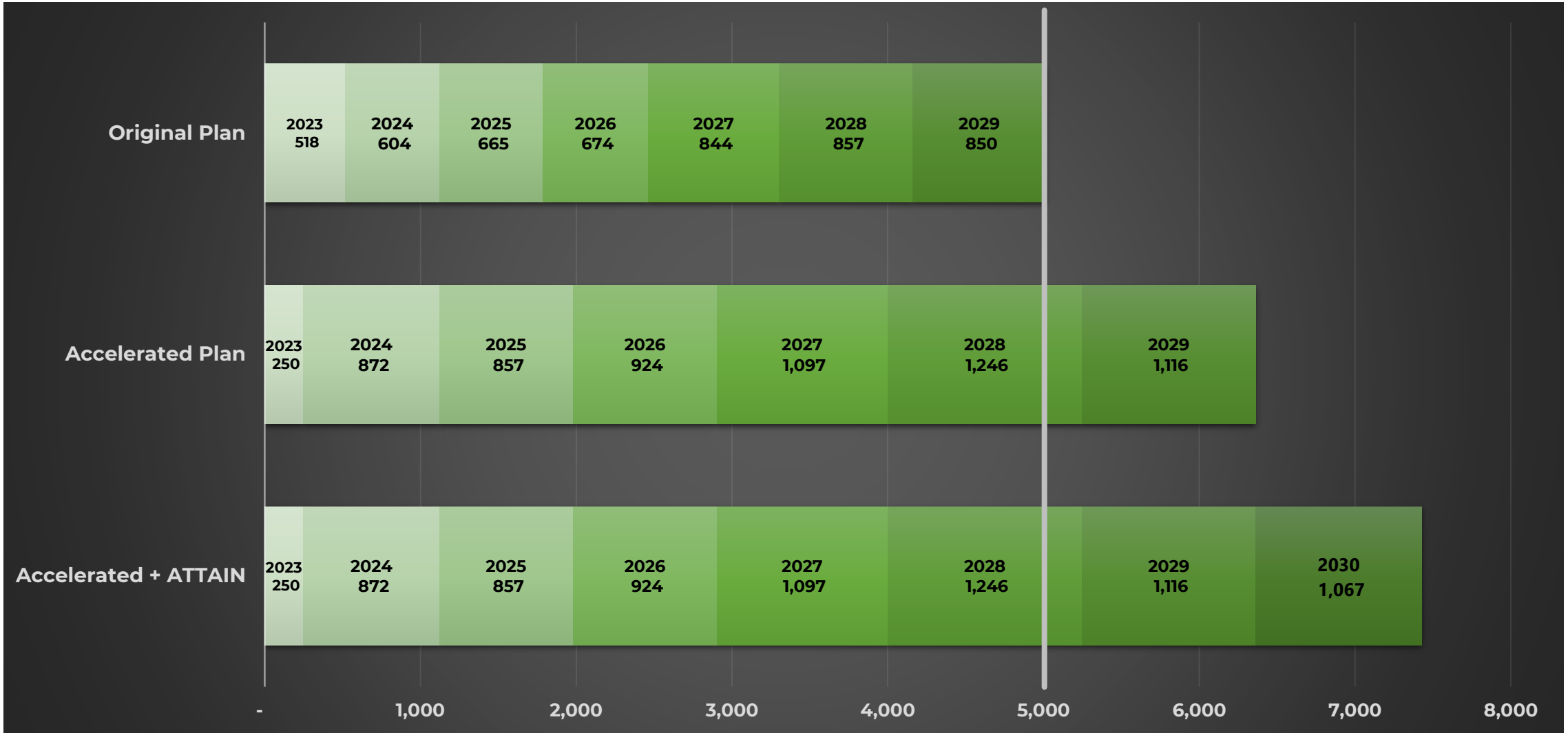
Block C

- Isolated signals
- 2,551 intersections





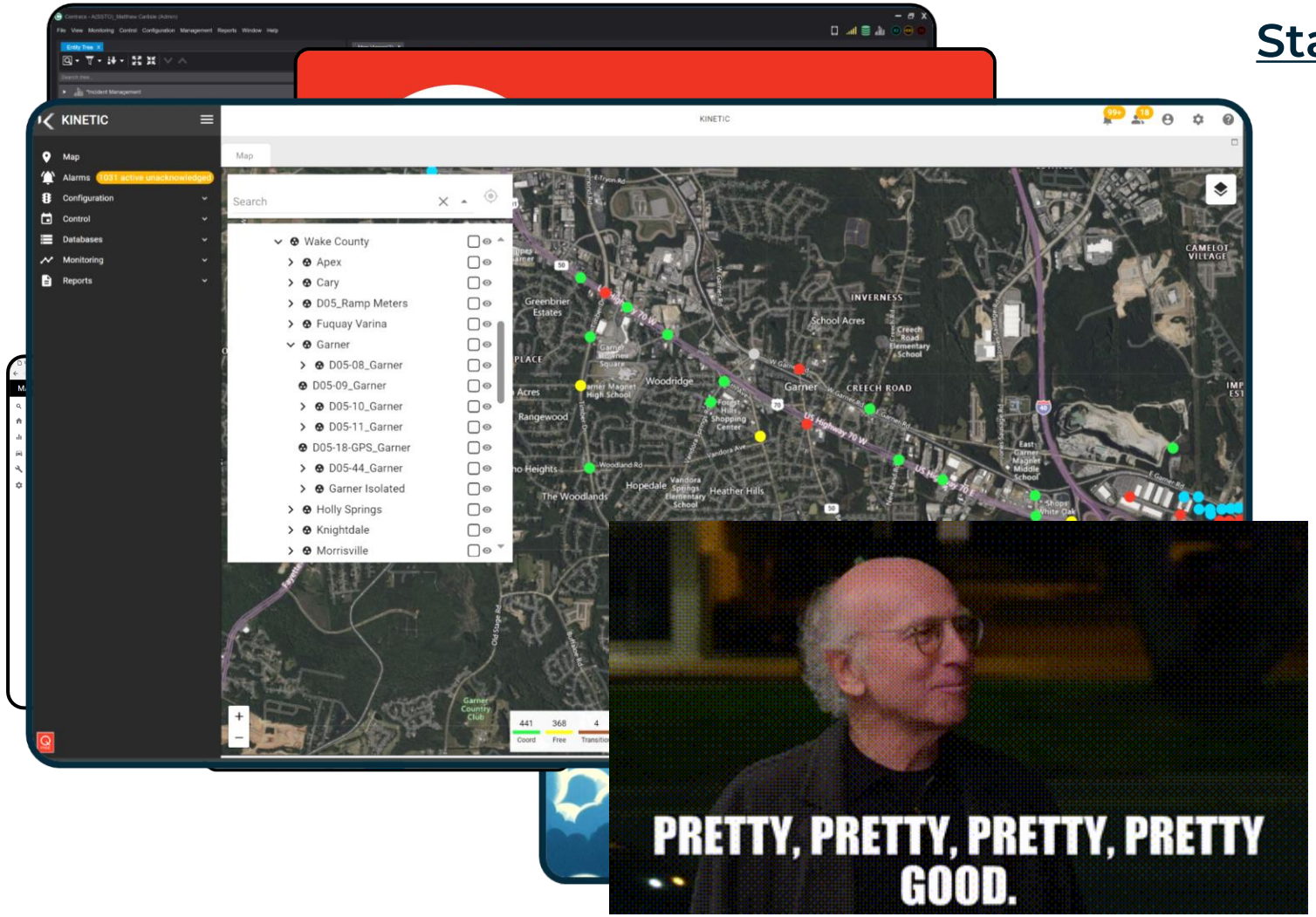
Signal Modernization Project – Accelerated Capabilities



ATTAIN Grant: "Smart Signals In Our Community"

- 1,067 signal upgrades
  - New controllers
  - MaxTime software
- Communications to central system
  - ~300 signals with fiber communications
  - ~150 signals with wireless communications
  - ~600 signals with modem communications
- Connected Vehicle Cloud Feed
  - Data in a standard format delivered to 3rd party providers for in-vehicle systems
- Signal Prioritization Dashboard
  - Will integrate ATSPM and probe data
- Design and construction beginning Q3 2025
- 24-month timeline

Statewide Signal System Progress



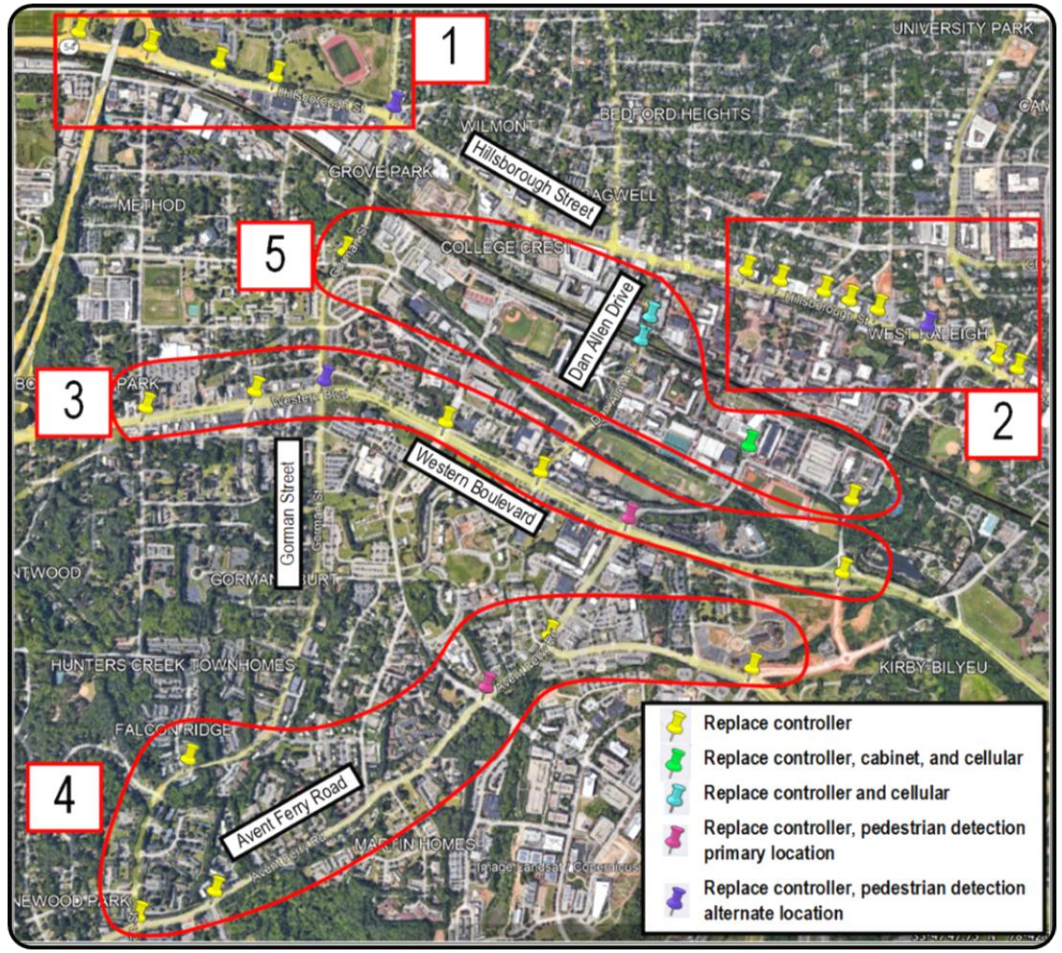
Statewide Signal System

- 2018: Non-existent
- 2019: Added central software
- 2020: 400+ Signals Online
- 2022: 900+ Signals Online
  New Software
  Signal Modernization Project Funded
- 2023: Signal Modernization Project Began
- 2024: 1,200+ Signals Online
  $12M ATTAIN Grant
- 2028: 2nd Largest Centralized Signal System in Nation

Multimodal Connected Vehicle Pilot Project

(MMCVP – ATCMTD Grant)

MMCVP Project – Scope



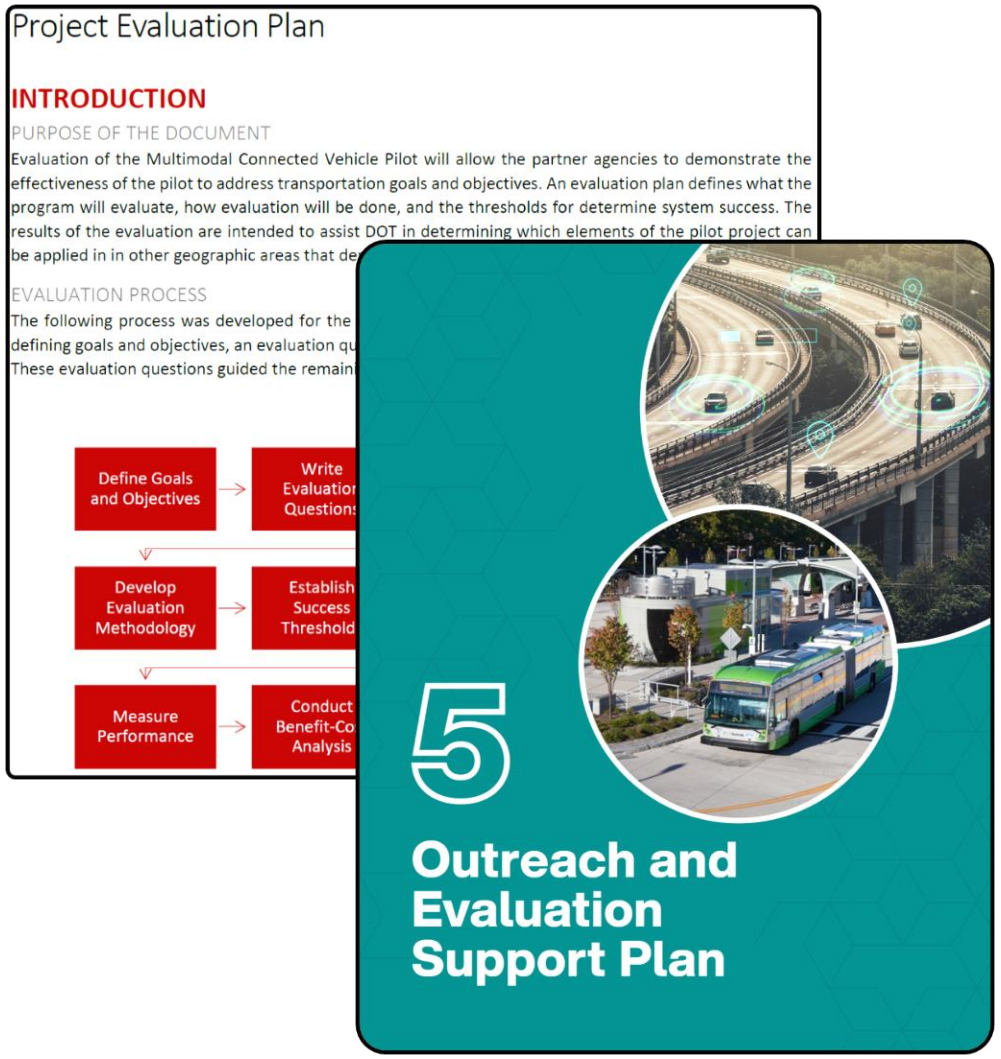
- 27 Signalized Intersections Upgraded:
  - Modern Controllers (2070LX)
  - Roadside Units (RSUs)
  - Non-Intrusive Vehicle Detection (cameras)
- 2 Locations Getting Pedestrian Detection
- 35 Wolfline buses getting Onboard Units (OBUs) for Transit Signal Priority (TSP)
- Deployment of Connected Vehicle applications accessed via Personal Information Device (PID)
- System maintenance, warranty, and evaluation services

MMCVP Project – CV Applications

- **Traffic and Transit Operations**
  - Signal Phase and Timing (SPaT)
  - Transit Signal Priority (TSP)
  - Intelligent Traffic Signal System (I-SIG)
  - High Resolution Data (HRD)
  - Automated Traffic Signal Performance Measures (ATSPMs)
  - Connected Eco-Driving (CED)
- **Safety**
  - Pedestrian in Signalized Crosswalk Warning (PSCW)
  - Mobile Accessible Pedestrian Signal System (PED-SIG)
  - Red Light Violation Warning (RLVW)
  - Speed Warning (SW)
  - Work Zone Warning (WZW)

Download YU2X App

MMCVP Project – Goals & Evaluation



- Improve mobility for motorists
  - Reduce travel times and delay
- Improve mobility for transit
  - Improve schedule adherence
  - Increase arrivals on green
  - Increase ridership rates and rider experience
- Improve safety for all users
  - Reduce crash frequency and severity
  - Reduce red-light violations
- Reduce environmental impacts
  - Reduce transportation emissions
- Demonstrate a positive Return-on-Investment

Contact Us

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ncdot.gov/divisions/highways/Pages/transportation-mobility-safety.aspx

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Thank you!